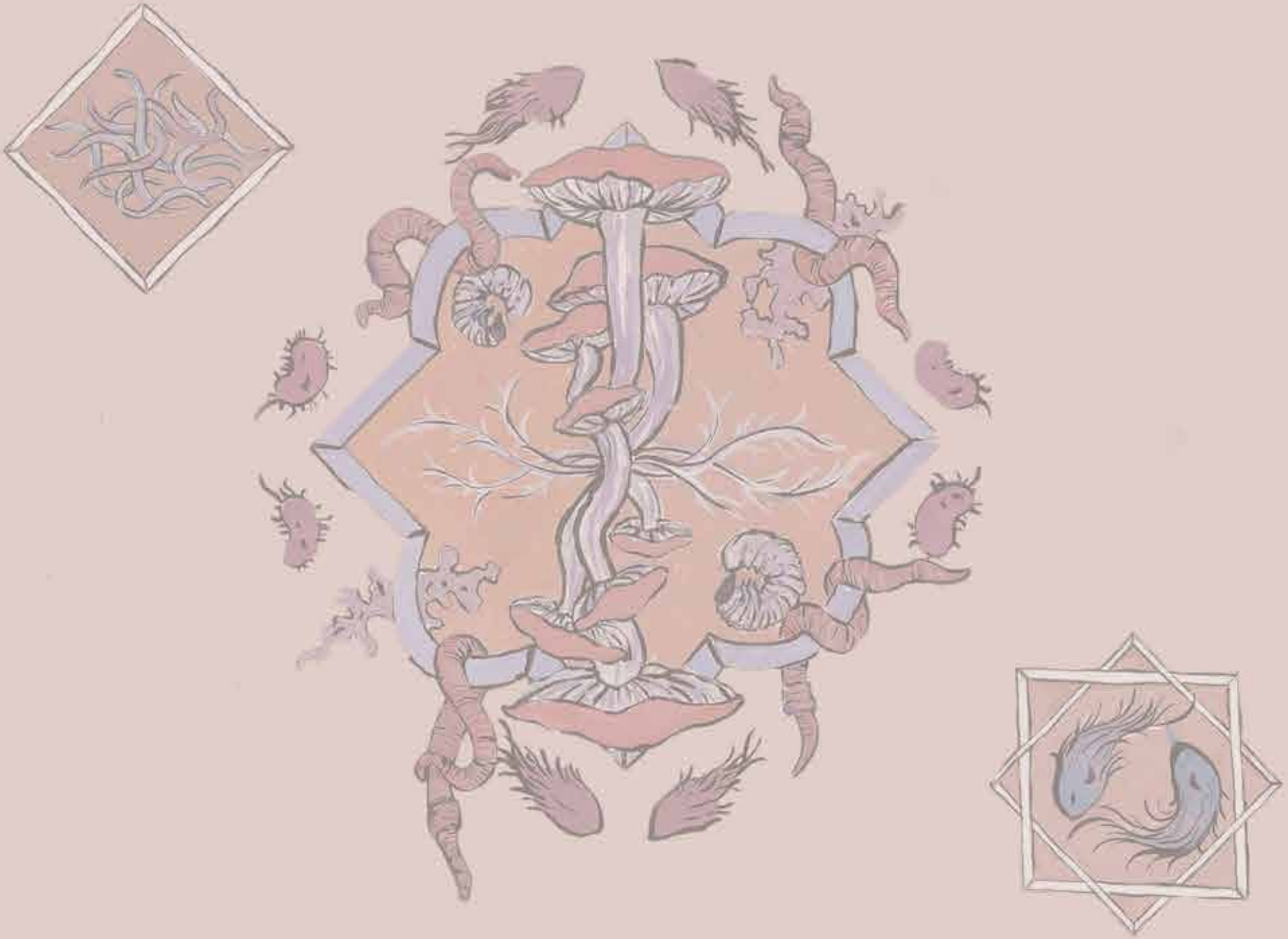

Soil's Alive



Soil's Alive

Biodiversity is the variety of life on Earth (from invisible bacteria through to the gigantic blue whale) and how they all interact with each other and the planet. The threads of biodiversity connect us all together.

We know a lot about the larger creatures that roam on the Earth's surface with us, because we can see them, follow them and use cameras to photograph them. However, we have lots to discover about sea creatures and soil critters as these places (habitats) are harder to explore.


You are part of a web of life and you need all the other creatures on the planet to help you survive. Everything you do; from what you eat for dinner through to what you throw in the bin; has an impact on the other creatures on the planet.
Did you know...
The soil network (called an ecosystem) is more diverse than the rainforest?
Soil might not look like much more than dirt but if you take a look at what's happening under your feet, you will find it is teeming with a variety of different living things - just all on a miniature scale.
So let's transport you into the soil network as we whizz through the lens of a magnifying glass...


