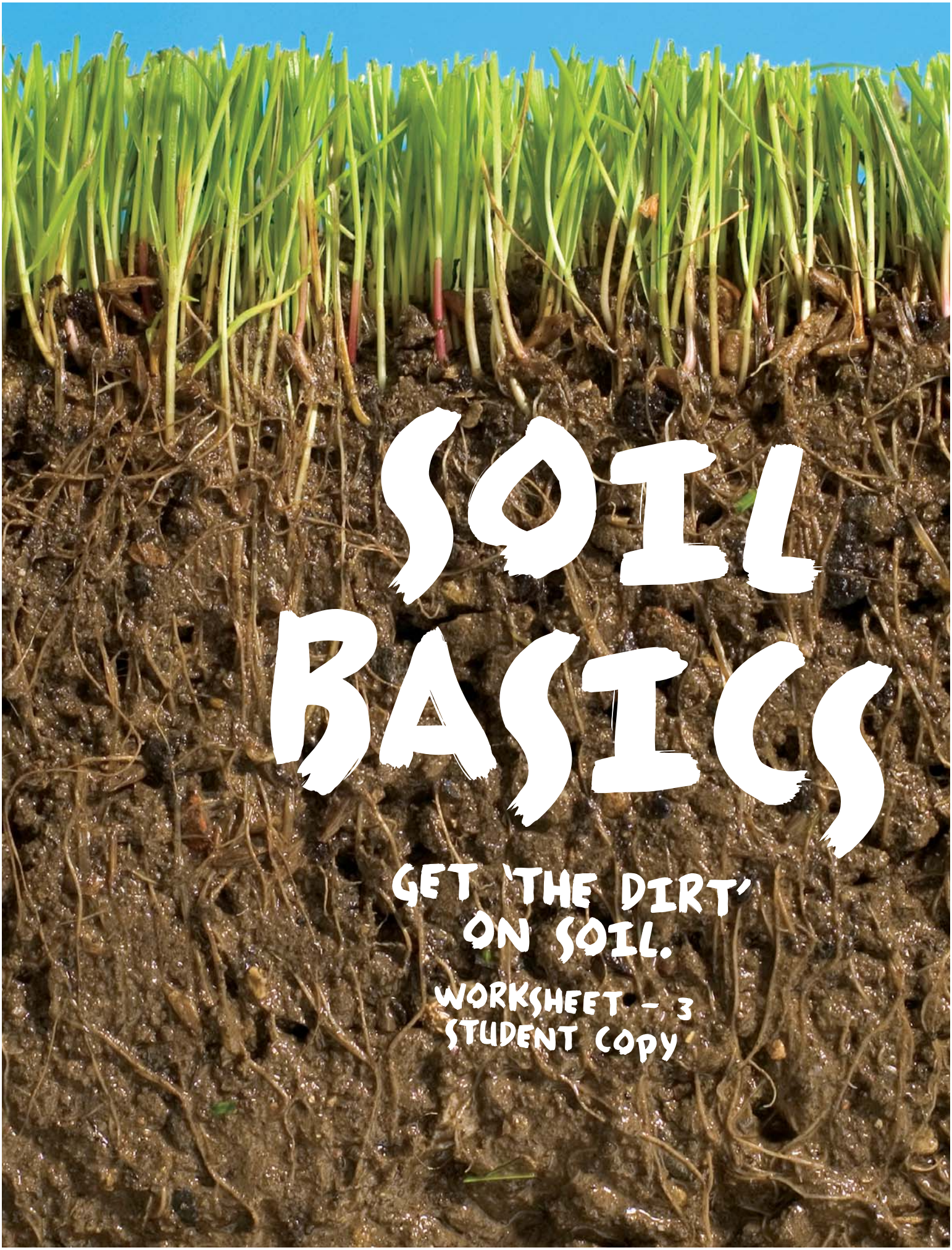


# SOIL BASICS

## GET 'THE DIRT' ON SOIL.

WORKSHEET - 3
STUDENT COPY

There is a rainbow of soil under our feet;
Red as a barn and black as a peat.
It's yellow as lemon and white as the snow.
So many colors are hidden below.

