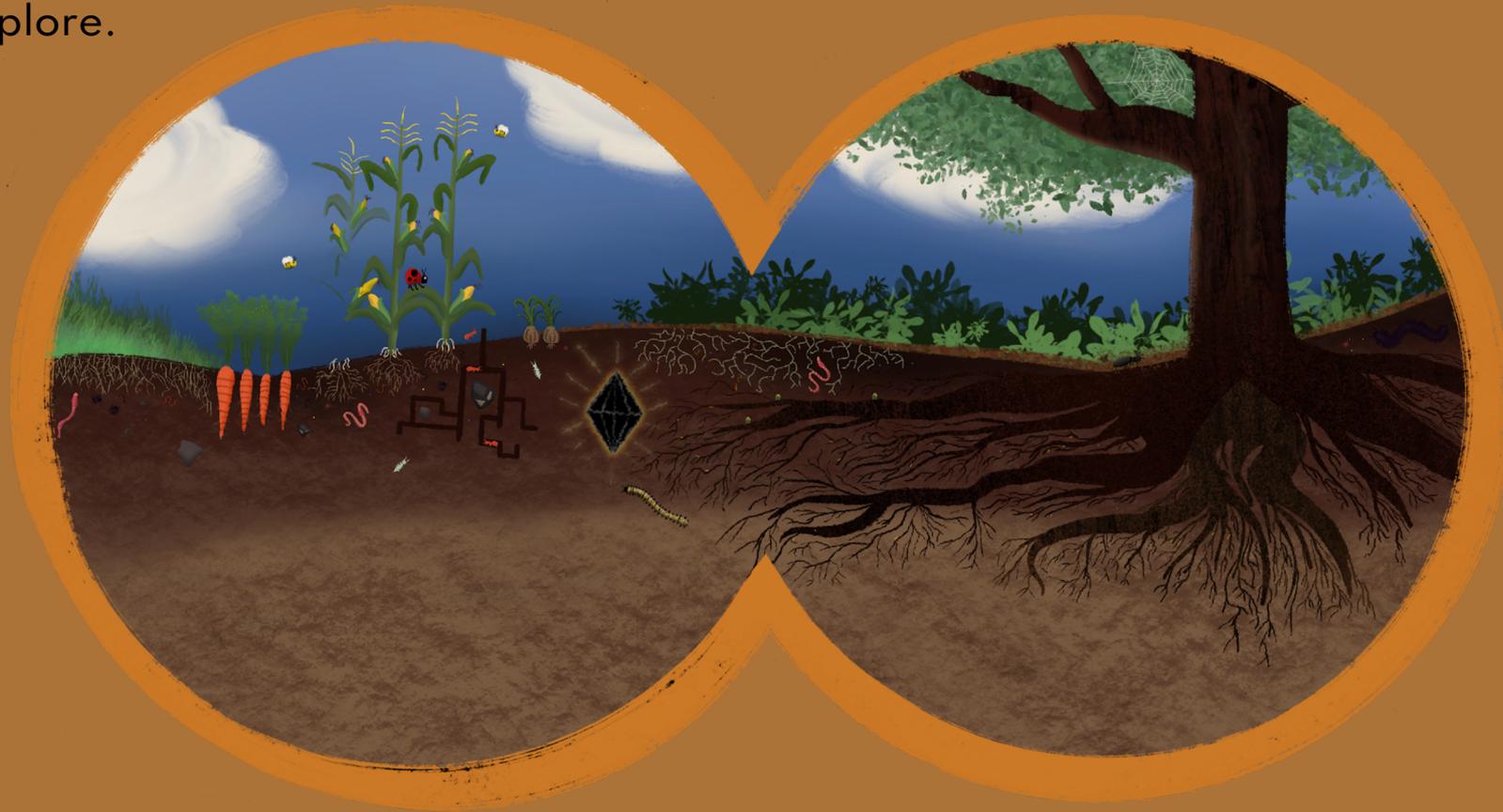


The Carbon Crystal Heist



Have you ever wondered what soil is? For some people, soil is simply the “dirt” below their feet. For those who care to dig a little deeper, soil can be a magical place full of wonder and opportunities to learn and explore.



You may not know that healthy soils are important for our wellbeing. Soils let us grow the plants that give us the food we eat, the clothes we wear, the medicine to keep us healthy, and the fuel to heat our homes¹. On top of that, soils can help clean the water we drink and the air we breathe, protect us from floods^{1,2}, manage greenhouse gases, and even help ecosystems adapt to climate change³.

