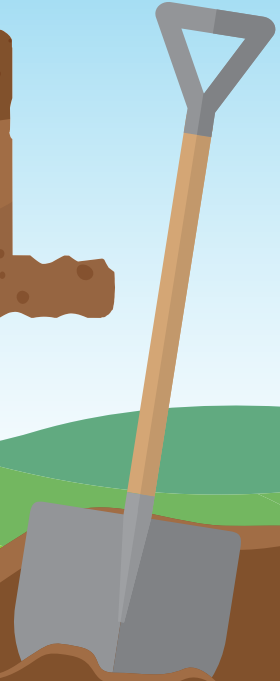


DIG



into

SOIL



**Activity
Book**



CANADA

Acknowledgements



Dig into Soil gives youth across Canada the opportunity to learn about the “Climate Action” and “Life on Land” United Nations Sustainable Development Goals and explore their role in supporting sustainable soils. This unique learn-at-home program would not be possible without the dedicated support of our partners.

FOUNDING PARTNER



Dig into Soil encourages 4-H'ers to understand and appreciate the importance of healthy soils. This unique learn-at-home program would not be possible without the commitment of Syngenta Canada, a long-time supporter of 4-H Canada. For more information about Syngenta Canada, please visit www.syngenta.ca.

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You'll notice there are links to videos and other information throughout this activity guide. Please download the digital version of Dig into Soil for easy access to these links!

Download and learn more at 4-h-canada.ca/dig-into-soil

Introduction



Hello!

We're so excited that you are joining us for Dig Into Soil! This is an opportunity for you to learn about an interesting topic, participate in activities (including the materials to start composting) and have some 4-H fun in your own home.

Throughout this activity book, you will find everything you need to know about soil conservation and climate action, along with a bunch of hands-on activities, and the supplies to start your own composting project. We hope that you achieve these learning goals:

- Understand the importance of healthy soils
- Learn about the United Nations' Sustainable Development Goals (SDGs), and their impact on the world
- Learn about soil conservation and health
- Develop skills in conducting soil experiments and activities
- Identify the ways you can help to address soil health - at home, in your community, or around the world!
- Champion soil conservation and create awareness about the importance of healthy soils

This kit contains:

- Dig into Soil Activity Book
- Soil Triangle Sheet
- Supplies for activities, including
 - » Bean seeds
 - » Trowel
 - » Gardening gloves
 - » Compost bin
 - » Magnifying glass

We wanted to grow the opportunity for youth to get involved in 4-H programming by making this kit available across Canada to 4-H members, families, and even youth who aren't yet members! For those of you who may not be familiar, at 4-H we believe in nurturing responsible, caring and contributing leaders who are committed to positively impacting their communities. We provide hands-on learning for youth across the country thanks to the support of volunteer leaders. To learn more about us, check out our programs at 4-h-canada.ca!

We hope you enjoy this opportunity to understand the importance of soils, learn how to keep our soils healthy and have fun! Take a minute to share your experience with us by tagging [@4hcanada](https://www.instagram.com/4hcanada) on Instagram, Facebook, or Twitter.

Happy 'Learn To Do By Doing'!

The 4-H Canada Team

What are the Sustainable Development Goals?

The Sustainable Development Goals (SDGs) are global goals developed by the United Nations. The United Nations is an international organization that encourages nations to protect peace, security, and work well together. The SDGs were agreed to by all 193 member nations, including Canada. Each nation is working to achieve these 17 goals, which deal with poverty, health, education, and the environment.



When setting a goal, it is always valuable to look to the future - what will it look like when the goal is achieved? How long will that take? Is it realistic? In 2015, the United Nations developed these goals and laid out what they wanted the world to look like in 2030.

EXPLORE THE 17 SDGS
You can learn more about what the 17 goals are at sustainabledevelopment.un.org

Digging deeper

What is a long-term goal you've set for yourself? Maybe it was to develop a new habit or achieve something important to you. How did you work toward that goal? Were there little steps, or a big effort all at once? How did you know when you achieved it?

.....

.....

.....

Consider the SMART template for setting your own goals!

Specific S G	Measurable M O	Achievable A A	Realistic R L	Timely T S
What do you want to do?	How will you know when you've reached it?	Is it in your power to accomplish it?	Can you realistically achieve it?	When exactly do you want to accomplish it?

DIG into SOIL

These are the goals the United Nations set:

SUSTAINABLE DEVELOPMENT GOALS



For Dig into Soil we are focusing on SDG 13: Climate Action and SDG 15: Life on Land, which have the following goals:

 <p>13 CLIMATE ACTION</p>	TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS
 <p>15 LIFE ON LAND</p>	PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

These two SDGs are linked, as the health of life on land is impacted by climate change. Our global climate is changing in ways that produce extreme weather, higher average temperatures, and changing patterns in our seasons. These changes to our climate, and the impact of human activity, put stress on the environment and make it harder for these ecosystems – including plants and animals – to remain healthy.



SOME KEYWORDS IN THESE GOALS:

SUSTAINABLE – to keep up, maintain or protect

ECOSYSTEM – a community of living plants and animals and their relationship with nonliving parts of the environment, all connected within a system

DEGRADATION – wearing down, lowering the health or quality

DESERTIFICATION – where the health of soil is lost because of things like climate change and human impact, cause soils to become dry and lose nutrients

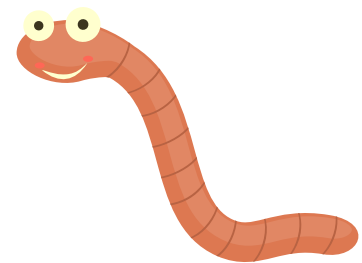
BIODIVERSITY – the different kinds of life on Earth – different kinds of animals and plants, large populations, and different types of ecosystems

For us to have sustainable ecosystems, they need to be built on a foundation of healthy soil, which provides nutrients to nearly every living thing. Climate change can also impact soil health – we'll talk more about this later on – so it is important to learn about these SDGs together.

When soils are degraded, or unhealthy it can affect:

- the ability to grow crops that feed people and livestock
- the ability to support a diverse range of animals and plants
- the ability to keep water and nutrients in the soil
- the ability to hold carbon, and absorb greenhouse gases
- the health of our forests and other ecosystems

That said, positive steps forward are happening! For example, there has been a significant reduction in erosion in cropland across Western Canada¹ and Brazil² due to encouraging no-till (not turning up the soil) practices in agriculture.



20% of the land around the globe (which is the size of Russia and India combined!) is degraded, which affects the lives of 3.2 billion people.³

WANT TO LEARN EVEN MORE?

Want to learn even more? Check out this site for everything about global soil health:

 [fao.org/soils-portal/en/](https://www.fao.org/soils-portal/en/)

13 CLIMATE ACTION



TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

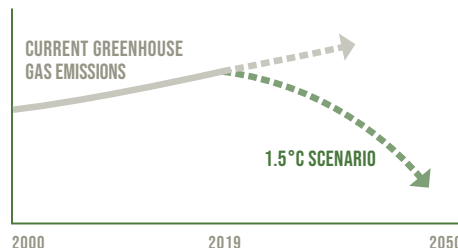
THE CLIMATE CRISIS CONTINUES, LARGELY UNABATED



2020 GLOBAL AVERAGE TEMPERATURE AT 1.2°C ABOVE PRE-INDUSTRIAL BASELINE

WOEFULLY OFF TRACK TO STAY AT OR BELOW 1.5°C AS CALLED FOR IN THE PARIS AGREEMENT

RISING GREENHOUSE GAS EMISSIONS REQUIRE SHIFTING ECONOMIES TOWARDS CARBON NEUTRALITY



CLIMATE FINANCE INCREASED



BY 10% FROM 2015-2016 TO 2017-2018, REACHING AN ANNUAL AVERAGE OF \$48.7 BILLION

125 OF 154 DEVELOPING COUNTRIES ARE FORMULATING AND IMPLEMENTING NATIONAL CLIMATE ADAPTATION PLANS

HIGHEST PRIORITY AREAS INCLUDE



FOOD SECURITY AND PRODUCTION



TERRESTRIAL AND WETLAND ECOSYSTEMS



FRESHWATER RESOURCES



HUMAN HEALTH



KEY ECONOMIC SECTORS AND SERVICES

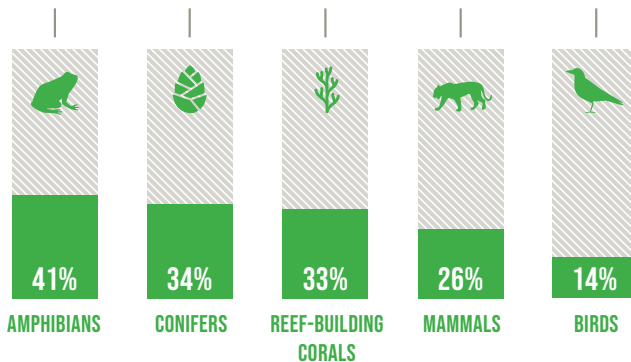
15 LIFE ON LAND



PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

MORE THAN A QUARTER OF SPECIES ASSESSED BY THE IUCN RED LIST ARE THREATENED WITH EXTINCTION

PROPORTION OF SPECIES THREATENED WITH EXTINCTION

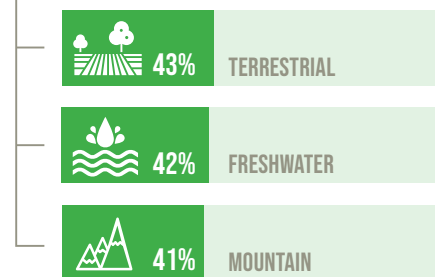


IUCN RED LIST

TRACKS DATA ON MORE THAN 134,400 SPECIES OF MAMMALS, BIRDS, AMPHIBIANS, REEF-BUILDING CORALS AND CONIFERS. MORE THAN 37,400 SPECIES ARE THREATENED WITH EXTINCTION.

