Curious Miguel Asks about Soil

Texas Education Agency

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This book was developed in collaboration with Region 4 Education Service Center, Houston, Texas.

region 4

Miguel was a typical third-grade student. He always did his homework for school and his chores at home.

Every day he was responsible for taking the vegetable and fruit scraps and some of the yard waste to the compost bin his family kept on the back porch.

One day, Miguel added banana peels, strawberry tops, and some dead leaves to the compost bin. He stopped and looked inside the bin. His parents never explained why they put these things in the bin, but he knew his mother would occasionally take some dark material out of the bin and add it to the soil in the flower garden along the edge of the porch.

Later that evening at dinner, Miguel asked, *"Mamá?"*

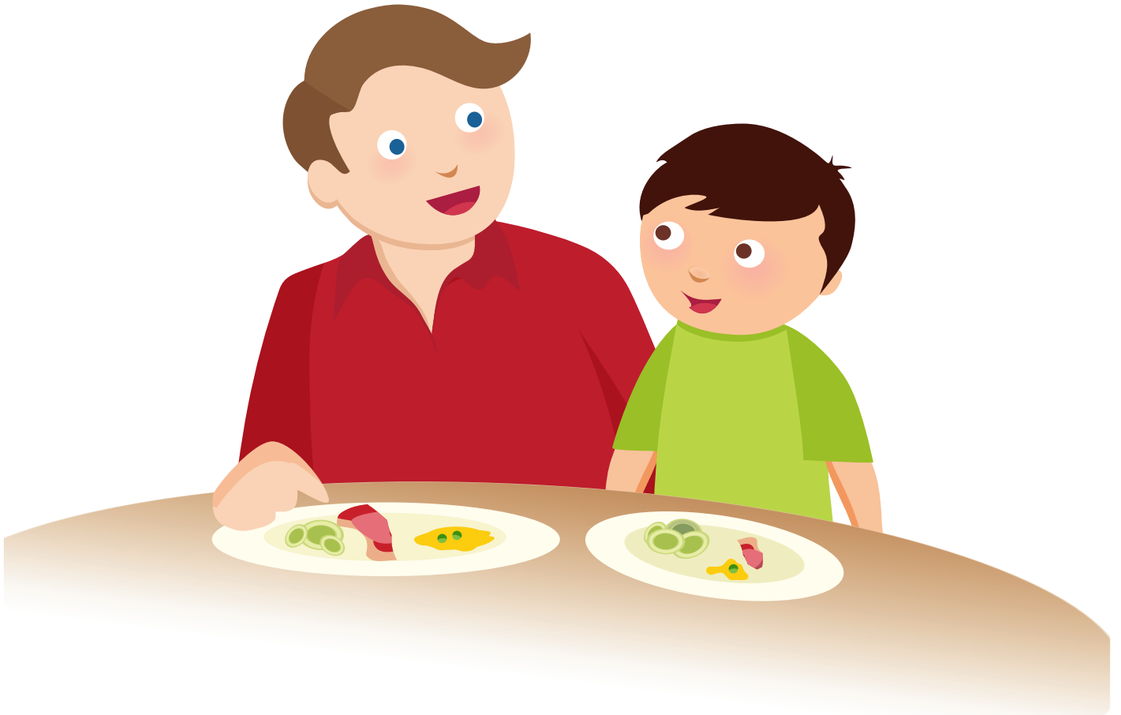
"Yes, *mijo**, what is it?" Miguel's mother replied.

"Mamá, why do we put leaves and vegetable scraps in the bin outside, and why do you put it in the flower garden?" Miguel questioned.

**a* Spanish word meaning *my son*

"Always so many questions, Miguel. You are your father's child," she replied with a giggle as she smiled at Miguel's father.

"Miguel, you should call your Aunt Sara. She is a soil scientist for the United States government. I'm sure she'd love to answer all of your questions," Miguel's father said.



Miguel responded with a smile. "Thanks, Dad. Can I call her tonight?"

"Absolutely, Miguel. Now finish your dinner," his father replied.

Immediately after dinner, Miguel called his Aunt Sara.

"Hi, it's Miguel. I asked Dad and *Mamá* some questions, and they told me I should ask you because you work with soil," he said excitedly.

"Hi, Miguel, it's so good to hear from you. You sound really excited about this," Aunt Sara said.

