

Caring for the Earth

Activity Level: 4-6 Grade | Time: 60 minutes

PURPOSE

Objective: Students will determine the texture of soil and demonstrate rain drop splash to determine its impact on soil.

NEBRASKA STATE STANDARD CONNECTION

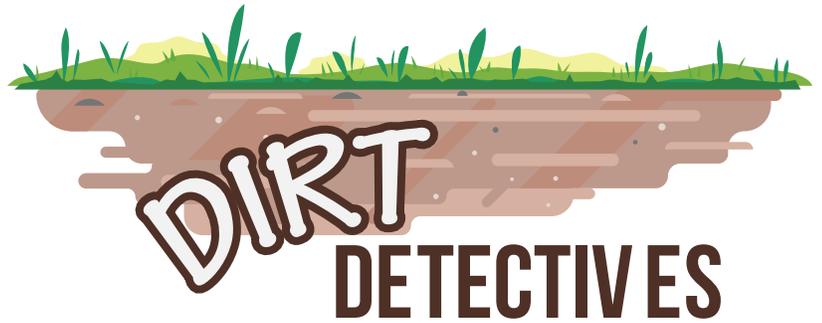
- SC.4.13.4.B Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- SC.4.13.4.D Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
- SS 4.3.3.a Identify physical processes that shape Nebraska's features and patterns (e.g., weathering, erosion).
- SC.5.3.1.A Develop a model to describe that matter is made of particles too small to be seen.
- SS 5.3.3.a Explain how physical processes shape the United States' features and patterns (e.g., weathering, erosion, plate tectonics and internal forces and climate)
- SS 8.3.2.c Analyze changes in places and regions over time (e.g., irrigation, growth of cities, Manifest Destiny)
- SS 8.3.5.b Identify and evaluate how humans utilize the physical environment (e.g., irrigation, levees, terraces, fertile soils, mechanized agriculture, changes in land use)

ACTIVITY SNAPSHOT

1. Organize and Prepare Supplies
2. Read Background Information
3. PowerPoint
 - a. Soil Scramble Activity
 - b. Dirt Shake
 - c. Target Splash

MATERIALS

- PowerPoint
- Soil scramble cards
- 4 mason jars with lids, (option, 1 jar per kid)
- Soil samples of clay, sand, silt, and potting soil. Potting soil is optional but will show organic matter. You can purchase soil samples here. agclassroomstore.com/soil-samples-soil-texture
- Ruler, 1 per group
- Splash zone target and graph, 1 per group



- Dry soil for splash zone targets, ½ tsp per group
- Eye dropper, 1 per group
- Water to fill jars and for the splash zone

WHAT'S THE CONNECTION TO AGRICULTURE?

Farmers take soil samples to understand their soil texture to ensure they are using the best practices to grow their crops. They also use various methods of conservation to protect their soil from erosion. Plants must have a good topsoil in order to grow.

PROCEDURES:

1. Organize and Prepare Supplies

See "Materials" on cover page.

Prepare supplies and set up PowerPoint.

2. Background Information

Sources: Utah Agriculture in the Classroom & (n.d.). Soil Studies: Soil Particle Sizes . Soil Studies: Soil Particle Sizes. NYSDEC Environmental Education.

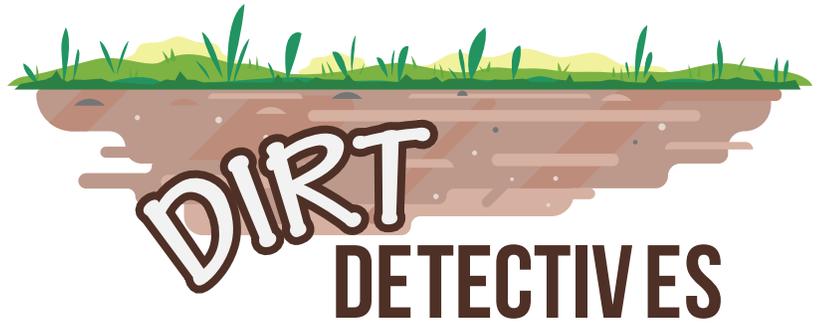
Retrieved from www.dec.ny.gov/docs/administration_pdf/lpsoilstudies.pdf

General rules about soil color:

- **Black, Black/Brown:** Dark soils have high organic matter content and are rich in nutrients for plants. These are often deep soils formed in parent materials transported by water, ice, or gravity. This includes glacial deposits and soil deposited by rivers.
- **Gold/Yellow:** Yellow soils form from certain sandstones.
- **Taupe:** These are clayey soils with low organic matter content that are formed mainly in residual materials from ancient sea beds.
- **Red:** High iron content makes soils red.
- **Cream:** These light soils have high amounts of lime and may form in wind-blown, silty material.

