

The Realm of Edaphos



A Robot and a Mole

The workshop of Dr. Theophilus Erdreich shone. Not because it was clean and orderly, but because of the countless bits and bobs of metal that gleamed in the warm spring sunlight. However, what shone most brightly in the middle of the nuts and bolts and scraps of metal was the satisfied smile of the scientist, for after years of work, Geatrix, his greatest creation, was finished. Into her he had put all his genius, all his energy, even all his hope, because the mission of his mechanical masterwork was fundamental to life itself. She was made to save earth's soil.

Dr. Erdreich had filled the robot's digital archives with all humanity's stored wisdom. However, she would be sent out into the world on a quest for new, first-hand knowledge.

"Welcome to the world, Geatrix," said Dr. Erdreich.

"Thank you. I am very eager to learn about it," replied the robot in a warm female voice that had the smooth texture of a papaya and would perhaps strike you as odd coming as it did out of the vocal apparatus of a stainless steel machine that looked only roughly human.

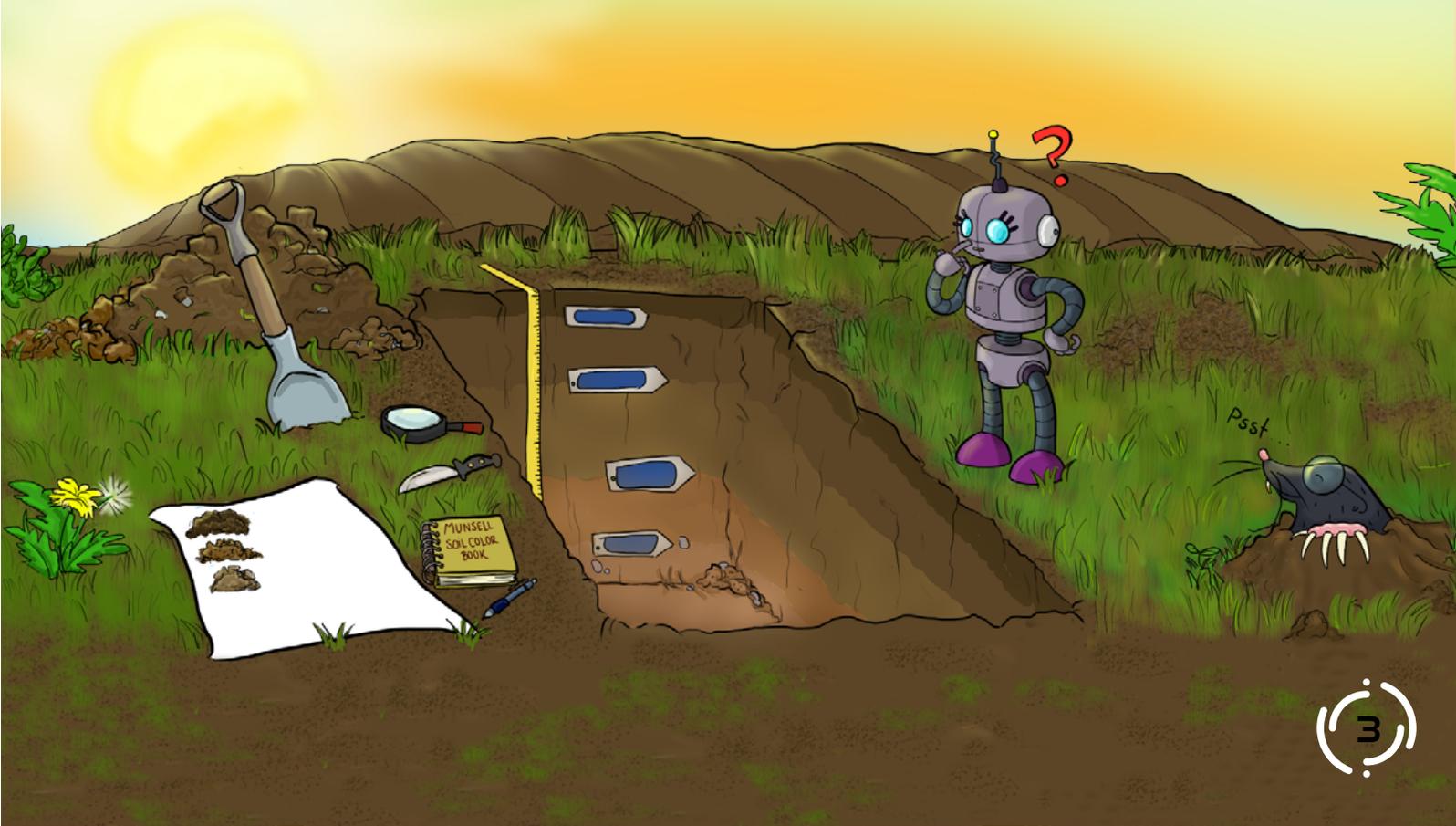
"Great. I shall take you to my nephew's farm. His name is Salvador. He's an edaphologist."