Everyone knows the worm! They pull down plant material from the ground surface into the underground world.
Most wriggling worms are active when it is dark and wet, as they need to keep their skin damp. SLIME helps with this.
Worms pull leaves, grass and other tasty foods under the surface where they can munch them in peace. Once they have finished, the worm poo (called worm cast) they produce is amazing plant food. Worms are a link between the ground surface and the underground world.
There are many different types of worms – some live near the surface all the time and some burrow much deeper into the soil.


As well as bringing their food into the soil, they also create a network of tunnels. Worms are part of a team helping to keep the soil healthy.
These tunnels help get air and water into the soil and help make the soil a better place to live.
Did you know...
Worms are the link between the ground surface and the underground world.
The bits of leaf, grass, or other plant pieces the worms pull into the soil is ORGANIC MATTER.
This organic matter is very important, it helps to hold water – it can even help reduce flooding and it provides a home and lots of food for the creatures in the soil.


Do you like cake? The type of cake you get depends on the ingredients you put in your bowl.
Well, guess what! You get different soils depending on the ingredients that are above and below ground. It can take 200-400 years to form 1cm of soil so don't expect it to form overnight.

So, what are these soil ingredients?

Natural material like leaves, grass and twigs fall on the ground all the time. These dead bits of plant might not be a tasty snack to you, but this is lunch for many of the living creatures in the soil.

There are loads of different creatures and many of them are nature's recyclers. They eat dead plant pieces, break them down and poo them out, helping us by forming soil!

We use soil to grow food, store nutrients and break down pollutants. Soil even helps with keeping the climate stable! Lets meet the tiny creatures who carry out these BIG TASKS.

LET'S MAKE SOIL!

INGREDIENTS

MINERALS (sand, silt and clay) that come from the rocks under the soil.

AIR to sit between the mineral particles.

WATER (also found in the spaces between the minerals).

ORGANIC MATTER is a mix of living creatures, roots and dead bits of plant and natural material.

METHOD

1. Rocks are eroded (broken down) into smaller pieces. The climate helps with this, with wind, water and frost eroding rocks into smaller particles.
2. Once the rock is broken into smaller particles, mosses and lichens start growing and help add organic matter. This breaks down the rock a bit more.

Soil takes 200 – 400 years to form just 1cm of soil so don't expect fast results!

PORTRAIT GALLERY

Some soils have millions of creatures working hard in the soil and others have very few – this depends on the soil ingredients.

Feisty **FUNGI** are tiny cells that join to make very long strands. These strands are called hyphae and they can push into the TINY soil spaces and get everywhere in the soil!

In the autumn, you can see mushrooms growing on the ground. These are fungi fruiting structures popping out of the soil to produce spores and help the fungi spread to new areas of soil. The mushroom is just one tiny piece of a big tangled net of threads under the ground.

MICROBES are microorganisms (creatures that are so small they can only be seen through a microscope) and the soil microbe family is MASSIVE; busy bacteria, active actinomycetes, feisty fungi, prowling protozoa and nimble nematodes.

Did you know...

One teaspoon of soil contains more microbes than there are people on Earth. That's mind blowing!

Most of these microbes make their home close to plant roots and plants even send food down to their roots for the microbes! These microbes help plants to grow and that helps us because we eat the plants that the microbes help!

Prowling **PROTOZOA** are only single cells, but are much larger than bacteria. They swim through the soil water using little hairs as paddles. They are hunters and they even eat each other!

Nimble **NEMATODES** are tiny worms that live around or inside plants. They live in the soil water and are food for many of the larger soil creatures. Some nematodes eat bacteria, some eat fungi and some are predators.

Active **ACTINOMYCETES** like to feast on the bits that are hard to break down, like plant cell walls (made of cellulose). Actinomycetes give the soil its lovely earthy smell. They are a type of bacteria that look like little white threads stretching through the soil.

Busy **BACTERIA** catch the plant root food and release the nutrients into the soil round the plant. Most are rotters (called decomposers) and they feed on the juice from plant roots and dead bits of plant – yum! These busy bacteria change food from something no one wants to eat, into food that other creatures in the soil food web gobble up.

