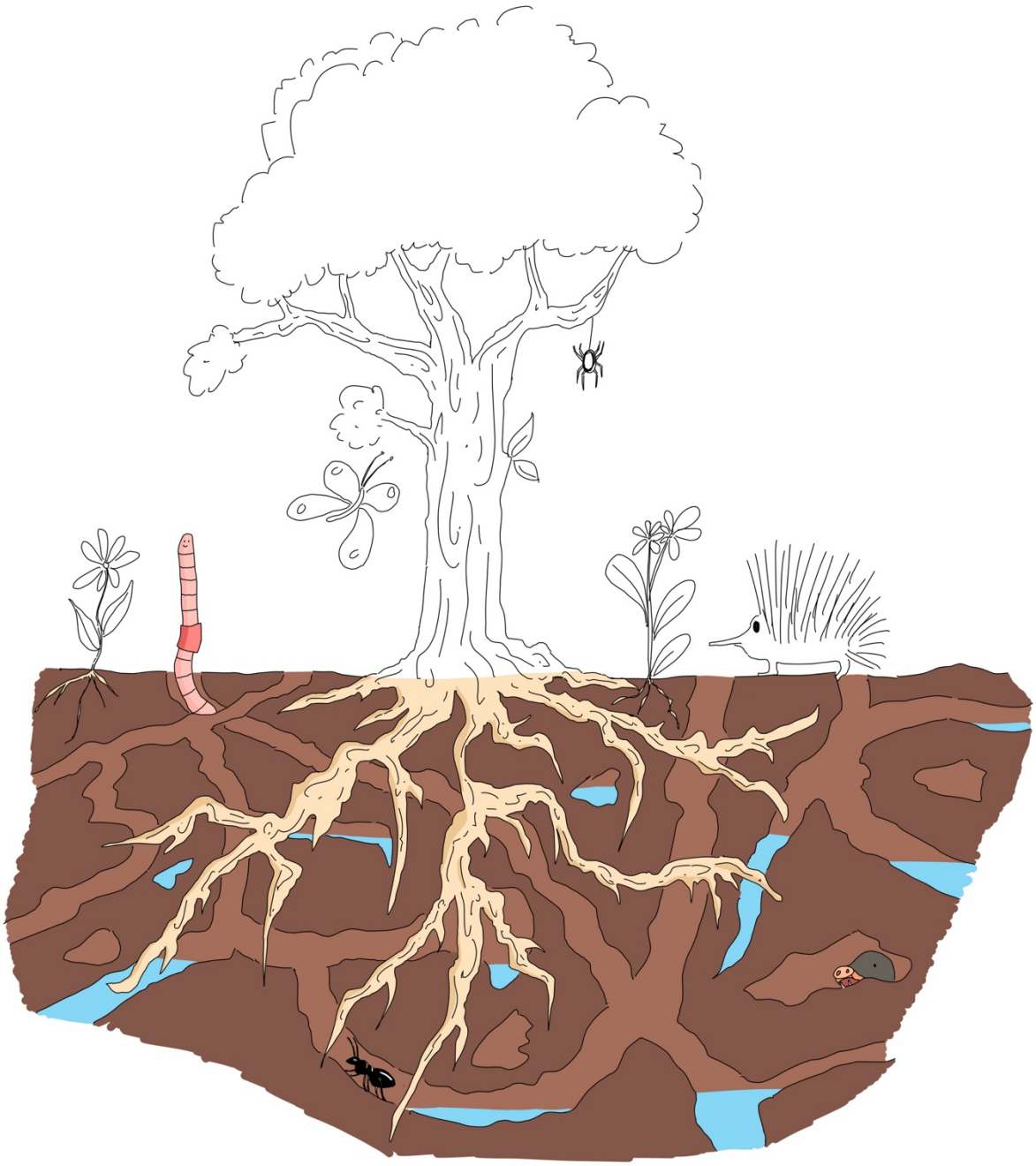
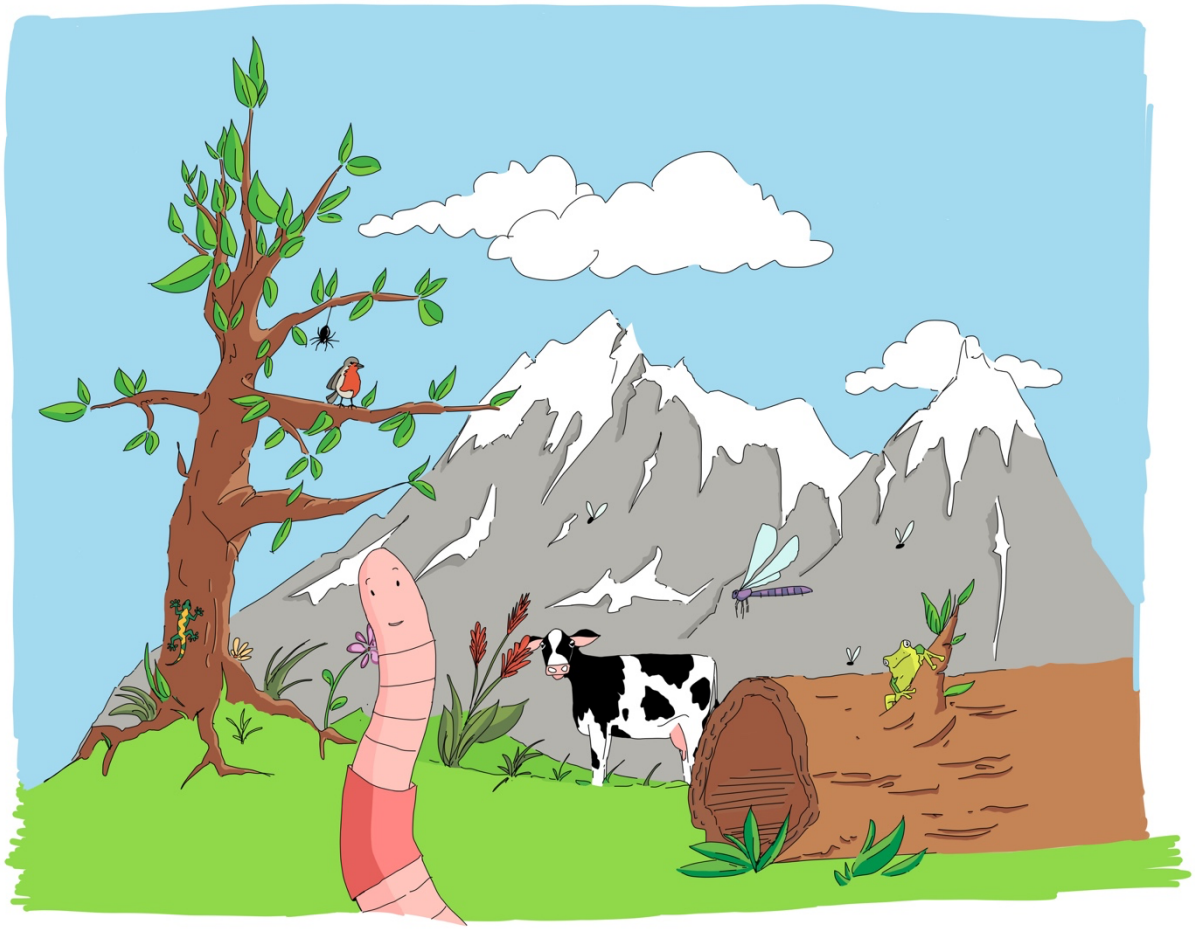