"An edaphologist," answered Geatrix. "Excellent. He studies soil. There is no better place to begin to understand the earth than in the soil."



After a long drive they arrived at Salvador's farm just as the sun was coming up and building layers of colored light upon the horizon. Dr. Erdreich led Geatrix to a pit and said, "This is a hole my nephew's research team dug a few days ago to observe the soil in this field. See what you can find, Geatrix. I'll check in with Salvador and be back later."

The robot went straight to work, kneeling down to look into the pit. She examined the dirt around it, running it through her chemically sensitive fingers. Then she peered into the hole. While inspecting its interior she heard a sound unfamiliar to her programming.



“Psst! Psst!”

“Hmm, that’s curious”, she thought. “Could that be the wind?”

“Psst! Psst! Down here, I am down here!”

Geatrix looked to her side and saw a tiny animal pop up out of the ground.

“Hi there. Who are you?” the robot said brightly.

“I’m Edaphos. A mole that mines –and minds– the soil. And who are you?”

Tiny lights on the robot’s forehead blink as she processed what the mole said.

She pulled up this data from her archives:



LOADING...



Mole: A small animal that dwells underground. Its eyes are very small and nearly blind, but it can sense vibrations and pick up the faintest of scents as it moves its keen snout about. With its strong claws it tunnels through the earth.

Edaphos: The Greek word for “ground”.

Edaphology: Soil science. An edaphologist studies soil, its components, composition and care, within a meter of depth.

Early soil scientists include the ancient Greek Xenophon and Roman Cato who wrote about soil. The Russian scientist Vasily Dokuchaev (1840/1903) put edaphology on a modern academic footing.



“It is nice to meet you, Edaphos. I am interested in the soil. I want to save it.”

“We have that in common then,” replied Edaphos. “Would you like to be my friend?”

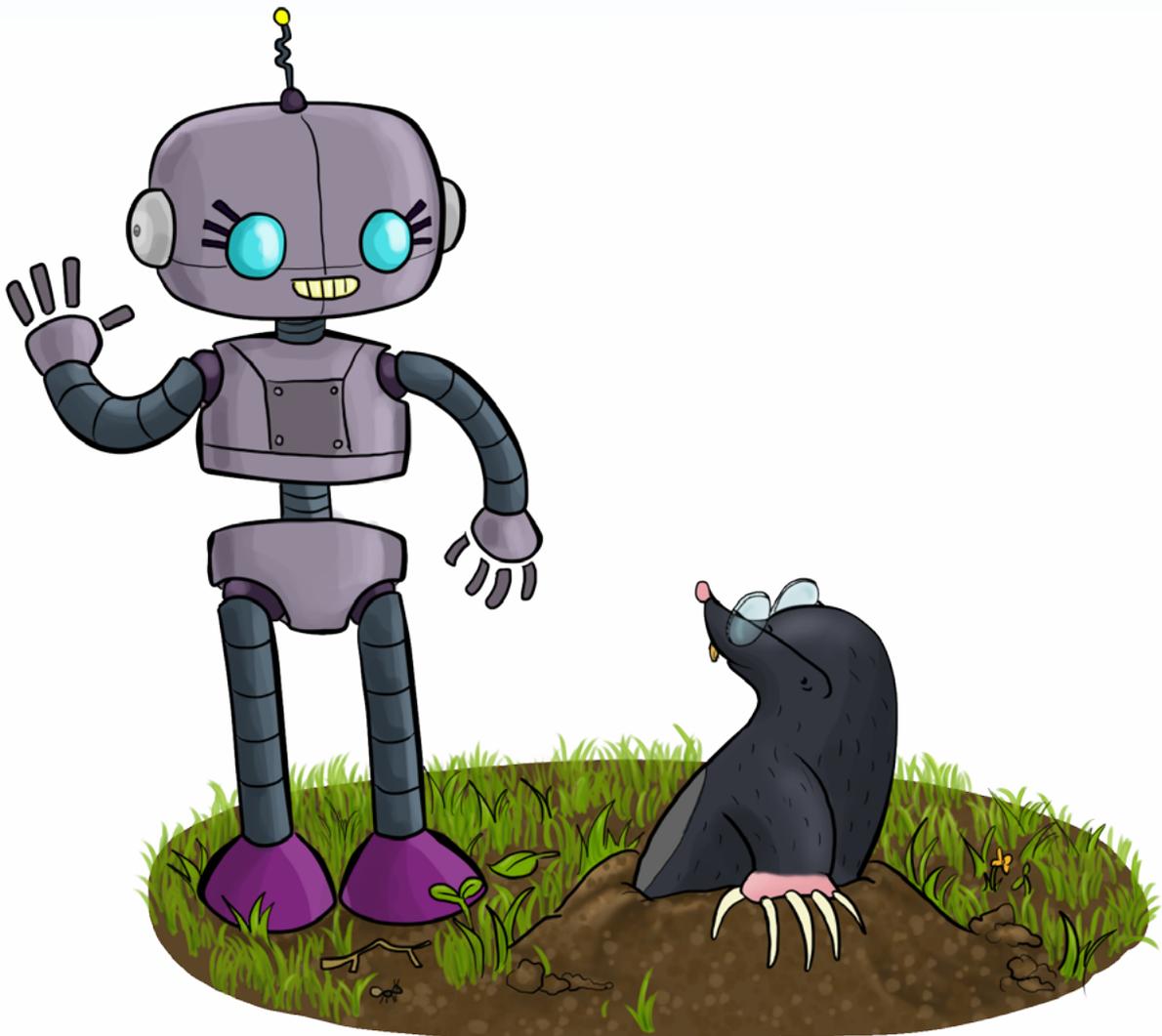
“Yes, I would. My name is Geatrix. Roughly it means Earth-maiden. I came to learn about the soil. Perhaps you can help me?”