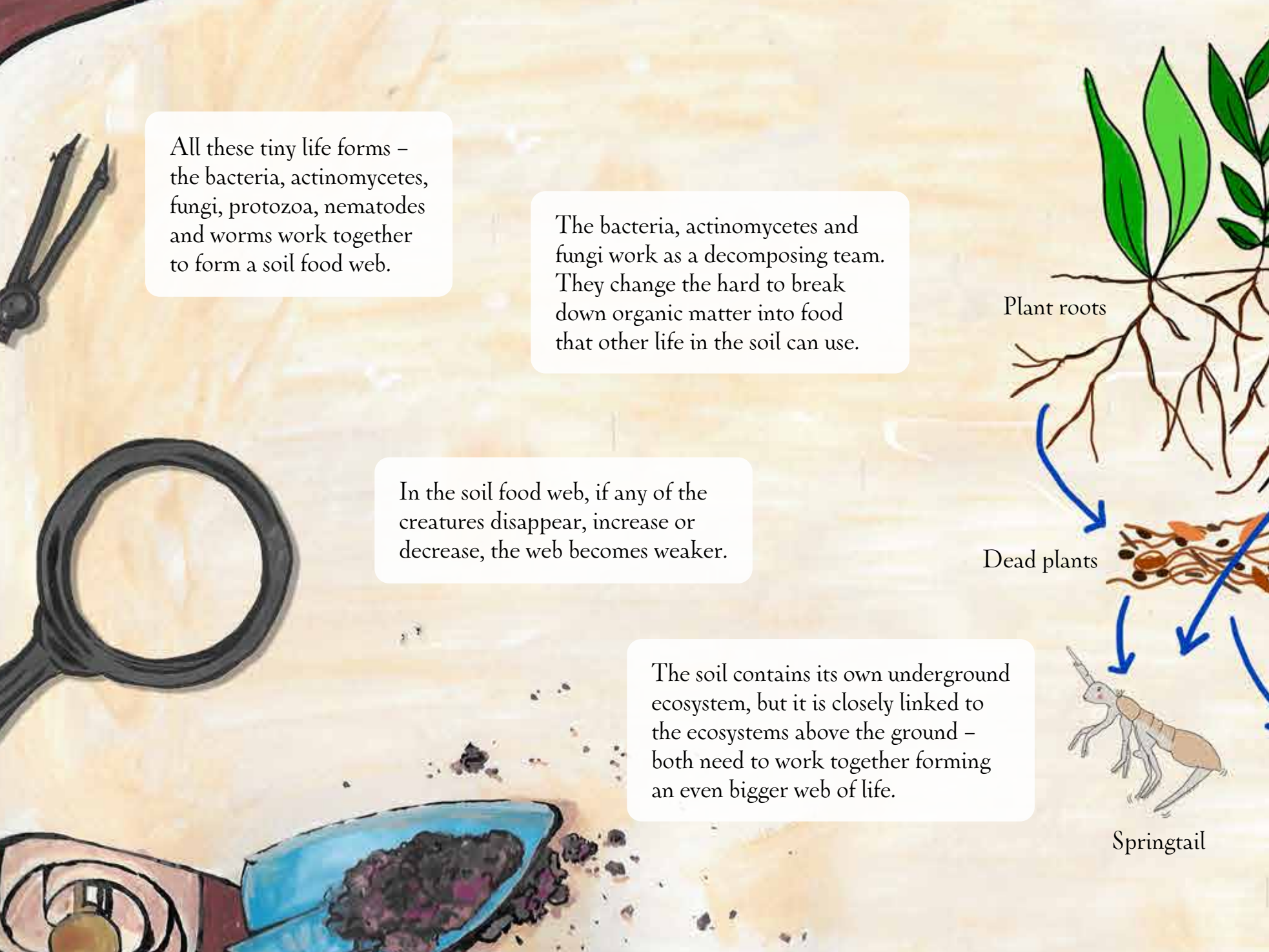
You also find **SPRINGTAILS** and **MITES** in the soil. Springtails usually feast on dead plants and fungi and soil mites love to munch up nematodes. Turn over to find out more!