A journey below the ground

A story on soil biodiversity

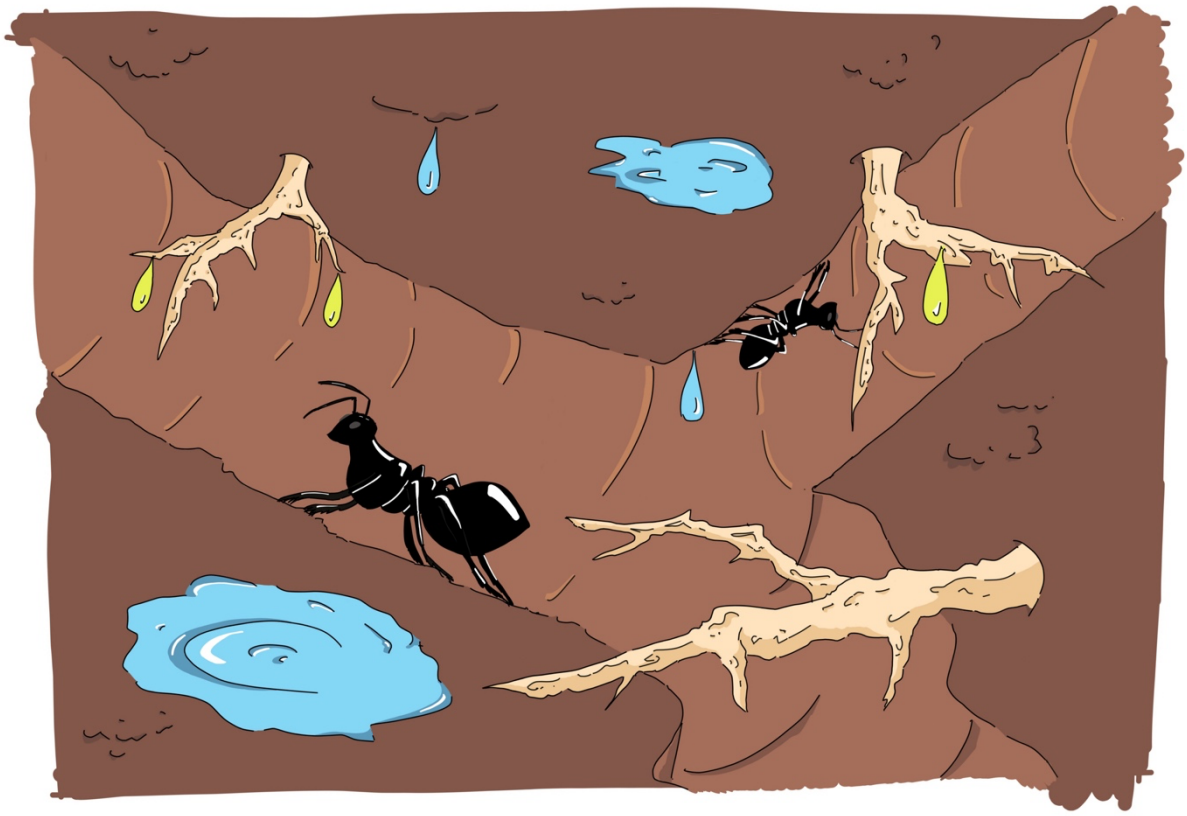
Johanna (illustration) and Vincent (text)