Soils don't do all of this alone. One quarter of the Earth's biodiversity is found in soils². The animals, fungi, and other microorganisms that live belowground make all of this possible. Having many different soil organisms, or a biodiverse soil community, ensures that soils can stay rich and healthy for a long time. Not all soils are as healthy as this one!

“Wow! Look at that rich and healthy soil! I wish I could live there... They have everything: clean water, clean air, a buffet of fruits and vegetables, and their humans are so nice to them! I’d say there are at least a thousand different organisms in a teaspoon of that soil⁴, and they all seem like they are best friends. But most importantly they have the Carbon Crystal!”

“My elders used to tell me legends about the amazing powers it holds. It’s all here in the secret book they wrote! My soil is made of the same minerals, it has water and air... the only thing missing is the Carbon Crystal!”

Beetle sneezes “AHchoOOooo!!! I know, I’ll steal it! But how? I’m big and I have two arms, four legs and two eyes, but I am not very fast. They’ll see me coming from a mile away... and I’m all alone.”



"I know, I'll form a team! Yes, I'll recruit from far and wide, assembling the most powerful group of organisms to take over the entire world!

Wait, no, I just want to make my soil richer, like it was back in the glory days of my elders.

Now, who can I ask for help?"



WHAM!

Whizzzzzzzz

CRACK!!!

"Ugh... is that the humans again?"

When are they going to learn that disturbing the soil, cutting down trees, and laying concrete over the ground is exactly why no one wants to live in this soil neighborhood anymore!"





"I can't think with all those tractors, chainsaws, and cars above me. I'll put up some signs telling them to stop and hopefully I can get some peace and quiet around here. I better ask nicely or else they will not help."

Tillage, use of agrochemicals, and removal of plant cover can decrease soil carbon and negatively impact soil biodiversity. Other factors that threaten soil biodiversity include climate change, soil degradation, and pollution ^{4,5}.

“Now that it’s a bit quieter, I can call my friends. But how? I know a fun guy who can communicate between trees... Hopefully, he can extend the fungal network so that it reaches my friends from Kinder Garden School!”

Beep Boop Beep Boop

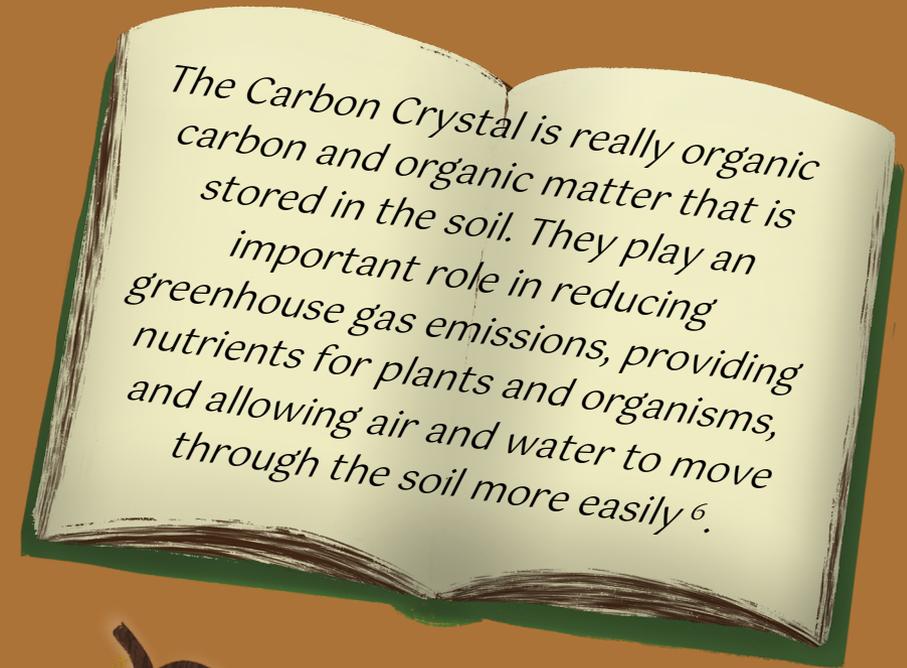
“Hello, this is My---cco, what can we --- do for you?” answers Mycco, the fungus.

Beetle replies “Mycco, old pal, our fungal connection is so poor that I can barely hear --- you. Listen, I’m looking to recruit you for --- a secret mission... stealing the Carbon Crystal”.

“Wow the connection is bad, it sounded --- like you said --- you wanted to STEAL THE CARBON CRYSTAL?!” says Mycco in disbelief.

“Yes Mycco, you heard me right. Please --- just trust me on this!”