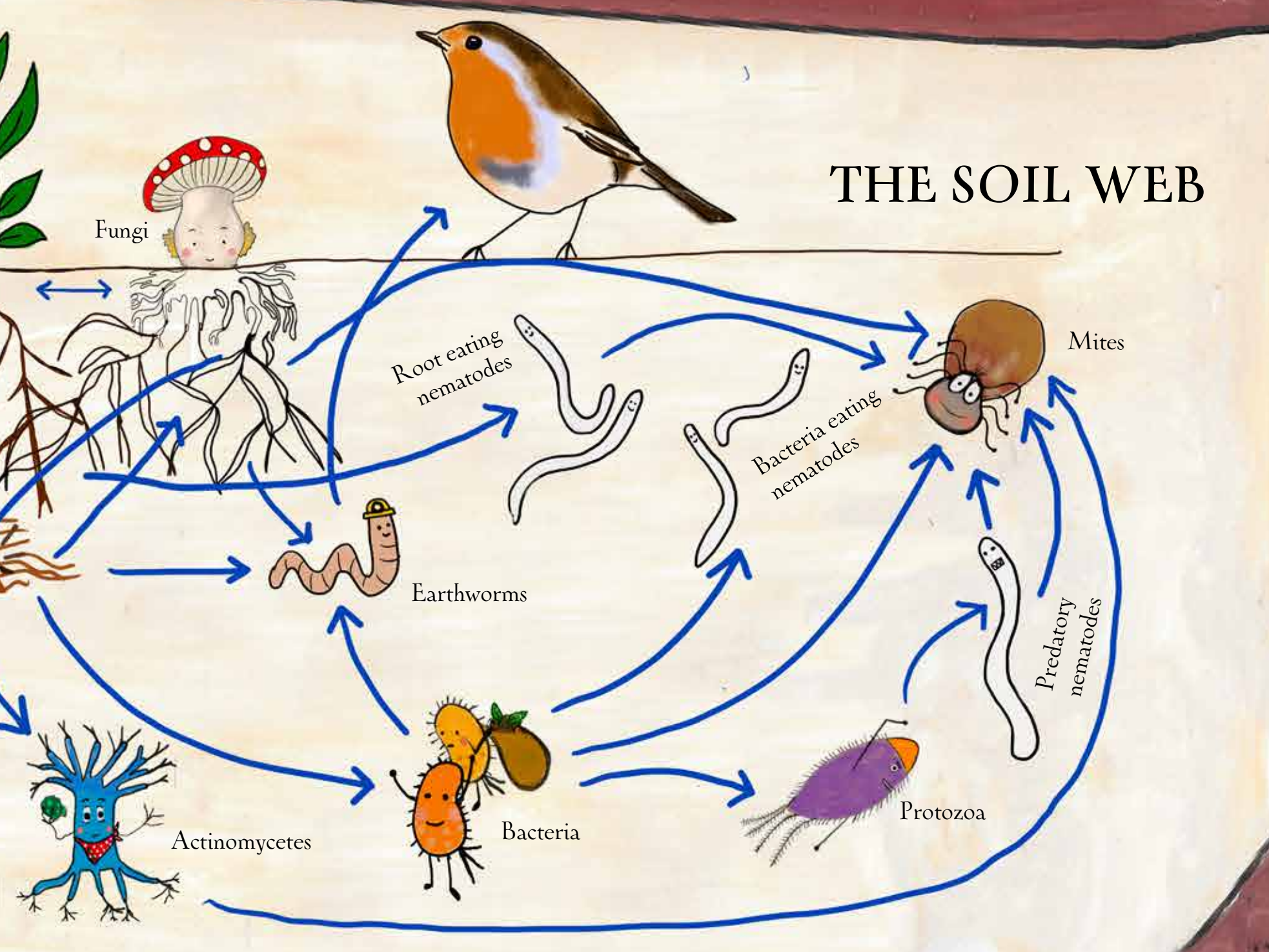
All these tiny life forms – the bacteria, actinomycetes, fungi, protozoa, nematodes and worms work together to form a soil food web.

The bacteria, actinomycetes and fungi work as a decomposing team. They change the hard to break down organic matter into food that other life in the soil can use.

In the soil food web, if any of the creatures disappear, increase or decrease, the web becomes weaker.

The soil contains its own underground ecosystem, but it is closely linked to the ecosystems above the ground – both need to work together forming an even bigger web of life.