“Certainly. The soil is my realm. I can tell you all about it. And since you want to save it, I will tell you about the bad things that have been happening down here lately.”

“Oh! I’d like very much to learn from you. I have so many questions. To begin with, what are these colored bands that I see in this hole?”

“Those blue bands mark the horizons.”

“What are horizons?”



“Well, horizons are layers of different soils lying one above the other and extending horizontally across the land. Think of how at sunrise above ground, one can see bands of sky layered one above the other, each revealing a special quality of air. The ground is like the sky, but upside down and much denser, but just as full of life. But come, Geatrix, see for yourself.”

Geatrix stuck her head into the pit. “Hmm, yes, I see. The top layer is dark, almost black, then come layers of lovely reds, terracottas, ochres and tans, before they bottom out in bedrock.”

“That’s right. And these horizons mark the changes in the composition of the soil as you go down. They also tell the story of the soil, how it has evolved over time. The soil is like history, biology and mineralogy combined in one book. Do you understand?”

“Yes,” said Geatrix.

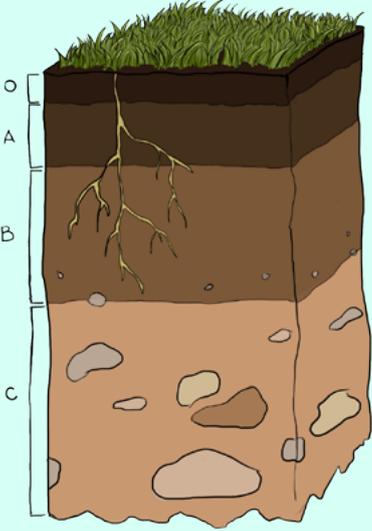
However, Dr. Erdreich had programmed her to be a bit distrustful of hearsay, so she searched her archives for additional information.

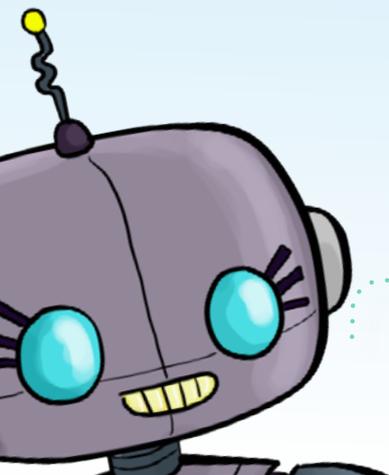
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Horizons

Layers of soil with different structure, color, and depth which reveal aspects about the soil’s formation over time.





“Edaphos, how did you come to know so much about the soil? Do you search in your archives too?”

“No, not exactly. I don’t have archives. I have instincts. Also, I come from a long line of soil experts. My parents, my grandparents, all my ancestors have delved in the earth and dug up her secrets since time out of mind. I’m a natural edaphologist.”

“Of course! That explains why you wear glasses: all that reading.”

