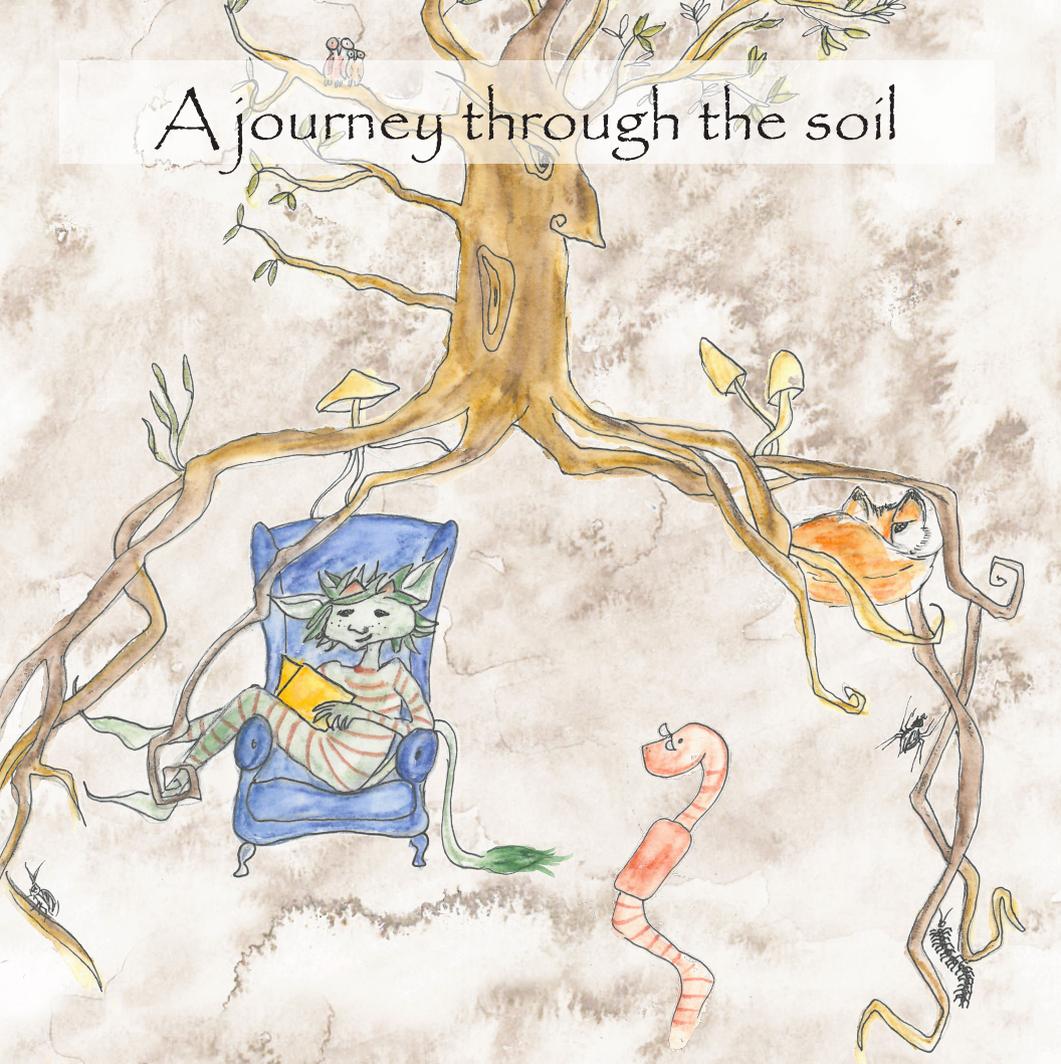
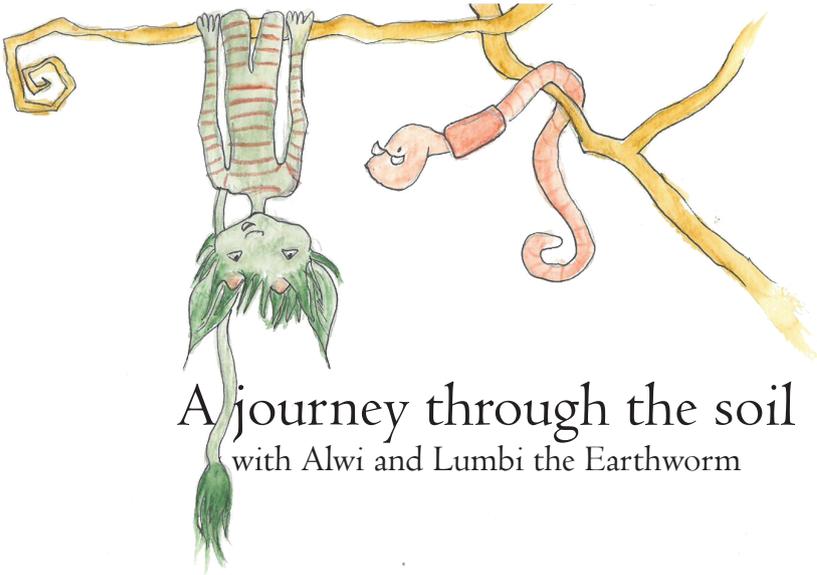


A journey through the soil







A journey through the soil

with Alwi and Lumbi the Earthworm

For children, from children of the earth



Alwi grew up in the cornfield. And to be honest, life was pretty boring there. Above ground there was not much going on and even in the soil, Alwis favourite place to be, hardly any playmates were around.