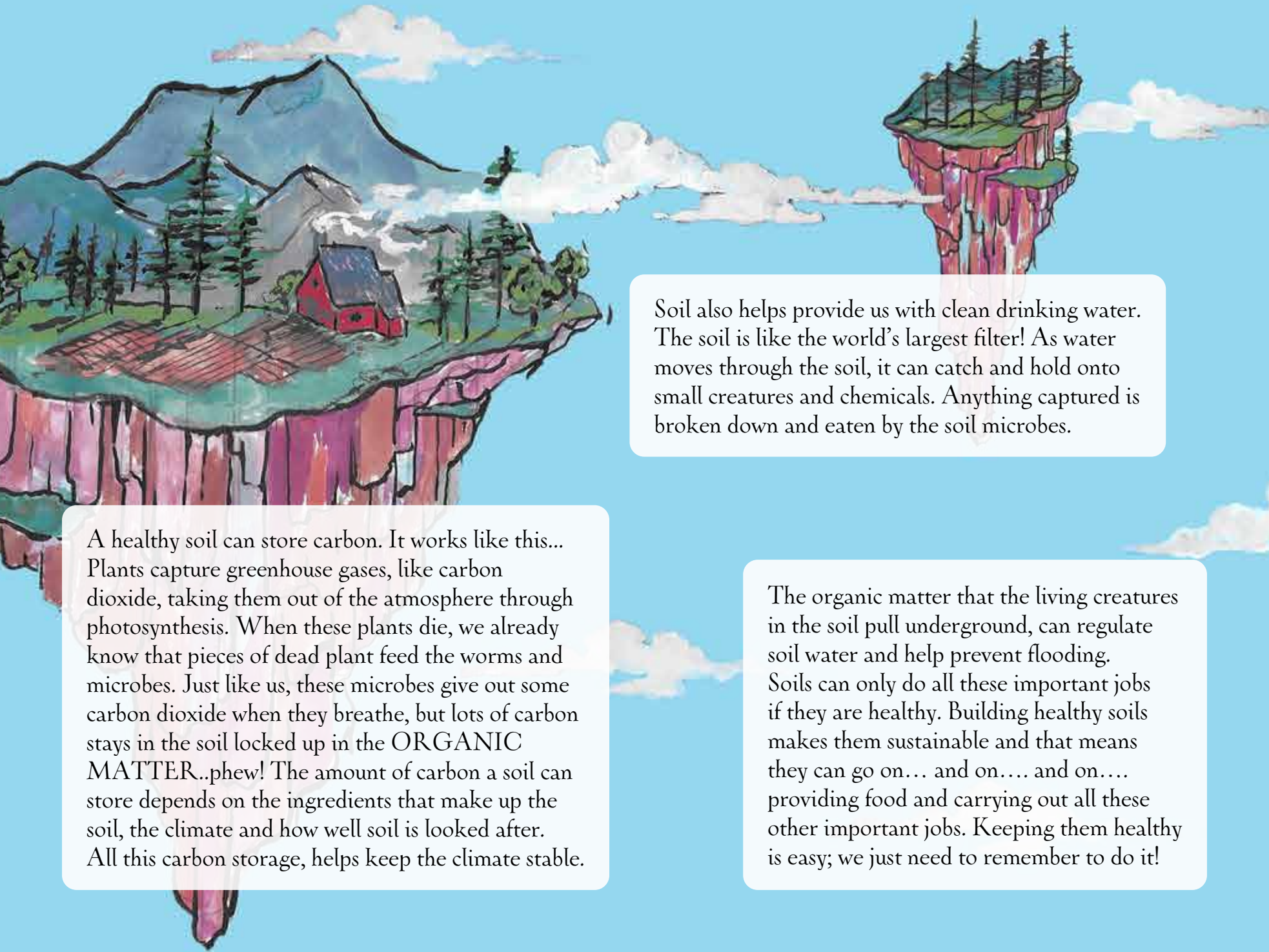

THE SOIL WEB
Fungi
Root eating nematodes
Bacteria eating nematodes
Mites
Earthworms
Predatory nematodes
Actinomycetes
Bacteria
Protozoa

Soil is essential for human life, as without it we can't feed ourselves. Plants like carrots and potatoes come directly from the soil. Other foods - like eggs, milk and meat - might come from animals but these animals need to eat and the food they eat comes from plants that grow in the soil. Everything leads back to the soil. Only foods coming from the sea or freshwater are not reliant on the soil.

Did you know...