“You got it, of course I will help you! I’ll ask a few of my fungi friends to join us too. They’re great at making trees grow and that will improve our fungal connection.”





While Mycco improves the connection, Beetle visits his friend Frankia, a type of bacteria that likes to live in the roots of certain plants.

“Hey Frankia, long time no association! I am on a mission to obtain something that I’ve had my eyes on for as long as I can remember... Can you help me reach out to my old friends from school, my connection is very bad!”

“Hi Beetle, we would love to! We will help trees grow and that should improve the connection.”

“Good idea! Thanks Frankia” says Beetle.

A Carbon Crystal too small for Beetle to notice, begins to form in the corner...

Some bacteria, like Frankia, and some fungi, like Mycorrhizae (Mycco), work together with plants. They provide the plant with nutrients or water in exchange for sugars that the plant makes ^{7,8,9}.



“Excellent! It’s time to contact all my old pals!” Beetle exclaims. The fungi is glowing bright with activity, and Beetle starts calling all of his friends, lighting up the fungal network, far and wide! ***Solve the maze to help Beetle.***

This is your #1 spy... Spy-der!



Ant here!



It is I, Pill bug.



You have reached Slug!



Global Worm-ing Center, how can I help you?



Hey it's Tardy, wanna party?



Bzz bzz I'm Bee!



Hello, this is Strepto.



Collembola here, what can I do for you?



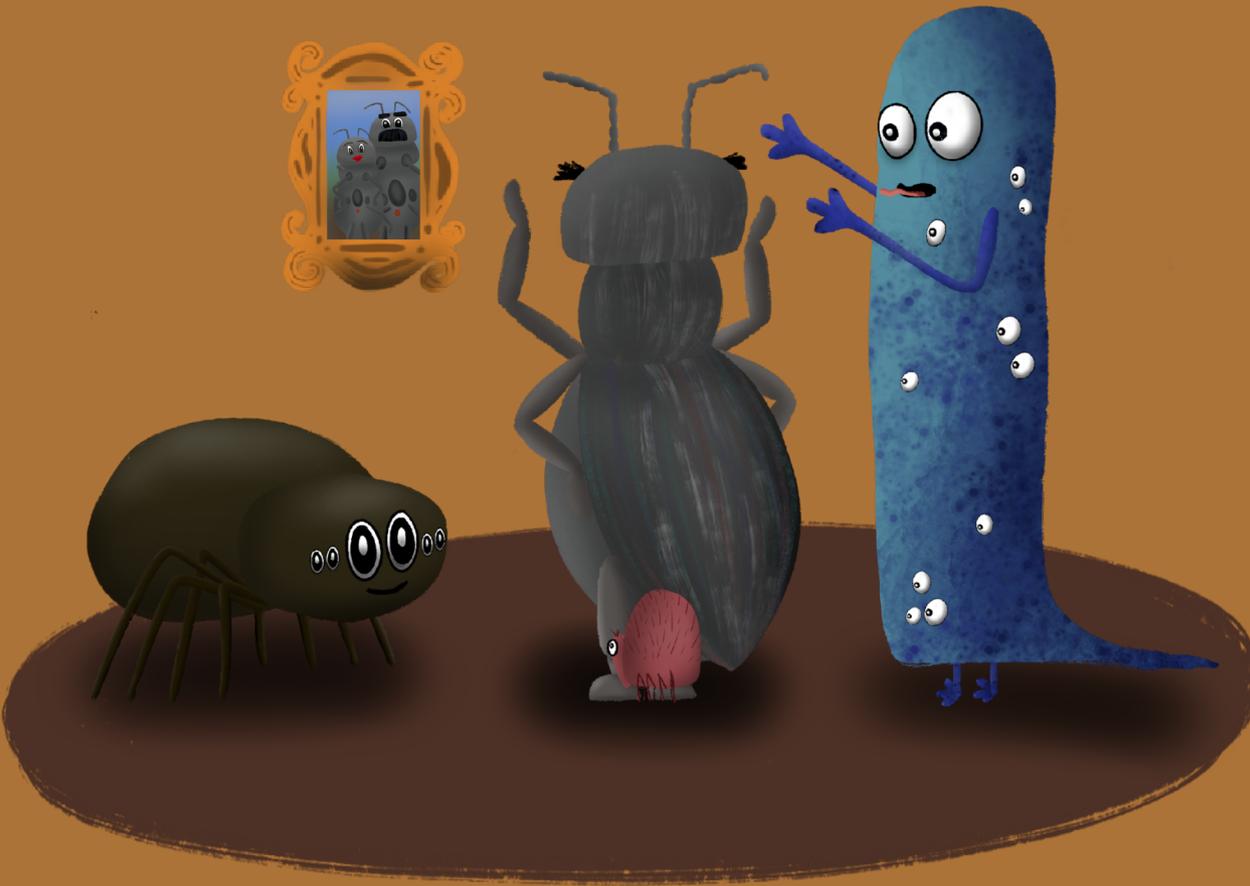
“Hi Spider, thank you for coming” says Beetle. “Of course you were fastest, you have eight long legs! You are so speedy compared to me. You will play a key part in stealing the Carbon Crystal. I see you brought a friend!”

