



Outdoors

***Note:** sections of the lesson plan template marked with * are optional, but may be useful for your planning.

| Getting our hands dirty with soils | |
|---|---|
| Grade level | 4-8 |
| Standards | MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.[...]Emphasis is on geoscience processes that shape local geographic features, when appropriate. |
| Goals | Students will identify at least three properties of soil (e.g., color, texture, moisture, nutrient content). Students will compare and contrast different soils. Students will observe how soils the movement of water. |
| Time | 1 hour |
| # students | 5-30 |
| Materials | <ul style="list-style-type: none"> ● One handout for each student (attached at end of lesson plan) ● Cups or containers of a few different soils: e.g., a soil from a garden, potting soil, cactus potting soil, soil from the side of the road, soil from a beach sand dune, etc. As long as there is some variation, it doesn't matter what exact soil types are represented. Transparent containers are best but any containers are okay. ● Soil auger or trowel ● A pitcher, watering can, or other container with a small amount of water ● Magnifying glasses or hand lenses (optional) ● A whiteboard and marker for the lesson facilitator to explain concepts outdoors (optional) ● Students should bring writing utensils and a clipboard, notebook, binder, or folder for a hard surface to write on. |

| | |
|--|---|
| Location | Outdoors on any area of soil/grass where perturbing small amounts of soil is acceptable. There should be enough space for up to 30 students to sit or stand without obstructing street or sidewalk traffic. |
| Logistics | <p>Lesson facilitator should gather a few examples of soils as described in the materials section.</p> <p>Lesson facilitator should identify an appropriate location prior to the lesson and confirm that the soil is soft enough to dig in with the available equipment.</p> <p>Students may need to walk a short distance but no vehicles should be needed.</p> <p>Students should dress for the weather (appropriate for temperature, sun exposure, etc.) but physical activity will be minimal.</p> <p>In case of rain, the lesson can be facilitated indoors, just omitting the step where the students dig and observe a soil sample from outdoors.</p> |
| Accessibility | <p>If any students have difficulty traveling on uneven surfaces (e.g., a grassy lawn), choose a location for the lesson that is accessible via and adjacent to a paved area.</p> <p>If any students have difficulty standing for up to an hour or sitting on the ground, lesson facilitators can provide a chair.</p> <p>This lesson includes visual and tactile observations. If students have a limited ability to observe by sight or feel, their partners can describe their observations to them.</p> |
| <p>Lesson activities</p> <p>Prepare (5-10 mins):</p> <ul style="list-style-type: none"> ● Lead students to the lesson location outside and allow them to settle in, sitting or standing, for an introduction to the lesson <p>Engage (5 mins):</p> <ul style="list-style-type: none"> ● As a warmup, ask some beginning questions to the class. For example: Where do you find soil? What are some important roles that soil plays for humans? For other organisms? Where do you think soil comes from? ● Introduce the different soil samples for the students—e.g., where they came from, what type of plants or animals were living/might live in each one. Each soil sample contains both biological and geological material, but these materials might be different between different locations. ● An example explanation: Soils form when rock materials are broken down by geoscience processes, like weathering from wind and water. These broken-down rock materials are combined with biological material | |

from plants and other organisms. The rocks and biological material provide lots of different nutrients that feed plants and decomposer organisms. Many soils provide a home for insects, reptiles, amphibians, or mammals. All soil contains both biological and geological material. However, different places on Earth have different biology, geology, and climate, and these differences create soils with different characteristics. If the class has specific materials introducing soils (textbook, handouts, key terms, etc.), refer/draw connections to those materials for this explanation.

