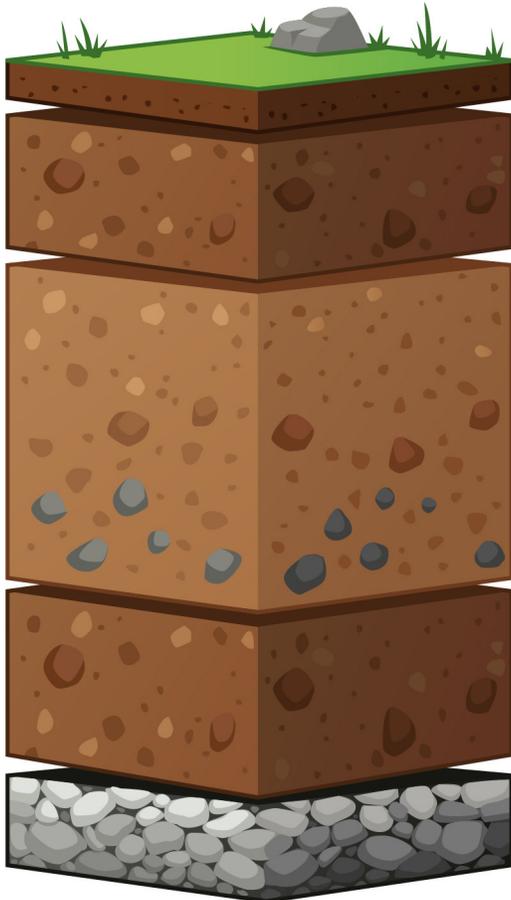




**Level 3**  
**Grades 4-5**

## Intro Story

There's a habitat all around us that we don't often think about. It's not above us but right under our feet. It's the soil! Healthy soils are part of a healthy life for humans, plants and animals. Soil plays an important role in energy cycling (think: food chains) and is habitat for many organisms. Humans interact with the soil, especially farmers and ranchers. People often have to design solutions to keep soil healthy and intact. Read on to dig in to soil science and some fun soil facts.



## Did You Know?

A quarter of the Earth's species are found in soils! This includes critters like small mammals, worms, fungi, and bacteria. Scientists are still learning about and discovering organisms that live in soil!

We rely on soils for food. In fact, 95% of food production relies on soil!

Soil has multiple layers, or horizons. These include organic material, like decaying leaves, the topsoil, the eluviated horizon, the subsoil, parent material, and bedrock. Food is produced in the topsoil.

Healthy soils can help the environment! Soil that's in good shape can prevent floods and mitigate drought because they store water.

Soil has three main particles: silt, sand and clay. These particles can combine in different ways to form different types of soils.

Many states have a state bird, flower, fossil or rock. But did you know that they can also have a state soil? This can include a soil that is unique or significant to each state.

## My State Soil

Using a computer or smart phone, find out what your state soil is!

I live in \_\_\_\_\_.

My state soil is \_\_\_\_\_.

A fun fact about this soil is \_\_\_\_\_.

## Meet a Soil Health Champion!

Meet the Sims Family! The Sims have been living on the land for five generations and they currently own and operate the Sims Cattle Company. Their ranch is 26,000 acres and supports 1,000 cows! In addition to cattle, the Sims harvest forage.

When thinking about their ranch, they make sure to keep soils in mind. The Sims work hard to preserve their soil and consider the whole ecosystem, including the water cycle, the mineral cycle, energy flow and community when they make decisions.

Because of their management techniques, they have increased the diversity of plants on their ranch, which has improved soil health and the health of their cattle. Through their dedication, the Sims have improved both their operation and the environment around them.



## Energy Moves Through Ecosystems

Every living organism is either a producer or consumer.

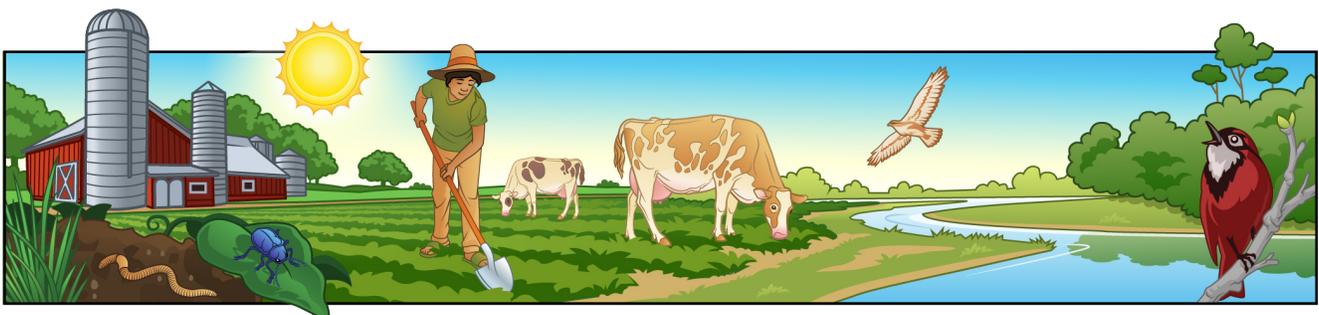
Producers make their own food. They do this by using light energy from the sun, carbon dioxide from the air and water from the soil to produce food.