“Well, actually, this is my dinner” admits Spider.

“EEEEEEEEK!” cries Mite.

“Spider!” says Beetle, “Mite is not for eating! He is too cute. Besides, he will be useful in the heist. Let’s just wait, no one else has arrived yet.”

Streptomyces are bacteria responsible for the “earthy” smell after it rains. They are also used to make medicine¹⁰.



“We are here!” a loud voice echoes.

“Who’s there?” Beetle says scared.

“It’s us!” say the Strepto bacteria, forming a big blue blob.

“Oh you all scared me!” gasps Beetle, but your small size and ability to move around easily in the soil will come in handy for stealing the Carbon Crystal!”

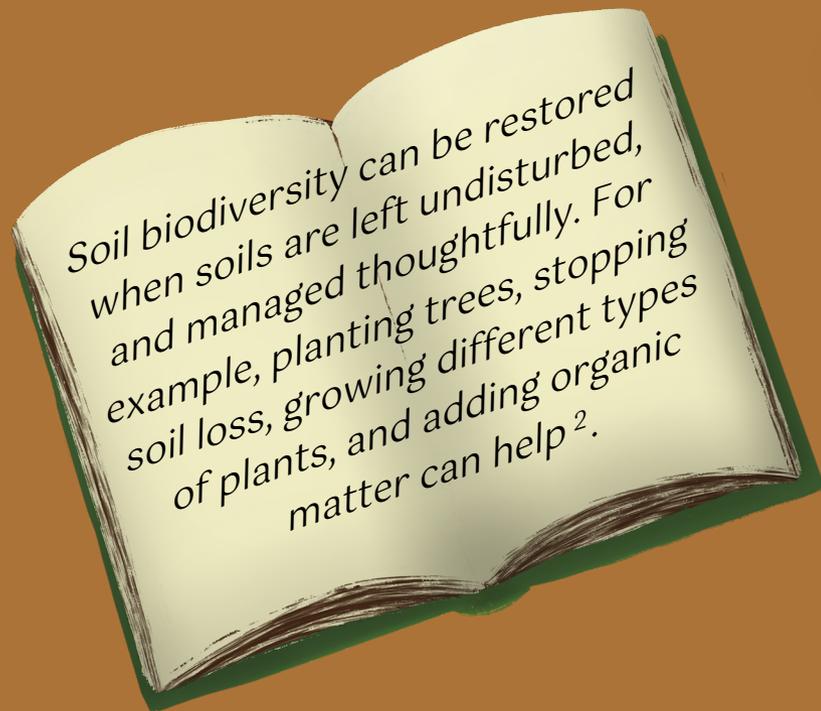
“Do we smell compost?” says Stepto, their tummies rumbling, “let’s have a big feast while we wait for the others!”

As more and more friends arrive, the Carbon Crystal grows, little by little... ◆

“I’d love to thank you all for coming. We were all once good friends, and I’m hoping that it can be that way again.” Explains Beetle, “as you all know, my neighbours are living the good life. They have clean water, are in good health, have lots of food, caring humans, and so many different kinds of friends. I’ve assembled you here to obtain what they have. I believe their good fortune comes from the Carbon Crystal, and they have had it for long enough. We must take it from them!”

“This is a good idea Beetle, but how are we going to do it?” Pill Bug wonders.

“I’m glad you asked. Before I tell you the plan, we must train and get ready for the heist.” says Beetle.





“Buzz Buzz Buzz” sings the little Ground Dwelling Bee.
 “Gosh it looks like there are more and more flowers to see!”