Soil particles are classified in 3 sizes. Sand, silt, and clay. Sand being the biggest of the three. Followed by silt, and then clay. Some clay particles are so small that ordinary microscopes will not show them. Particles larger than 2.0 mm are called gravel or stones. Most soils contain a mixture of sand, silt and clay in different proportions. The size of soil particles is important. The amount of open space between the particles influences how easily water moves through a soil and how much water the soil will hold. Too much clay, in proportion to silt and sand, causes a soil to take in water very slowly. Such a soil gives up its water to plants slowly. These soils are sticky when wet.

Size of soil particles is important for other reasons, too. It affects the ease of working the soil, what crops can be grown, and the efficiency of certain fertilizers. Sandy soils that have no fine clay or silt



particles filling the pore space cannot hold as much moisture since there is no surface area for the water to cling to and the pores are so large that the weight of the water causes much of it to run down and out of the soil. For this reason, medium and coarse sandy soils, low in clay are known as droughty soils. Crops cannot live long in them without very frequent rains. When fine soil particles fill the large pore spaces, the soil can hold more water for plants because there is more surface area for water to cling to. And since the size of the pores is reduced, the weight of the water is less and it does not run out of the soil so readily.

Vocabulary:

- Clay- The smallest of all three soil particle sizes; measuring less than 0.002 mm
- Loam- Soil that has roughly equal mix of sand, silt, and clay particles.
- Organic Matter- The dark, light weight component of the soil that is formed when leaves and other plant and animal-based materials decompose.
- Rock- The solid mineral material that forms part of the earth's surface.
- Sand- The largest mineral soil particles, measuring between 2.00 and 0.05 mm
- Silt- Medium-sized mineral soil particles, measuring between 0.05 and 0.002 mm
- Soil- A mixture of minerals, organic matter, water, and air, which forms the land surface and can support the growth of plants.
- Texture- Surface characteristics that can be seen or felt.

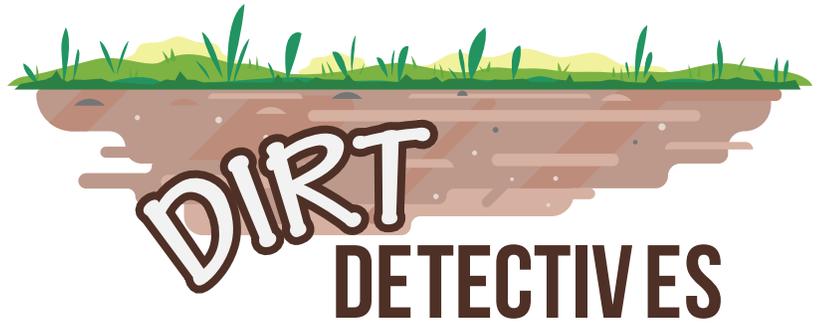
Erosion is a naturally occurring process. Erosion has given us some of our most beautiful landscapes. There are beautiful erosion formations such as the Grand Canyon and Bryce Canyon in Utah. Erosion is the loosening, transportation, and relocation of soil particles from one place to another. Erosion occurs primarily due to the action of wind and water. The rate and extent of erosion are determined by soil type and condition, slope of the land, plant cover, land use, and climate. Erosion does not occur only on wilderness landscapes, and the effects are not always positive, especially when you are talking about productive topsoil. Landslides, can bury towns and claim thousands of lives. Streams or rivers loaded with eroded soil can turn sources of clean drinking water into major health hazards.

Water erosion includes raindrop splash, sheet erosion, rill erosion, gully erosion, and slumping or mass erosion. Raindrop splash is the most obvious on bare ground during a torrential rainstorm. The raindrops strike the ground and upon impact break soil particles apart, splashing these particles into the air. The impact of raindrops can be lessened by plant cover. Plants break the fall of the raindrops and allow for water infiltration or percolation.

3. PowerPoint

Slide 1:

- What did you learn in the previous lesson, Our World with the play-doh activity?