And so Alwi decided to leave the cornfield.
Maybe Frieda the Vixen was right and there was a lot more life
in the soil in this beautiful place called “The Farmyard”.



Hours passed by as Alwi wandered through the cornfield.

But the journey seemed to be worth it.

“This must be the beautiful farmyard!” Alwi cheered.

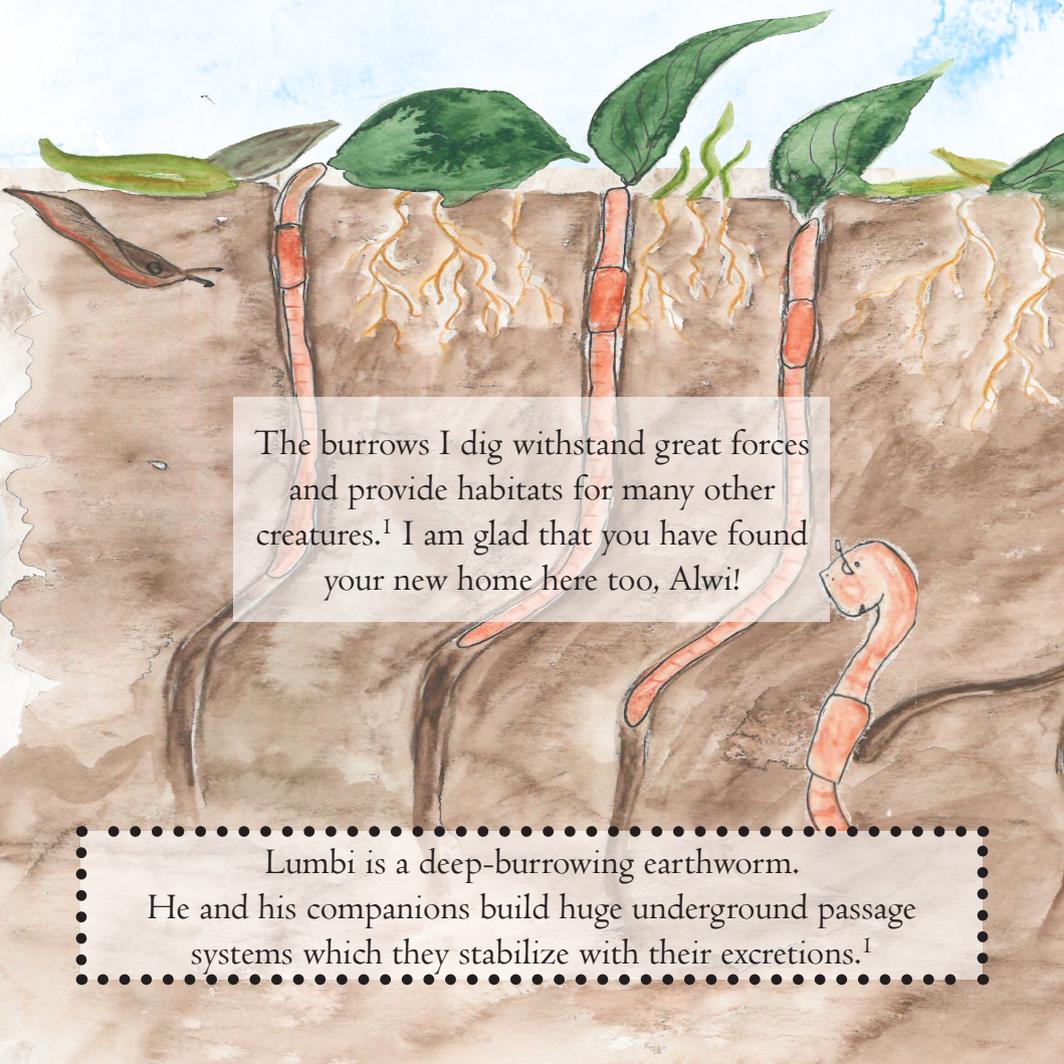
Tired from the journey, Alwi hopped into the mousehole to rest a little.

Oh! Someone lives in the soil
after all! I thought I was all
alone here. I am Alwi.
Who are you?