Can you think of a producer? Draw one below!

Consumers cannot make their own food, so they eat plants and/or animals. There are three types of consumers. Herbivores eat only plants. Carnivores eat only animals. Omnivores eat plants and animals.

Draw a consumer below!

How are producers and consumers connected to each other? Check out this picture below and draw arrows to show how producers and consumers interact with each other and how they transfer energy. Where do you think this energy comes from?



# Soils - A Hidden World Beneath Our Feet

Soil forms a complex environment. The component parts of soil are:

**Sand:** The largest type of soil particle. You can feel individual grains of sand with your fingers and see them with your eyes, but they are still pretty small! An individual sand particle can range from 0.05 to 2.0 mm.

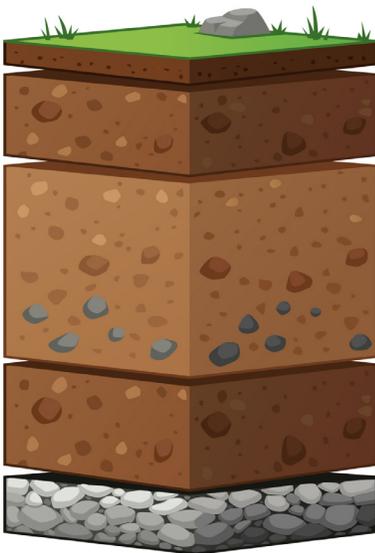
**Silt:** Time to grab a magnifying glass! You'll need it to identify a silt particle since they are 0.002 and 0.05 mm wide. Silt is fine and feels powdery.

**Clay:** The smallest particle of them all! Clay particles are less than 0.002 mm in diameter.

Which of these do you think will hold water or nutrients best? Why?

Different soils contain different amounts of sand, silt, and clay. When you hold a handful of soil you can feel its texture. It may be coarse or fine, dry or wet, lumpy or smooth, due to the amount of these particles.

Soil scientists may study the composition of soils or the soil horizons (layers.) See if you can identify each soil horizon.



O (organic) - matter including things like decomposing leaves. Not present in every type of soil.

A (topsoil) - includes minerals and organic matter. Where many plants and organisms are found.

E (eluviated) - mostly sand and silt particles. Found mostly in older soils and forest soils.

B (subsoil) - full of minerals that have moved down from other horizons. Roots from plants can be found into this horizon.

C (parent material) - the deposit at the Earth's surface where the soil developed.

R (bedrock) - mass of rock that forms the parent material of some soils.

Soil is truly a foundation of life on Earth. It's where crops and other plants grow and provides them with nutrients. Soil filters water and air. And, it's home to many organisms. Soils also support roads and buildings. If we take care of the soil it will help take care of us!

# How Much Soil Can We Use?

95% of food production depends on the Earth's soils! Soil is an important natural resource and we depend on it, along with other organisms. But, how much soil do we have?

Go ahead and take a guess! What percentage of the Earth can be used for agriculture (growing crops)? :

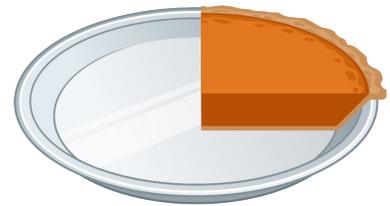
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Let's figure it out!



Here's a delicious pie. It represents the Earth.

$\frac{3}{4}$  of this pie is oceans! These slices have got to go. This leaves  $\frac{1}{4}$  a slice of Earth!



$\frac{1}{2}$  of this slice represents deserts, swamps, and regions that are too cold or mountainous to grow crops. We're left with  $\frac{1}{8}$ th of the pie.

This slice has to be cut up even more! This slice represents habitable land, where people can live and grow crops. We can cut this into 4 very small slices. One slice represents land developed by people for our homes and infrastructure. One slice is land that is habitable, but may be too wet for food production, it could flood during some seasons. One slice represents places that are too hot to grow crops. Another represents land that is too rocky for food production. So, where can we grow our food?



If you cut off a small piece of crust, about 3% of the total pie, you'll have a representation of the part of Earth where we can produce food. Soil is an important natural resource, just like air and water. How do you think we can protect our soils?