Slide 2: Review

- How much land is in the world to grow our food and raise our livestock animals? *1/32 of the world.*
- How do farmers use technology? *GPS, drones, pivot sensors.*
- Is soil renewable or nonrenewable? *Nonrenewable.*
- Is soil important to us? Why? *Soil is the foundation for plant growth.*

Slide 3:

- Soil Scramble Activity, use the terms and definitions located at the end of this document.
- Give students a term or definition and see if they can guess which it belongs to. Help them to match the correct terms to the definitions.
- See background information under vocabulary for correct answers.

Slide 4:

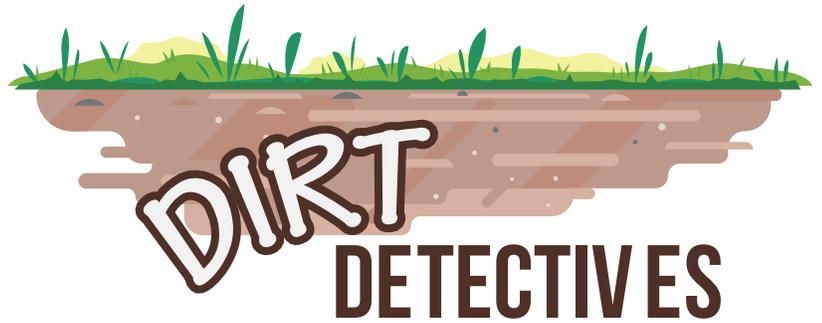
- Explain that soil is classified into three sizes. Sand, silt, and clay.
- Which one is the biggest? (Sand)
- Which is the smallest? (Clay) Silt is a little bit smaller than clay.
- Anything bigger than sand is considered gravel.

Slide 5:

- Which do you think is best for growing crops?
- Most soils contain a mixture of sand, silt and clay in different proportions.
- The size of soil particles is important.
- The amount of open space between the particles influences how easily water moves through a soil and how much water the soil will hold. Too much clay, in proportion to silt and sand, causes a soil to take in water very slowly. Such a soil gives up its water to plants slowly. These soils are sticky when wet.

Slide 6:

- Soil will water flow through the fastest? Hint it is the largest particle! *Sand.*
- Which soil will water run through the slowest? *Clay, because it is the smallest.*
- The size of soil particles is important for other reasons, too. It affects the ease of working the soil, what crops can be grown, and the efficiency of certain fertilizers.
- Sandy soils that have no fine clay or silt particles filling the pore space cannot hold as much moisture since there is no surface area for the water to cling to and the pores are so large that the weight of the water causes much of it to run down and out of the soil.
- For this reason, medium and coarse sandy soils, low in clay are known as droughty soils.
- Crops cannot live long in them without very frequent rains.
- When fine soil particles fill the large pore spaces, the soil can hold more water for plants because



there is more surface area for water to cling to. And since the size of the pores is reduced, the weight of the water is less and it does not run out of the soil so readily.

Slide 7:

- Loam soil is desired for most crops to grow. It has equal parts of sand, silt, and clay.

Slide 8:

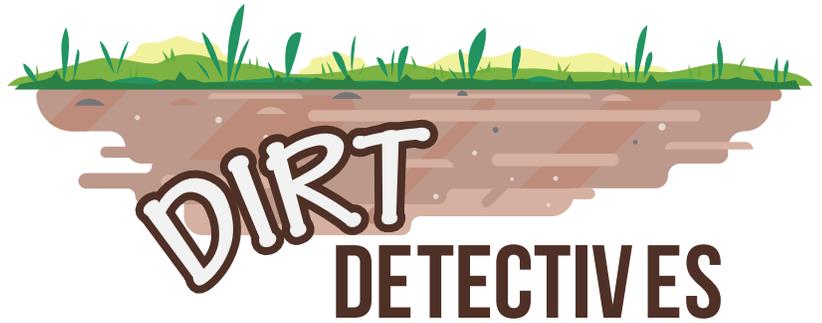
- When a soil is dry there is more air in the soil. When wet, there is very little air in the soil because the water has filled in the spaces! Some plants are aquatic and thrive in saturated soils, but many others do not. Most land-based plants need air in the soil to grow.

Slide 9:

- To determine the texture of a soil, farmers and soil scientists perform a type of “dirt shake” some times we call this a hydrology test.