PROGRESS TO SAFEGUARD KEY BIODIVERSITY AREAS HAS STALLED OVER THE LAST 5 YEARS

GLOBAL MEAN PERCENTAGE OF EACH KEY BIODIVERSITY AREA COVERED BY PROTECTED AREAS (2021)



ALMOST ALL COUNTRIES HAVE ADOPTED LEGISLATION FOR PREVENTING OR CONTROLLING INVASIVE ALIEN SPECIES

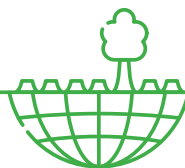


INVASIVE ALIEN SPECIES NEGATIVELY AFFECT NATIVE BIODIVERSITY AND COST THE GLOBAL ECONOMY BILLIONS OF DOLLARS ANNUALLY.

PROGRESS HAS BEEN MADE TOWARDS SUSTAINABLE FOREST MANAGEMENT

BUT THE WORLD HAS LOST 100 MILLION HECTARES OF FOREST

IN TWO DECADES (2000-2020)



DIG into SOIL



DIGGING DEEPER

No-till agricultural practices keep carbon in the soil. And because it requires fewer passes with a tractor, less fuel is used than the usual tilling practices. In one year alone, the amount of CO₂ saved by using herbicide-resistant crops - which helps to allow no-till practices - was equal to removing every car from the streets of a major city for five years! This is a great way to take positive action against climate change!⁴



World
Soil Day

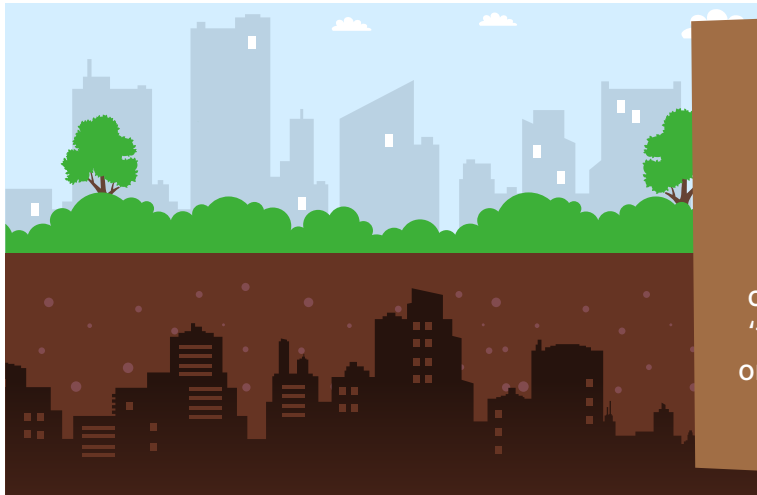
Soil is so important that it gets its own day! World Soil Day happens every year on December 5, as a day to bring attention to the importance of healthy soil and calling for the sustainable management of soils. Since 2014, this event has produced educational campaigns, videos, activities, and other ways to engage people around the world in digging deeper into the exciting world of soil! Check out the theme for this year's World Soil Day at [fao.org/world-soil-day/en/](https://www.fao.org/world-soil-day/en/)

Closer to home, check out Canada's **National Soil Conservation Week**, which happens the third week in April every year. Learn more about it here: [soilcc.ca/programs/national-soil-conservation-week/](https://www.soilcc.ca/programs/national-soil-conservation-week/)

Soils – More than Dirt!

We rarely think about the importance of the ground beneath our feet, but it is important to understand how soil is connected to nearly every living thing. That may sound like an exaggeration, but soils are alive, full of activity, and support the growth of plants, animals, and the food we eat!

Imagine soil like a giant, highly productive, hidden underground city.



DIGGING DEEPER

How might climate change affect this city? How would extreme weather affect city 'structures'? How would higher average temperatures affect city 'residents'? How could the changing season patterns affect the 'farms'? We see the effects of climate change on our planet, but it's important to zoom in and think about its impact on our soil.

Soil City:

- It 'houses' trillions of bacteria, microbes, fungi, and other soil-dwelling animals, like worms.
- It has 'factories' that can break down organic material like plants and animals into nutrients.
- It can 'transport' these nutrients, or basic building blocks of life, to plant roots so they can soak them up and grow, not only in size but to produce food for us to eat.
- It has 'banks' with rich stores of nutrients, water, carbon – all valuable and necessary components for plants and ultimately, all life on earth!
- It has 'waterways' that water can be filtered through, stored, and taken up to plant roots, or down into groundwater.
- It has 'farms' where seeds, spores, and other things can grow and take root.
- It has 'storage' where it removes greenhouse gases from our atmosphere and holds onto the things it filters out of the water passing through it.

Ideas taking root...

Draw your own Soil City! Have some fun and imagine all of the stuff that is happening under your feet. Think of what can be happening in the different layers? What lives down there? What is stored down there? What is made down there? Consider adding to your drawing by digging up a bit of soil and looking at it closely – what do you see? Let your imagination run wild and share your Soil City with us by tagging @4hcanada on Instagram, Facebook, or Twitter.

The Nitty Gritty of Soil

Before we dig deeper into the importance of healthy soils, and the impact of climate change on soil health, it's important to have a good soil back-'ground'!

The Basics

Soil is all around us, but where did it come from and how was it made? Soil is formed based on five key things⁵:

Parent material: This is the rock that has been worn down, or weathered, over thousands of years to create the mineral matter of the soil. Different types of soil are formed by the weathering of different types of rock. The parent material of a soil might be the bedrock, or rocks left behind by glaciers.

Climate: Temperature and rain or snow impact the weathering of the parent material and organic matter.

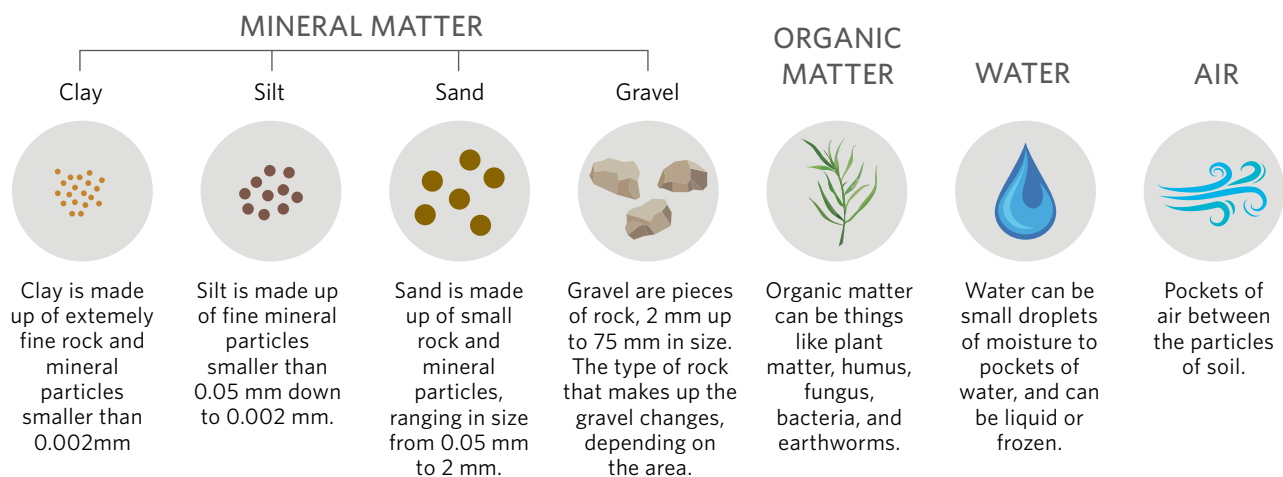
Organic matter and organisms: Organic matter (like plants) break down over time and add nutrients to the soil. Organisms like bacteria, worms, insects, and fungus live in the soil and help to break down the organic matter.

Topography: Whether an area is hilly or flat, and how water and wind move through that area will affect the formation of soil.

Time: It can take up to 500 years to form 25mm of soil! Whether this happens slowly or quickly is a key factor in soil formation.