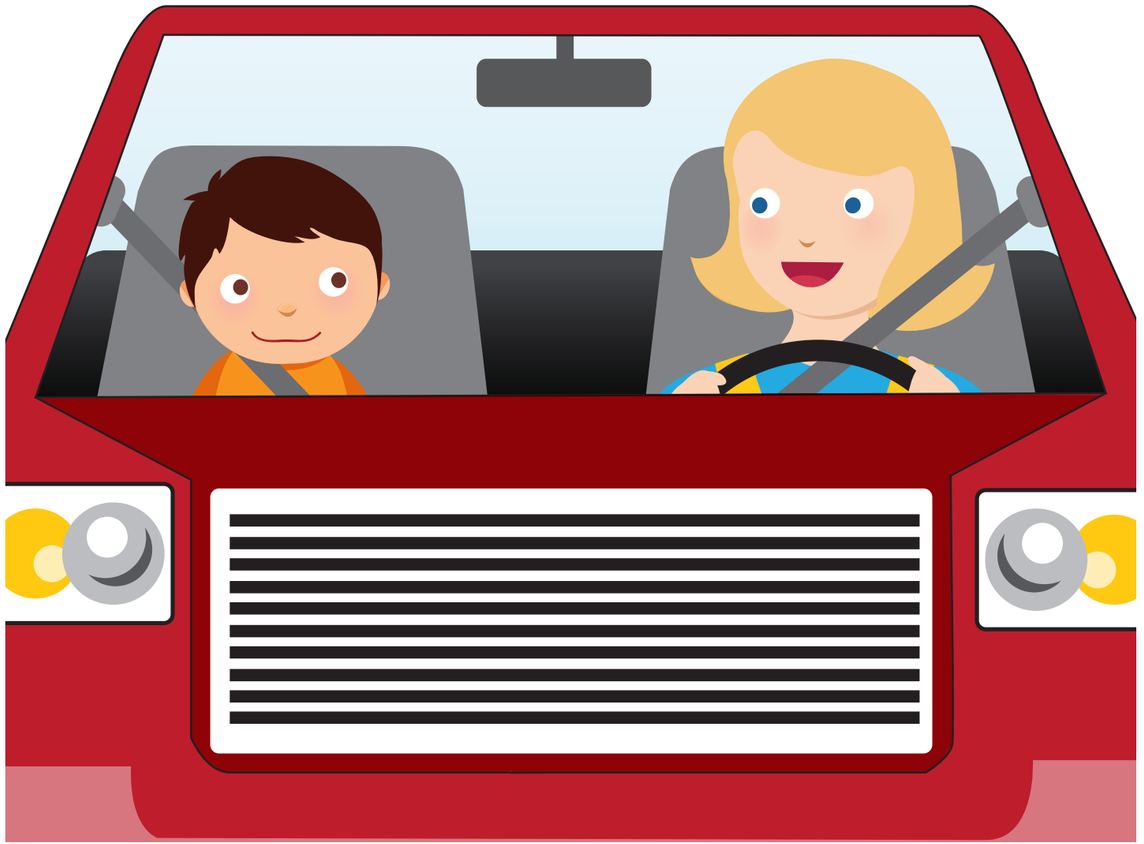
"I would love to talk to you about it. Can you come to work with me on Thursday afternoon?" she asked.

"My Dad and *Mamá* said I can. I have a half day at school that day," Miguel happily replied.

"Great! See you then, Miguel. Go get your homework done now," Aunt Sara said with a smile.

"Okay, Aunt Sara. I will. See you on Thursday," he replied.

On Thursday, Aunt Sara picked up Miguel from school and drove him to her latest field office, located in a farming community.



"Before we get to your questions, Miguel, tell me what you already know about soil," Aunt Sara said.