Content of this book



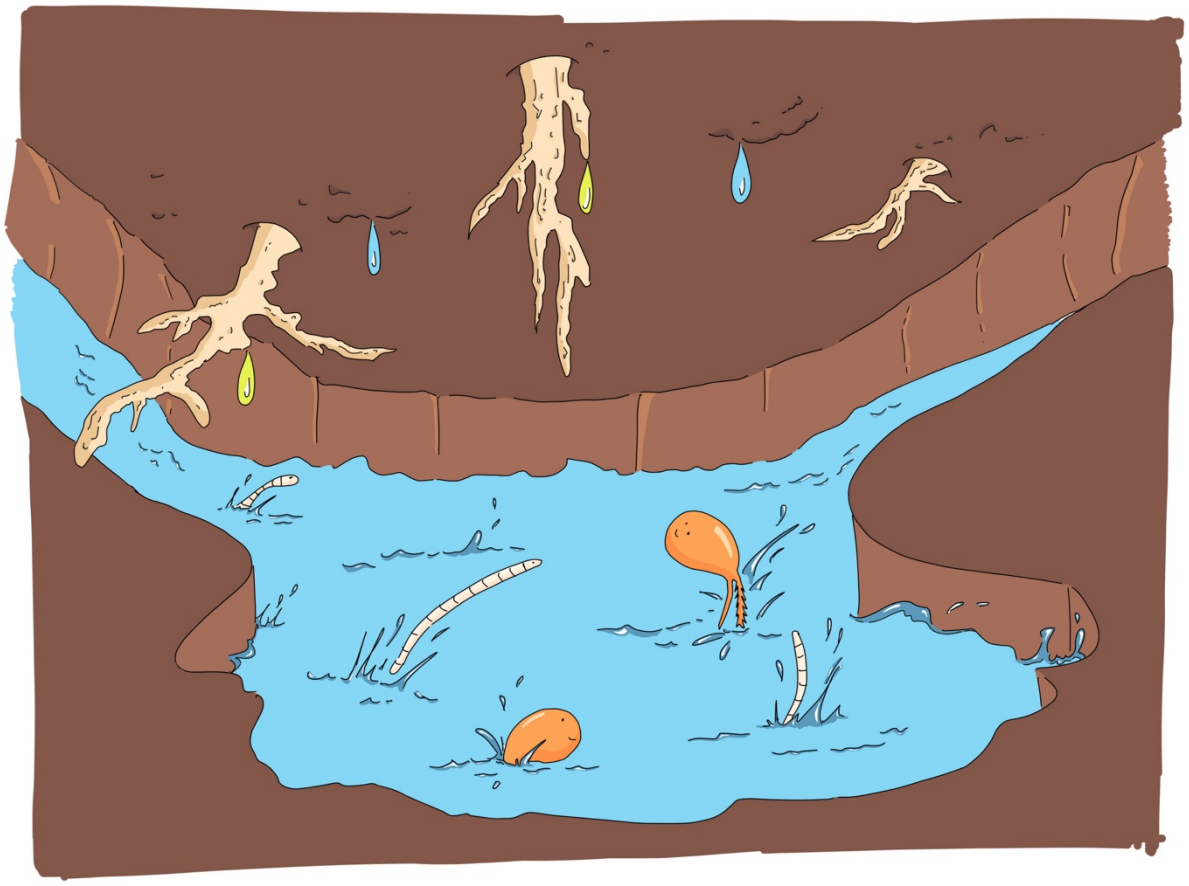
Hi there, my name is Lumbry, I’m an earthworm and I will be your guide through this book. I hope you will learn lots about the many organisms that live, with me, in soil. The universe below the ground, like the universe above the ground where you live, is rich and diverse. I will show you that life below the ground is just as diverse as the one above!

Surprisingly, even though you can walk or build houses on the soil, soil is not a fully compact, solid material. About half of soil is “hollow”, filled with air and water!



Many tunnels and galleries, that are called pores, makes soil look and act a little like a sponge. These pores or openings allow air and water to circulate through the soil. This is important as the roots of plants, as well as many animals and micro-organisms living in the soil need air and water to live and grow.

Oh nice, there is a pool party going on! The small worms called nematodes and micro-organisms such as *Phytophthora* and *Pythium* need water to move around the soil. They like heavy rainfall, which fills these pores with water, creating a network of roads for nematodes and micro-organisms to move around in!