Dirt Shake Activity:

1. I am going to demonstrate another way (in addition to feel) to determine the texture of soil. Soil particles are classified into three different sizes: sand is the largest particle, silt is the medium size, and clay is the smallest. In water, the largest particles will sink the fastest.
2. In order to determine the texture of each sample, measure and place two inches of each sample into its own individual jar.
3. Soil also contains air. Although air is invisible, when water is added to the soil sample, they should be able to see air bubbles rising to the top.
4. Add water to each jar so that the jar is two-thirds to three-fourths full. Point out the air bubbling to the top. The air that was held between the soil particles has been displaced, or forced out, by the water.
5. Tighten the lids and ask for student volunteers to shake the jars. Ask for another volunteer to be the time keeper.
6. Instruct students to shake the jars vigorously until all the particles have been sufficiently separated by the water. This will take two minutes. Ready, set, shake! *(Note: Soil scientists using this test shake soils for 24 hours—it can take this long to break apart some clay particles, but in the classroom you will have adequate results from a short amount of shaking.)*
7. After two minutes, have the students set the jars down. The time keeper should keep timing. Allow the soil to settle for one minute, and then measure the amount of soil on the bottom of the jar. This is the sand—the largest mineral particles in the soil.
8. The next layer to settle will be the silt. This can take three to four hours to see. Clay particles will be the last to settle and may take a day or more to form the last layer (some very clayey samples could take a week or more).
9. A soil scientist will be able to use the measurements to determine the actual soil texture, but for young students, just seeing the differences will be meaningful. *(Note: If you purchased clay, silt, and sand samples, the greatest layer distinction will be in the “garden” loam soil jar because the other*



samples are fairly pure.)

10. Your students may observe “stuff” floating on the surface of the water. This “stuff” is the “onceliving” component of the soil—the organic matter. If you make a dirt shake out of potting soil from a bag you will notice that the entire sample will float. Why? Because there are no mineral particles, just organic matter!
11. Explain that the texture of the soil affects how it holds water. A soil with very small (clay) particles holds a lot of water. A soil with large (sand) particles lets the water drain through very quickly. Texture affects what kinds of plants will grow best in the soil. All plants need water to grow, but some need more than others.
12. Set the jars aside and observe from time to time or at the beginning of each lesson to see if you can see any clay settle.

Slide 10:

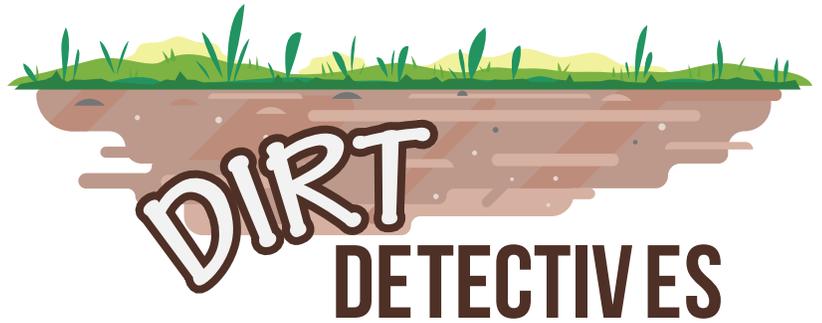
- How were these land forms were created?
- These were created over many years through erosion. What is erosion? Explain that erosion has given us some of our most beautiful landscapes.
- There are beautiful erosion formations such as the Grand Canyon and Bryce Canyon in Utah. Erosion is the loosening, transportation, and relocation of soil particles from one place to another. Erosion occurs primarily due to the action of wind and water.
- The rate and extent of erosion is determined by soil type and condition, slope of the land, plant cover, land use, and climate. Erosion does not occur only on wilderness landscapes, and the effects are not always positive, especially when you are talking about productive topsoil.

Slide 11:

- We have wind erosion, water erosion, streambank erosion, sheet erosion, rill and gully erosion.

Slide 12: Splash Zone Activity

1. Divide the class into groups or partner up.
2. Give each group a Splash Zone Target, eyedropper, and a small container of water.
3. Instruct student to put enough soil (about ½ teaspoon of dry soil) in the center of their target to just cover the center circle.
4. Fill the eyedropper with water.
5. Hold the eyedropper about 18 inches (or 46 cm) above the soil sample.
6. Drop 5 drops of water directly onto the soil sample. If a drop misses the soil, continue until 5 drops hit the soil.
7. Record the number of water “splashes”—drops containing soil—in each zone.
8. Complete the graph to show your results.