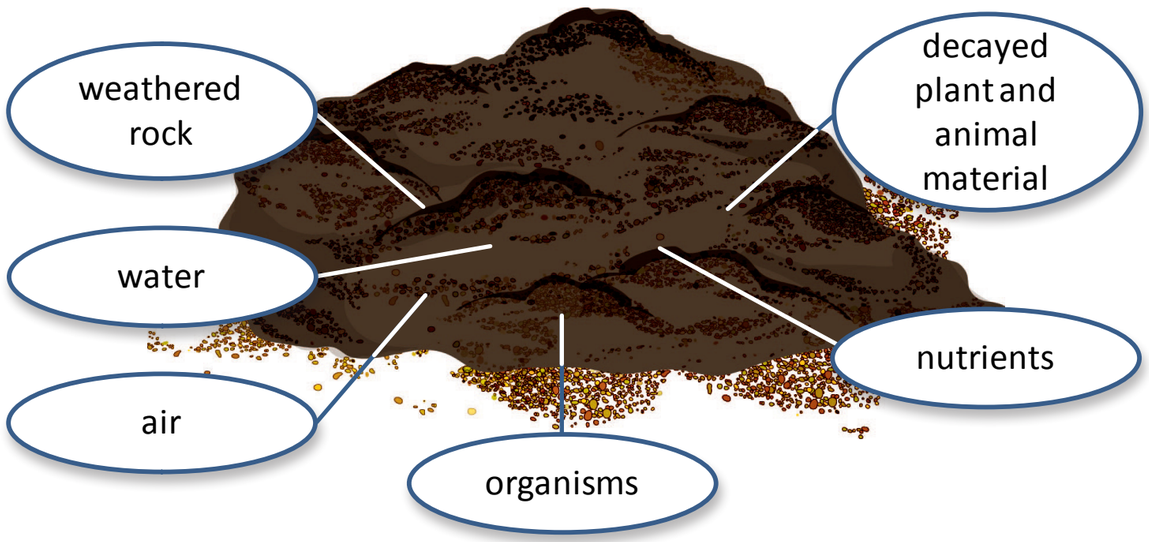
"Well," Miguel said, stopping for a moment to think, "it has rocks and leaves in it and sometimes worms."

"That's a good start, Miguel," Aunt Sara said sweetly. "Soil is like a meal your *Mamá* might prepare for dinner."

Miguel quickly replied, "No way! Soil isn't like *Mamá*'s *caldo**. That's yummy; soil would be gross to eat!"

*a Spanish word meaning *soup*

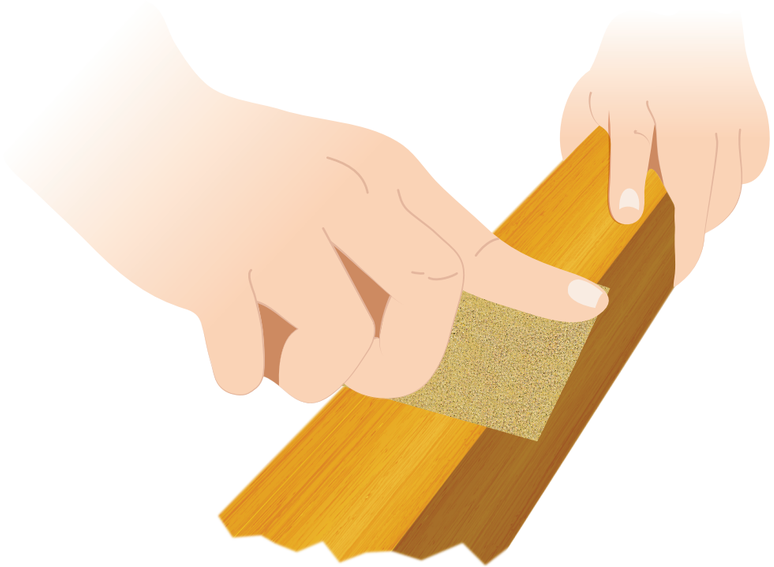
"Soil is a mixture of many components, just like your mother's *caldo*," Aunt Sara said. "Soil is made of many things, but do you know about weathered rocks, where the story of soil begins?" Aunt Sara showed Miguel some of the soil samples she had collected.