“Yes. I love to read and learn. But studying in the dark made my eyes weak.”

“So, Edaphos, you were saying, the soil changes. It was different in the past.”

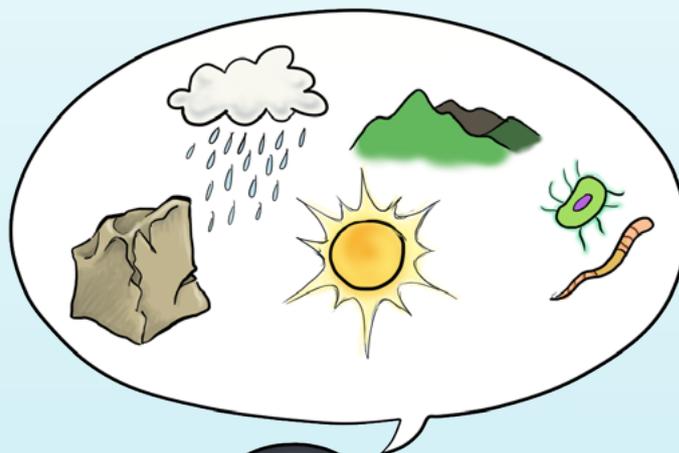
“Correct. The soil began more than four million years ago. Over time it has grown layer by layer as each day, each year, each epoch adds new material.”

“And how did soil begin?”

“First there was just rock. But over time wind and water, heat and cold, and living things worked the rock into soil and gave it life.”

“So you mean to say that the soil is alive?”

“Absolutely. It is alive. It’s full of life. It feeds life. Over 95% of the world’s food comes from the soil – all the fruit, vegetables, cereals, and grass that man and animals eat. Everything that lives on land depends on the soil.”



Ever a critical thinker, Geatrix checked the mole's information against the data in her archives.

SAVING...

Climate: Influences in soil building involving wind, water, heat, and cold.

Organisms: Living beings which build soil with their bodies and action.

Relief: The shape of the landscape which determines how stone and soil will be weathered, worked, and shifted over time.

Parent Material: The original rock upon which soil begins.

Time: The dimension in which change occurs.

The mole gave the robot a serious look, for he too was a critical thinker. He decided he could trust her. "Geatrix, would you like me to give you a tour of my realm?"

"Oh, I'd like that very much," said Geatrix, clapping her metal hands together.

"But there's one hitch," replied the mole. "You can't go down my tunnels. You are too big."

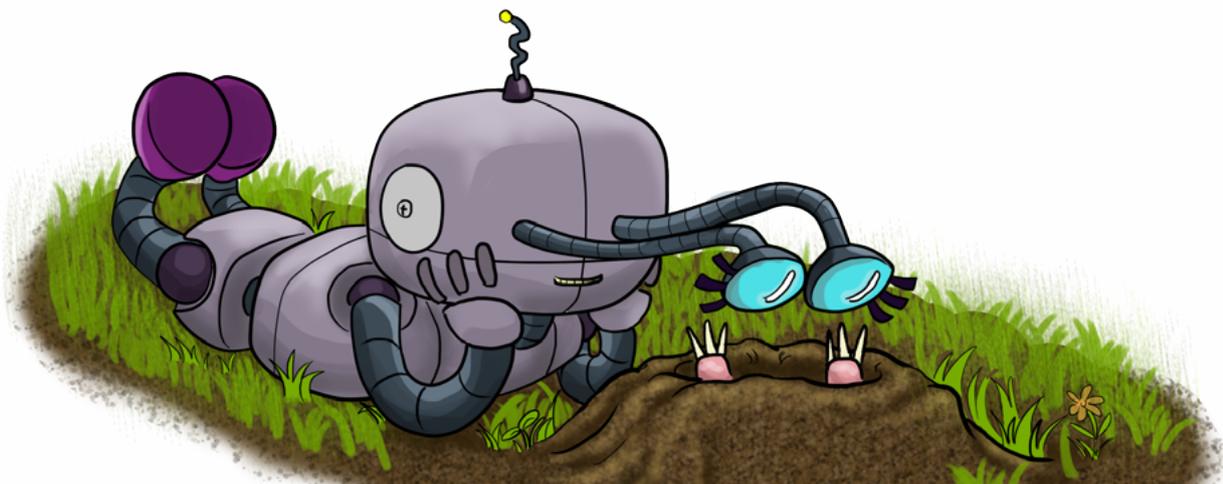
"My body is, yes, but my eyes are not. My creator attached them to very long spools of optic fiber sheathed in rectilinear locomotive cable, equipped with bolometric laser-vision."