All soil is made up of some combination of mineral matter, organic matter, air, and water. Soils can have a mixture of all of these elements, or they may only contain some of these elements. For example, in a desert, water may be lacking, or in compacted soil, the pockets of air may be gone.

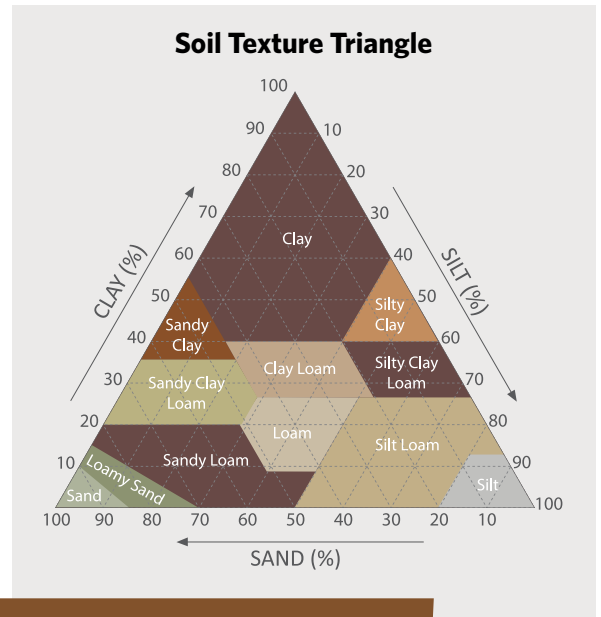
IT'S ALIVE!
A teaspoon of healthy soil has more microbes living in it than there are people on Earth!¹³¹



Sand, Silt, or Clay?

Soil can have different combinations of sand, silt, and clay. The amounts of each are what determine the type of soil. More clay, less sand, an equal combination of the three – each mixture forms a different type of soil!

When looking at the different amounts of sand, silt and clay in a soil, we use a **Soil Texture Triangle** to make it easier to identify what type of soil we are looking at. You'll notice that "loam" is a word used to describe many types of soil that have a mixture of sand, silt and clay. **Check out the soil identification activities you can do with your Soil Triangle in 4-H Canada's Steeped in Soil resource at** 4-h-canada.ca/steepedinsoil



The Big Three

The organic matter in soil – made up of carbon (C), hydrogen (H), and oxygen (O) – is the foundation of soil health. Plants get carbon, hydrogen, and oxygen from the air, and when they break down they deposit these elements to the soil. Having a high level of organic matter has biological, chemical, and physical benefits.

A Balancing Act

We can figure out the health of soil by examining the physical, chemical, and biological parts of soil and how these three parts interact with each other.⁶ These three parts of the soil are connected to each other and therefore need to be balanced to achieve healthy soils.

BIOLOGICAL:

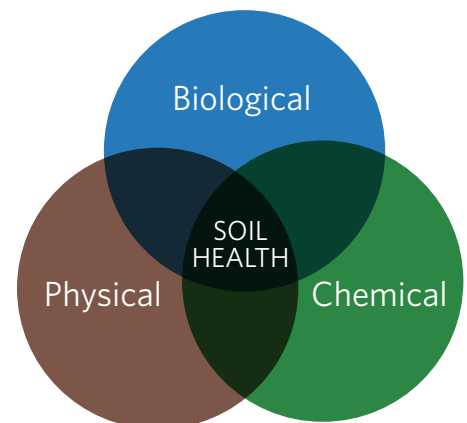
- Earthworms
- Organic matter
- The amount and rate of releasing carbon dioxide (CO₂) – called soil respiration
- Nutrients
- The total amount of organic carbon in the soil

When soils are unhealthy and affected by climate change

- Earthworms and other living things are not found or are in low numbers
- There isn't much organic matter

DID YOU KNOW?

It can take more than 500 years to form 2.5 centimetres of topsoil, the top layer of soil, which has a bunch of nutrients, organic matter and living organisms – all of which support plant growth.⁷ Since it takes so long to develop, we must protect the soils we have, because it will take multiple lifetimes to produce more.



DIG into SOIL

- Soil respiration is too low or too high
- Nutrient levels are too low or too high
- Uncontrolled growth of pests, or soil-based diseases

CHEMICAL:

- Soil pH - whether it is acidic, neutral or basic
- Carbon in the soil that can react and be used by plants and microbes
- The salts and minerals in the soil

When soils are unhealthy and affected by climate change

- The pH is too high or low for plants and organisms to grow or live
- There isn't enough available reactive carbon to support the chemical processes of plant and microbe life
- The salt content is too high in the soil and stunts plant growth and ability to absorb water

PHYSICAL:

- How the materials making up the soil stick together
- How much water the soil can hold
- How dense the soil is
- How water moves down through the soil
- Overall soil structure

When soils are unhealthy and affected by climate change

- The soil structure is weak, doesn't stick together, and can be easily broken down and washed away by water or wind erosion
- Soil can't hold water (runs right through it)
- Soil is densely packed - no space for air or water
- Water moves very quickly through the soil, or stays on the top and isn't able to soak down into the soil

IN SUMMARY:⁸

- Biological: organic matter is a food source for organisms, and by having a healthy and diverse soil ecosystem of microbes. Diseases and pests are kept at low levels.
- Chemical: soil must keep and supply essential nutrients for plants, break them down when they die, and balance changes in pH.
- Physical: the structure of the soil allows water to filter through, ideally with spaces to hold air and water.

Now that we've looked at the basics of what is in our soils, how it is formed, and its most important parts, we're ready to look at the health of our soils, the impact of climate change, and how soils are directly connected to our lives!

DIGGING DEEPER

Soils Across Canada!

Each province and territory is made of different types of soil. But each one has a kind of soil that is unique to that area. Kind of like each province and territory has its own flower, or bird, this map shows us the unique soil that best represents that area. Check out what Canadian soils look like from coast to coast to coast! What is your provincial or territorial soil type?

 <https://bit.ly/351ayKU>

Want to learn even more? Using your address, check out the type of soil found right in your own community:

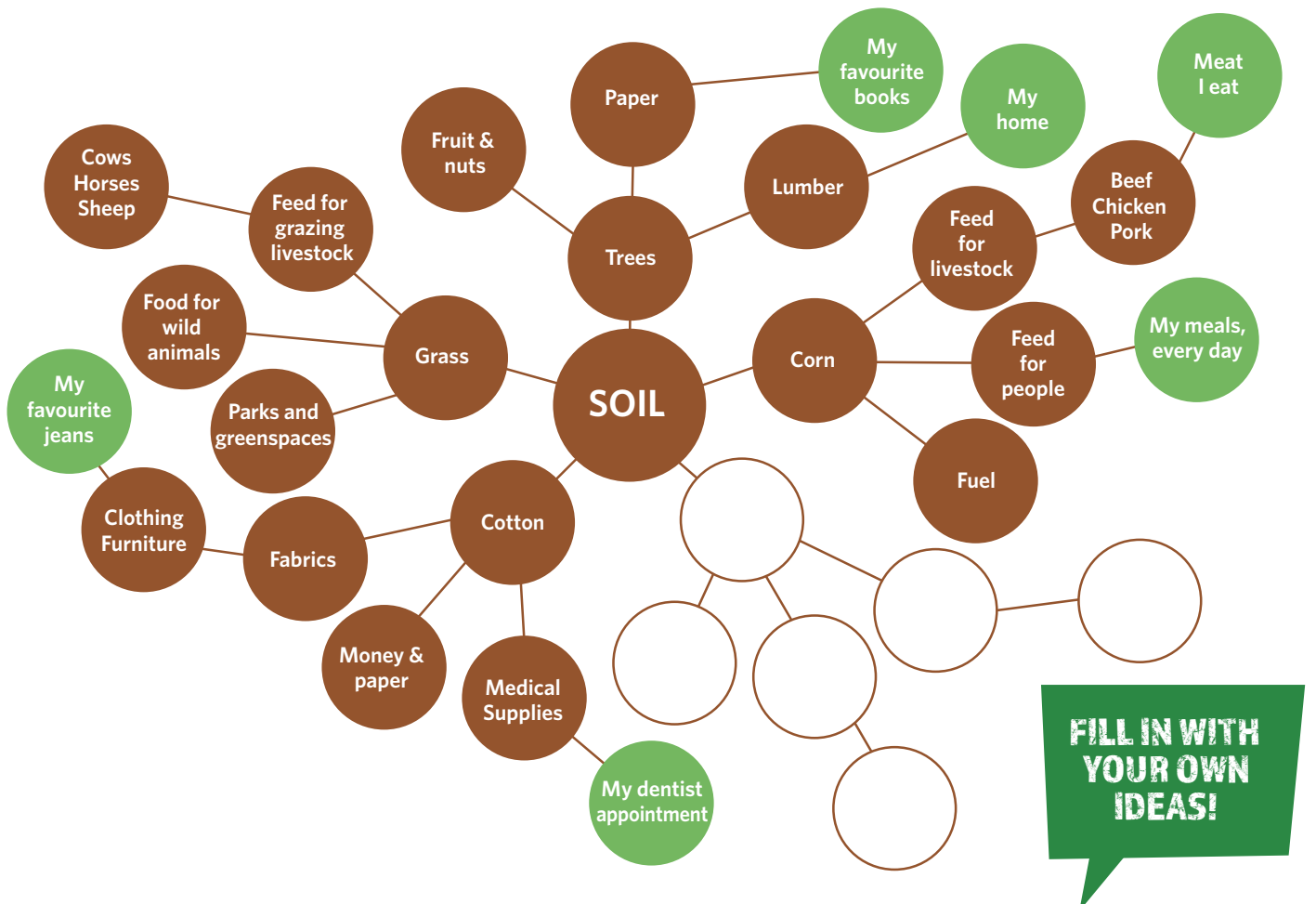
 agr.gc.ca/atlas/agpv

A Solid Grounding

Soil is the foundation for nearly every living thing on Earth, but what does that really look like? This section looks at how truly connected we are to our soil, particularly when it comes to agriculture and how our food is produced.