# Design Your Farm!

Farmers and ranchers have a limited amount of land to work with, since soils are an important natural resource. If you were a farmer, how would you design your patch of land? Here are a few things to consider:

1. Planting cover crops. Cover crops are plants that can protect and put nutrients back into the soil, they aren't grown for food. They can also help slow erosion!
2. Rotating crops. This is when farmers plant different crops on the same patch of land at different times of the year. This keeps soil healthy by ensuring that soils stay nutrient rich, since not all the same nutrients are being used with each crop.
3. Keeping soil intact. Tilling is a process that breaks up the soil to make it easier for crops to grow. But, breaking up soils means that they may be washed away by rain or blown away by the wind. Keeping soil intact by having no till fields keeps soils in place and keeps moisture in the soil.
4. Using buffer zones. A buffer zone is an area of vegetation between fields that are used to grow crops. Sometimes they are also near streams and lakes. These green spaces can keep soils in place and out of bodies of water.
5. Will your farm have other animals? These might include cows, goats, chickens, ducks or even bees!
6. What's the climate of your region? Do you experience all four seasons or is it more temperate?
7. What kind of structures are on your farm?

Draw your farm and write about why you chose to design it this way!

# Word Search, Fill In The Blank & Word Bank

Fill in the blanks in the sentences with words from the Word Bank. Next, find the words in the puzzle and circle them.

## Word Bank

SAND	RESOURCES	NUTRIENTS
FARMER	WATER	CROPS
TOPSOIL	COVER	CARNIVORE
FOOD	HERBIVORE	SOIL
RANCHER	CLAY	EROSION
SILT	HORIZONS	OMNIVORE
PRODUCTION	CONSERVATION	ROOTS

D B A N W H D Z D N Q Z O Q H  
L M A O P O P L I O S A M D B  
F Y S I I R G O P I I R N R R  
A G P T T I C R L T P E I P A  
R M O C Q Z L T W A C S V L N  
M Z R U S O A H E V O O O I C  
E C C D T N Y R S R V U R O H  
R V W O N S O T M E E R E S E  
I Y J R E V O L H S R C D P R  
V T V P I O R Y B N T E O O B  
T N I B R E K Q R O W S O T X  
C L R G T S E U I C L D F C Q  
R E I A U P T G H X G N N U S  
H U W S N G E R O V I N R A C  
R G T N O I S O R E R E R D S

The three parts of soil are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

Plants absorb \_\_\_\_\_ and other \_\_\_\_\_ from the \_\_\_\_\_ through their \_\_\_\_\_.

\_\_\_\_\_s and \_\_\_\_\_s grow crops and raise livestock to provide us with food to eat.

It is important to practice \_\_\_\_\_ habits to protect our natural \_\_\_\_\_.

The layers of soils are called \_\_\_\_\_.

A \_\_\_\_\_ eats only plants, a \_\_\_\_\_ eats only animals, and an \_\_\_\_\_ eats both plants and animals.

\_\_\_\_\_ includes organic matter and minerals, it's where most plants are found.

95% of \_\_\_\_\_ depends on Earth's soils.

Farmers may plant \_\_\_\_\_ to keep soils healthy and prevent \_\_\_\_\_.

# Mad Libs

## A Day on the Farm

\_\_\_\_\_ (Name) arrived on the farm for the first day of \_\_\_\_\_ (plural noun). The day had just begun and they wanted to get as much \_\_\_\_\_ (verb) done before the \_\_\_\_\_ (noun) got too \_\_\_\_\_ (adjective) for \_\_\_\_\_ (verb, -ing).

They started the difficult task of \_\_\_\_\_ (verb, -ing) but then heard the \_\_\_\_\_ (noun) calling \_\_\_\_\_ (adjective) from the barn. It turns out that \_\_\_\_\_ (Name) needed a \_\_\_\_\_ (verb) to help them with planting because the soil was too \_\_\_\_\_ (adjective.)

Working together, they \_\_\_\_\_ (verb) and \_\_\_\_\_ (verb) until the sun went down and the \_\_\_\_\_ (noun) went up. They were so \_\_\_\_\_ (adjective) after a long day of work that they \_\_\_\_\_ (adverb) went home to eat.

The next day, to their \_\_\_\_\_ (adjective) the \_\_\_\_\_ (noun) had already started to grow! The soil must have had so much \_\_\_\_\_ (noun)! They knew exactly what they had to do!

They harvested their \_\_\_\_\_ (adjective) crop and headed to market to sell them for \_\_\_\_\_ (number amount). The people at the market \_\_\_\_\_ (adverb) bought their whole harvest! The farmers went back to their \_\_\_\_\_ (plural noun) hoping they could do it all again the next day.