Edaphos looked a bit puzzled. Geatrix noticed this and described her eyes in more molish terms.

"What I mean, Edaphos, is that my eyes can slither down your tunnels like snakes and they can see in the dark."

"I hope they don't bite," said the mole.

"They don't," said the robot with a giggle.





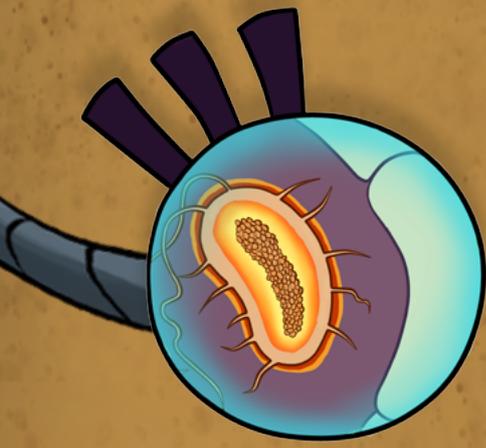
So off they went, Edaphos scrabbling down his tunnel and Geatrix's eyes slithering after him. With great enthusiasm Edaphos showed his new friend the wonders of his realm.

“Here are the ants. They are our great builders. Their underground cities are wonders of efficiency, style and design. They import huge amounts of organic matter underground to feed their masses, and all their busyness loosens and enriches the soil.”

They went a bit deeper. “Oh, look here. The industrious, succulent earthworms. They are the air and cooling engineers of the realm. They dig ventilation ducts throughout the soil. The soil that goes in their front end and exits out their back is called castings. It's fantastic plant food. Earthworms are also the favorite food of moles. Yum.”

Next they stopped at an open chamber that sounded like a concert hall.

“Meet the Crickets, Geatrix. They are the musicians of the realm, the superstars of rock and soil. They live down here but often go on tour above ground. Look quick! There go the centipedes. They run fast on their many legs. They are the hunters of the realm. Frightful things if you're a bug, but they have a job to do. They keep the insect population from getting out of hand”.



The more the mole showed her of his world the more Geatrix saw that every creature had a role to play. Everything big and small, plant and animal, alive and dead, was interconnected in some way. She had not expected to see all this life within the soil, nor to find it so well organized.

“In addition to all these creatures you can see,” continued Edaphos, “there are living organisms in the soil too small to see, like bacteria.”

“But I can see them,” said Geatrix with a tinge of self-satisfaction in her voice. “I have microscopic vision.”

Geatrix’s pupils dilated in and out and flashed colored light. “Oh yes. There they are. I see them. There’s a slew of them.”

“Can you really see them? I’ve never seen one!” protested Edaphos.

“Then It’s my turn, Edaphos, to give you a tour. Come close and look into my eyes.”

The enlarged images of microbial life played across in Geatrix’s clever eyes. Together mole and robot enjoyed the parade of tiny life.

“Amazing,” said Edaphos. “These little creatures feed the plant roots nitrogen from the air, minerals from the stone, and nutrients from recycled life. The roots in turn grow the plants feed the rest of us.”

“What are these white thread-like organisms running through the soil, Edaphos?”

“Those are the fungi, or more precisely, the mycelia of the fungi. Fungi are the chefs of the soil. They mince wood and leaves into delicious dishes for plants, bugs, even the bacteria. Yeasts puff bread, mushrooms make every dish elegant and add umami. Also, fungi are the techies. They provide the plants with internet service. Trees can speak to each other, root to root, through the wood-wide-webs that fungi weave in forest soil.”

“It seems inventiveness is not a strictly human quality,” said Geatrix.



“Oh, no,” said the mole. “Man’s inventiveness is firmly rooted in nature. And speaking of roots, take a look at the abundance of them in this rich soil. What roots! The living girders of the earth. They hold the soil together, bind it into a carpet that doesn’t wash or blow away. They anchor the plants. They mix the nutrients and water from the soil with sunlight and make the food that sustains us all. The roots are a fundamental element of an ecosystem shared by man and mole alike.”