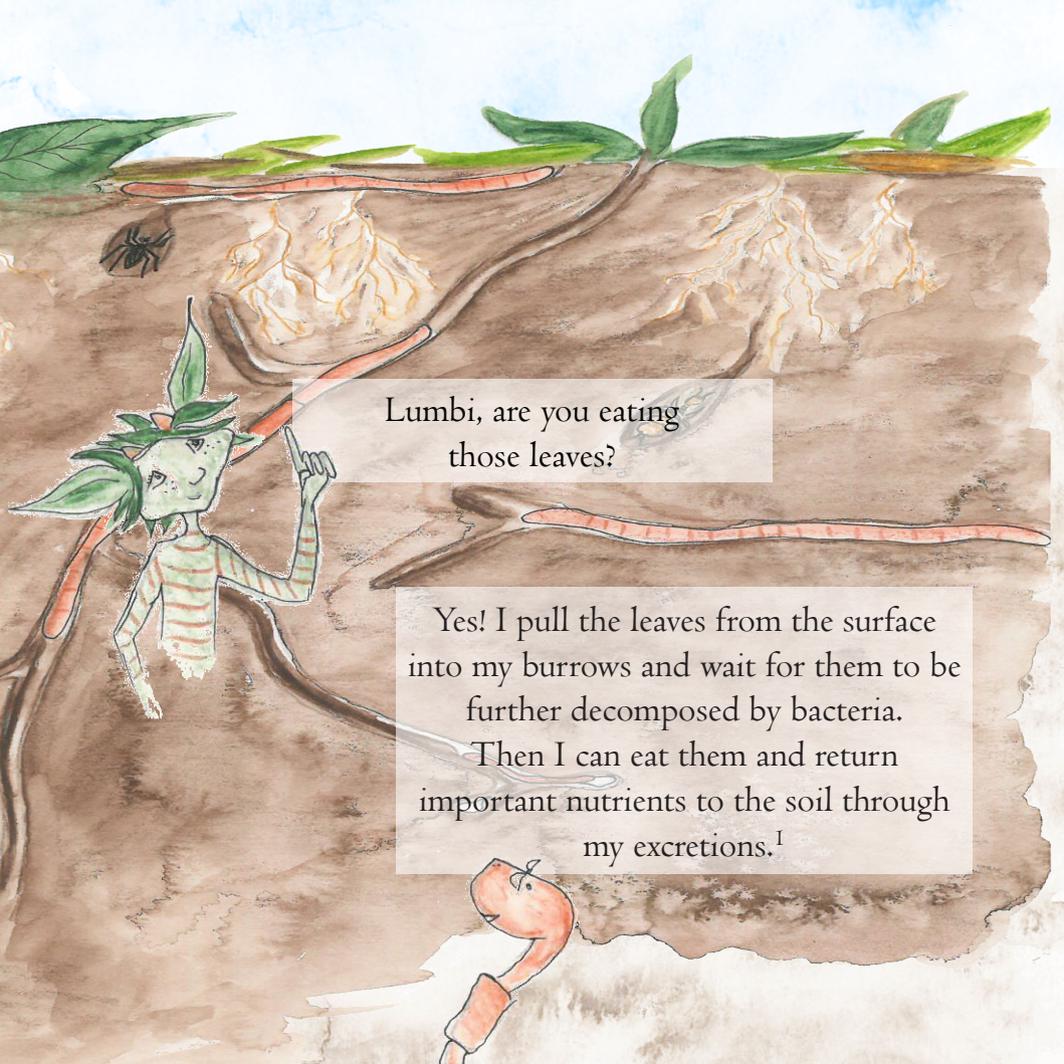
I am Lumbi the Earthworm.
We are a huge community of
different living beings here.
Come with me, I'll show you around!





The burrows I dig withstand great forces and provide habitats for many other creatures.¹ I am glad that you have found your new home here too, Alwi!

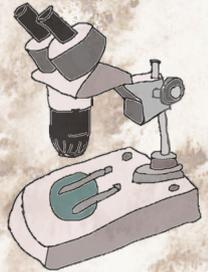
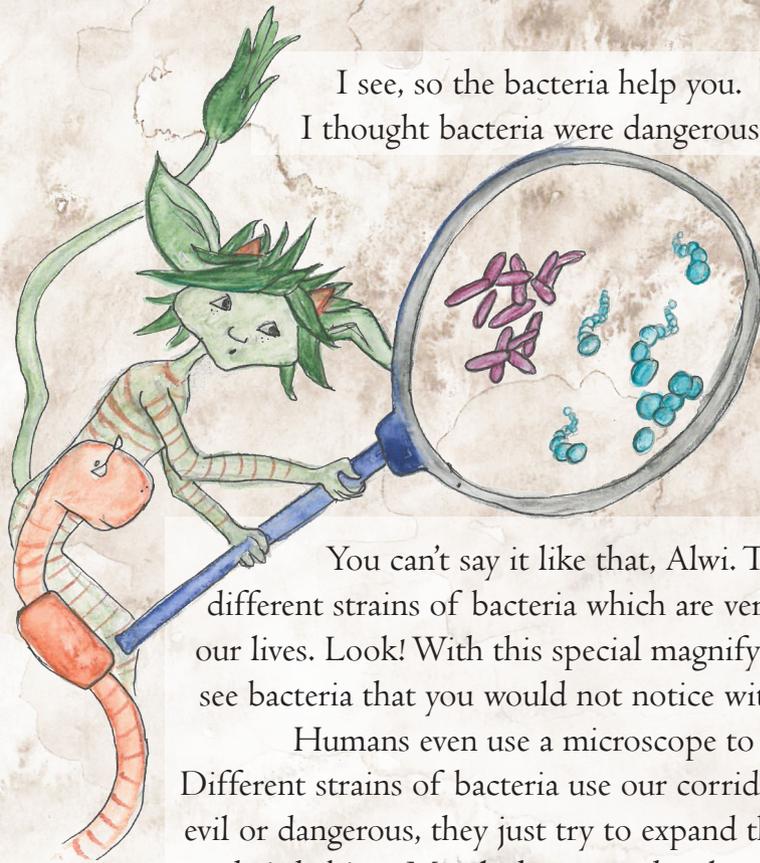
Lumbi is a deep-burrowing earthworm. He and his companions build huge underground passage systems which they stabilize with their excretions.¹



Lumby, are you eating those leaves?

