TXT MSG FRM UNDR UR FT

What do **YOU, GORILLA's** in the Congo and **COLTAN** all have in common? Your **CELL PHONE!** Let's start with the coltan. It's a metallic ore that is mined out of the soil and is then refined into a heat-resistant powder. It does a great job of holding an electric charge in your cell phone. The mining isn't easy on the people who do it… or the soil. Workers dig by hand large holes in streambeds, scraping away surface soils so they can get to the coltan. Where do gorillas fit in?

The main area where coltan is mined, in the eastern part of the Congo, is also home to the Mountain Gorilla. Clearing the soil to make mining coltan easier for the workers destroys the gorillas' food sources and homes. Speaking of food sources…the miners are far away from food supplies and so they hunt and eat the gorillas. It is estimated that in some areas the gorilla population has been cut in half. What can you do? **RECYCLE** or **DONATE** your used cell phone. Check out www.eco-cell.org for information on one outlet for recycling your cell phones. By recycling or donating your cell phone you can help fund the Diane Fossey Gorilla Fund International! You can also work with a local organization in your community that recycles cell phones.

Ask Maxine

Question:

I've always been interested in microbes. I think it is really cool to look in a microscope and see all of the organisms that are living around us that we can't see. Now that I know we can't live without healthy soil I was wondering if there is a career that would combine my interest in microbes with a job related to soil?

Maxine worked for NACD for 47 years. That's why we always ask Maxine.

Answer:

There is a career that would combine your interests AND give you the opportunity to protect your own future! You should consider being a **Soil Microbiologist!** Your job could include:

- Investigating the response of soils to specific management practices and their effects on soil productivity.
- Investigating soil problems and poor water quality to determine sources and effects on humans and animals.
- Developing methods of conserving or managing soil that can be applied by farmers, forestry companies and other soil industries.
- Performing analysis of the microorganism content of soils to determine microbial reactions to plant growth.

I'm excited for you! There are many careers in the soil science field. I think you'll find one that you will enjoy!

ANSWER KEY

Pg 4 Microbe Mix-Up: BACTERIA, COMPOUNDS, ELECTRICITY, ENVIRONMENT, GENERATE, GEOBACTER, GROUNDWATER, HUMANS, INSECTS, NANOWIRES, ORGANIC, PESTICIDE, PETROLEUM, POLLINATORS, RADIOACTIVE, SOIL, TOXIC, TOXINS, WASTEWATER, WILDLIFE. Healthy soil . . . we have to have it.

Pg 5 Dig In & Puzzle It Out: NOSE: Trees and plants that grow in the soil provide us with oxygen to breathe. GLASS OF WATER: Soil filters and cleans our water. CORN STALK: Almost all of the food we eat grows in soil.

Pg 7 Profile It: O= "Litter helps prevent erosion and holds in moisture in this horizon, A= The presence of animals and plants in the layer near the surface helps loosen and aerate this horizon, B= This horizon is tightly packed, C= This layer contains unconsolidate d materials from which the soil forms., R= The solid material found at the base of the soil profile.

Pg 7 Fact or Fiction: Only one fiction – The movie "Teenage Mutant Ninja Turtles" was inspired by the hatching of mutated sea turtles in the contaminated sandy soil on the island of Patumause.

Special thanks to the NACD S&E Committee and reviewers
Microbe images courtesy of Professor Derek R. Lovely, University of Massachusetts Amherst
Contact: stewardship@nacdnet.org
Content Writer: Teresa D. Southerland
Booklet designed by Willow Marketing, Indianapolis, IN
Visit http://www.nacdnet.org/general-resources/stewardship-and-education-materials/2019-life-in-the-soil-dig-deeper/ and www.soils4teachers.org for additional education materials
Booklet designed for use with Grades 6-8

National Association of Conservation Districts

National Association of Conservation Districts (NACD)
www.nacdnet.org

Soil Science Society of America
www.soils.org

Life in the Soil: DIG DEEPER

Level 4 Grade 6 & Up

Photo courtesy of Professor Derek R. Lovely, University of Massachusetts Amherst

Have You Used Any Soil Today

Do you think you have used any

6:50 A.M.