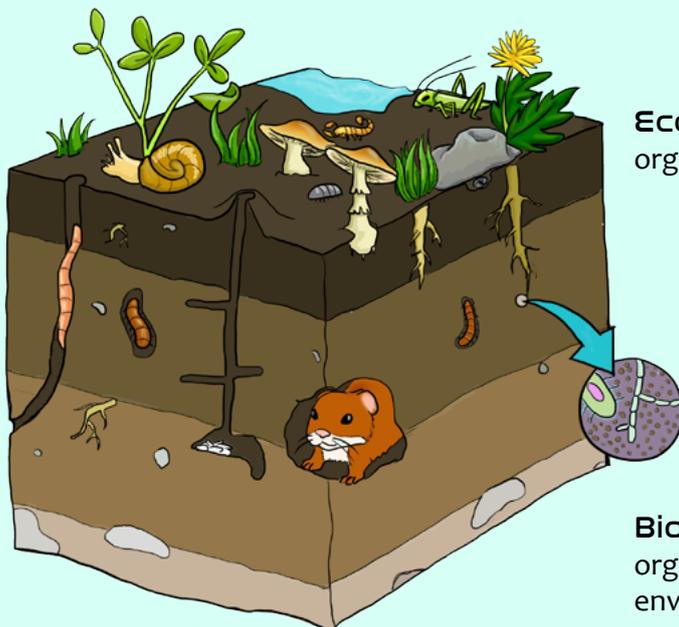
Geatrix focused her eyes on the vital roots that zigged and zagged like pale lightning across the dark inverse horizon of the soil.

“We are near my home,” said Edaphos. “Would you like to see it?”

“Yes,” said Geatrix. “I’d love to.”



SEARCH...



Ecosystem: A community of organisms in a defined environment.

Biodiversity: The variety of organisms that live within a defined environment.

Problems in the Realm of Edaphos



The robot's eyes followed the mole around a couple more bends in the tunnel and they came to his little house. It was a cool yet cozy burrow, with a leafy bed and many books.

Edaphos nestled down in his bed for a moment and listened to the subterranean sounds that he never grew tired of hearing. To him it was the soft, dark music made of little creatures stirring, digging, building, nibbling. It was like slow magic.

Your house is very nice, Edaphos," said Geatrix with sincerity.

"Thank you. I like it. But I haven't always lived here. Not long ago I had to move, together with my family."

"Why did you have to move?"

"Come. Now I will take you to see some places that you won't like so much and you will find out why."

They traveled far, beyond the border of Salvador's farm, so far in fact that Geatrix was afraid she might run out of eye cable. Abruptly they came to a sign hanging over the entrance to a gloomy tunnel.

They went into this passage and everything grew dim and gave off a horrid stench. It was a wasteland.

"This soil is ruined," said the mole. "Men have buried so much garbage here: plastic bags and bottles, paints cans, car tires, old machines, and worst of all, batteries: big ones, little ones, full of lead and mercury and Lord knows what else. This trash clogs and poisons the soil. Once this land was beautiful, but some years ago the owners of the farm began to plant crops using heavy machinery which crushed the soil. Through overcropping and careless use of herbicides and pesticides the soil lost its root systems. With no roots to hold it in place, the rain washed it down into the streams as toxic sludge. Now there are just gullies and garbage. It took thousands of years to build the soil up and only a single generation of human mismanagement to strip it down and kill it. Look over the edge of this deep rut. That was my childhood home".

Tears welled up in the glasses of the little mole. Geatrix was not sure what the water dripping from the animal's eyes meant. Was he leaking oil? Somehow the look on the mole's face made her want to give him a hug. But her metallic arms were too far away. She just said, "I will try to prevent this from happening again."



She was quiet for a moment, then she asked, “If humans with their machines and chemicals ruin the soil, does that mean they should cease to cultivate it? If so how will they feed themselves? Must they starve to save the soil?”

“No, not at all,” answered Edaphos. “For humans to live they must continue to farm. But there are some good conservation practices they can follow that will allow them to cultivate the land without causing erosion, contamination, and a loss of biodiversity. Indeed, by treating the soil well, humans can share the riches of the earth with the rest of life and live happily ever after on it.”

Geatrix was encouraged by the mole’s optimism.

When Edaphos and the eyes of Geatrix returned to the surface, Dr. Erdreich was there waiting. Now the robot could hug the mole.

“I see you’ve made a friend,” said Dr. Erdreich.

“Yes, this is Edaphos. He has given me a mole’s eye view of his wonderful realm within the soil.”