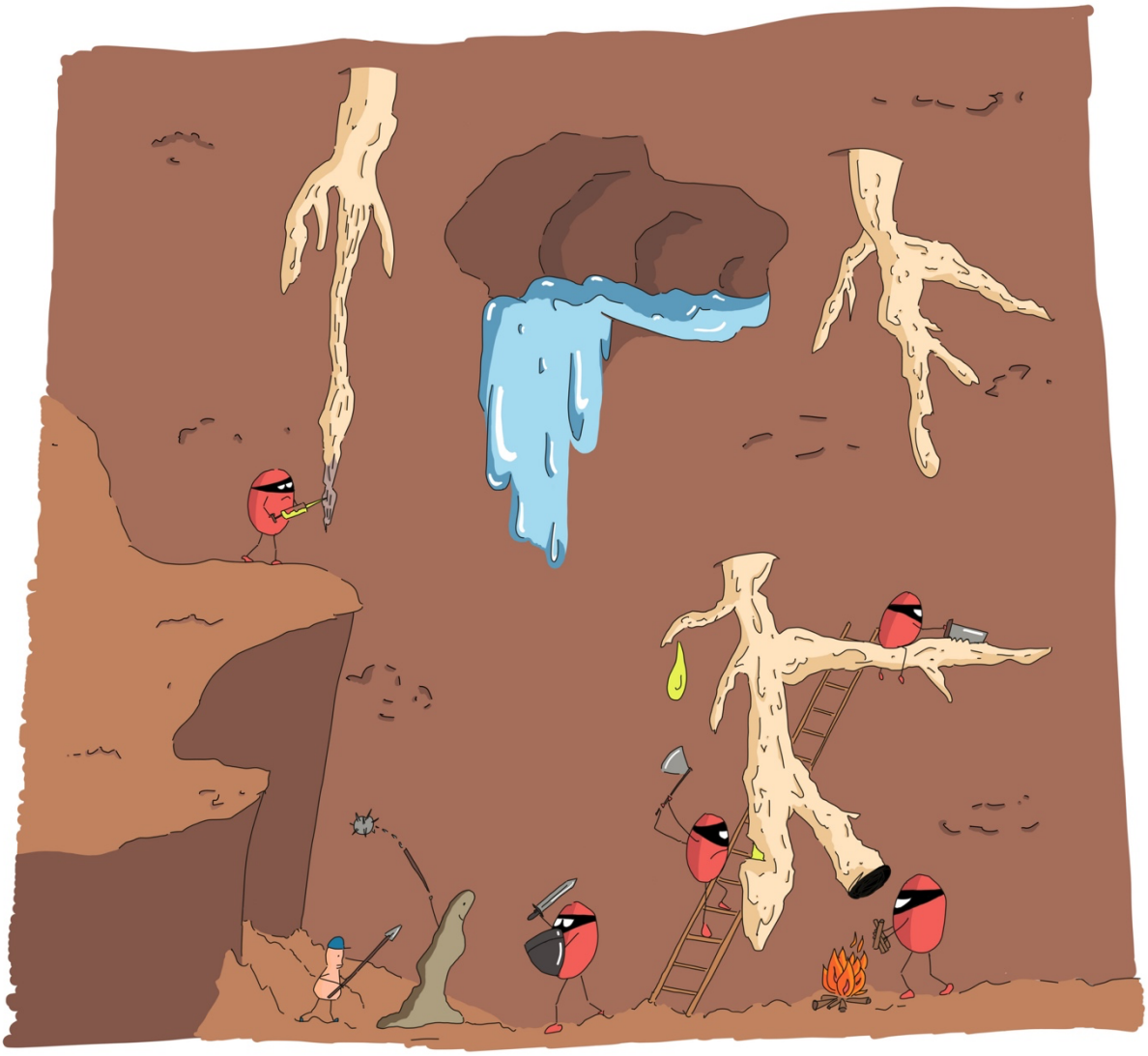


Oh, I’m starting to get hungry. Luckily, we have arrived at the Rhizosphere Village.

This lovely place is formed by plant roots which release a lot of food, called exudates, that contain sugars and proteins, to feed the micro-organisms around them. In return, these microorganisms create food for the plant roots,

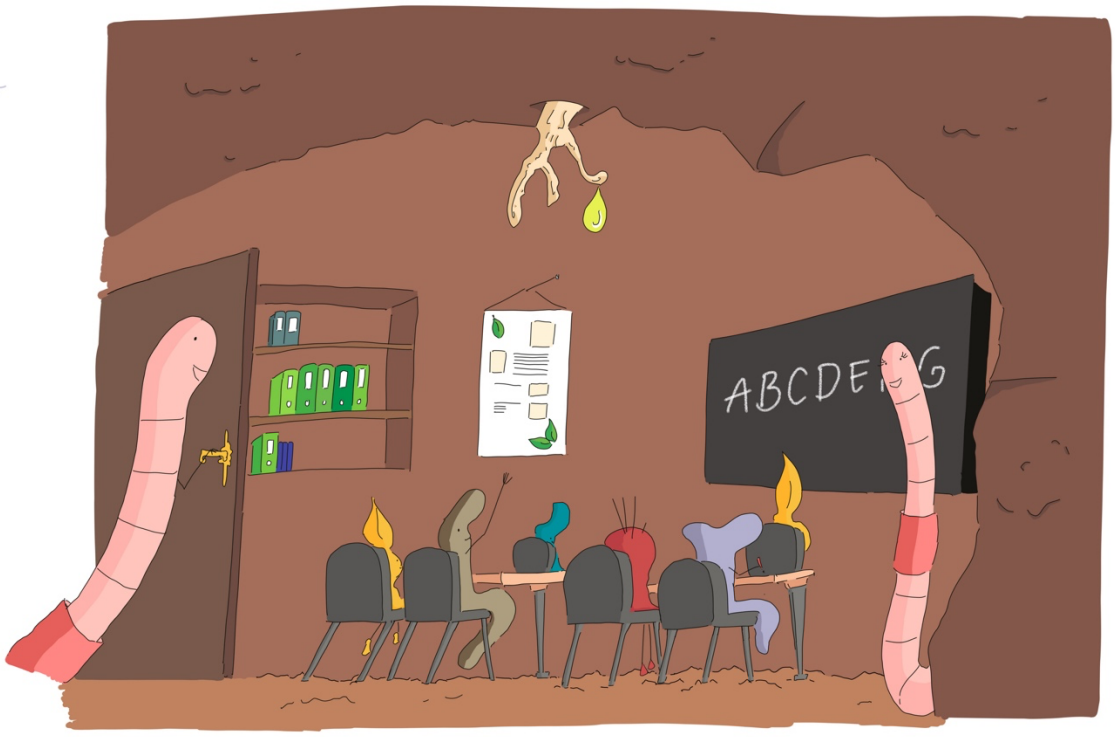
by breaking up the minerals in the soil to make them the right shape for plant roots to eat! A great example of our diverse community working together to make sure we all get fed!