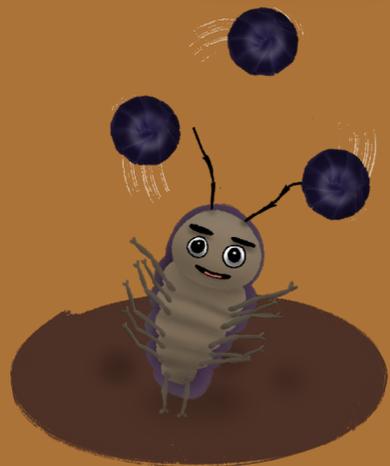
“Hiya” greets Earthworm “I’m breaking it down!
 Decomposing sweet detritus all over this town!”



“YeeHaw” shouts Spider, lassoing some flies.
 “I keep spotting new snacks with my many eyes.”

“Nom Nom Nom” munches Strepto chewing on a stump.
 “Cycling nutrients makes us all plump!”

“Look at me!” says Pill Bug, while juggling his buddies.
 “I have to read my book” says Beetle, resuming his studies.



“Hhrrraah” booms Ant, bench-pressing some sand.
 “If I rearrange the soil this place will look really grand!”

Thoughts of the crystal help the friends do their best.
 Training will help them put their plan to the test.



Beetle unrolls a leaf. “Now everyone! Since we are all in shape, and we’ve practiced our best skills, we are finally ready for the secret plan” he explains.

“But Beetle!” bellows Strepto, “since we got here, we have been cleaning up the water to make sure we all have enough to drink, and recycling some old tree stumps.”

“And while I’ve been eating all the dead leaves, I noticed some new plants growing” points out Earthworm. “And... I’m the one that’s been pooping like crazy.”

Ant chimes in, “We have been making some tunnels to sleep in while we’re here too, so now we can breathe a little easier!”

“I have been reconstructing all the mini tunnels that were destroyed” says Collembola.

“Also, it seems like Beetle has stopped sneezing too!” Bee notes.

“It looks like the humans have been reading our signs! They’ve been adding compost, planting cover crops, and even some trees!” says Spider.

The Carbon Crystal grows even larger...



“Wow, you all really did this for me?” Beetle says while teary eyed.

“Of course, we love you Beetle. You’re a bit of a grump, but we know you’re a good beetle. We want to make the soil a better place for all of us. We always knew your neighbourhood had potential and it seems we all worked together to make a better home for each other - even the humans!” Says Strepto.

Bark! Bark! BARK! Mite points at the now large Carbon Crystal shimmering in the corner.

“Hey look!” says Spider. “My dinner... I mean... Mite found something!”



“Wow!” cheers Beetle. “Thank you so much, everyone. It seems that by having all of you here, doing the things you love to do, we have created our very own Carbon Crystal! Ours is almost as big as our neighbours. I bet they are going to want to move here now!

It seems there’s nothing we can’t do together! Maybe we could take over the world now?” Beetle jokes.

Slug slowly glides in out of breath, and wheezes *“I got here as fast as I could.”*



I am ready to help steal...
The... Carbon... Crystal!

When living things work together in harmony, they can improve their surrounding ecosystem. We humans have to do our part too!

*Keep soil alive,
protect soil biodiversity!*

DID YOU KNOW?

Biodiversity refers to the many different types of living organisms (hence “bio”) in a particular habitat; the more variety of organisms in the ecosystem, the higher the biodiversity.

Carbon (C) is the element of life, all living things are made of carbon and it is also in things that are not alive! This means that you, me, a giraffe, an apple, and a rock all have carbon within us.

Collembola or “springtails” are tiny organisms that can use their furca (which is like a tail) to jump up to 15 cm into the air.

Earthworms cycle organic matter, create pores in the soil to allow for air and water to flow, and are considered ecosystem engineers.

Greenhouse Gases let sunlight and heat into the atmosphere, but prevent them from leaving, Leading to climate change. The main ones are carbon dioxide, methane, nitrous oxide, and water vapour.

Organism is anything that is alive! Humans, plants, animals, fungi, and bacteria are all organisms.

Pill bugs or “rollie-pollies” are a type of crustacean, not an insect. They are more closely related to shrimp that live in the ocean, than to the insects you would find in the soil.

Soil is a layer of the Earth’s surface, made up of interacting minerals (sand, silt, clay), organic matter, air, water, and living organisms. It is where we grow food and is vital for ecosystem functions. Soil is not dirt!

Soil organic matter refers to the dead plant and animal tissues at different stages of decomposition in the soil.

Tardigrades or “Water Bears” are able to live through big changes in climate, from very dry and cold to hot and wet. They were taken up to Space to see if they could survive there, and they did!

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Draw yourself in the open space.

After you finish colouring, get an adult to help you share it online using #carboncrystalheist and tag us on instagram/twitter @carboncrystalheist.

Share your own drawings and photos of soil organisms too!

