Investigating the Soil Department

SOIL DEPARTMENT
An eco-service provided by ecosystems throughout Garden Earth

Soil is an amazing resource. Without soil, we would not have most of the plants that grow on Earth. And without plants, there would be no food for animals and humans to eat. Soil takes a very long time to form, so it is considered a non-renewable resource. It can take more than 500 years to form just one inch of topsoil, which is the most productive layer of soil. There are many insects, fungi, and bacteria that live in the soil that are very important too. Without these important Soil workers, the world would be covered in dead animals, plant materials, and poop. Ugh! Worms, beetles, ants, fungi, and other organisms work very hard to break down organic materials into healthy soil. This is called decomposition. We should be very thankful for the hard work of the Soil Department. Let’s learn more about soil and some of the critters that live in it. Time to get dirty!

Oli Earthworm
Department Manager

The BIG QUESTION:
What would happen if the Soil Department workers stopped doing their job?

Write the Spanish translation every time you see a blank after a word.

<table>
<thead>
<tr>
<th>English</th>
<th>Spanish</th>
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<tbody>
<tr>
<td>Soil</td>
<td>Suelo</td>
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<tr>
<td>Worms</td>
<td>Gusanos</td>
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<td>Ants</td>
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<td>Plants</td>
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<td>Decompose</td>
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You may be wondering...

How is soil made?

Well, just like when you bake brownies, we have a recipe for soil. There are many “ingredients” that make up soil. The base ingredient is rocks. Wind, rain, freezing, and thawing all help rocks break down into smaller pieces. Other ingredients that make up our recipe for soil are dead plants, sticks, fallen trees, leaves, dead animals and even animal poop.

Dirt Pudding:

Ingredients
- 1 package Oreo cookies, crushed
- 1 package chocolate instant pudding mix
- 1 package gummy worms

Directions
- Make the instant pudding according to the instructions on the box.
- Put the cookies into a plastic Ziploc bag and crush into small bits using the back of a spoon or rolling pin.
- Stir most of the crushed cookies into the pudding, mixing well.
- Put a layer of crushed cookies into a cup; then top with a layer of pudding.
- Sprinkle the remaining cookie crumbs and a few gummy worms over the top of the pudding.
- Share with the rest of your dirt-loving friends and family!

Here is a recipe for Dirt Pudding.
I’m sure you will think it tastes much better than my recipe for soil!

Soil Workers – Who Am I?

Along with fungi _____________ and bacteria ________________, worms and ants are top workers in the Soil Department. Worms help to break down organic materials in soil that come from plants. They also add air to the soil through the burrows that they make. Ants ________________ help aerate the soil and carry organic materials farther underground to decompose ________________, as well. Though ants help with soil development in the United States, they are even more important in warm, wet areas like the tropics. Let’s explore the world of ants and worms to find out more on how they help our Soil Department!

Can you match the Soil Department worker with its job by putting its number in the blank?

1. ANTS
   ___ Aerate the soil by burrowing. Break down organic materials in the soil.

2. BACTERIA
   ___ Carry organic material underground to decay. Especially important for soil development in the tropics.
   ___ Break down organic material. Examples are mushrooms.
   ___ Microorganisms that help organic material decay.

3. FUNGI

4. WORMS
Though we may not care for those nasty biting fire ants or the pests on our picnics, ants are very important in our lives. They are hard workers in the Soil Department, burrowing tunnels in the soil to allow air and water to pass through. Ants are also wonderful scavengers of small dead animals. They eat more than 90% of decaying bodies. That is a great help in recycling organic matter. Can you imagine if ants didn’t help get rid of all these bodies? Yuck! And even though these insects often get overlooked, there are many kinds of plants and animals that depend on ants. If ants were to become extinct, hundreds of thousands of species would be affected. Talk about messing up the balance of the world’s ecosystems!

**The Ant Hill**

Ant hills are a maze of tunnels.  