But not all micro-organisms are nice guys. Some of them, the pathogens, are really bad boys.

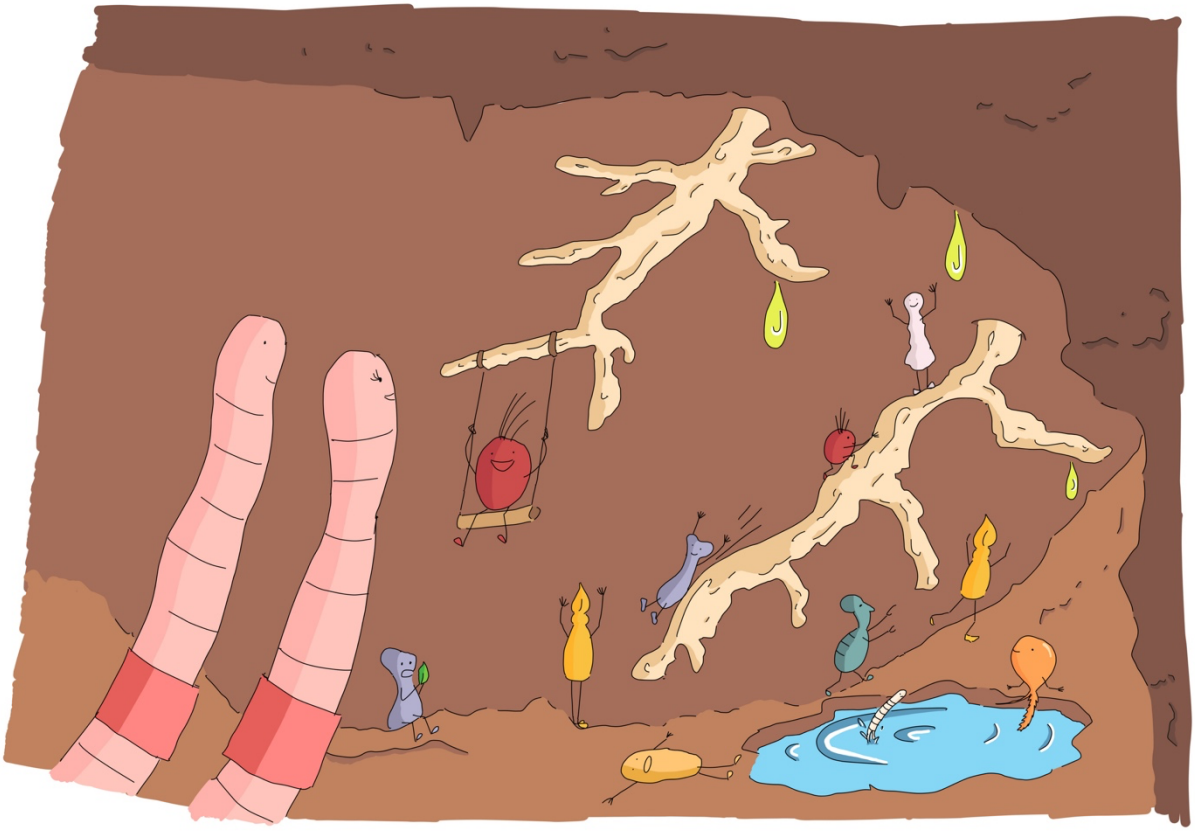


They attack and destroy plant roots. Sometimes, they can even cause the death of plants. But there is hope, many other micro-organisms, called the antagonists, defend the plant roots and fight the pathogens off.

Hey, there is my old school! There are classes for all kinds of micro-organisms: fungi, oomycetes, algae, bacteria, viruses and others. A friend of mine, Wormine, is a teacher here. She can tell us more about the diversity of pupils in this soil school.