95% of our food comes from soil

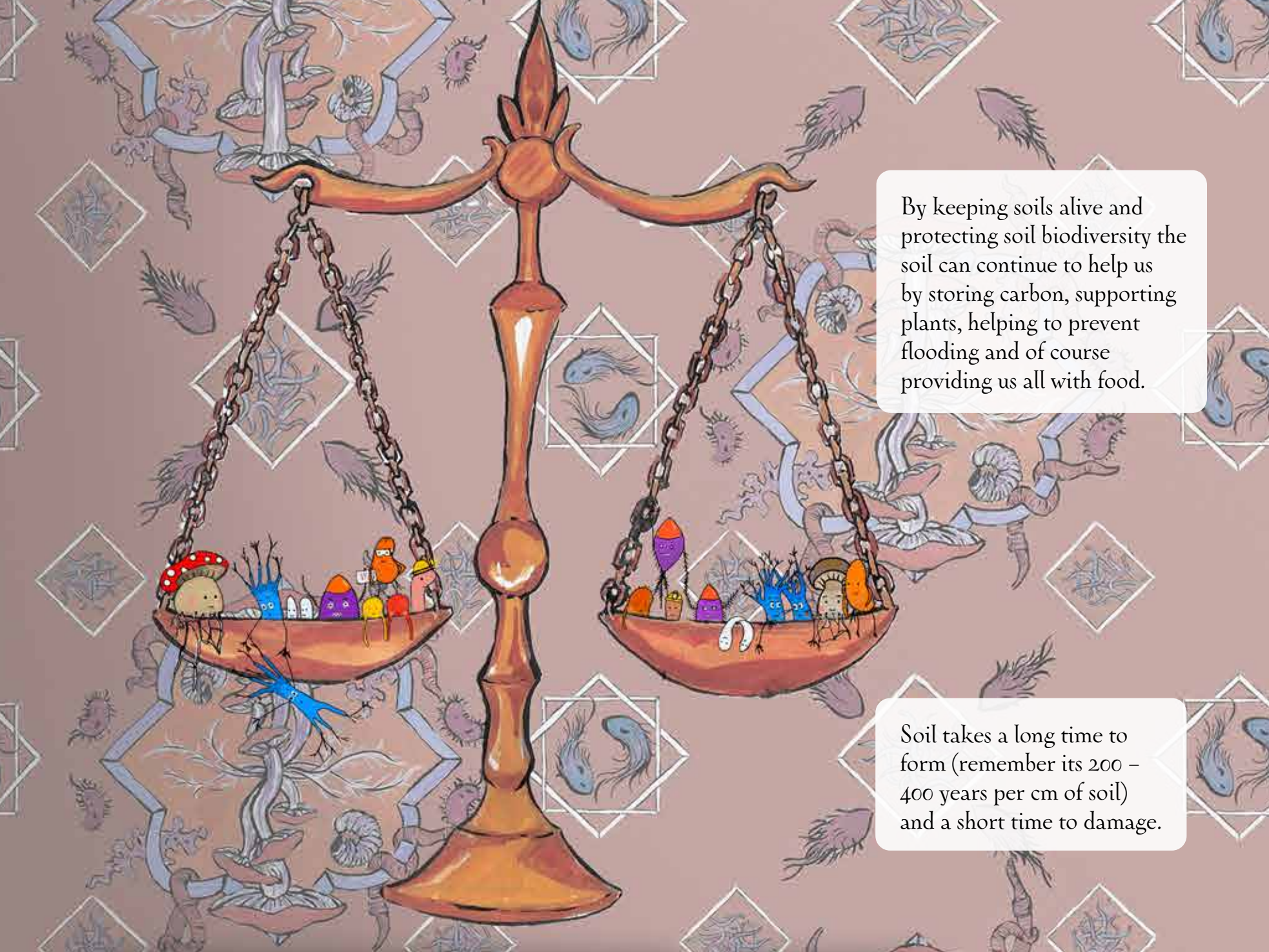
We need to look after soils to provide us with food, but the soil helps with more than just providing food. Soil provides somewhere for plants to anchor their roots. Plants use carbon dioxide, water and sunlight to make themselves food. As well as making food, they also produce the oxygen that we need to breathe. This process is called photosynthesis.



Soil also helps provide us with clean drinking water. The soil is like the world's largest filter! As water moves through the soil, it can catch and hold onto small creatures and chemicals. Anything captured is broken down and eaten by the soil microbes.

A healthy soil can store carbon. It works like this... Plants capture greenhouse gases, like carbon dioxide, taking them out of the atmosphere through photosynthesis. When these plants die, we already know that pieces of dead plant feed the worms and microbes. Just like us, these microbes give out some carbon dioxide when they breathe, but lots of carbon stays in the soil locked up in the ORGANIC MATTER..phew! The amount of carbon a soil can store depends on the ingredients that make up the soil, the climate and how well soil is looked after. All this carbon storage, helps keep the climate stable.

The organic matter that the living creatures in the soil pull underground, can regulate soil water and help prevent flooding. Soils can only do all these important jobs if they are healthy. Building healthy soils makes them sustainable and that means they can go on… and on…. and on…. providing food and carrying out all these other important jobs. Keeping them healthy is easy; we just need to remember to do it!



By keeping soils alive and protecting soil biodiversity the soil can continue to help us by storing carbon, supporting plants, helping to prevent flooding and of course providing us all with food.

Soil takes a long time to form (remember its 200 – 400 years per cm of soil) and a short time to damage.

There are 4 simple steps that keep our soils fit and healthy:

HOW TO KEEP SOIL HAPPY

1. Make sure there is organic matter (dead plant material) in the soil: there are many hungry microbes to feed. They will eat the dead plants and help feed new plants.

2. Limit disturbing! The soil is home to millions of creatures who do not like their underground roof being turned upside down!

3. Keep a plant covering on the soil, so the wind or the rain doesn't blow or wash it away. Soil is worth more than GOLD!

4. Give soil a break. The soil doesn't like having the same crop planted in it year after year, after year – as all the food for the microbes is taken away by the plants! Planting different crops makes sure there is enough food for microbes and plants in the soil.

ACTIVITIES

Why not have a go at some of these activities to find out more about the soil near you.