Explore (30 mins)

- The facilitator or a student can dig up a small amount of soil from the lesson location with a soil auger or a trowel. This will serve as an additional soil sample, and will help students understand and be curious about the soil under their feet!
- Allow the students to break into groups and examine all of the soil samples.
- Encourage students to fill out the handout as they make observations and ask questions. How do the characteristics of the soils connect to where those soils came from and how they formed? What might these soils provide to plants and decomposer organisms?
- With magnifying glasses, hand lenses, or their eyes, students can examine the size, shape, organization, and color of the particles in the soil and the space between these particles.
- With their fingers, students can feel the different textures and moisture contents of the different soils.
- Once students have finished observing the appearance and texture of the soil samples, ask students to predict what will happen when water is poured on the soils. (Will it sit on top? Will it sink to the bottom? Will it soak into the soil?)
- Now, the facilitator or a student can pour a small amount of water on each sample, being careful not to overflow the cup. Students can watch what happens when water soaks into the different soils and write down their observations.

Wrap up (5-10 mins)

- Optional: each group of students can briefly present their observations on one of the soil samples.
- The instructor can lead a brief discussion. What did the students notice about the soils? Connect the students' observations to the class's

important concepts on soils: they are an important part of the cycle of nutrients in the environment, especially plant growth and decomposition. They are important for determining the movement of water in the environment. They form through geological and biological processes, and these processes create variation in the characteristics students observed.

- Can the students think of places on Earth where the soils would be very different from the ones we looked at today? Examples might be a desert, a rainforest, or the tundra. Emphasize that because these places have different geologic characteristics, organisms, and climate, they create different soils.

Optional extension activities

- If the school or neighborhood has a community garden, the instructor can organize a visit or encourage students to visit themselves. Students can think about how the soils help us grow food, and how we take care of the soil (fertilizer, water, weeding, etc.).
- Students can go on a “soils walk”, observing the different types of soil they see—in planters, on the side of the road, in grassy fields, in yards, mulched soils, composts, etc.
- Students can grow vegetable seeds or potted plants in the classroom or at home. They may wish to explore how different types of soils (different potting soils, soils with or without fertilizer, soils with or without earthworms, soils with more or less water, etc.) influence how the plants grow.
- Students can write a few sentences, a paragraph, or a lab report on what they observed about each soil, and how it connects to biology, geology, and the movement of water.
- Websites for students to visit:
 - <https://www.soils4kids.org/about/>: a website with tons of soil-related information, experiments, and even career inspiration for young students.
 - <https://climatekids.nasa.gov/soil/>: a kid-oriented discussion of how climate change is affecting soils, especially in California.
 - <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=17084>: a short article about California’s state soil.
 - <https://kidsgardening.org/garden-how-to-native-wisdom/>: a (somewhat limited) kid-oriented resource describing some of the methods Indigenous peoples have used over history to take care of the soil.
 - <https://forces.si.edu/soils/>: a website to explore a soil exhibit from the Smithsonian.

<https://www.youtube.com/watch?v=if29mjcd5bc>: a good introduction from SciShow best for younger students.

<https://www.youtube.com/watch?v=BArbrfmsxeQ>: a more detailed (still kid-appropriate) introduction to soils and a tour of soils around the world from Atlas Pro that might interest students with stronger language and science skills and/or a lot of curiosity!

Handouts

The attached handout provides a template for students to make observations about their soils. The teacher or facilitator may wish to edit the template to connect to specific key terms, concepts, or goals.

Getting our hands dirty with soils

| Observation | Soil 1 | Soil 2 | Soil 3 | Soil 4 |
|--|--------|--------|--------|--------|
| <p>Appearance: what does this soil look like? <u>You might notice:</u> color, size and shape of particles, spaces between the particles.</p> | | | | |
| <p>Texture: what does this soil feel like? <u>You might notice:</u> the soil is grainy, soft, rough, chunky, smooth, squishy, moist, dry.</p> | | | | |
| <p>Water: how does water move into or through this soil? <u>You might notice:</u> the water sits on top, sinks to the bottom, soaks in quickly or slowly, changes the color.</p> | | | | |
| <p>Connect: how is this soil connected to biology and geology? What resources might it provide to the environment? <u>You might notice:</u> visible pieces of rock, roots, leaves, moss, or even insects.</p> | | | | |
| <p>Compare/contrast: how is this soil similar to or different from the other samples? Draw on all the observations you have made above.</p> | | | | |