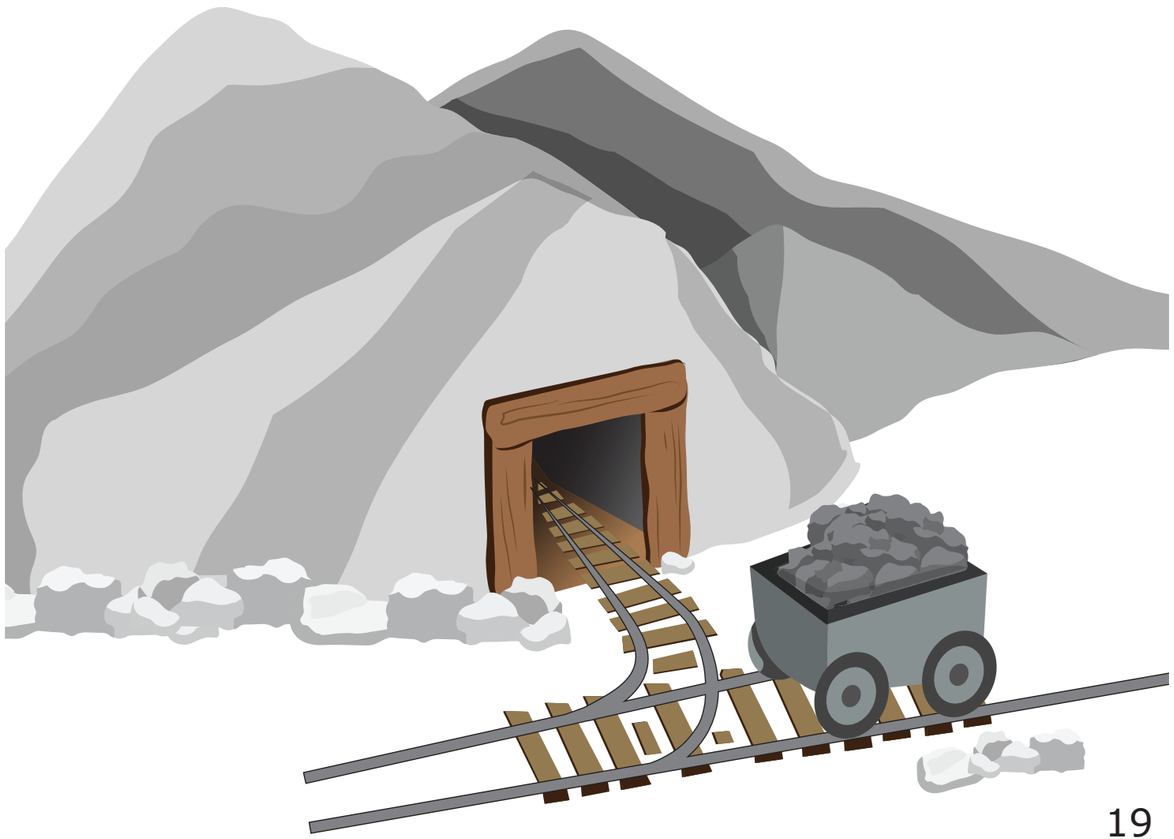
Miguel asked, "What are weathered rocks? Are they rocks that have been through a thunderstorm?"

"That's a good connection, Miguel. Weathered is a synonym for broken down. The layer of solid rock you see as hard ground on Earth is called bedrock. Bedrock is weathered, or broken down, due to forces from water, wind, or ice. These forces can break rocks apart into smaller and smaller pieces. This happens over a very long period of time," Aunt Sara said.

“Huge pieces of bedrock are weathered into boulders. Boulders are weathered into pebbles. Pebbles are weathered into even smaller pieces. Imagine sandpaper on a piece of wood, smoothing it out and changing the corners from pointed to rounded, slowly making the piece of wood smaller and smaller. Weathering of rocks is very similar except it takes a lot longer than sanding wood,” Aunt Sara explained.



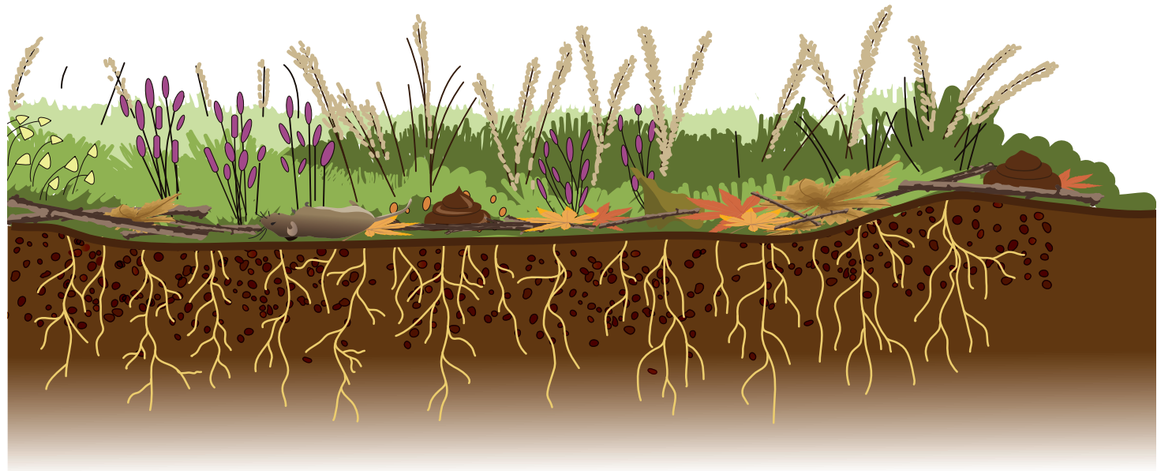
“Although rocks are mostly weathered this way, rocks can be weathered by human activity such as mining and the grinding down of rocks for use in construction materials. In any case, rocks are broken into smaller and smaller particles,” she continued.