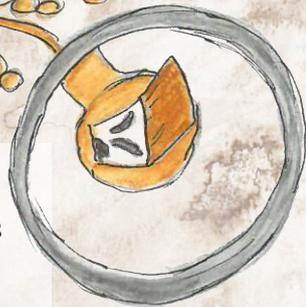
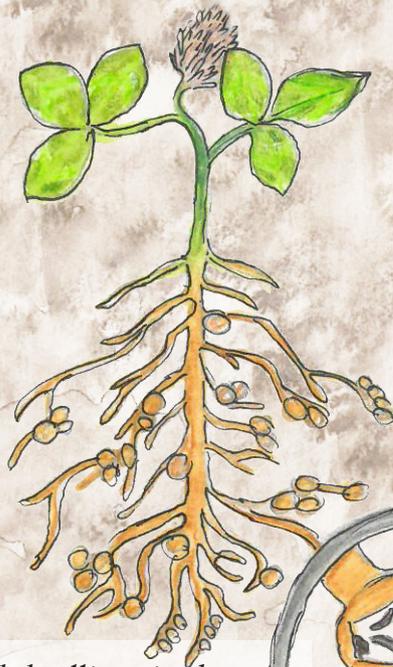
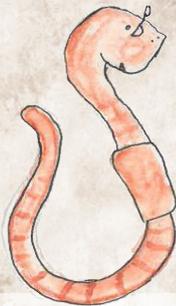
Yes! I pull the leaves from the surface into my burrows and wait for them to be further decomposed by bacteria. Then I can eat them and return important nutrients to the soil through my excretions.¹

I see, so the bacteria help you.
I thought bacteria were dangerous!?

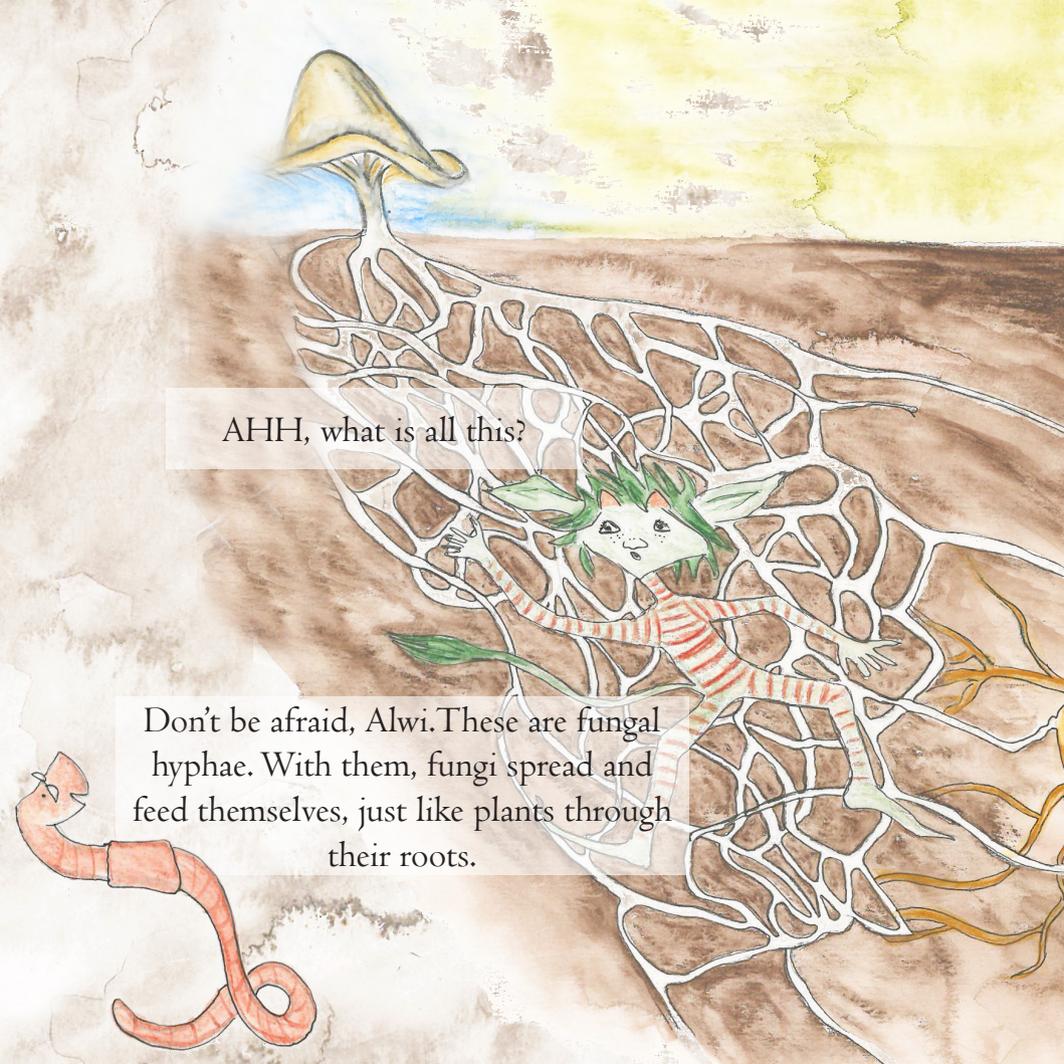


You can't say it like that, Alwi. There are many different strains of bacteria which are very important for our lives. Look! With this special magnifying glass you can see bacteria that you would not notice with the naked eye.