Think of the many things that require soil to grow: trees, flowers, vegetables, fruit, and crops. And then think of all of things we use, or materials we need, or the foods we eat. It would be challenging to find something in your life that didn't 'start' with soil.

Look at the diagram below to see how connected soil is to everything. Some of the branches have been left blank for you to fill in with your own ideas, and feel free to add even more! Try to continue to extend the branches until you reach something that directly impacts you and your life - "My...".



FILL IN WITH YOUR OWN IDEAS!



Healthy Soils, Healthy Environment

Soil is alive with microbes and nutrients, and it supports almost all life on earth. So, it is incredibly important for us to keep it healthy.

2019 was the second warmest recorded year on Earth, and the end of the warmest decade (2010-2019) since records began⁹. There were more intense storms, unseasonable temperatures, too much or too little rain, and many more changes to our climate. Have you noticed changes to the weather patterns in your area? These changes in our climate directly impact our soils, threatening their health.

	Typical Climate in Canada	Climate Change Impacts
 <p>SPRING</p>	<p>The snow layer slowly melts and soaks slowly into the soil. An average amount of rain happens over enough time that the rainwater can soak in. Moisture builds in the soil.</p>	<p>Unseasonably warm days cause the snow to melt too early and quickly, which means it doesn't soak into the soil and would eventually lead to the groundwater system. Water flows over the ground, carrying soil with it, directly into waterways. When water can't go anywhere, it pools and floods, stopping plants from growing. These warm days without rain can also cause the soil on the surface to dry out, leading to erosion.</p>
 <p>SUMMER</p>	<p>Warm to hot weather, but no longer extremely hot periods. The warm weather allows plants to grow, and the organisms in the soil can break things down. Slow rain allows the water to soak into the soil.</p>	<p>Extreme heat takes the moisture out of the soil. Heavy storms cause rain to wash away the top layer of soil and nutrients. Plants and crops are unable to get the water and nutrients they need from the soil, which can also make them at risk to disease and pests.</p>
 <p>FALL</p>	<p>The weather becomes cool, an average amount of rain happens over enough time that it can soak into the soil. Dying plants and leaves protect the soil from the cold, and add organic matter into the soil.</p>	<p>Heavy rains, unexpectedly warm or cold days (early snow, hot days), stop the natural pattern of breaking down leaves and other organic matter.</p>
 <p>WINTER</p>	<p>The weather becomes cold and the soil is protected under an insulating layer of snow.</p>	<p>When the snow comes late it leaves the ground exposed to extreme temperatures. This can kill off plants and crops that would typically come back in the spring. Unseasonably warm days cause the snow to melt too early, and quickly, so the water doesn't soak into the soil.</p>

So what can we do?

It's clear that our climate and the health of life on land – including our soils – are directly connected. This is why climate action is so important! Here are six simple ways for you to take climate action right now:

- Use a refillable water bottle and travel mug.
- Air dry your hair and clothes.
- Take short showers.
- Recycle paper, plastic, glass and aluminium.
- Bring your own bag when you shop.
- Speak up and share your passion!¹¹

Remember, small steps taken by lots of people can have a huge impact! Take these steps towards climate action and encourage others to join you.

And how will we know when climate action is working and we are keeping our soils healthy?

- The soil holds moisture, from water soaking into the ground
- It contains the right balance of nutrients
- Soil texture and structure that allows for air and water to slowly pass through, supporting plant roots
- There is balanced animal and microbial activity – bacteria, fungi, insects, worms
- The soil filters water and minerals, and even pollution
- Soil stores and cycles nutrients, including holding onto carbon
- The soil contains organic material, with the right balance of organic matter being added, and organic matter that is breaking down

DID YOU KNOW?

Every 5 seconds, around the world the equivalent of one soccer field of soil is eroded.¹⁰ Finding ways to reduce erosion is important to help preserve the health of our soil, and our environment.



DID YOU KNOW?

Our health is directly related to soils! Soil is home to lots of different bacteria and fungi, many of which are useful to us. Penicillin, which is an antibiotic used when people are sick, is produced by a fungus that lives in soils and was discovered in 1945-1955.¹² So healthy soils = healthy humans!

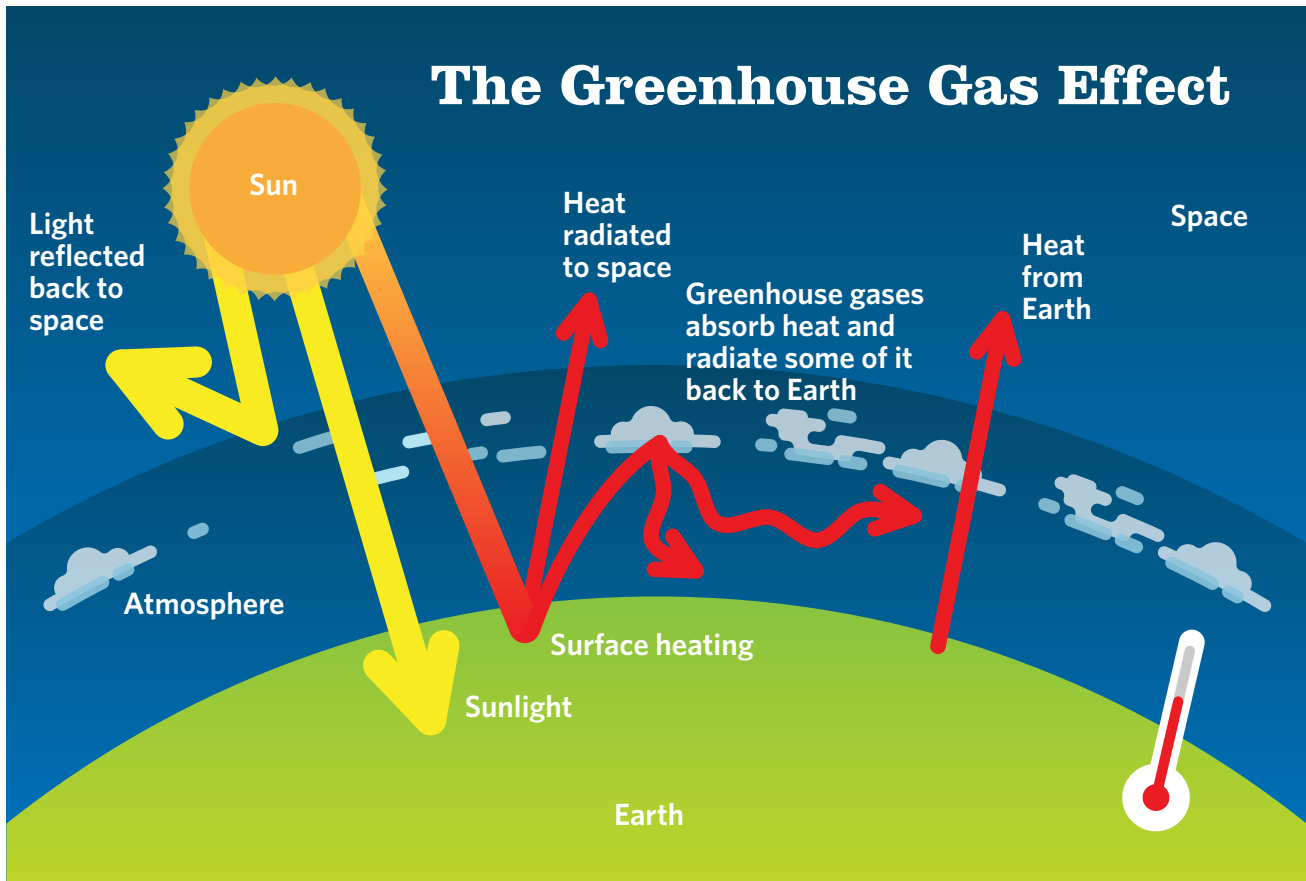


CHECK OUT
this article about
amazing youth around
the world taking steps
to address climate
change: [unicef.org/
environment-and-
climate-change/
youth-action](https://www.unicef.org/environment-and-climate-change/youth-action)

Keeping the Lid on Carbon

We've covered the basics of what is soil, what is in it, and why it is important that it is healthy. In addition to everything else that soil does, it is also a vault, holding an incredibly important treasure. Carbon! The building block of life.