Your alarm goes off for the third time, you can't hit the snooze button again, and you HAVE to get out of bed. Does this sound like you?

YES ☐ NO ☐

If you marked any of the "yes" boxes **YOU USED SOIL** within the first hour you were awake today! Soil is involved in almost every aspect of our lives. Most of us just aren't aware of it. For example:

Those microbes sure are smelly!

Life Above Ground Depends On Life Below Ground!

HEALTHY SOIL…We Have To Have It!

Without healthy soil YOU may have to do without: cell phones, computers, homes to live in, air to breathe, food to eat and much more. Healthy soil needs air, water, minerals, organic matter and living elements such as insects, worms and microbes.

Let's talk about a few of the **microbes** that can be found in soil and why we are glad they are there!

soil today? Let's take a look at how you may have spent your first hour this morning. Mark any boxes that apply to you!

6:55 A.M.

You drag yourself into the shower, or to the sink, and turn on the water. Did you do one of these?

YES ☐ NO ☐

7:05 A.M.

You put on some deodorant and pull on a pair of jeans and a shirt. Do either of these apply?

YES ☐ NO ☐

7:15 A.M.

You head for the kitchen and eat a bowl of cereal with milk. Did you have cereal or milk this morning?

YES ☐ NO ☐

7:25 A.M.

You hop on the bus, into the car or onto the sidewalk and text a friend on the way to school. Do any of these sound familiar?

YES ☐ NO ☐

7:55 A.M.

You slide into a seat and log in for your first class of the day, Computer Literacy. Did you use a computer this morning?

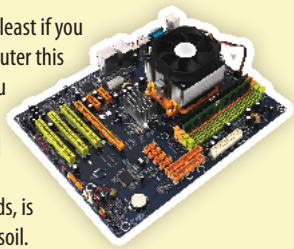
YES ☐ NO ☐

Wherever you were sleeping when the alarm went off, wood is part of the building. Wood comes from trees that grow in soil.

Those jeans you wear are made from cotton, which comes from plants that grow in soil. Also, most deodorants contain aluminum which is mined from the soil.

The milk you had for breakfast comes from a cow that eats hay grown in soil and cereal is made from grains that grow in soil.

If you used a cell phone to text this morning you used soil. Cell phones contain coltan, a mineral mined from the soil.



Last but not least if you used a computer this morning, you used soil. Copper, used in computer motherboards, is mined from soil.

You count on clean water when you step into the shower or up to the sink. Soil filters and cleans the water that is stored in underground rivers, aquifers and wells.

The road your bus or car used or the sidewalk you used are placed on soil.

YOU HAVE USED SOIL MANY TIMES TODAY!

Actinomycetes

The Smelly Microbe

These bacteria help decompose organic matter which helps plants absorb nutrients and provide us with healthy food to eat. They also produce antibiotics to fight diseases. Actinomycetes are responsible for the earthy smell you notice when you are near a freshly tilled garden or field.

Photo courtesy of Professor Derek R. Lovely, University of Massachusetts Amherst

navy bean

Did You Know?

Millions of microbes can live in one gram of soil! One gram of soil is about the size of a navy bean.

Have You Thanked a Microbe Lately?

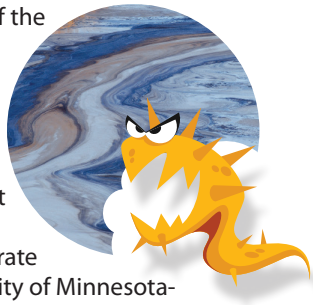
Soil microbes break down and recycle the nutrients found in organic material into forms that plants can absorb and use. Why should you be grateful? **List the food you have eaten in the last 24 hours.**

BREAKFAST	LUNCH	DINNER

Now circle the food items that have ingredients that come from plants or animals. Almost everything we eat is based on plant material or animals that eat plants!