9. Discuss the following questions:

- What did you observe? How did the soil particles move from the center of the target? (they were picked up and moved with the water)
- Which zone contained the greatest number of water drops with soil particles? Why?
- Which zone contained the least number? Why?
- What would happen if the drops were larger? (splashes would travel further)
- How might you prevent splash erosion? (plant vegetation, cover the soil with mulch)
- How do farmers decide which erosion control methods to use? (it depends on the slope, soil types, and what he or she wants to plant)

10. This activity represents a light rain shower. Now hold the eye dropper 24-30 inches above the soil sample.

11. Drop 5 drops of water directly onto the soil sample. If a drop misses the soil, continue until 5 drops hit the soil.

12. This represents what would happen in a heavy rain storm. Having a way to prevent soil erosion is important especially when it comes to growing crops.

Slide 13:

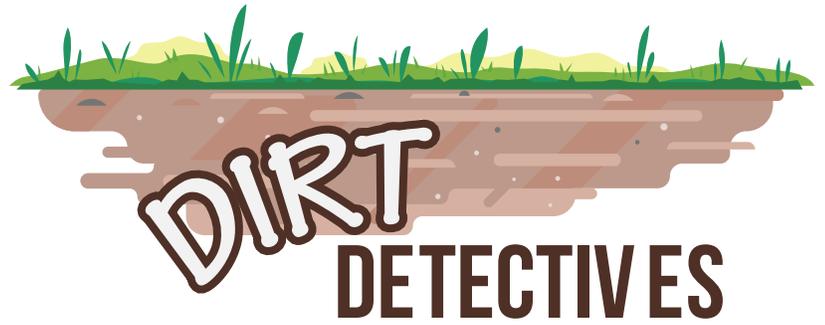
- How could we prevent soil erosion? *Through practices such as contour planting, terraces, by planting forest or grass areas, or trees for wind break.*

Slide 14: Next Lesson

- We will discuss traits. Traits are characteristics that are passed down from one parent plant to an offspring plant.

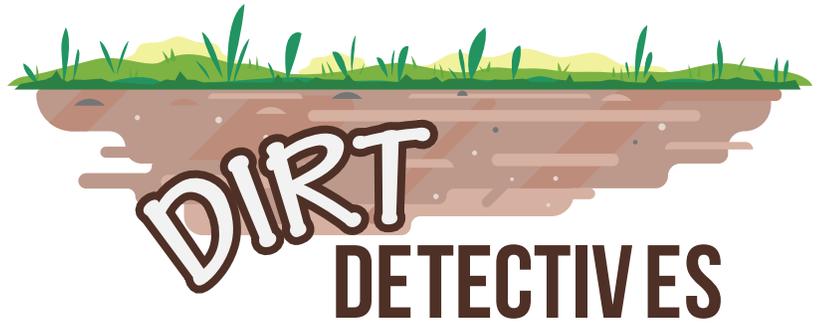
Review:

- Ask students to get out their scientific journal.
- What have you learned from today's lesson? Write down key concepts and ideas that will help us solve our problem: how we grow more food with less land?
- Brainstorm new ideas and ways to solve this problem and write it in the ideas box.