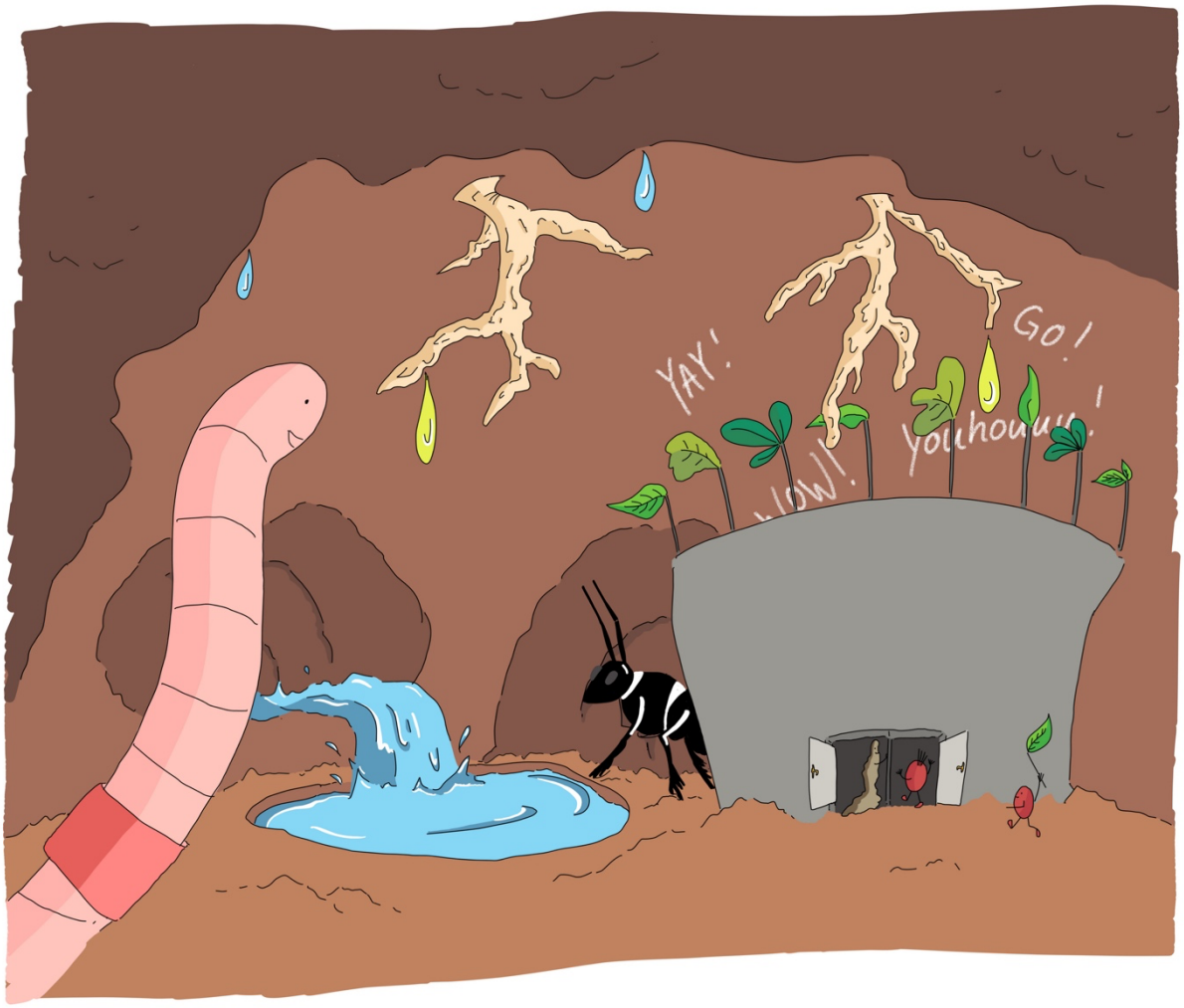
“Hello my dear, how are you doing? Can you introduce us to all the kids playing in the school yard?”



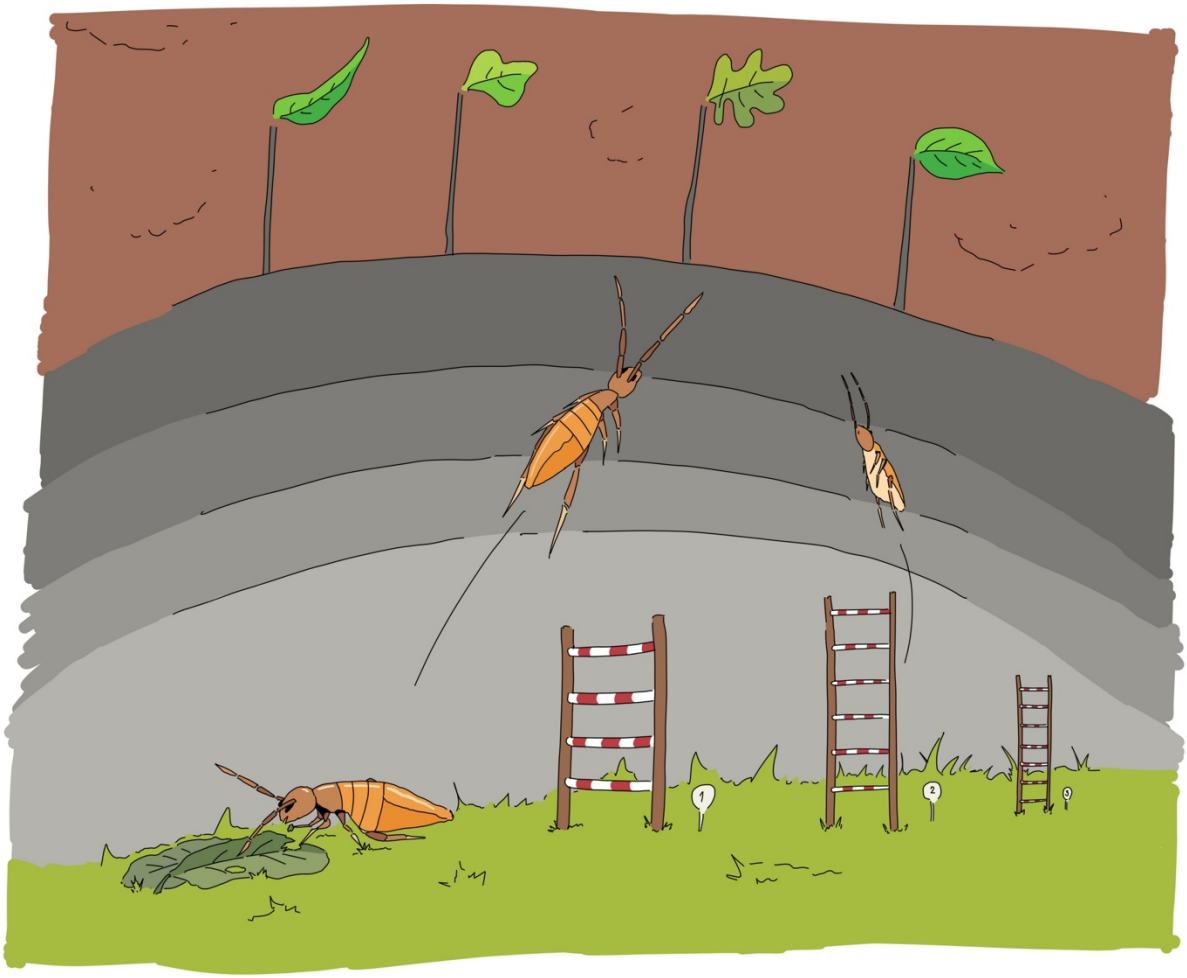
“You know Wormy, this will be difficult. I know the ones in my class, but I don’t know most of the others. There are so many different species of micro-organisms, it is just impossible to know them all. Many of them don’t even have a name yet, can you imagine that?”