Discover soil mineral ingredients

You will need a spoon and access to water

You can feel sand, silt and clay in a soil using your sense of touch! Find a teaspoon of soil with no large stones in it and add enough water to make it wet. You then need to rub it between your fingers. The sand particles are the largest and they feel gritty, the clay particles are the smallest and they feel smooth and help make the soil sticky.

- Can you feel the grit if you rub the soil between you thumb and first finger? If you can, you have SAND in your soil
- Can you roll your soil into a worm shape? How long a worm can you make? CLAY helps stick the soil together and the longer the worm shape you get, the more clay you have in your soil.

Make sure you wash your hands well afterwards with warm water and soap!

Do you need the soil?

Try making lists of all the food you eat over one day.

How many of these foods can you link back to the soil?

Try making two lists:

1. A plant food list with foods that come directly from the soil like fruit, vegetables and cereals
2. An animal food list (like meat, milk and eggs). Can you work out how these animal foods link to the soil by going back a few steps and thinking about what the animal eats?

How many things have you eaten that need the soil?

This shows you how important the soil is to you!

Thank you for purchasing

Soil's Alive

As well as spreading the word about the vital role soils have to play, you are also helping to support The Royal Highland Education Trust.

RHET

This charity works across Scotland to educate young people and teachers about food, farming and the countryside.

To find out more visit www.rhet.org.uk

Scottish charity number: SC007492

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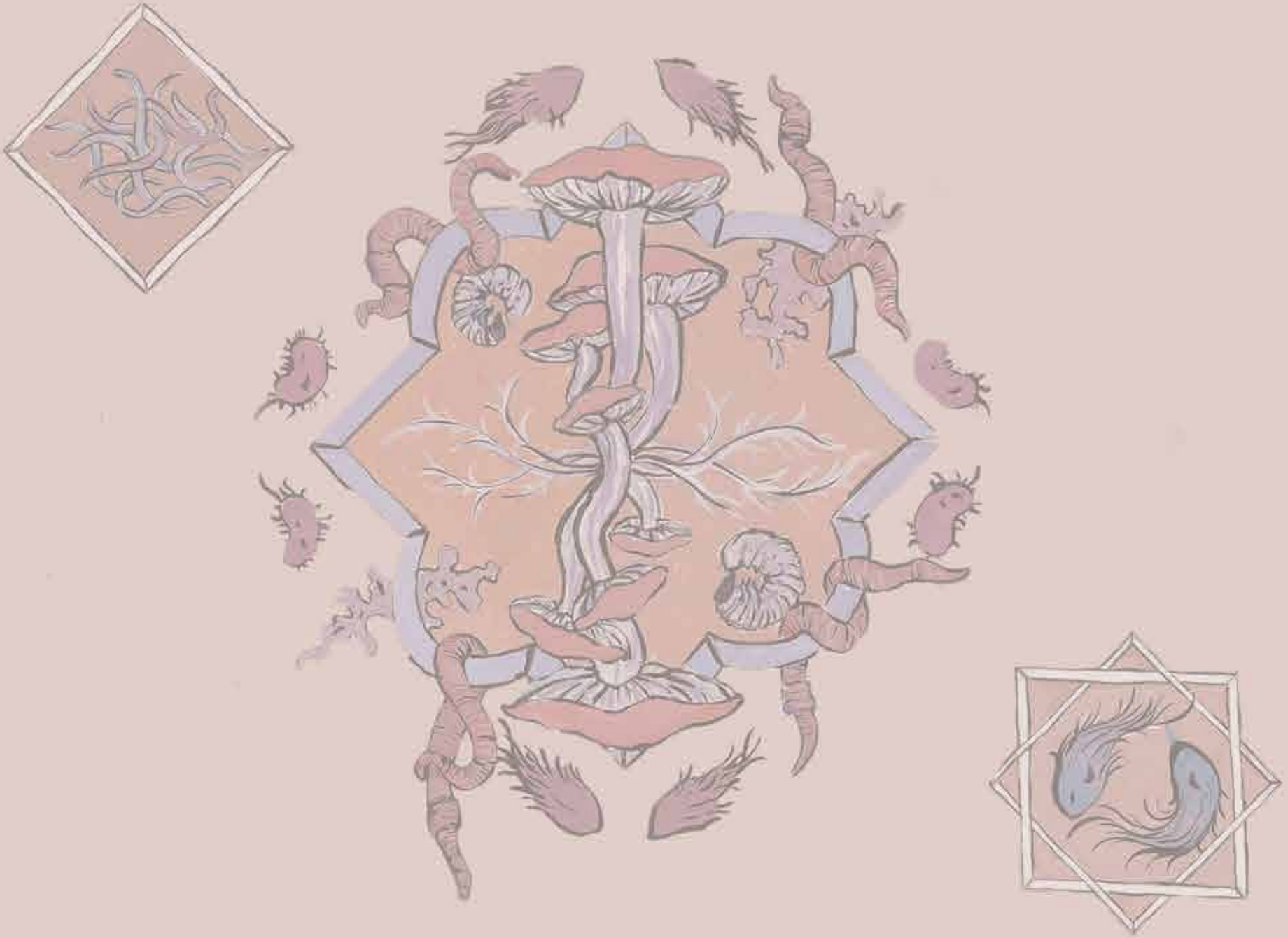