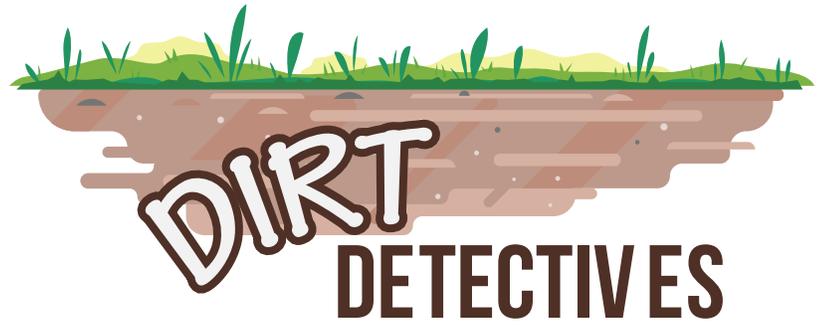
CLAY

LOAM



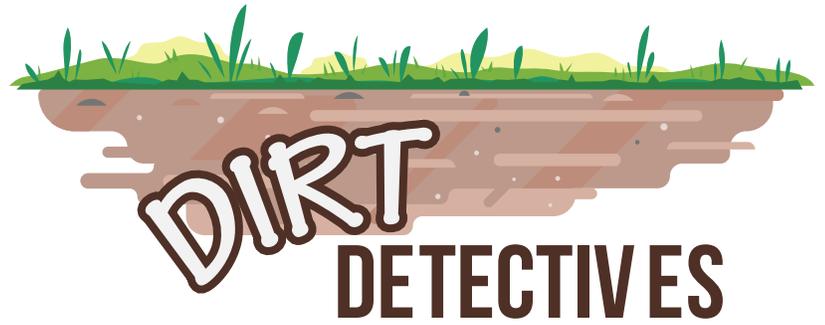
ORGANIC MATTER

ROCK



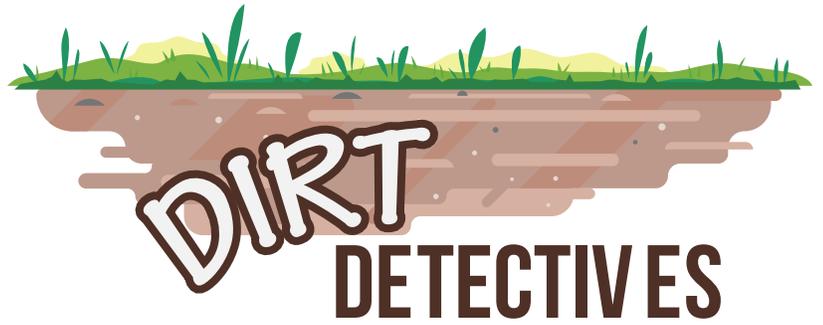
SAND

SILT



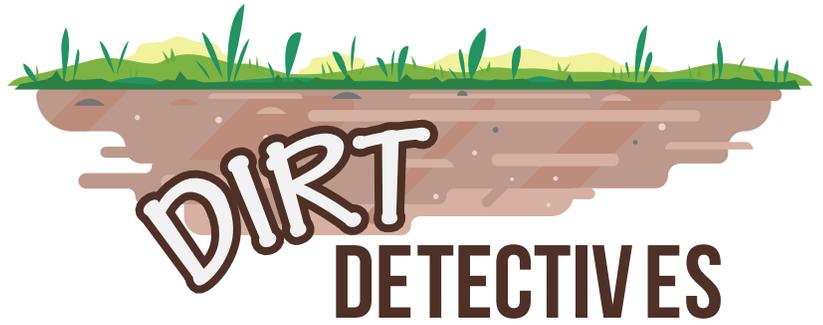
SOIL

TEXTURE



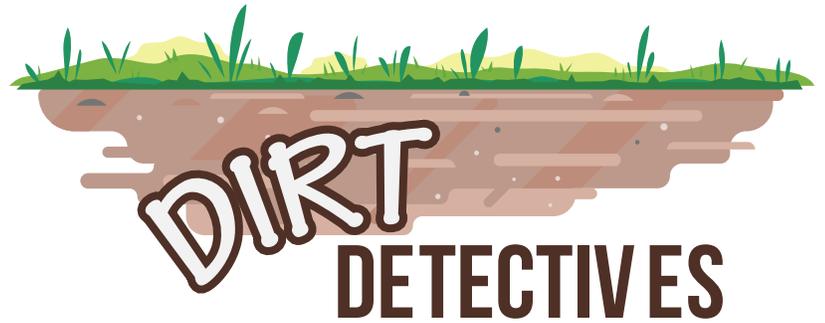
The smallest of all three soil particle sizes; measuring less than 0.002 mm.

Soil that has roughly equal mix of sand, silt, and clay particles.



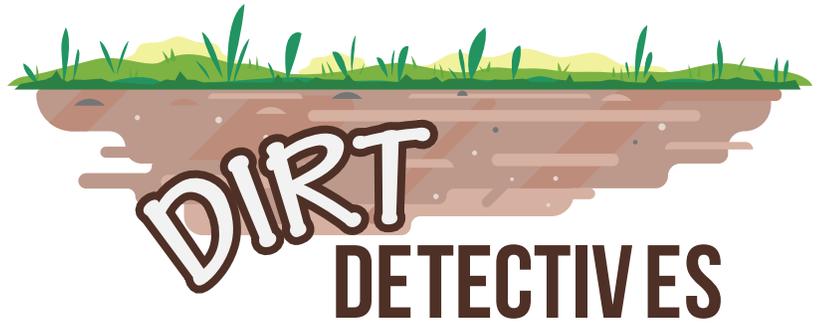
The dark, light weight component of the soil that is formed when leaves and other plant- and animal-based materials decompose.