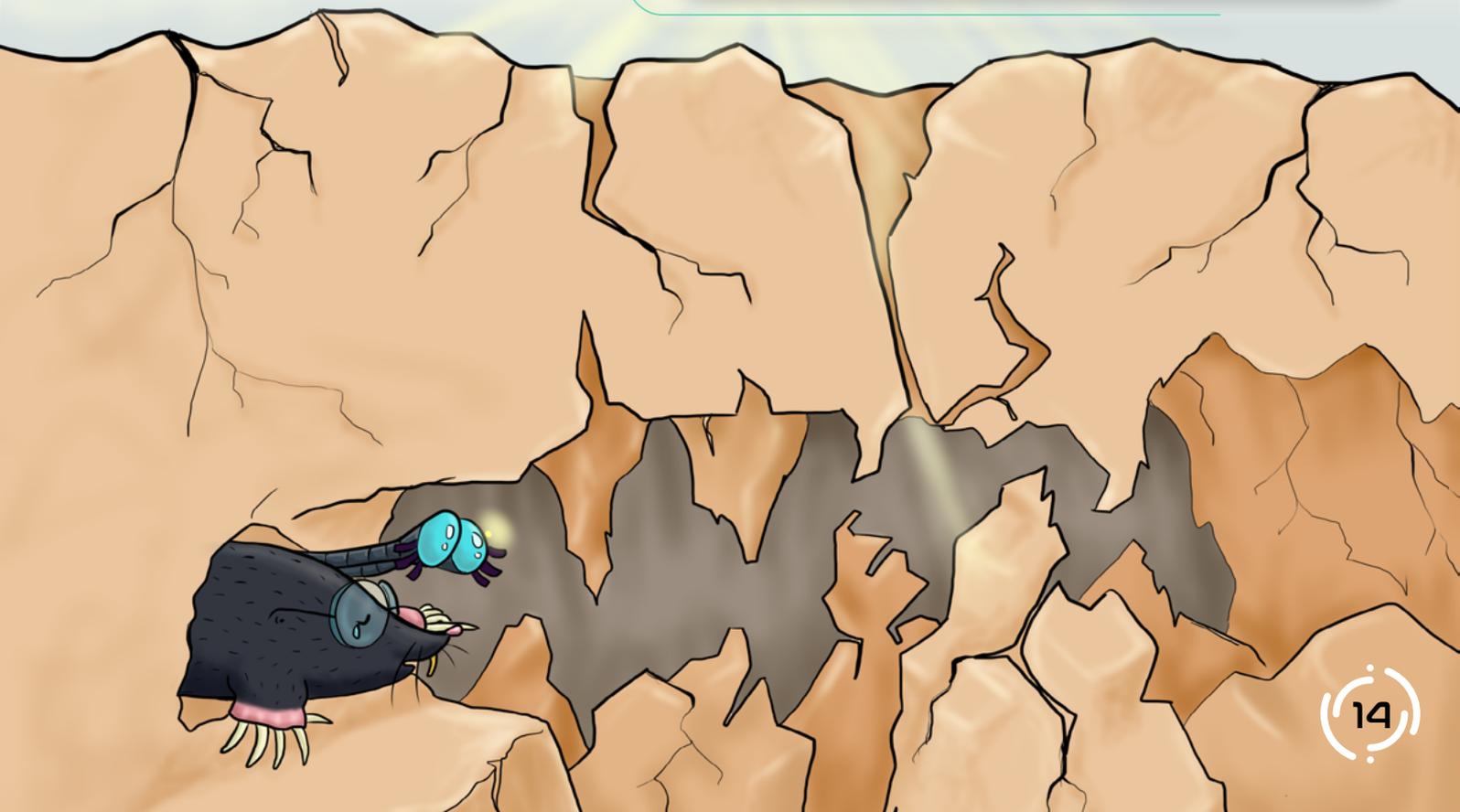
SEARCH...

Erosion: The weathering away of topsoil over time, which can be accelerated by human agricultural malpractice such as clearcutting of woodland and overcropping.

Good Conservation Practices: A body of land use techniques and technologies whose aim is to maintain or increase the agricultural productivity of land without causing soil degradation and loss.

Pesticides and herbicides: Chemical substances applied to farmland to limit crop loss caused by insects or economically undesirable plants.

Fertilizers: Materials, organic or inorganic, which contain growth-stimulating nutrients for plants.



Seminarex

On the way back, Geatrix talked non-stop, sharing with her creator all her newfound knowledge about the soil, as well as her thoughts on how to save it. As soon as they returned to the laboratory the scientist together with Geatrix started to work on a new creation.

A few months later, Seminarex was completed and ready for a trial run. He was an agribot designed to farm the land for humankind in a way that did no damage to the soil. Taking his motive design from centipedes, Seminarex moved with whiplike speed but lightly across the ground on his hundred plus legs. These many legs allowed his weight to be so well-distributed that he did not compact the soil and as he scurried over the fields injecting seeds. The agribot was programmed to pick up all the discarded batteries and other trash and teleport it to safe disposal centers.

Best of all, Seminarex was powered by a green technology inspired by plants that converted chemical waste and sunlight into clean energy, and left behind, earthworm-style, only simple elemental fertilizer.