As you may know, one of the key issues of climate change is the increase of CO₂ (carbon dioxide) in the atmosphere. This is because an increase in CO₂, along with other gases, called 'greenhouse gases', cause the atmosphere to slowly get warmer as they trap the heat.



Want to see where carbon is currently being held by our soils?

Check out this interactive map to see where carbon sinks exist around the world:

<http://54.229.242.119/GSOCmap/>

Find your hometown - what does your area look like on the map?

Carbon and the Carbon Cycle

Now we understand why the amount of carbon being released is important to control if we're going to take on climate action. But what role do soils play?

This infographic uses information from the Food and Agriculture Organization of the United Nations, from the 2015 International Year of Soils. It explains the importance of carbon in the soil, and how it is created, released, trapped, and stored as part of the Carbon Cycle.

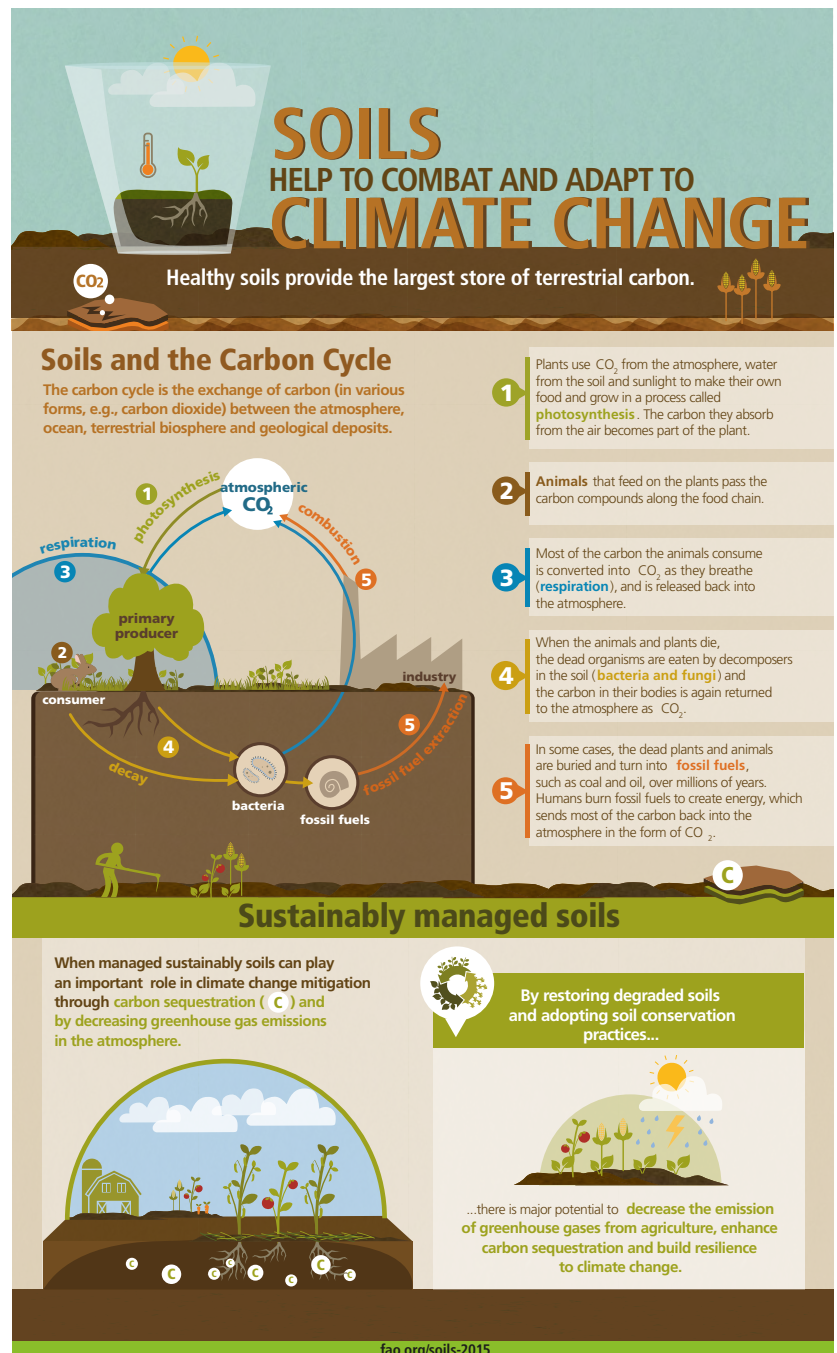
The Carbon Cycle illustrates how carbon cycles through the environment. Plants absorb carbon from the air (carbon dioxide) and it becomes part of the plant. Animals eat the plants, and breathe carbon dioxide back into the atmosphere. When plants and animals decay or deposit waste (for example, leaves, manure), bacteria and fungi break it down and the carbon in their bodies and waste is released into the atmosphere as carbon dioxide, or from the burning of fossil fuels.

When soil is poorly managed, and the carbon stored in it is not preserved, it can release lots of greenhouse gases.

When soil is sustainably managed, carbon is stored in the soil instead of adding to the carbon dioxide in the atmosphere. By managing the carbon in the soil, we can reduce the amount of greenhouse gases entering the atmosphere and their impact on our climate.

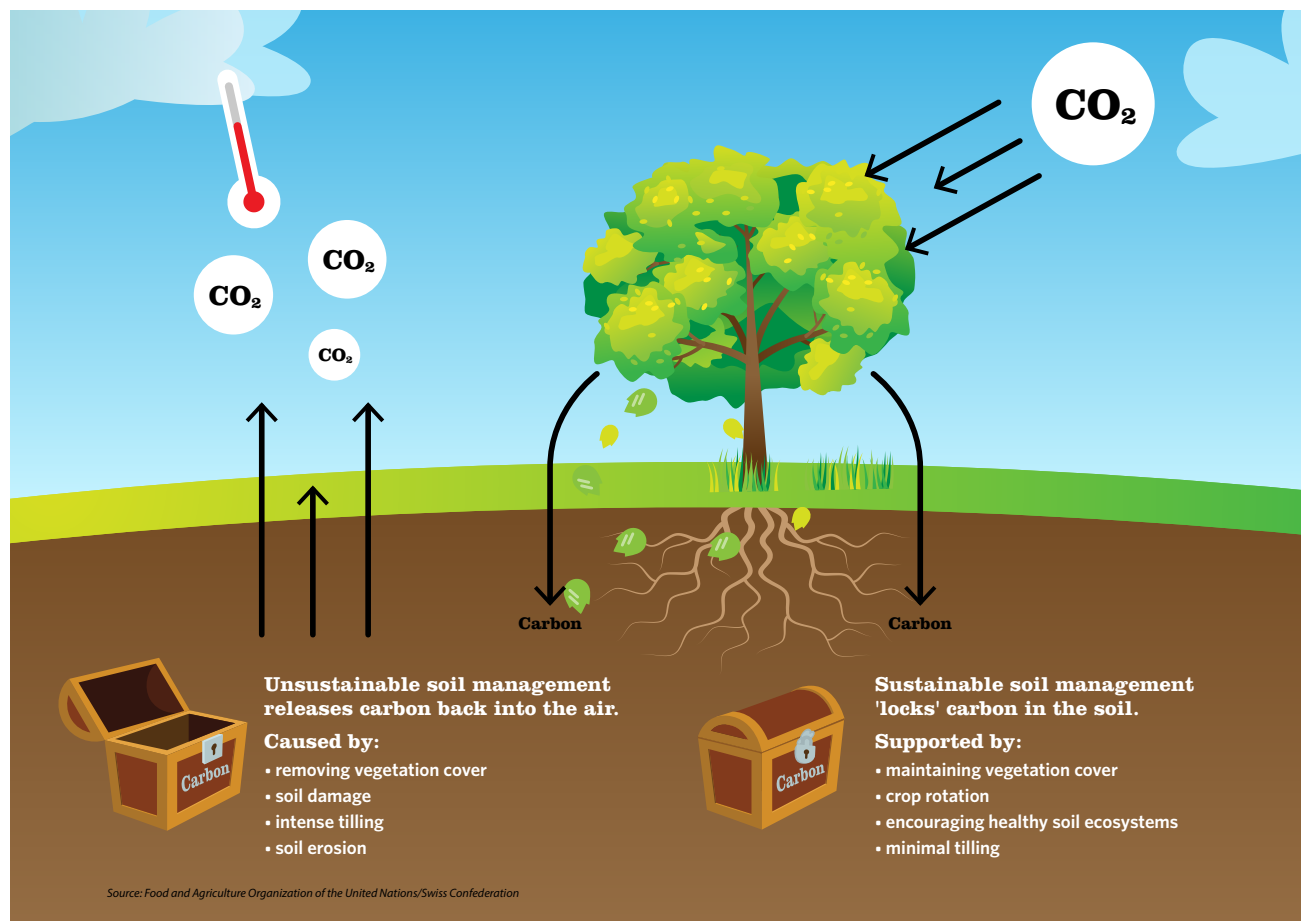
When carbon is trapped, it is held in the soil, creating a build-up of carbon, also known as a carbon sink. It is 'locked in the vault' and supports healthy soil, which:

- Grow plants
- Allows microbes to survive
- Supports the soil structure



DIG into SOIL

Check out this diagram to see the benefits of carbon being stored in the soil, along with the threats to soil health and climate change if it is released. 🌐 <http://www.fao.org/3/a-i6478e.pdf>



Your part in supporting our soils

With soil being connected to nearly everything, it is clear we need to keep it healthy. This includes understanding soil's importance, addressing climate change, and keeping carbon stored in our soils. To do this, we all need to make efforts at personal, community, country, and global levels. Big changes like environmental protections or sustainable agricultural practices may be challenging for a single person to change, so adding your voice to support these causes is important!