The solid mineral material that forms part of the earth's surface.



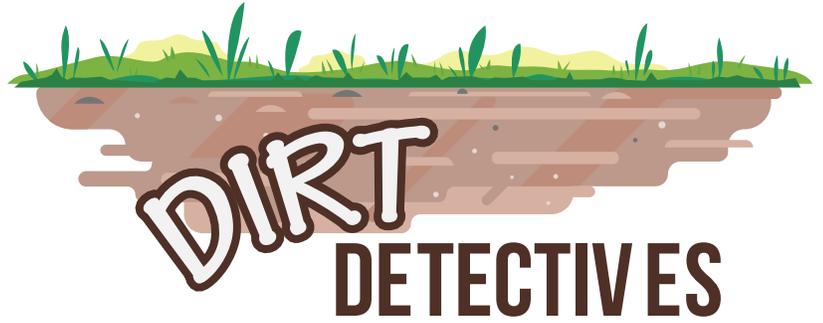
The largest mineral soil particles, measuring between 2.00 and 0.05 mm.

Medium-sized mineral soil particles, measuring between 0.05 and 0.002 mm.

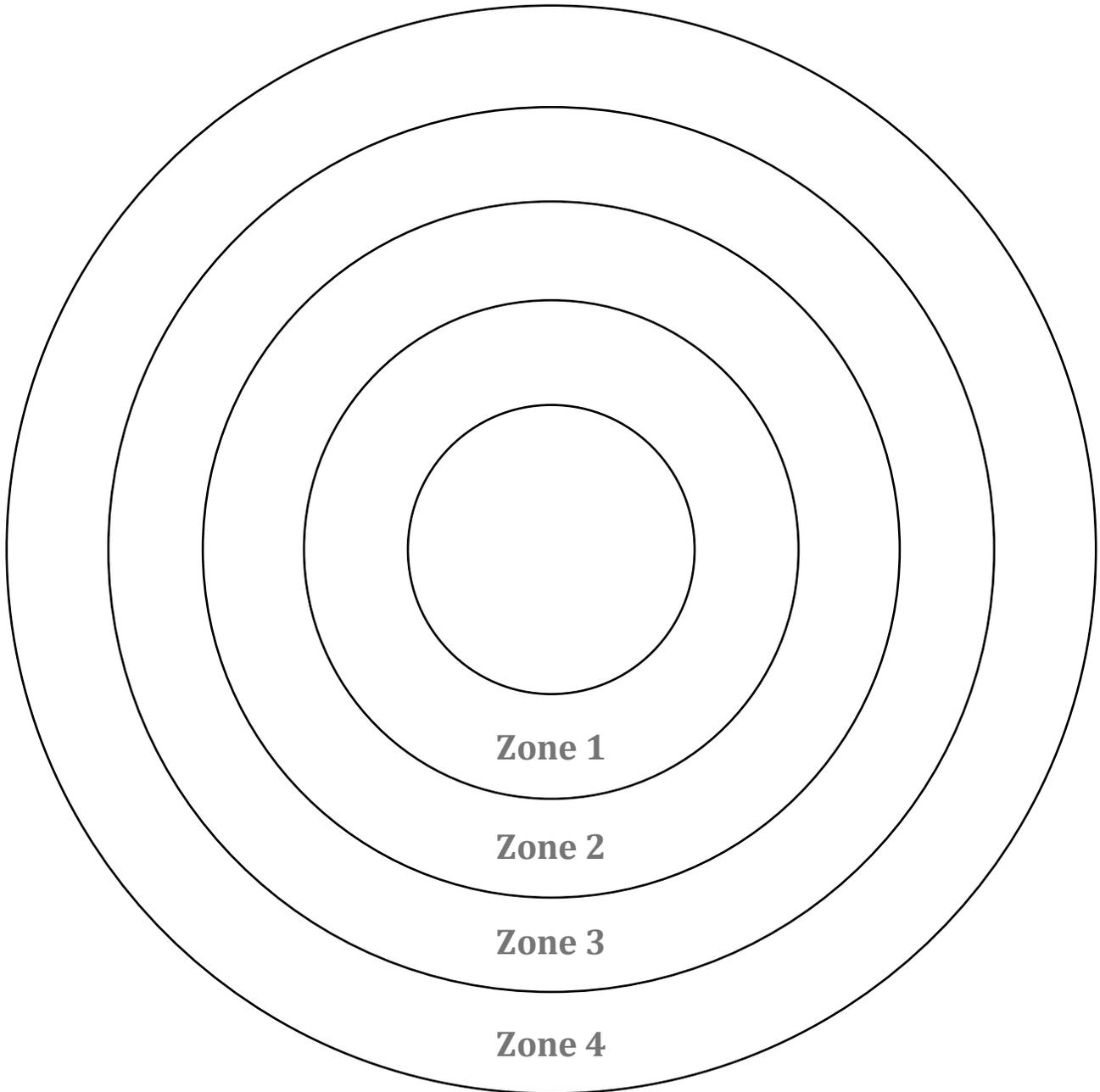