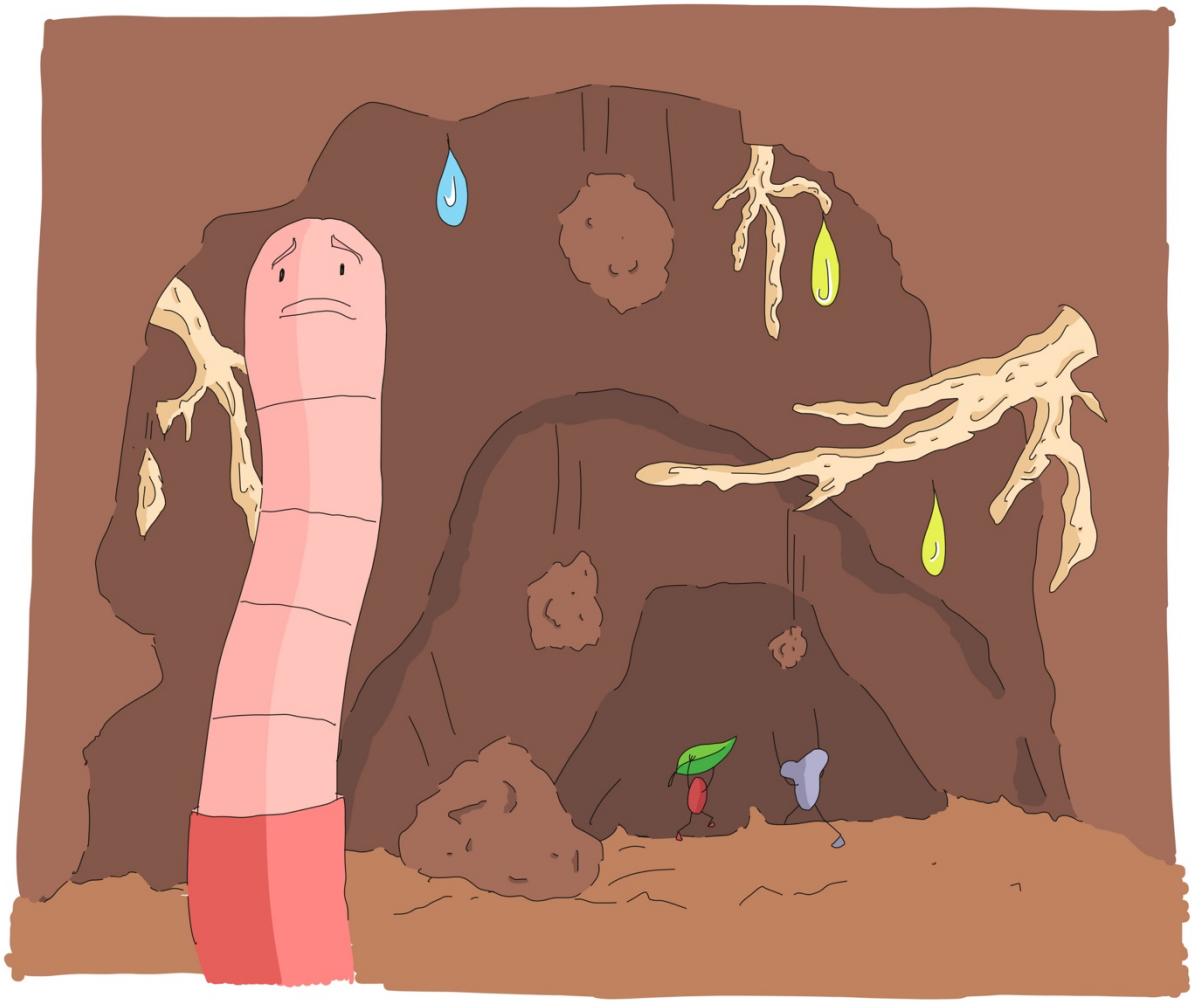
Do you hear this? The noise must be coming from the stadium over there. Maybe a concert is taking place? Or a soccer match?

Let‘s leave the school and have a look at what is going on.



Oh wow! A jumping show! Look at the springtails! They are tiny hexapods which eat dead leaves and other organic litter. With their tail between the legs they can jump up to 15 cm high. If they were the size of humans, they could jump up over the Eiffel Tower!