Humans even use a microscope to see them. Different strains of bacteria use our corridors.¹ They are not evil or dangerous, they just try to expand their territories, so their habitat. Mostly, however, they keep themselves in balance so that no tribe can seize power!

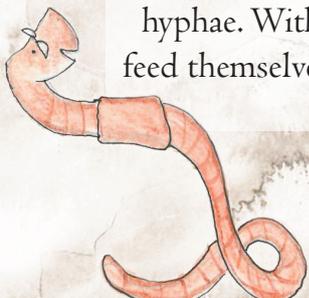


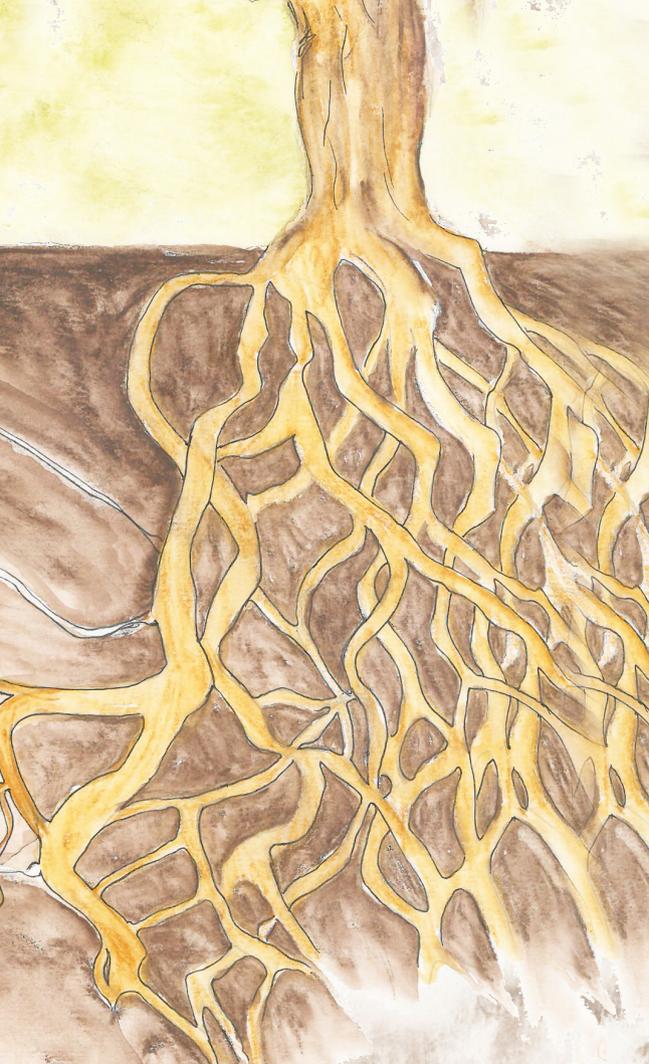
Here bacteria even build dwellings in the plant roots of a clover. In these small nodules live the nodule bacteria, which are extremely important for plants. They store a certain nutrient, called nitrogen, from the air and make it available to the plant. In return, the clover provides these protected spaces.²



AHH, what is all this?

Don't be afraid, Alwi. These are fungal hyphae. With them, fungi spread and feed themselves, just like plants through their roots.





Almost all plants form lifelong friendships with fungi. They are connected with each other through a huge underground network of roots and hyphae. They exchange nutrients and together they can cover much larger areas in their search for water. This friendship, in which every partner benefits, is also called symbiosis.³



What is this big
worm?

This is a cockchafer grub, Alwi.





But cockchafer look very different, I saw them flying past in the cornfield!

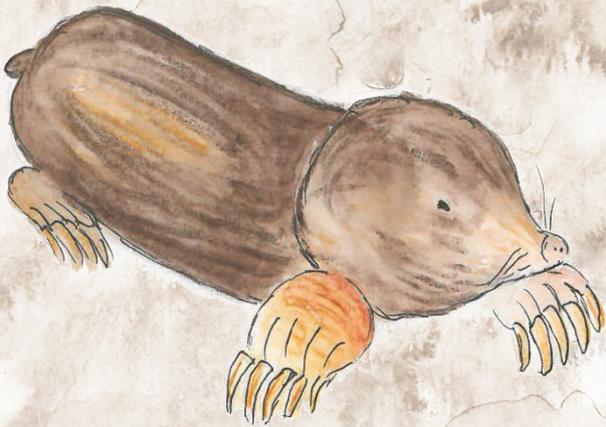
As with many other insects, the eggs are laid in the soil where they develop into cockchafer as you know them.



Hello!
You sure have big hands!
You remind me of someone...
Who are you?



I am Marie, the mole cricket.
My big hands help me to dig my way
through the soil. You probably know my
namesake, the mole. He too has such
big hands for the same reason.



Hello? I can hardly see you. Who is this?