"So the small particles of rock that I find on the playground at school used to be part of a larger rock?" Miguel asked.

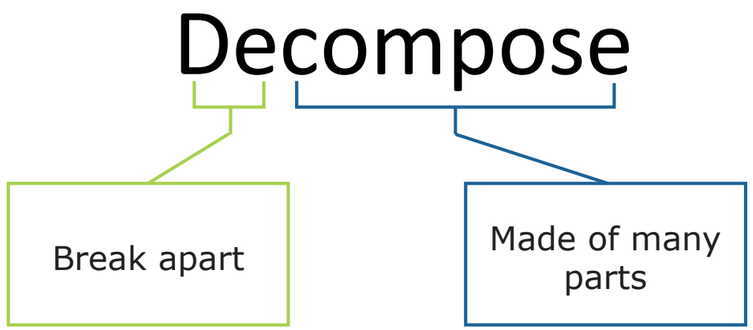
"Absolutely, Miguel. Eventually they become so small that they're hard to see without a hand lens. A handful of sand is made of thousands and thousands of small weathered pieces of rock. Silt is also weathered rock made of particles that are even smaller than sand. Clay is made of even smaller pieces of weathered rock. In nearly every type of soil I study, I see different amounts of sand, silt, and clay. Without the weathering of rock, we could never have soil," Aunt Sara replied. "But then again, we could never have soil without plants and animals."

With a puzzled look on his face, Miguel asked, "How do plants and animals help?"



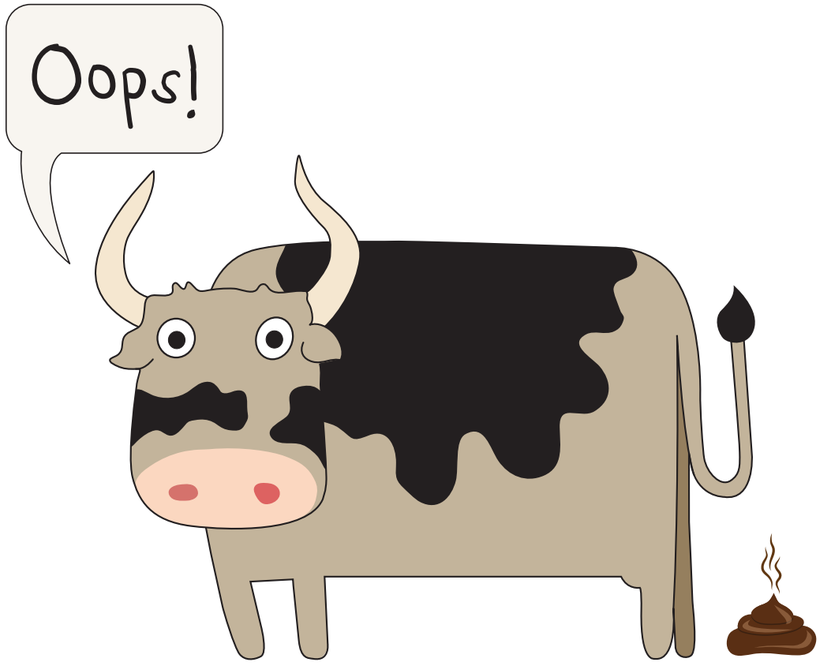
"Small plants begin to grow in the soil. Parts of these plants, such as leaves, as well as plants that have died, litter, or pile on the ground. This dead plant material is where the process of decomposition begins," Aunt Sara replied.

"Decompa-who?" Miguel asked with an even more puzzled look.



"It's not a who; it's a what, Miguel," Aunt Sara said with a smile. "Decomposition is the process in which plant and animal remains decay or decompose. Remains are parts of plants or animals that are no longer living and are left behind. The *de* in decompose means to break apart, and *compose* means something made of many parts. *Decompose* means to break down plant or animal remains that were once part of the whole organism. When the decomposition process is complete, you are left with a substance called humus."

"Okay, that seems simple but kind of yucky," Miguel said with a chuckle.



"It's not always just plant remains, either. Sometimes dead animals and waste products from animals, such as cow manure, also pile on the plant remains," Aunt Sara said.

"So humus has animal poop in it, too? That's really yucky, Aunt Sara. What does humus look like, and how does it help us?" Miguel asked.