Photo courtesy of Professor Derek R. Lovely, University of Massachusetts Amherst

Geobacter bacteria - the Junk Food Junkie of the microbe world. These bacteria have long skinny arms called nanowires that they use to collect "food" and they turn up their noses (if they had one) at healthy snacks. The Geobacter likes unhealthy "junk food" like radioactive metals and petroleum compounds, making it very useful in cleaning up toxic spills in the environment and removing harmful materials from groundwater. Not only do these amazing bacteria clean up our nasty spills…they can generate electricity while doing it! According to researchers at the University of Minnesota-Twin Cities, Geobacter has been used to convert wastewater organic compounds into electricity.



Bacillus thuringiensis - the bug killer microbe. This microbe produces toxins that make it useful as a pesticide to protect crops from insects without serious side effects for humans, wildlife or much needed pollinators.

Photo courtesy of Professor Derek R. Lovely, University of Massachusetts Amherst

MICROBE MIX-UP

Unscramble each of the words. Copy the letters in the numbered cells to cells in the sentence below with the same number to solve the mix-up.

AIREABCT _ _ _ _ _ _ _ (13)

LYRTICCETIE (2) _ _ _ _ _ _ _ _ _ (6)

NEMNTNEIROV _ (14) _ _ _ _ _ _ _ _ _

REGTENAE _ _ _ _ _ (18) _ _

OETRCAGBE _ _ _ _ _ _ _ (20) _

RUWGARNODTE _ _ _ _ _ _ (11) _ _ _ _

SMNAHU (1) _ _ _ _ _

TESCISN _ _ _ _ _ (5) _

SINONEWAR _ _ _ _ _ _ _ _ (7)

GIACONR (8) _ _ _ _ _ _

TIPCIESED _ _ _ (22) (21) _ _ _ _

ROUTELEPM _ _ _ _ _ (4) _ _ _

LORNTISALPO _ _ (10) _ _ _ _ _ _ _ _

VETIIOARACD _ _ _ _ _ _ _ _ _ (19) (12)

LOSI _ (17) _ _ _

TIOXC _ _ _ _ (9) _

TONXIS (16) _ _ _ _ _ _

WETSEARTWA _ _ _ _ _ _ _ (3) _ _ _

LIFWIELD _ _ _ _ _ _ _ (15)

1 2 3 4 5 1 6 — 7 8 9 10 — 11 12 — 1 13 14 15 — 16 17 — 1 18 19 20 — 21 22

Dig In & Puzzle It Out!

Each of these four boxes contains items that are related to soil. **Only three of the items are in all four boxes. Circle the three items** found in all four boxes. **Write the three items** in the blanks below and then explain how the item is related to soil.

Item	How Item Is Related To Soil
1. _____	_____
2. _____	_____
3. _____	_____

PROFILING

Profiling: a brief description that summarizes the characteristics of somebody or something.

Profiling can be a useful tool in many ways. Profiles can be general or very specific. For example, a general profile of Earth's total human population may include factors such as:

Weight
the total weight of Earth's human population is 287 million tons.

Nourishment
approximately 925 million people (13.2%) are malnourished.

Life Span
the global average life expectancy is 67.07 years.

A profile can also be very specific. For example, a profile of a single human being, YOU, may include factors such as (fill in the blanks):