A mole can only distinguish between light and dark, and that's all it needs in the soil. For orientation it uses its sensitive muzzle with tactile hair.

I am Alwi and I am just discovering life in the fertile soil, which was previously unknown to me. But I have seen you before, when you looked out of a heap of earth up there! Why do you always put heaps of earth into the meadow?

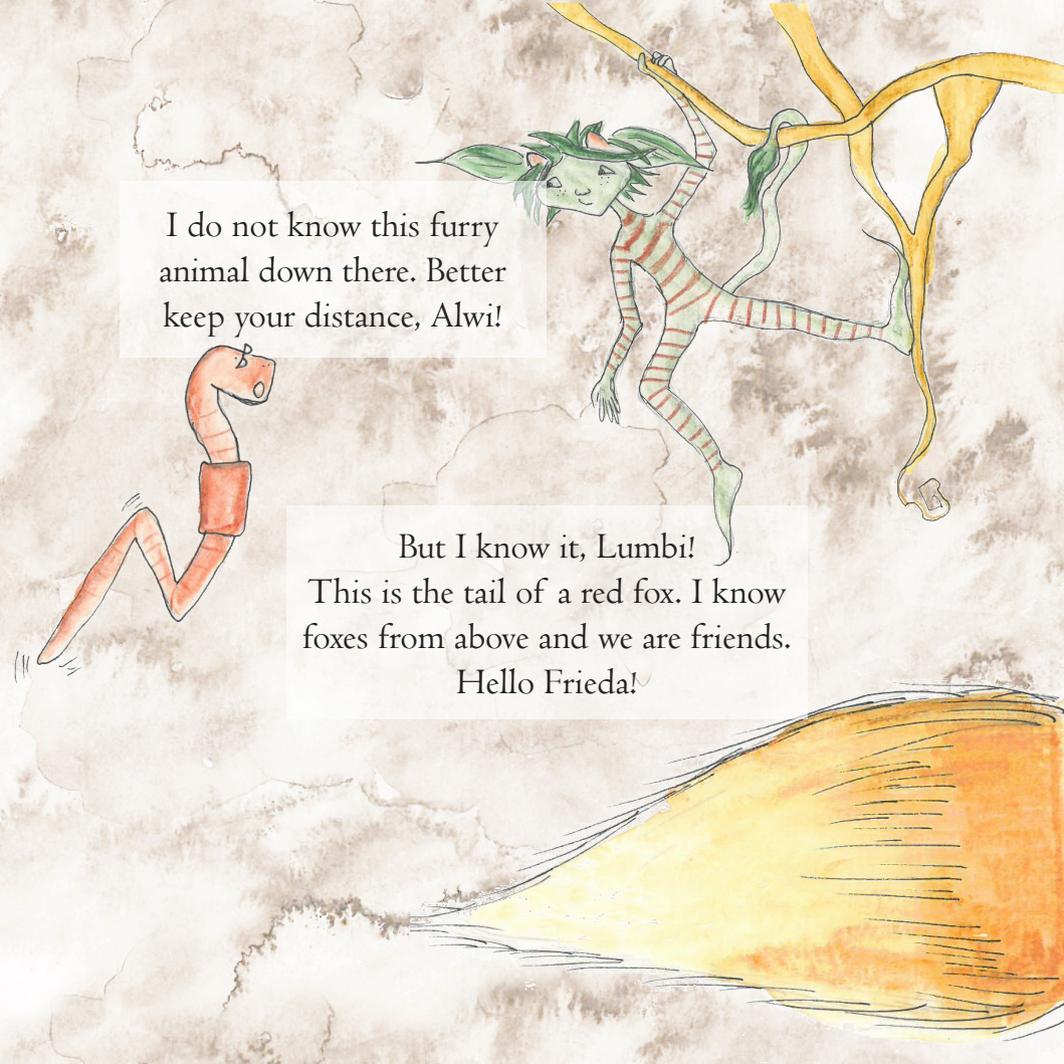




When I dig my paths and living spaces
in the ground, excess soil is created.
I then push it to the surface and that's how
the heaps you saw on the meadow are created.