"Humus is a dark brown or black material that doesn't look like its ingredients. Humus has a lot of nutrients that are necessary for the soil to support life, and it helps the soil retain, or hold, water," Aunt Sara said.

"Miguel, you said you were wondering why you put the vegetable scraps and leaves in the bin on your back porch. What do you think is happening in the bin?" Aunt Sara asked.

"I think the vegetables and leaves, which come from plants, are decaying in the bin. That would mean that the dark-colored stuff *Mamá* is putting in the flower beds is humus!" Miguel exclaimed.

“Excellent! Now think about this, Miguel. The compost bin is a model for the decomposition that happens in the natural world,” Aunt Sara said.

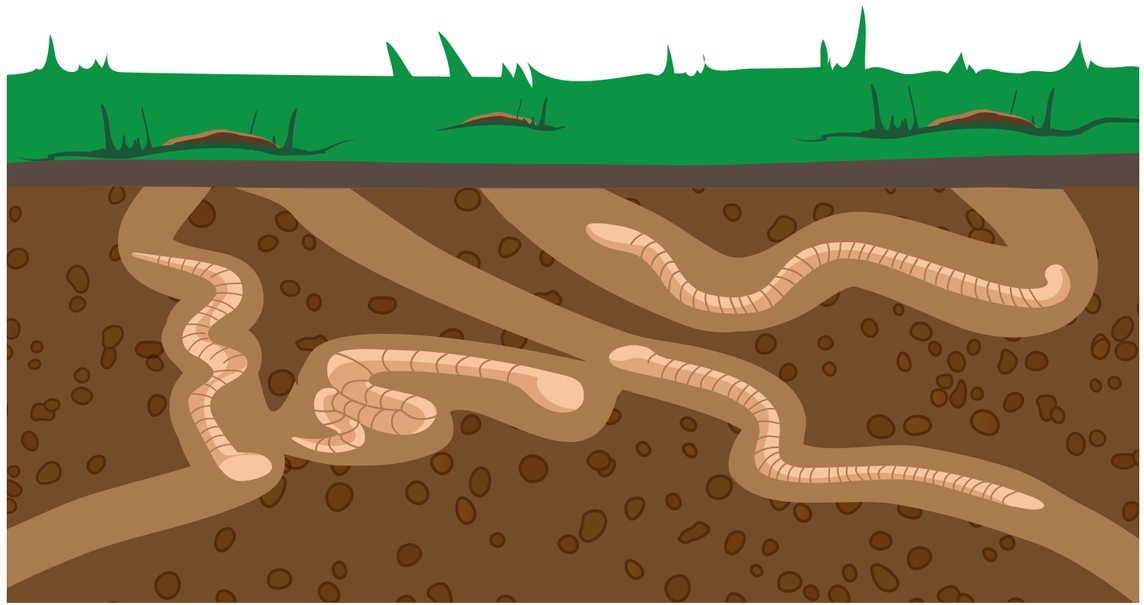
Aunt Sara then quickly asked, “What would happen if you didn’t pick up the leaves from the yard and put them in the compost bin, Miguel?”

“They’d stay on the ground,” he responded.

“Correct. They would pile together with animal waste, twigs, and other things left on the ground to decompose,” she said.

“How do they de-com-pose?” Miguel asked, slowly pronouncing the word.

“In your bin, and on the ground, there are worms and insect larvae that help with decomposition. There are also small organisms that you cannot see with just your eyes. Many you can only see with the help of a microscope,” Aunt Sara explained.



“In my work with other scientists, we call these microorganisms because the prefix *micro* is a synonym for extremely small, so it means small organisms. Microorganisms help break down the dead plant and animal material for energy. Humus remains after the process is complete,” Aunt Sara said while allowing Miguel to observe a humus sample using her microscope.

“I put all different types of vegetables and leaves in the bin. So humus is a mixture?” Miguel asked.

“Yes, humus is a mixture of the decomposed plant and animal remains that were the original ingredients,” Aunt Sara answered.

"Okay, that makes sense," Miguel quickly replied.

"Now why do you think your *Mamá* adds it to the flower beds?" she questioned.