*Can you help the ant find its way through the maze?*

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**LEAF-CUTTER ANTS**

Leaf-cutter ants are found in the tropical rainforests of Central and South America. They have powerful, scissor-shaped mandibles (jaws) that they use to cut leaves and flowers. They don’t eat the leaves though. They carry leaf fragments back to their underground nests, where they are broken down into smaller pieces. The ants work the plant pieces into a pasty pulp that grows a fungus that eventually becomes food for the ants. That’s right, fungus for dinner!

Are you wondering what this has to do with soil? Well, the plant material that is brought underground is a wonderful nutrient for the soil. This is important because rainforest soil is quite poor in nutrients. The leaf-cutter ants do their part to help insure healthy plant life throughout the rainforest. And don’t forget the tunnels that add air and water into the mix—two much needed ingredients in our recipe for soil.

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Factoid: An underground leaf-cutter ant mound can be as large as 80 meters. That is almost as big as a football field!
**Ant Parts!** Do you know the 3 main body parts of an insect? What other body parts do all insects have? Try to label the parts of the ant. Do you remember the term for the leaf-cutter ant's powerful jaws? What body part do they use to tunnel underground? These tunnels can be up to 15 feet deep. Can you believe it!?

Use these words to label the ant parts:
- Abdomen
- Antennae
- Compound Eyes
- Head
- Jointed Legs
- Mandibles
- Thorax

Find the answers and more at [http://www.enchantedlearning.com/subjects/insects/ant/](http://www.enchantedlearning.com/subjects/insects/ant/)

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**Worms**

Earthworms are also great workers in developing soil. They eat organic material in the soil. In fact, worms can eat more than 1/3 of their body weight in one day! Their castings, or worm poop, are very nutrient rich. Worms are a great addition to any garden as they produce natural fertilizer. Like ants, worms burrow, allowing air and water into the soil. Worms also mix the soil by bringing organic material from the top down to the soil below.

**Wow! Worms are Amazing! Did you know…**

- There are approximately 2,700 different kinds of earthworms.
- There can be more than a million earthworms in one acre of land.
- The largest earthworm ever found was in South Africa and measured 22 feet long!
- Baby worms are hatched from cocoons smaller than a grain of rice.
- The Australian Gippsland Earthworm grows to 12 feet long and can weigh 1-1/2 pounds.
- Worms don’t have eyes, but can sense light. They tend to move away from light since they can become paralyzed if exposed to light for too long (approximately one hour).
- If a worm’s skin dries out, it will die.
- Worms are hermaphrodites. This means that each worm has both male and female organs.
It usually isn’t too hard to find earthworms. Just do a little digging or look around after a hard rain. If you are having trouble unearthing a worm, you can use dry mustard, which can be purchased at any drug or grocery store, to bring them to the surface. Mix a small amount of dry mustard with water and pour it over an area of soil. The solution will bring the worms to the surface. Have some clean water to rinse the worms off, since the mustard irritates their skin. Remember, worms need to stay moist to breathe, so don’t let them get too dry while you are checking them out. Can you locate the different worm parts from the diagram on your live worm? How cool!

Ever wonder just how a worm eats? Worms don’t have teeth, but have very muscular mouths. Their mouth is located right behind the prostomium (the pointy end). The firm prostomium helps them push their way through the soil. Their setae move in and out to grip the sides of the tunnel wall and advance them forward. As they move along, worms swallow pieces of dirt, leaves, and other organic material. This is how their burrows are formed as well. Their meal gets digested and the outcome is nutritious fertilizer that plants just love.

Have you ever thought about why you see a lot of worms on the surface after a heavy rain? Well, water saturates the soil and floods the burrows that worms live in. They could drown if they do not come to the surface until the ground dries out. Unfortunately, this is a risky endeavor. Birds have a heyday eating worms after a heavy rain. The sun is also damaging to worms and they may die if they get too dry. So, if you see a worm on the sidewalk, driveway, or parking lot, help your worm friends by getting them back to their moist soil home.
Invite Some Worms for Dinner!
You've heard of composting, right? Well, another way to compost is by letting worms help break down organic matter a bit faster. This is called vermiculture. The worms help to decompose leaves, newspaper, and kitchen scraps and provide wonderful fertilizer for your garden. It is really easy and fun to have worms eating your garbage.