One of the ways you can directly support soil health in your own community, and the Sustainable Development Goals 13 and 15, is by composting. You can follow along with **The Ultimate Compost Challenge** activity in the following pages, but you may be wondering how something as simple as composting can relate to things like climate change and the carbon cycle:

WHY COMPOST?

- It reduces greenhouse gases that come from landfills by keeping wet, organic materials out
- It reduces greenhouse gases coming from the transportation of garbage
- It returns carbon (in the form of organic matter) to the soil
- It protects groundwater by keeping wet, organic materials out of landfills
- It cuts your garbage by one-third
- Your garbage won't smell
- It produces Gardener's Gold - the best fertilizer possible for your plants and lawn
- It's easy!¹³

IDEAS TAKING ROOT...

Interested in digging even deeper into the topic of soils? Check out: ***Steeped in Soil***, the first of these 4-H Canada soil resources, will guide you through the basics of soil, and has some awesome activities that you can check out! You can learn more about it, and download it at 4-h-canada.ca/steepedinsoil

4-H Ontario's ***Loyal to the Soil*** club project, which was launched in 2017 and is full of information and activities you can participate in as a 4-H member.

You can check it out at 4-h-learns.org



Activities

ACTIVITY 1: Sprouts and Soil Health

We've talked about the importance of healthy soils, and how climate change can hurt soil health, but let's put it to the test! Soil that has bits of organic matter in it – which contain nutrients, feed microbes, and help to hold moisture – is what plants need to grow. Soil that doesn't have enough organic matter in it is missing the nutrients, microbes, and moisture to support plant growth. As climate change damages soil, and strips away the nutrients and moisture, it is important to understand how that will affect the ability of plants to grow. Try this activity to see how different types of soil can impact plant growth!

LEARNING GOAL: Understand the importance of the organic matter in soil and how it impacts plant growth.

Materials:

- Bean seeds
- Different types of soil – topsoil, sand, clay, a mixture of all three, sandy gravel, etc.
 - » Walk around your yard or community to find different types of soil. With permission, dig up at least two cups of each type. You may find different types of soil by a driveway, under a tree, in the garden, by the fence line, etc. So take your trowel, and go exploring! You could also buy different types at a garden centre.
- Cups or containers – clear if possible
- Water
- Marker and tape to label

Instructions:

1. Put each type of soil you collect into a different cup or container – don't mix them.
2. Using a marker and tape, label each container with the type of soil in it.
3. Plant five bean seeds in each cup, following the directions on the packet.
4. Add water – enough that the soil is damp, but not soaked.
5. Set up all of the cups in the same area, so that they all receive the same amount of sunlight, are at roughly the same temperature, etc.
6. Watch the progress of your bean seeds! If you chose clear containers, you should be able to watch the roots develop underground (4-5 days) before the seeds sprout through the top of the soil (10-11 days).
7. Track the growth of the bean sprouts by taking photos, or taking measurements every other day. Give each type of soil the same amount of water every other day or so, or when you notice the soil is dry to the touch. Make notes of your observations, and remember to use your senses – what do you see, feel, smell?

Activities – DIG into SOIL



Questions:

1. How did the different types of soil affect the growth of the beans?

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2. Which type of soil was the most successful at growing the beans? Why do you think that was?

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3. Which types of soil were the least successful at growing the beans? Why do you think that was?

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4. Which type of soil was the best at staying moist?

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5. With desertification and soil degradation increasing because of climate change, what do you predict will happen to plants growing in dry, unhealthy soil?

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6. If our soils continue to degrade, how will that impact our ability to grow crops to feed 10 billion people by 2050?

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DIG into SOIL – Activities

ACTIVITY 2: Movers and Shakers...and Wigglers!

Worms are an important part of the flow of nutrients through the soil. Like little blenders, they mix the different layers of the soil, and spread nutrients as they eat green waste and break it down - they are small but mighty! Check out this activity to see these little mix-masters in action¹⁴.

LEARNING GOAL: Discover how worms move soil around and see their impact on the soil ecosystem.

Materials:

- Big clear jar (plastic or glass)
- Mesh or tin foil with holes poked into it
- Different types of soil
- With permission, dig up some soil from outside - you should see a change in soil colour the further down you dig. Try to get at least two soil colours, or look elsewhere for different types. Avoid collecting just sand, as this is not a good environment for worms, and could hurt them.
- Worms - gently collected from outside
- Dead leaves and green waste
- Water

DIGGING DEEPER

Over half a million earthworms can be found in a healthy acre of soil. Earthworms' activity offers many benefits - increased nutrient availability, better drainage and a more stable soil structure, all of which help to improve soil productivity.¹⁵

Experiment Ethics: Taking care of these squirmy creatures!

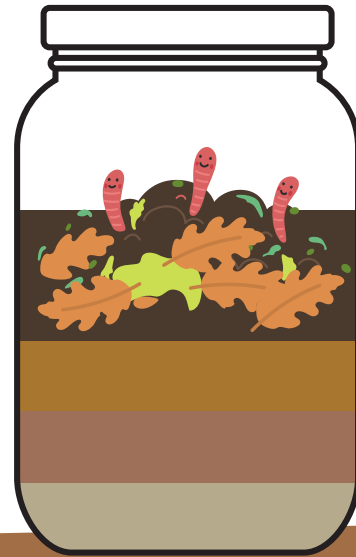
- It is important to treat animals involved in our experiments and activities with respect.
- Worms should be kept in a dark, cool, humid environment until the experiment begins.
- Wash your hands before handling the worms and handle them gently.
- When you're done with this experiment, place the worms back outside in a compost pile or garden soil.
- And finish by washing your hands again.

Instructions:

1. Add the different types of soil to the jar, keeping them in separate layers. Leave space at the top of the jar so air can flow in and out of the holes in the lid.
2. Spray some water on the soil so it is moist - not muddy.
3. Add some dead leaves and green waste on top of the soil, covering it.
4. Add 20-30 worms on top.
5. Close the container with the lid and keep the container in a cool place for up to one month.
6. Take photos of the side and top of the container at least once per day. You can also take notes or record videos on some days.

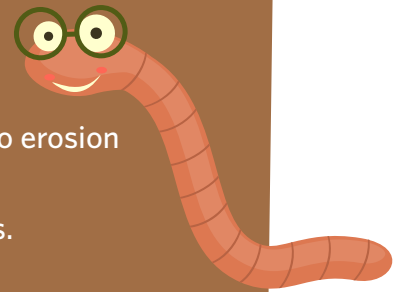
Activities – DIG into SOIL

7. While making your observations, make sure the jar doesn't dry out. Add more water (spraying gently, not dumping) if needed.
8. Arrange the photos in a time sequence and explore the differences between the beginning and the end. What can you see? How does the soil change? Which beneficial role do you think earthworms play and how can you see this in your experiment?
9. When you're done, put the worms back where you found them. While worms are very beneficial to the mixing of soil, and breaking down organic matter, it is important not to introduce them to new environments as they can disrupt the soil of a new ecosystem.



DIGGING DEEPER - WORM WONDERS¹⁶

- They loosen the soil to allow water and air to flow through
 - They leave holes in the soil, which is called aerating
- They also change the soil structure so it is more stable, and resistant to erosion
 - They can eat up to $\frac{1}{3}$ of their body weight per day!
- They are a source of food for animals like birds, rats, and toads.
 - They are capable of digging as deep as 6.5 feet.
 - They can also be known as "nightcrawlers" because they can be found feeding above ground at night.



DIG into SOIL – Activities

ACTIVITY 3: The Ultimate Compost Challenge



We've talked about the importance of keeping nutrients in our soils, and this is a way for you to have a direct impact on the soils in your community...and right in your own backyard! A lot of green waste that could be composted ends up in our landfills – stopping the waste from breaking down, and preventing the nutrients in it from being added back into the soil.

When we compost, the breaking down of green waste creates something that's called 'Gardener's Gold' – a rich fertilizer that can be added to soil in flower beds and vegetable gardens, making the soil healthy, and plants thrive!