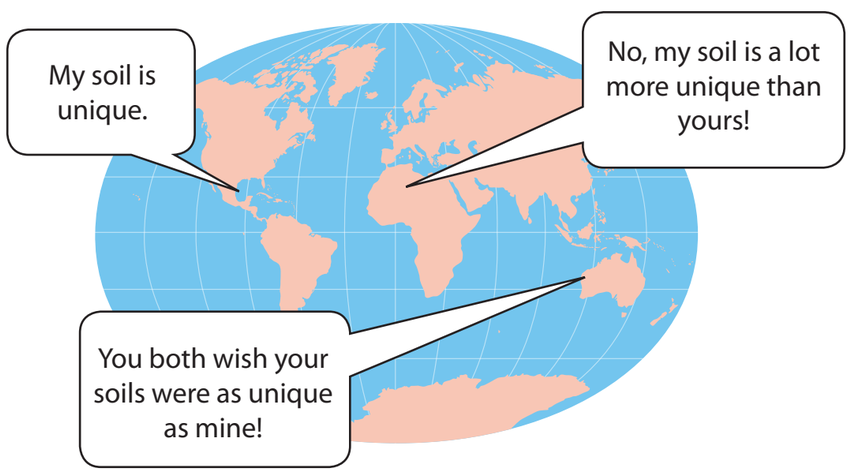
Miguel thought to himself, "If soil is a mixture, and *Mamá* is adding humus to the flower beds, maybe it's like when she adds different ingredients for her *caldo*. She wants the mixture to be just right for the plants to grow their best."

Miguel answered Aunt Sara, "*Mamá* adds it because the soil there doesn't have enough humus in it for the plants to grow well. She adds more humus to the mixture of weathered rock particles, humus, water, and air that is already there. *Mamá* is changing the recipe of the soil in the flower beds."

"Absolutely, Miguel. Now in the natural world, the weathered rock particles and humus mix naturally as organisms move through the soil and plants push with their roots," Aunt Sara said.

"Is soil the same everywhere, Aunt Sara?" Miguel asked.

"Different areas of the world have different types of plant material, different types of animal remains and waste, and different types of rocks and minerals. Each soil forms from these different materials. Therefore, soil depends mostly on geography, or where the soil is located. These are some of the things I study in my work as a soil scientist," Aunt Sara said.



"We help areas across the United States ensure their soil has all the necessary components for growing crops. The exciting thing about soil is that it is constantly forming slowly over time as more rock is weathered and more plant and animal materials decay," Aunt Sara explained.