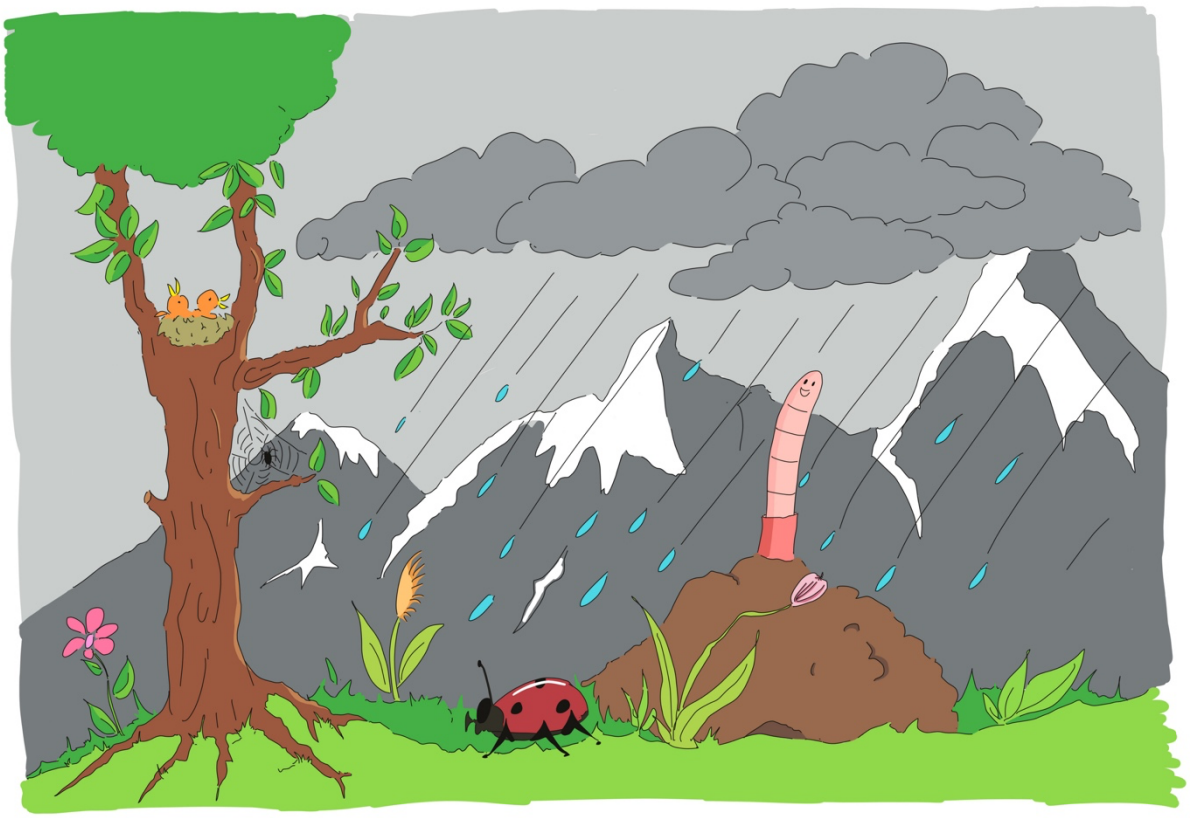




Oh, what is this? The soil is shaking, it must be an earthquake! Or is it an animal passing by? I wouldn’t be surprised, there are some quite big animals living in the soil.

Of course, it’s Molly, the old mole grandma! There are even bigger animals living in the soil, such as hares or badgers. But as they spend most of the time above ground, they are not really considered be part of the soil life.

We will follow Molly, as the tunnel she is digging will bring us back to the soil surface. Keep your distance, she looks quite nice, but beware, moles eat insects and also . . . earthworms!



I hope that after this journey through the soil you will have a little idea about the soil biodiversity.

Planet Earth is an incredible world, above and below the ground. Take care of it!

What are . . . . ? Interesting information for the reader, in first line the children (but also for the adults, of course).

Earthworms
They are big worms that eat soil and dead plant parts, such as leaves that dropped from the trees, and transform it into nutrients for the plants. They dig tunnels in the soil, which help the plant roots to grow through the soil.

Organisms
An organism is a living thing. The bigger ones are called macro-organisms, and the smaller ones micro-organisms. The macro-organisms, such as earthworms or moles, can be seen without difficulties. Micro-organisms, however, such as nematodes or bacteria, can only be seen with the help of instruments, for example a microscope.

Nematodes
These are very small worms, much smaller than earthworms.

Phytophthora, Pythium
These micro-organisms belong to the oomycetes, which are also called water molds.

Rhizosphere
This is the space in the soil just around the roots. It is an important place, because it is here were the roots will take up the nutrients they need for their growth.

Pathogens
This name designs all micro-organisms that are harmful to other organisms, plants or animals. The pathogens that attack plants are called phytopathogens.

Springtails
These small animals were longtime considered to be insects, but nowadays they belong to the hexapods. Another name for springtails is *Collembola*.

This is the story of Lumbry, an earthworm, who will guide you through the incredible world of soil and all the different kinds of life which lives there just below your feet. You will see that soil is much more than just a surface on which you can stand and on which the plants are growing.

So, start now reading this book, start your journey below the ground!

A word on the authors of this book

Vincent is a plant pathologist, working at Agroscope, the Swiss Centre for Agricultural Research. For the last 30 years, he has worked on methods to improve soil health. He wrote the text of this book.

Johanna is actually student at the Haute École Pédagogique de Fribourg, training to become a teacher. But she is also a gifted young artist and created the illustrations for this book.

Both live in Switzerland, and as well as having this book in common, they are also father and daughter!