CHALLENGE #1 – Track Trash and Reduce

LEARNING GOALS: Learn about composting efforts in your own community. Challenge yourself to get involved and reduce the amount of waste that ends up in your garbage.

First, let's track it!

Think about all of the food waste, garden waste, and other organic things you and your family might throw out in the garbage every week. Even if your community has a compost program already, does your family participate in it? Or are you all aware of everything that can go into it?

1. Look up and list of all of the green waste that can go into a compost bin: Your community may have a website or even an app with this information!

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Activities – DIG into SOIL

2. How many bags of garbage does your family put out each week?

- If you can, to get a more accurate picture, try to weigh the bag(s) of garbage. You can do this by either putting the bag on a weigh scale, or you can stand on the scale holding the bag of garbage, and then again without the garbage, and subtract the second weight from the first to find out how much the garbage itself weighs.



3. Check out if your community has a compost program – you can search for it online. Does your family already participate in it? How much compost do they put out each week? (You can weigh this too!) If your family doesn't participate, how could you start? And if they do, are you composting everything you can?

Now let's try to reduce it!

After tracking what your household produces, and how you dispose of it, create a plan for how you can increase what you compost, and reduce what goes into the garbage.

Here some questions to help you start making a plan:

- If your community has a compost program, when does your family have to put it out? Is that schedule posted somewhere in your home?

- If your community doesn't have a compost program, or if you want to try it yourself, talk to your family about how you could start your own. Check out Challenge #3 for more information.

- What are at least three things you could start putting in your compost?

- What is something you learned that you can compost that surprised you?

After following your plan for a few weeks, try weighing your compost and garbage again – were you able to make a change? Remember, everything we can switch to compost instead of ending up in a landfill means those things can break down and add nutrients back into the soil!

DIG into SOIL – Activities

CHALLENGE #2 – Bag It Up!

LEARNING GOALS: Learn a new skill in creating your own compost bags!

Make your own compost bags! It's quick and easy, and there are great reasons to do it:

- This is a great way to not just recycle but also reuse newspapers.
- The paper also helps to cut down on the smell of compost because the carbon in the paper (carbon is what wood, and therefore paper pulp, is made out of) helps to absorb the smell of food decomposing¹⁷.
- The carbon in the paper is also needed in the composting process, so this is a useful thing to add to your indoor compost bin before dumping it outside.
- It's free!

Instructions:

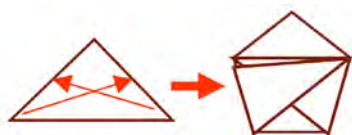
1. Take two sheets from a full-sized newspaper and stack them on top of each other.



2. Take the opposite corners and join them, making a big triangle. The sheets aren't perfectly square, so don't worry if they don't fold neatly - it doesn't have to be perfect.



3. Take the two small corners and fold them up, to the middle of the opposite side.



4. Open the pocket you've created by folding down the top triangles, on both sides.



5. And now you can put this bag in the compost bin as a compostable liner!

DIGGING DEEPER...

Are you passionate about gardening? Interested in learning more about food security? Check out *My Plate and the Planet* at 4-h-canada.ca/healthyliving for more information and activities that build upon our planet having healthy soil!





CHALLENGE #3 – Growing Gold!

LEARNING GOALS: Develop your own composting system and understand how your food waste can break down and turn into a nutrient-rich addition to the soil in your backyard.

Whether you are committing to using the provided bin to compost in a community composting program (where they pick up a green bin regularly), or you want to try composting on your own, this is the challenge to put what you've learned into action, add nutrients back into the soil, and be a Soil Superhero!

Note: This challenge will work best in the spring, summer, or early fall. You want to give your compost a chance to get started before winter comes, when decomposition can slow down.

1. Talk to your family about composting, and make sure everyone is aware of what can and can't go in.
2. Collect green waste in the compost bin provided in the Dig into Soil kit, or a compost bin that you have at home (ideally lined with a compost bag you made in Challenge #2!)
3. Make your own compost box outside:
 - a. Talk to your family about finding a spot in your backyard for the compost box. It should be a sunny spot, that will be easy to get to (even in the winter!) to frequently dump your green waste

SOME COMPOSTING TIPS AND TRICKS¹⁸:

As the green waste decomposes, the pile breaks down and heat is generated – this is how you can tell your compost box is working! If your compost pile does not decrease in size or give off heat, composting may need a boost. If the pile is dry, add water – mixing thoroughly. If the pile is wet and muddy, spread it in the sun and add dry material.

If the centre of the pile is damp and warm, but the rest is cold, the pile may be too small. Try to keep your composter as full as possible.

If the pile is damp and sweet-smelling but not heating, it may need nitrogen. Add grass clippings, table scraps or a sprinkling of fertilizer from a garden centre.

If the compost pile develops a foul odour, it may not be getting enough air. Loosen up the pile, break up clumps, unblock any vents in the box, and make sure to turn the pile more often.



DIG into SOIL – Activities

- b. Check to see if your community offers subsidized composting boxes or look online for free plans to build your own from old wood pallets, or even sticks! Remember, it is a basic frame, or an open-bottomed 'box', so it isn't complicated to build.
 - c. Rough up the soil where your compost box will go. This will expose the bacteria and fungi living in the soil and give them easy access to the compost pile on top.
 - d. Place your compost box – whether purchased or made yourself – ovetop of the roughed-up soil. Cover the 'bottom' of the box with a layer of small branches. This will help with water draining off and getting air around the compost as it decomposes.
 - e. Add some garden soil, 'finished' compost, or compost starter (available at most garden centres) to jumpstart the composting process. Now it's ready for your green waste!
4. Dump out your indoor compost bin once a week, or if it starts to smell. You can also keep your bin in the freezer to prevent smells. When your indoor bin is full, dump it in your backyard compost box (if you're trying it at your own home). Or, dump it in your green waste collection bin (if you're participating in a community composting program).
 5. Every now and then, 'turn' your compost pile with a shovel, moving the green waste that was on the bottom to the top. This keeps the decomposing active by adding air and spreading around the green waste, bacteria, and fungus. Break up any clumps or layers stuck together.
 6. In the fall, collect bags of leaves and prop them against the compost box. From then on, every time you throw green waste into your compost box, you can add in a handful or two of leaves. This adds carbon into the compost mix (which is important!), and the bags stacked around the compost box help to insulate the pile throughout the winter.

Don't have space in your backyard, but still want to try composting?

You still can! Build a mini composter out of a clear jar.

1. Dig up some dark soil outside, and add it to the bottom of the jar, and then add torn up bits of newspaper, green waste, and then repeat the layers.
2. Spray some water over the top layer so it is good and wet.
3. Cover the jar with a lid with holes poked into it and place the jar in a sunny spot.
4. Check on it in a couple of days, spray some more water so it all stays moist (but not muddy), and keep that cycle going until you start to see the green waste and newspaper breaking down over weeks (and possibly months!).
5. It won't be exactly like a large-scale compost box, but over time, you'll see things change and break down – that is what composting is all about!
6. When you're done your experiment, find a garden or some soil you can add your jar contents to, returning those nutrients into the ground.

We mentioned that what comes out of your composter is called 'Gardener's Gold', but when will it be ready? Well, that depends! The composting process can take from two months to two years, depending on the climate in your area, what you've put into your compost box, how often you've turned it, etc. Compost is ready to be used when it is dark in colour, crumbly and has an "earthy" smell. You can return any big chunks that haven't yet broken down to the compost box. And when your compost is ready, share it with us by tagging **@4hcanada** on Instagram, Facebook, or Twitter!



AND HOW DO YOU USE YOUR 'GARDENER'S GOLD'?

Compost is the perfect fertilizer - it helps soil hold water, increases its nutrients, increases air flow, and helps to control erosion. By improving soil health, you are making positive climate change in your community! You can use it on your lawn, in your garden, around trees, or combine it with potting soil for your plants. We can't wait to see what you grow with it!



DIG into SOIL – Activities

ACTIVITY 4: Shout-out about Soil!

With everything you've learned about the Sustainable Development Goals 13 and 15: Climate Action and Life on Land, and soil sustainability, this is your chance to share it with your friends, family, and the world! These are global issues, and we all have a part to play in raising awareness and encouraging others to join in protecting soil health in our communities, countries, and world!

**YOUNG PEOPLE
MAKING THINGS
HAPPEN**



LEARNING GOAL: Share what you've learned with others and spread your soil passion!

Give these some thought:

- What was the most interesting thing you learned from the Dig into Soil?

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- What was something that surprised you as you went through the guide and activities?

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- How has your understanding and thoughts about climate change and soils changed?

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- What was something new you tried in one of the soils activities?

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- What small change or impact on soil and/or climate change could you work to improve in your own life? How will you take climate action?

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Now take action - challenge yourself to make a big impact!