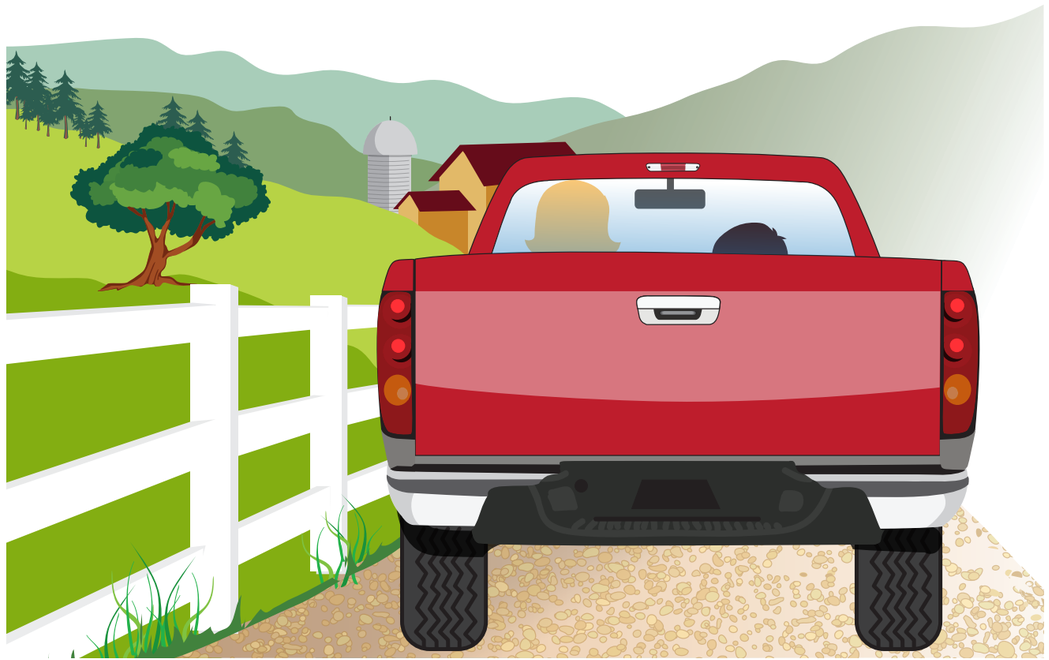
Soil

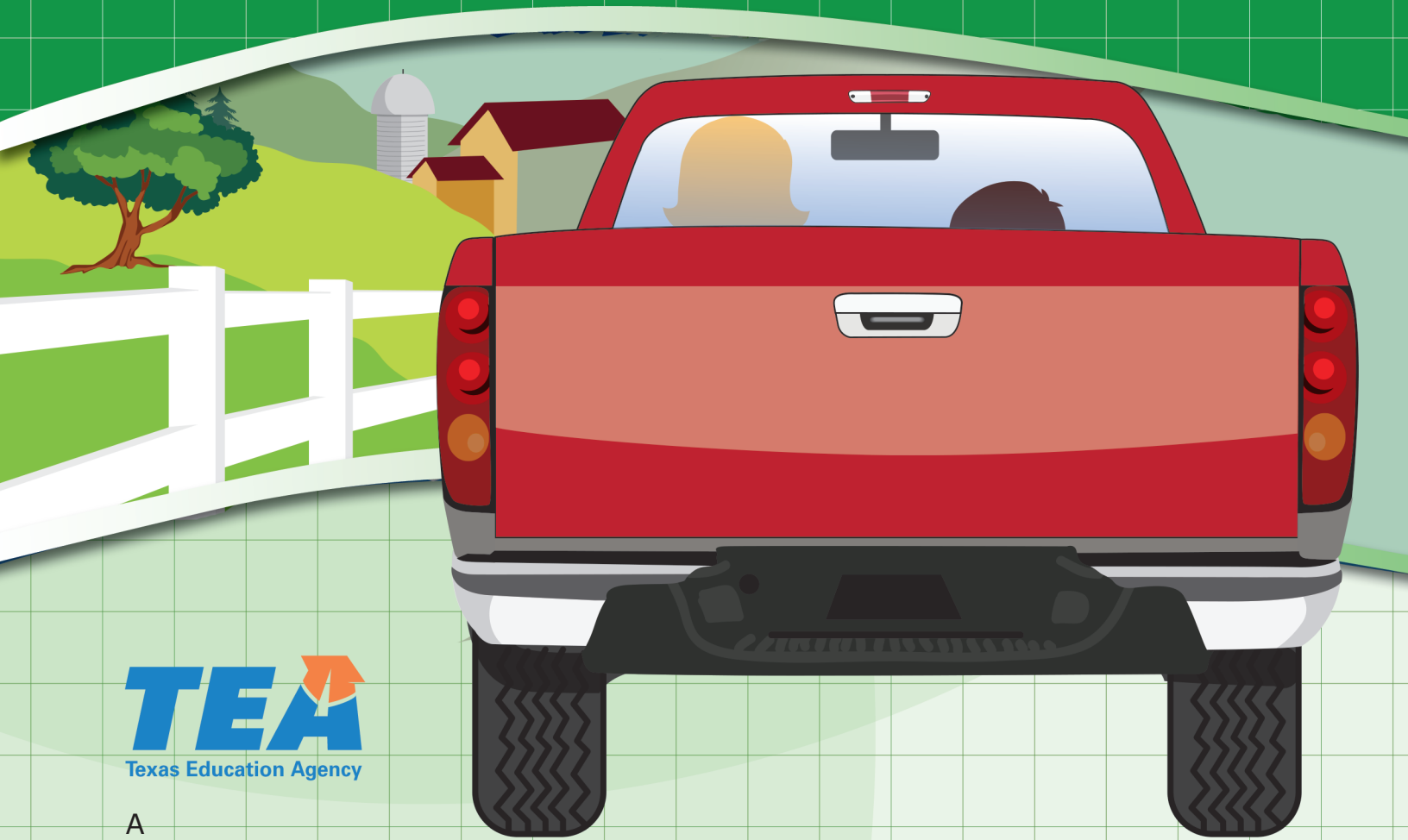
- particles of weathered rock
- humus
- air
- water
- living organisms

"I think I understand it now. Soil forms from the weathering of rock into small particles. The small rock particles combine with decaying plant and animal remains that have decomposed into humus. Different areas will have different types of soils with different ingredients, depending on the types of plants and rocks and other factors in the environment. Wow, I feel like I know so much more now, Aunt Sara," Miguel said with a smile.

“I’m so glad, Miguel,” Aunt Sara replied. “Now let’s get you home in time for dinner.”

As they drove home, Miguel was thankful for all the things he learned today, excited for the new things he would learn tomorrow at school, and eager for a bowl of *Mamá*’s *caldo*.





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