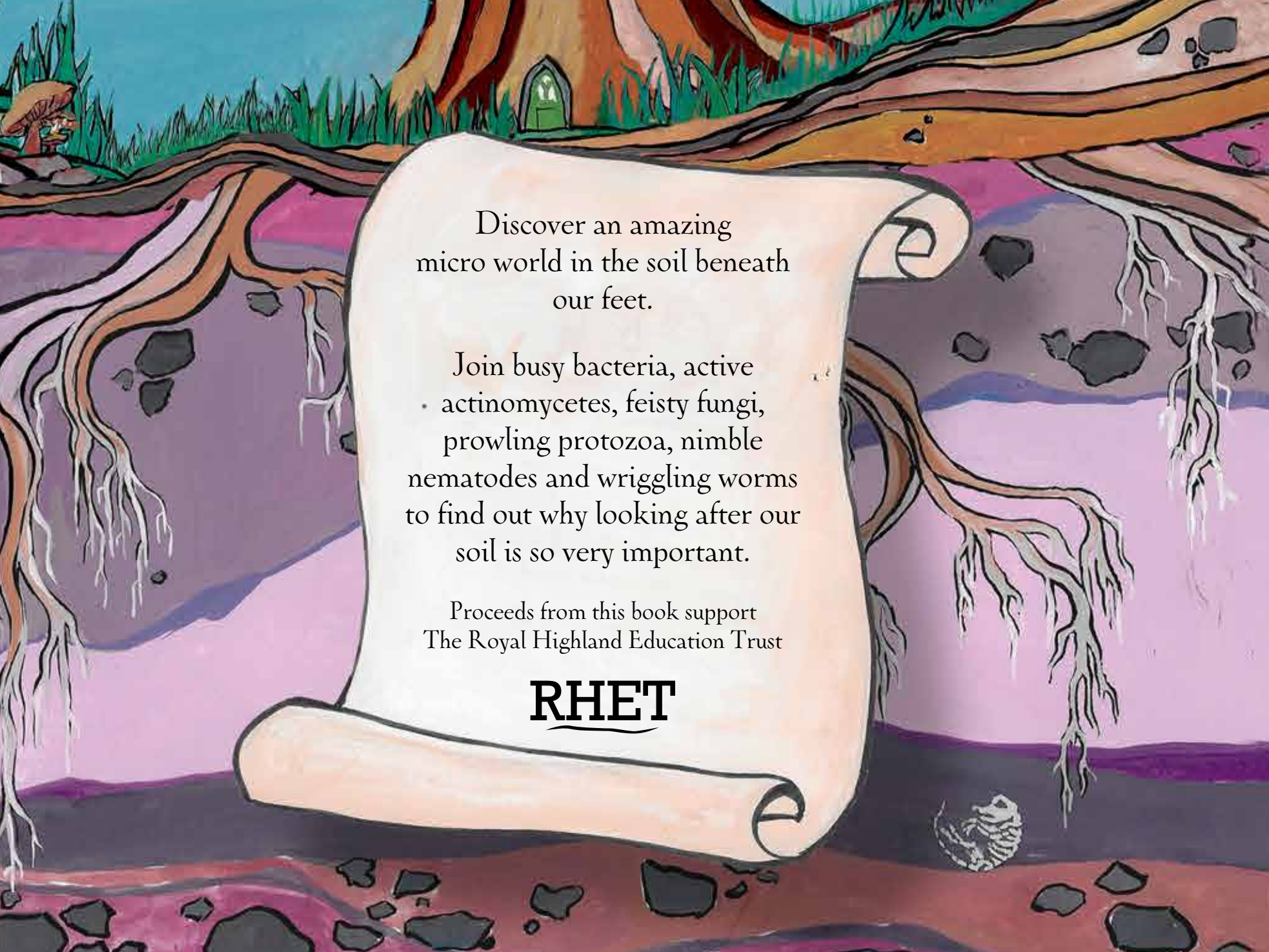

Discover an amazing micro world in the soil beneath our feet.

Join busy bacteria, active actinomycetes, feisty fungi, prowling protozoa, nimble nematodes and wriggling worms to find out why looking after our soil is so very important.

Proceeds from this book support
The Royal Highland Education Trust

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