Learn more about vermiculture at [http://www.epa.state.il.us/kids/fun-stuff/wormbin.html](http://www.epa.state.il.us/kids/fun-stuff/wormbin.html)

**VERMICULTURE:**
Setting Up Your Own Worm Box

All you need is a plastic bin with a tight fitting lid and a drainage tray. Have an adult drill a number of small holes (about 1 cm or 1/4") in the bottom and all around the bin. Place the bin on the drainage tray to make sure no moisture gets on the floor. The worms require bedding: dried leaves, ground cardboard, peat moss, shredded paper or straw. Yesterday's newspaper torn into strips is great bedding. Next, it is important to keep the bedding very moist. Use a spray bottle to moisten the bedding with water. Check it periodically to make sure it is not drying out.

Now add the worms. Redworms are best for worm boxes. You can order redworms online or may be able to find them at your local bait and tackle store. Your worms will be hungry, so start feeding them immediately. Your kitchen scraps are their favorite meal. They love vegetable and fruit peels, coffee grounds, tea bags and egg shells. Make sure not to put meat, fat or dairy products into your worm bin. These are not easily composted and will make your bin smell and attract bugs. Food waste should always be dug into the bedding and well covered. Put the lid on and place the bin in a cool spot. Outside or in a garage is fine as long as the bin is brought in during winter. You would hate for your worms to freeze!

**Make your own Compost Holder**

Compost holders are wonderful for gathering your kitchen scraps until you are able to transfer them to your worm box or compost bin. As long as you empty it regularly, it will not stink or attract bugs. These kitchen scraps would end up in the landfill if they weren’t composted. Good job recycling your waste and providing healthy compost for your garden!

Here’s what you do. Have an adult cut the top off a plastic jug, as shown. Decorate your compost holder with permanent markers. Keep the holder by the sink for food scraps (no bones or meat), and carry it out to your worm bin or outdoor compost heap after dinner. Your holder can be washed with hot, soapy water and reused each day.
Dear Diary,

________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
EARTH’S SOILS NEED YOUR HELP!

You have already learned that soil is pretty important stuff, but did you know that soil is in danger? That’s right. Soils are threatened by erosion, which occurs when raindrops and moving water wash soil away. Trees and other plants normally protect the soils, but if the plants are removed when people make buildings, roads, or farms, the soil can just wash away. Removing the trees is called deforestation. When deforestation happens, good topsoil is washed away and plants aren’t able to get the nutrients they need. Pollution is another major problem for soil. People sometimes dump wastes, such as used motor oil, onto soil. The waste seeps into the soil, making it unhealthy for the plants that depend on it.

What can you do?

- Plant trees and other plants to help prevent soil from eroding.
- Use compost to help enrich garden soil with nutrients.
- Recycle or properly dispose of any waste that could be toxic to the soil.

Here are some fun books and websites where you can learn more about soil and the critters that live there.

**Books:**
- *Diary of a Worm* by Doreen Cronin
- *Filet of Soil* by Barry Rudner
- *A Handful of Dirt* by Raymond Bial

**Websites:**
- [http://www.urbanext.uiuc.edu/worms/index.html](http://www.urbanext.uiuc.edu/worms/index.html)

Soil Department Crossword Puzzle

ACROSS
1. The process of breaking down organic materials.
4. The main kind of soil found in Georgia.
8. Worm poop is called ________.

DOWN
2. The term for ant’s jaws.
3. A soil profile consists of several soil ________.
5. The main soil worker in the tropics.
7. The base ingredient of all soils.

**Crossword Puzzle:**

1 2 3 4 5 6 7 8

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