In spite of all Seminarex's technological advances, he was also programmed to carry on traditional soil conservation practices such as crop rotation, mulching, field resting, and the responsible application of chemical herbicides, pesticides, and fertilizers when natural controls were not available.

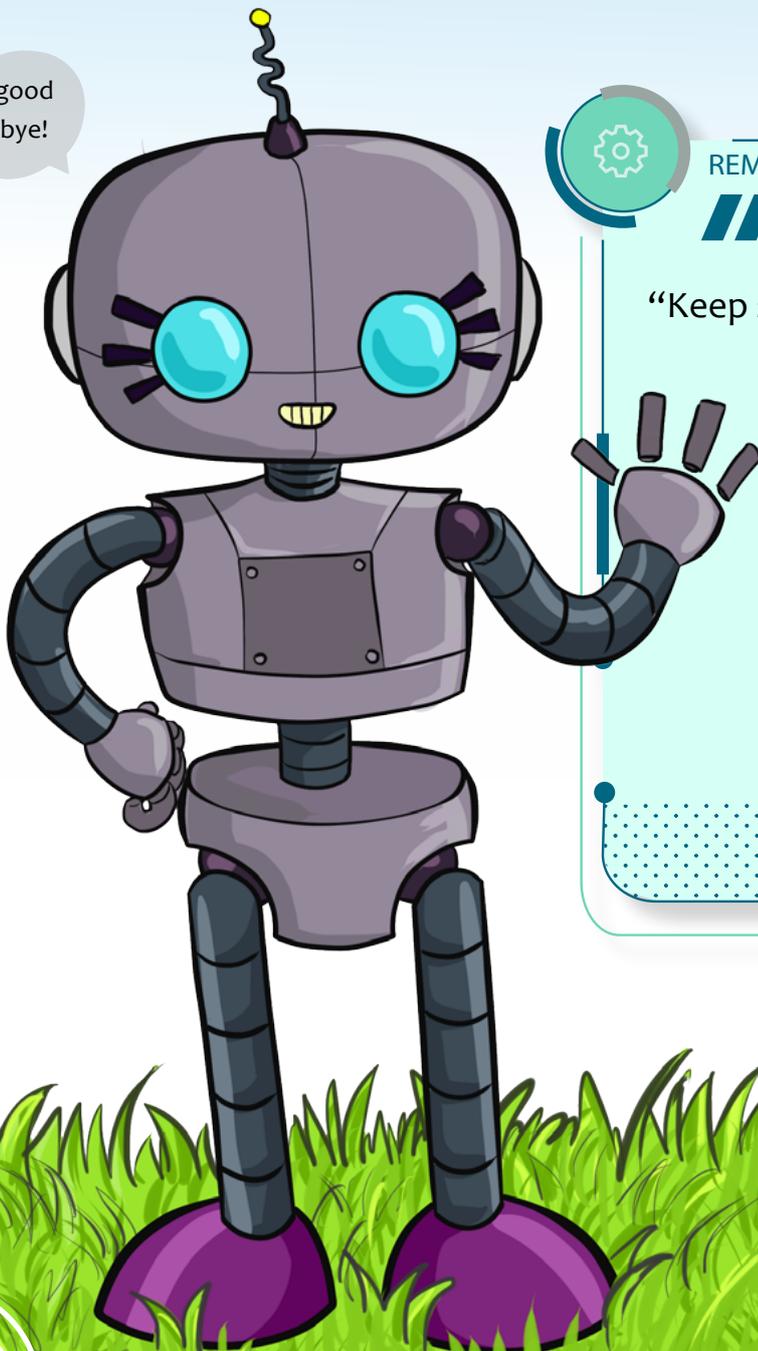
One early spring morning Dr. Erdreich, Geatrix, and Edaphos watched Seminarex perform his trial run in a field on Salvador's farm. He sped along the ground like a great centipede sowing seed. The dawn broke and spread layers of color across the horizon in the east like an inverted earth.



Our planet is named earth and her soil is an essential element of life. The gentle robot Geatrix continues to uncover the secrets of the soil, hand in paw with her friend, the mole Edaphos. Together, armed with knowledge, they fight the dangers that threaten the earth's fertility and health. One day, along with Dr. Erdreich and Seminarex, they will sow the seeds of soil conservation in the minds and practices of all men and in doing so save the earth.

Activate the code QR to go to Geatrix's blog and learn about other ways you at home can care for the earth.

good
bye!



REMEMBER...

“Keep soil alive, protect soil biodiversity”.