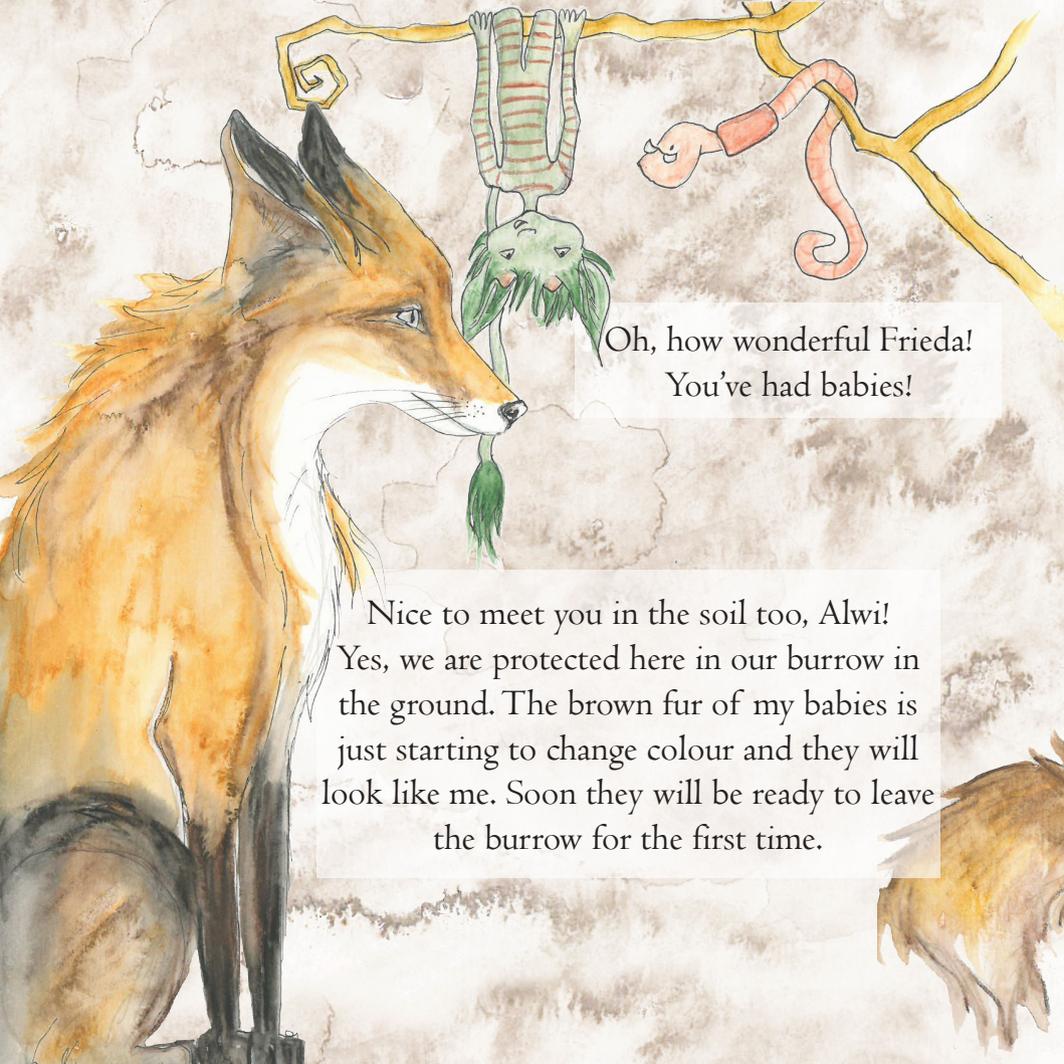
We better get going quickly
Alwi. The mole's favourite
food is earthworms.





I do not know this furry
animal down there. Better
keep your distance, Alwi!

But I know it, Lumbi!
This is the tail of a red fox. I know
foxes from above and we are friends.
Hello Frieda!



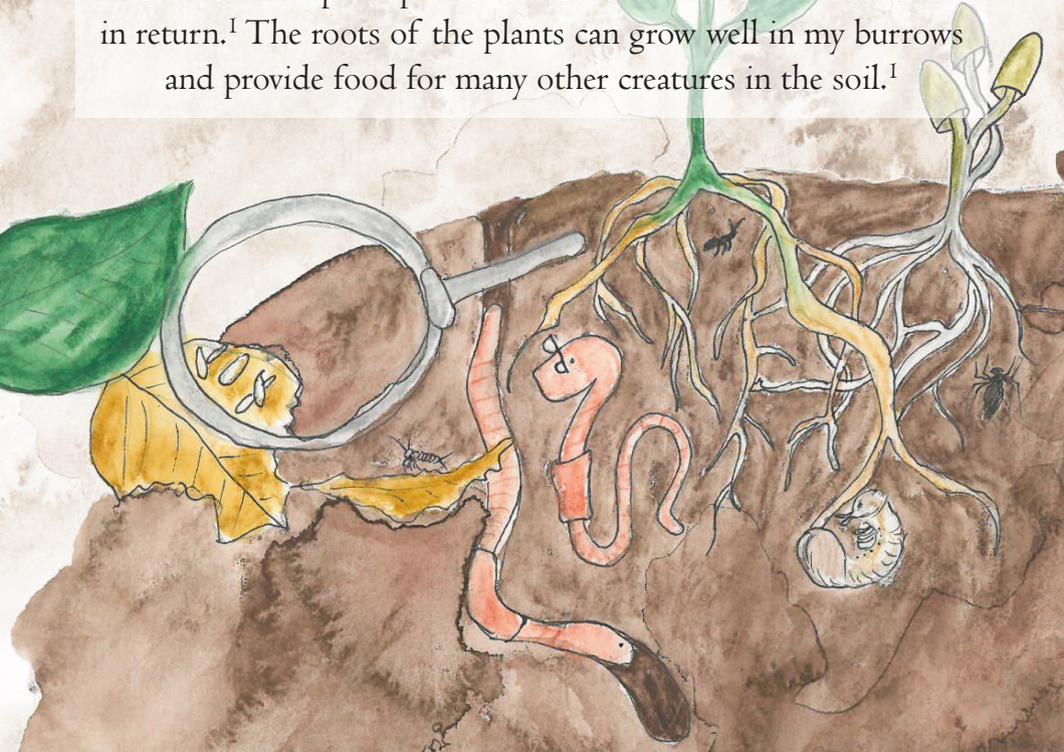
Oh, how wonderful Frieda!
You've had babies!