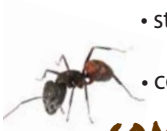
Modified from: A Rainbow of Soil Words (by F.D. Hole, 1985)

We refer to all earth as soil but you are learning that soils can be quite different. They come from a variety of parent materials. They can differ in age, form and nutrient levels. We also know the plants and animals that live and die on soils affect how they function. So let's get down to the specifics, let's burrow deeper into the earth and take a closer look at soil basics.

## Classifying Soils:

There are tens of thousands of different types of soil around the world. How do we group them? Soil scientists classify soil using three main characteristics:

- texture
- structure
- colour



## Something to Think About:

In Canada, we use almost all of the land we have available for agriculture to grow food. The rest of it supports cities, parks, forests and areas that might not be as productive for growing. This means there isn't much additional space to build new farms. But like other countries, Canada's population is growing and there is more demand for food and products made from plants. We also need more space to build homes, schools landfills and parks to serve the larger community. Which takes priority, building or growing?

## Soil Texture: Soil and Baseballs?

There are four main ingredients in soil: sand, silt, clay and organic matter. Let's call the first three ingredients particles. Sand is the largest of the mix, followed by silt with clay being the smallest. To get an idea of the size of each particle think of it this way: If sand was the size of a basketball, silt would be a baseball and clay would be smaller than a golf ball.

The size of the particles is important because it tells us how much room is in a particular soil for air, water, bacteria and other living things like plant roots. It also tells us whether the soil will be a good storage house for water and nutrients. For example, sand has large particles that leave a lot of room for air and water. The down side is that there is nothing to trap the water and it slips right past the roots. For the same reason sand does not hold nutrients very well. Plants prefer a soil that has some sand as well as silt and clay particles.

## What About Clay?

At the other extreme, the tiny particles of clay pack together so tightly that they can limit the amount of water and air in the soil. Plants growing in a clay-based soil might feel as if they are growing in cement because clay is packed so tightly around them. If the plants cannot spread their roots to gather water and nutrients, this soil could affect their ability to grow and produce food.

A clay-based soil may not be great for a garden but it makes a great liner to hold things. A good example on how it could be used effectively would be a to hold a pond or garbage dump.

So, the different amounts of sand, silt and clay that are in the soil are important. The mix is known as soil texture. Perfect texture is a soil that contains a balance of sand, silt and clay. This mixture is called loam soil.

Soil texture should be an easy term to remember because sand, silt and clay all feel different when you rub them between your fingers. Use the chart on the next page to learn about all three.


| | SAND | SILT | CLAY |
|---|---|---|---|
| SIZE OF PARTICLES | Largest<br>0.05 to 2 mm<br>(visible to the eye) | Mid-sized<br>0.002 mm to 0.05 mm<br>(may need a microscope to see) | Smallest<br>Less than 0.002 mm<br>(will need a microscope to see) |
| SPACES BETWEEN PARTICLES | Has large spaces between the particles allowing water to slip though | Spaces are smaller and will hold water and nutrients fairly well | Spaces are very small and will trap water |
| WHEN WET, IT FEELS... | Loose, gritty and rough like sandpaper | Smooth and slightly sticky like silly putty | Smooth and sticky like glue |
| WHEN IT IS DRY... | The particles are loose | It feels like baby powder | It is hard like cement and can crack at the surface |
| WHERE WOULD YOU FIND IT? | Beach side | Along the river bank | At the bottom of a river |
| HOLDS WATER AND NUTRIENTS | Lots of room for air and water but water and nutrients quickly slip through the particles beyond the plant's reach | The smaller particles hold water and nutrients better than sand | Lots of water but not as much room for air. Plants in a clay-soil could suffocate |
| PLANTS IN THIS SOIL MIGHT... | Not get enough water and begin to wilt | Get better access to nutrients that are in the soil | Feel like they are growing in cement preventing their roots from accessing nutrients |

## SOIL STRUCTURE:

Another indicator of soil is its structure. Soil structure is the arrangement, or grouping of sand, silt and clay particles in the soil. These particles are glued together by organic matter to form larger shapes that can be identified in the soil. These shapes can look like crumbs, plates, blocks, prisms or columns. How the shapes are positioned is important in understanding how water, air and roots move through it. A tightly packed structure is said to have a higher density because it has less open space for air and water.

While you can't easily change the texture of the soil, you can change its structure to improve growing conditions for plants. This would happen at the surface when you rototill or turn the soil in your garden. Some plants will change the soil density for you like carrots, canola and clover. These crops have strong roots that push through the tightly packed soil and make room for themselves. When they are harvested they leave more space in the soil for the next crop.