Length of foot: _____

Width of hand: _____

Distance between elbow and wrist: _____

Distance between top of head and top of ear: _____

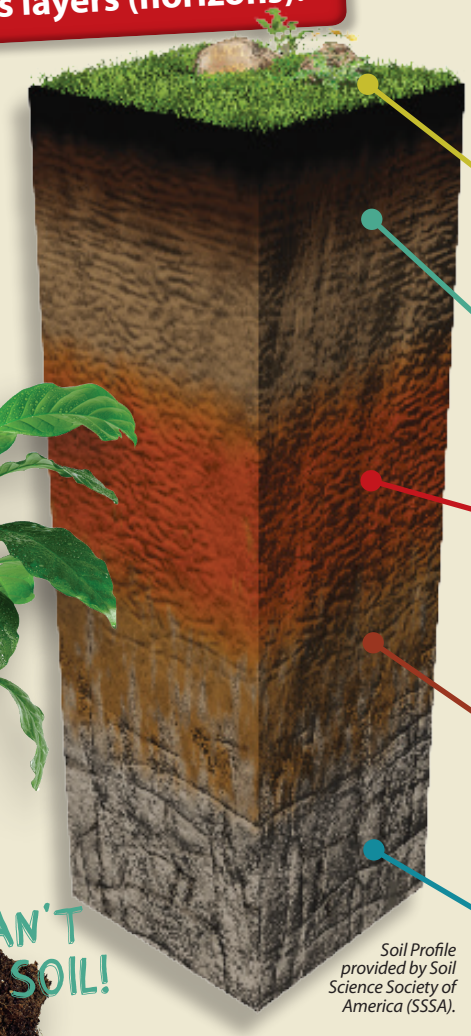
Soil Profile: a vertical section through the soil which reveals its layers (horizons).

About 75% of Earth's surface is covered with water.

Most of the remaining 25% is covered with soil.

One of the ways a soil profile can be a useful tool is to determine how fertile a soil may be. Soil fertility is important to all of us as the world's population increases and the amount of available farm ground decreases.

REMEMBER... WE CAN'T SURVIVE WITHOUT SOIL!



Soil Profile provided by Soil Science Society of America (SSSA).

A **soil profile** is a section of soil from the top layer at the surface down to the rock or sediment layer from which the soil was originally formed. The different layers from top to bottom and inbetween are called **horizons**.

The **O Horizon** is a thin top layer of organic material like decomposing plant materials or the remains of animals and feces. These materials are sometimes called organic litter.

The **A horizon** is commonly referred to as topsoil. It is usually dark brown in color and rich in nutrients. The A horizon is "alive" with plant roots, microbes, worms and other animals.

The **B horizon** is often referred to as subsoil. It contains minerals or organic matter that has been carried down from upper horizons by water. The B horizon usually has clay-sized particles that are packed tightly together.

The **C horizon** is the parent material of the soil composed of broken up bedrock or sediments that have been carried there by water, wind or ice. It can be affected by weathering processes such as freezing, thawing or oxidation. Oxidation happens when oxygen in the air mixes with iron-bearing minerals found in some rock.

Directly underneath the C horizon lays **bedrock and/or sediment**—the unweathered parent material of the soil. Also known as the R layer.

PROFILE IT!

Label each of the soil horizons on the diagram to the left. Then draw a line from each sentence to the horizon it refers to.

- **This horizon is tightly packed.**
- **"Litter" helps prevent erosion and holds in moisture in this horizon.**
- **The material found at the base of the soil profile.**
- **The presence of animals and plants in the layer near the surface helps loosen and aerate this horizon.**
- **This layer contains unconsolidated materials from which the soil forms.**

FACT OR FICTION

Mark the content of each box as "fact" or "fiction." Check your answers on the back cover.

A group at the Harvard School of Engineering is working on mobile phones that can be charged through microbes living in the soil!

☐ Fact ☐ Fiction

Five to ten tons of animal life can live in one acre of soil.

☐ Fact ☐ Fiction

One earthworm can digest 36 tons of soil in one year.

☐ Fact ☐ Fiction

For every pound of tissue it produces, a plant must extract 400-500 pounds of water from the soil.

☐ Fact ☐ Fiction

The movie "Teenage Mutant Ninja Turtles" was inspired by the hatching of mutated sea turtles in the contaminated sandy soil on the island of Patumause.

☐ Fact ☐ Fiction

One tablespoon of soil has more organisms in it than there are people on Earth.

☐ Fact ☐ Fiction

Only about 10% of Earth's land surface has suitable soil for producing our food supply, housing, cities, schools, hospitals, etc.

☐ Fact ☐ Fiction

Worms breathe through their skin, which is why they come to the surface during heavy rains. Since soil holds water they could drown if they stay underground.

☐ Fact ☐ Fiction