- Make a post on social media. If you have an account, share:
 - » What you've learned!
 - » The outcome of your soil activities
 - » Track your composting efforts, reducing household food waste, and increasing soil nutrients
 - » Invite others to join you in learning more about soils, trying out activities, and discussing soil conservation!
 - » And remember, we love to hear from you and support your learning, so share your posts with us by tagging **@4hcanada** on Instagram, Facebook, or Twitter.
- Talk to your friends and family about what you've learned, include them in these activities, or encourage them to read the guide too!
- Make a sign and post it in your window, or on your lawn, encouraging others to support the SDG 13 and 15
- Volunteer with your local conservation organization to see what they are doing to protect soil, and raise awareness about soil degradation, climate change, and/or carbon sequestration
- Your own idea of how to make change:

Example sign you could make

**SUPPORT SDGS
13 AND 15!**

<p>13 <small>CLIMATE ACTION</small></p>	<p>TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS</p>
<p>15 <small>LAND</small></p>	<p>PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS</p>

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Reflection

You have just completed a series of activities about soil health, and we hope you feel like you've achieved the goals we mentioned in the beginning! When we learn and do something new, one of the key steps is to reflect at the end of it all...how did it go? What did you achieve? What would you do differently next time?

Consider the following questions and see how they link up to the skills you've developed in Dig into Soil:

REFLECTION QUESTIONS	OUTCOMES
How have you advocated for soil health and climate change awareness, or supported others in their learning?	<i>Leadership development</i>
What skills have you learned by going through these activities?	<i>Skill mastery</i>
What positive change can you make by supporting SDG 13 and 15 - Climate Action and Life on Land?	<i>Positive values</i>
What responsibility do you feel you have in supporting soil health and climate change efforts?	<i>Responsibility</i>

What goals have you set for yourself to continue to learn about and support soil health and climate change efforts?

Planning and decision making

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How will you make your mark as a member of your community, and as a global citizen?

Sense of purpose

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What was the most fun part of this kit? What was something you learned in a hands-on way? Did anyone help you with your learning - acknowledge them here.

Learn To Do By Doing

Fun

Supportive adults

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Thank you for joining 4-H Canada, and youth across the country in learning more about soil health and climate change, gaining skills, and having fun with soil as you explored Dig into Soil. We look forward to seeing what you've accomplished (remember to share it with us on social media by tagging **@4hcanada**) and hope you'll take part in other 4-H Canada opportunities!

References & Photos

References

👉 <https://sdgs.un.org/goals>

👉 <https://www.un.org/sustainabledevelopment/climate-change/>

👉 <https://www.un.org/sustainabledevelopment/biodiversity/>

👉 <http://www.fao.org/world-soil-day/en/>

Soil Conservation Council of Canada 👉 <https://soilcc.ca/>

👉 <https://ingeniumcanada.org/agriculture/exhibitions/soil-superheroes>

👉 <https://letstalkscience.ca/educational-resources/backgrounders/what-soil>

👉 <https://agriculture.canada.ca/en/agriculture-and-environment/soil-and-land/our-home-and-native-land-significant-agricultural-soils-across-canada>

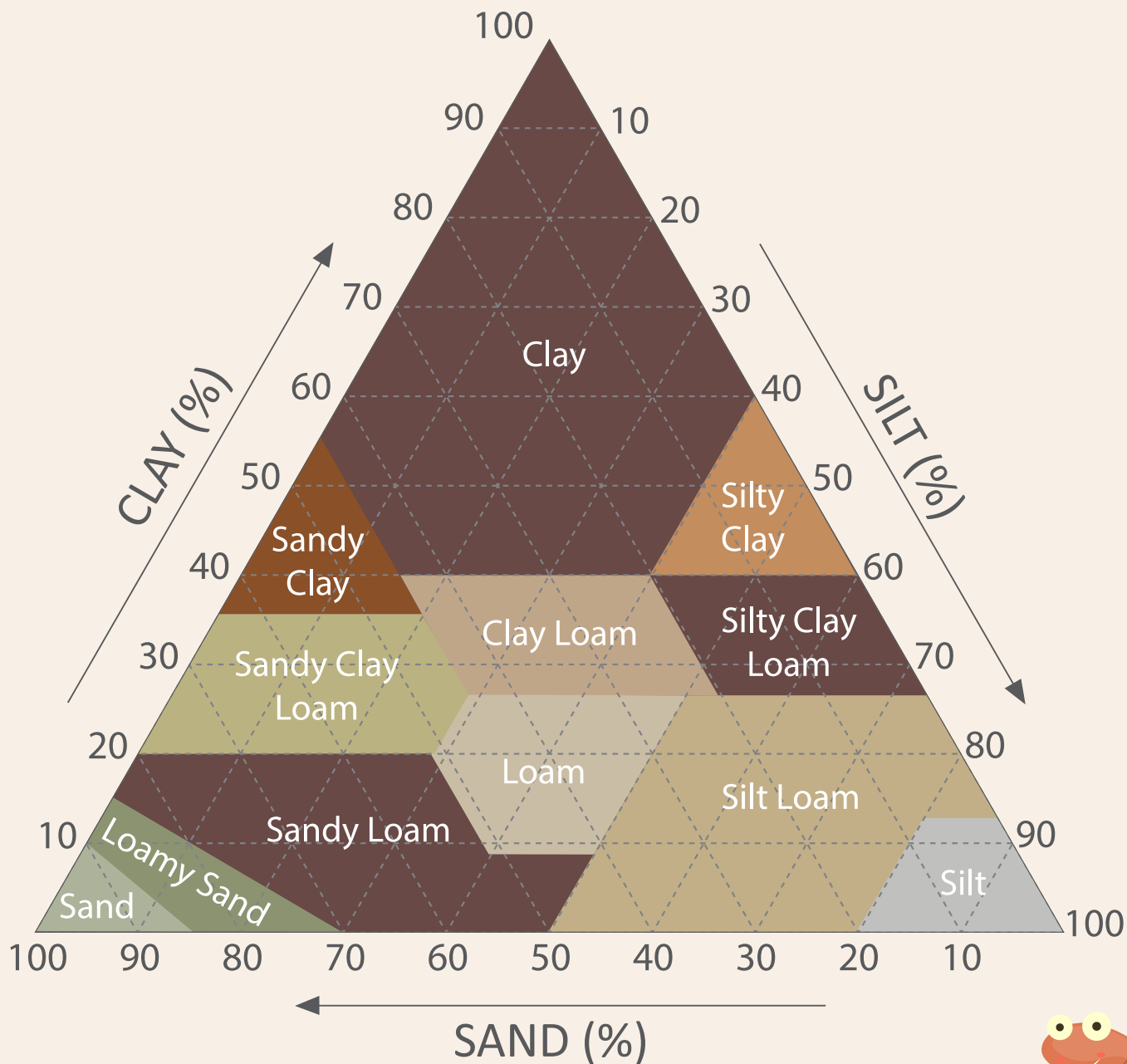
Photos

Photos and illustrations © Shutterstock

Endnotes

- 1 <https://www.agr.gc.ca/eng/agriculture-and-climate/agricultural-practices/soil-and-land/soil-erosion-indicator/?id=1462893337151>
- 2 <http://www.fao.org/3/a-bc595e.pdf>
- 3 https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/15_Why-It-Matters-2020.pdf
- 4 Six Fascinating Facts About Soil - <https://soilcc.ca/>
- 5 <https://www.extension.umn.edu/agriculture/soils/soil-properties/five-factors-soil-formation/>
- 6 https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/assessment/?cid=nrcs142p2_053870
- 7 Six Fascinating Facts About Soil - <https://soilcc.ca/>
- 8 <http://homeguides.sfgate.com/ideal-percentage-organic-matter-soil-73408.html>
- 9 <https://www.un.org/sustainabledevelopment/climate-change/>
- 10 <https://www.un.org/en/observances/world-soil-day>
- 11 <https://www.voicesofyouth.org/climate-action>
- 12 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2731226/>
- 13 <https://www.reaction.ca/greenspace/compost-demonstration-site/composting-how-to/#:~:text=Line%20the%20container%20with%20newspaper,carbon%20to%20the%20compost%20pile.&text=This%20will%20help%20the%20compost,up%20into%20the%20compost%20pile.>
- 14 <http://www.fao.org/3/a-i7957e.pdf>
- 15 Six Fascinating Facts About Soil - <https://soilcc.ca/>
- 16 <https://utah.agclassroom.org/matrix/lesson/345/>
- 17 <https://www.reaction.ca/greenspace/compost-demonstration-site/composting-how-to/#:~:text=Line%20the%20container%20with%20newspaper,carbon%20to%20the%20compost%20pile.&text=This%20will%20help%20the%20compost,up%20into%20the%20compost%20pile.>
- 18 http://www.compost.org/backyard_compost/

SOIL TEXTURE TRIANGLE



To classify the texture of a soil sample, use this diagram. Soil texture is made up of the proportion of the three different components: **SILT**, **SAND**, and **CLAY**. Follow to find the name for the soil type.

FOR EXAMPLE: If the soil sample is made of 10% clay, 30% silt, and 60% sand, find 10% along the side of the triangle marked "Clay". Then find 30% along the side of the triangle marked "Silt". And then follow the line from 60% on the "Sand" side. Where these three lines intersect, will give you your soil type: sandy loam.





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