## SOIL COLOUR:

Soil colour is the most obvious way to learn about a particular soil. It can tell us how old the soil is, where it sits on in the landscape, the type of materials that formed it, how warm it might get, and how it handles water. Colour will tell you a lot about whether plants will grow well in the soil.

When classifying soil by colour, soil scientists look at three things:

1. Hue – the actual colour of the soil - red, yellow, grey, brown, black
2. Value – the richness of that colour or how much light is reflected
3. Chroma – the purity of the colour. Pure colours rarely occur in soils. Most often the colour of the soil is cloudy.

By learning to read the soil clues you have new power. You could discover how soils might be used to affect climate change. You could figure out how to get the most from soil and produce enough bio-energy to heat a city. Most importantly, you can understand how to assign the land according to its best use.

# SOIL HUES

### RED

Red soils received a lot of iron from their parent material. They are found in humid environments that have long periods of dry weather. These conditions make the soil actually rust!

### YELLOW

Yellow soils are similar to red soils but remain wet and humid most of the time. They are often found in the tropics and are known to be very old.

### GRAY

Gray soils tend to be found in wet and colder environments such as a swamp and forested areas.

### BROWN TO DARK BLACK

Darker soils are thought to be better for growing than lighter soils. The blacker the soil the better. Their colour tells us how much organic matter it contains.

An average soil sample is 45 percent mineral matter, 25 percent water, 25 percent air and 5 percent organic matter.

## 90,000,000,000 to 1

A single gram of coarse sand would have approximately one thousand particles. In comparison a single gram of clay would have approximately ninety billion particles!

# ORGANIC MATTER: THE SOIL IS AN AVID RECYCLER

Organic matter is one of the 5 soil forming factors but is also important throughout the life of a healthy growing soil. Organic matter forms when plants and animals live and then die on the land. Compost and manures also add to organic material because they are from plants, or waste from animals that eat plants. The soil breaks this material down and supplies nutrients to the soil, which are then available to plants to start the cycle again.

## ORGANIC MATTER IS ESSENTIAL BECAUSE IT:

- glues particles together allowing them to hold more water and nutrients
- provides food for soil organisms that keep the soil healthy
- prevents the surface from crusting and allows seeds to take root
- is a source of nutrients for plants to be healthy and resist disease



## INTERESTING FACT:

Practices that increase soil organic matter also increase the soils' ability to store carbon. Not only does this help us reduce carbon emissions and possibly reduce their affect on global warming, but it also provides a good growing medium for crops to grow and produce nutritious food for us to eat.

## INTERESTING FACT:

We need approximately one acre of land for each person in the world to supply them with the food they need to be healthy. Think about how much land we need to feed populations today and how much we'll need five years from now. Look up the world population clock on the Internet and see the increases every minute!

COMPOST AND MANURES ALSO ADD TO ORGANIC MATERIAL BECAUSE THEY ARE FROM PLANTS.

# SOIL EXERCISE

UNSCRAMBLE THE WORDS BELOW AND USE THEM TO COMPLETE THE SENTENCES!

GRICANO ERWTA LACY DASN GUEL TISL TAMTER IOSL TIPRACLE ETUXRET

1. Compost adds partially decomposed _____ _____to the soil. This acts like a _____ to hold the particles together.
2. What type of soil would be best for a water treatment site? _____.
3. Which soil particles allow water to pass through quickly? _____.
4. Soil is composed of a range of _____ sizes including _____, _____ and _____.
5. Soil with a lot of _____ may be more prone to wind and water erosion.

## CONSIDER THE FOLLOWING:

A company has been contracted by a city government to find a place for a dump to serve the people who live in the area. The company approached a farmer who was looking at retiring from farming and selling his land. They are willing to pay the farmer a high price for his land.

What are the advantages for the farmer if he sells this land?

What are the disadvantages?

What are the concerns of the farmer's neighbours?

What issues would need to be researched before any agreements are made?

Who is responsible for costs related to this research: the farmer, the company wishing to purchase the land or the City? Why?

We need to grow food and we need a place to store and recycle waste. Write a short paragraph on what solutions might exist to accommodate both needs based on the limited amount of space we live on.

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