Nice to meet you in the soil too, Alwi!
Yes, we are protected here in our burrow in
the ground. The brown fur of my babies is
just starting to change colour and they will
look like me. Soon they will be ready to leave
the burrow for the first time.

Vixen (female fox) give birth in a cave, which they dig into the soil. This cave is called fox's burrow.



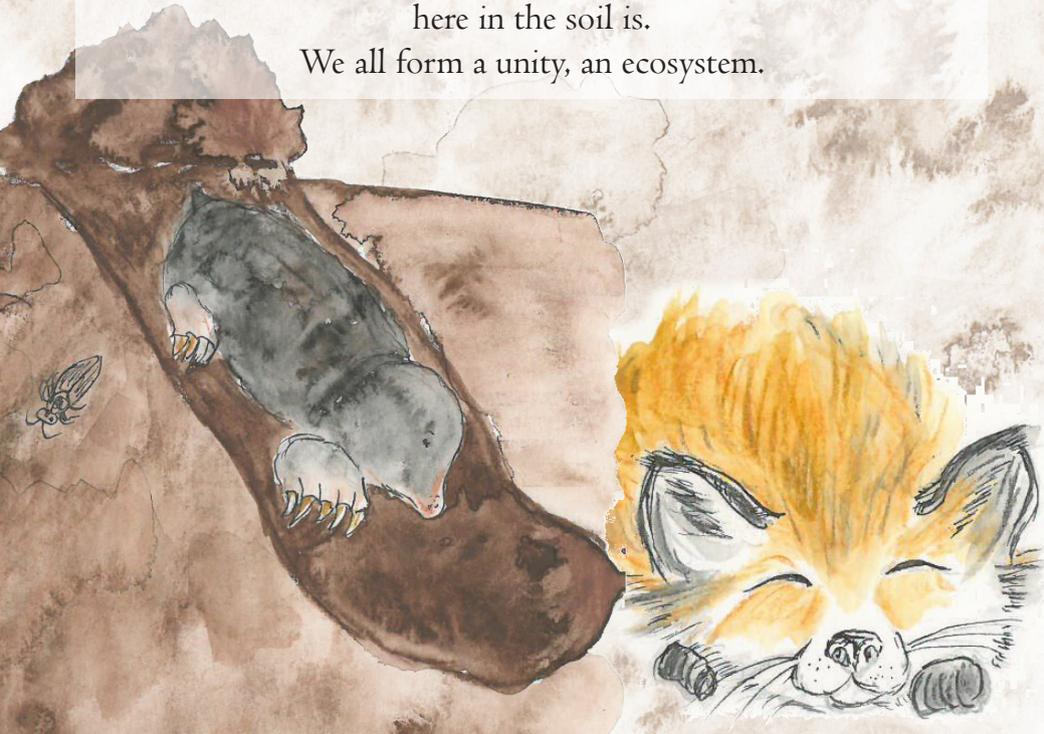
Unfortunately I could not introduce you to all the creatures here in the soil. We are so many! We all enrich the soil and influence each other. I decompose plants and with my excretions I provide a stable structure in the soil.¹ In my burrows bacteria find a habitat.¹ These in turn help the plants to absorb nutrients and receive food in return.¹ The roots of the plants can grow well in my burrows and provide food for many other creatures in the soil.¹



Fungi connect with plant roots and provide each other with food.³ Cockchafer grubs eat plant roots and at the same time serve as food for other animals such as the mole. Even the fox needs the soil to find shelter or to raise its offspring.

Now you probably understand how important the diversity here in the soil is.

We all form a unity, an ecosystem.





Rhizosphere



How nice that I am now part of a diverse community in this species-rich farmyard. I will never have to starve here. Even if the cockchafer grub eats a lot of corn roots at once there is many other delicious food. The living soil will nourish us all.⁴

Become a scientist and discover the behaviour and diet of Lumbric the Earthworm. Scan the QR code in the lower right corner to learn in detail how to build this worm observation station, how to do research with it and how to take care of Lumbric.



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- ³ STRACK, D., FESTER, T., HAUSE, B., WALTER, M.H. (2001) Die arbuskuläre Mykorrhiza. Eine unterirdische Lebensgemeinschaft, *Biologie in unserer Zeit*, Vol.31(5), pp.286-295
- ⁴ WAGG, C., SCHLAEPPI, K., BANERJEE, S., KURAMAE, E.E., VAN DER HEIJDEN, M.G.A. (2019), Fungal-bacteria diversity and microbiome complexity predict ecosystem functioning, *Nature communications* Vol. 10:4841, <https://doi.org/10.1038/s41467-019-12798-y>

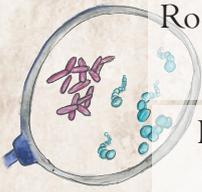




Common Earthworm
Lumbricus terrestris



Common Cockchafer
Melolontha melolontha



Rod-shaped bacteria
Pseudomonas

Round bacteria
Arthrobacter



European mole cricket
Gryllotalpa gryllotalpa



Nodule bacteria
Rhizobiaceae



European mole
Talpa europaea



Symbiosis between
root and fungus
Mycorrhization



Red fox
Vulpes vulpes