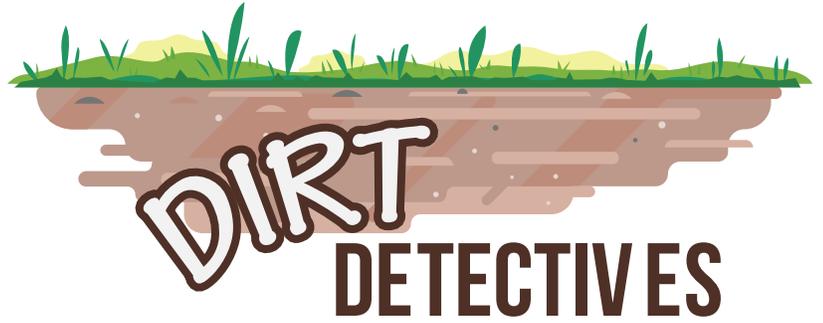
A mixture of minerals, organic matter, water, and air, which forms the land surface and can support the growth of plants.

Surface characteristics that can be seen or felt.

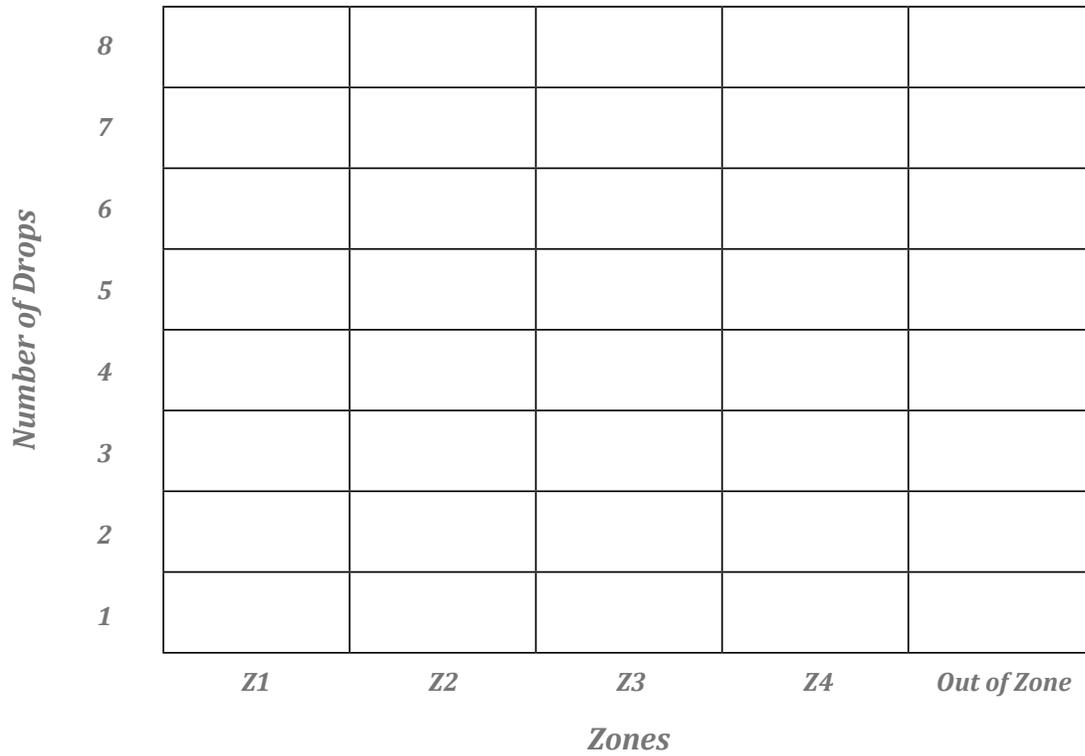


Splash Zone Target





Splash Zone Graph



Raindrop Splash

