

Sample translation

The Secrets of the Forest

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FANCY A WALK IN THE FOREST?

When you walk through the forest, what you'll notice most is the trees. Because they're so big. A lot bigger than you. But a forest is so much more than trees! Behind the bark and beyond the branches, the forest's secrets are just waiting for you to discover them.

Nowhere else on the face of the Earth will you find as many different species of plants, animals and fungi. The forest teems with life. Life in cooperation and life in conflict – battling for space and light and food and water, or to eat each other.

In this book, you'll find out more about the strange species in the forest. Especially the tiny creatures, the ones we don't often talk about. I study insects and fungi that live in the forest and as far as I'm concerned, these teeny-tiny species are the ones that are greatest fun of all! You have to look carefully to find them. It's like going on a treasure hunt. Some of them you'll never see, but it's great to know they are there all the same.

I'm going to share some of my forest secrets with you. Stories about species that are common and rare. Stories from forests all over the world.

You'll hear about a bee that makes perfume for its boo and a fungus that moves faster than a bullet. You'll learn about the tree of death and the zombie snail, about tadpoles and tufts of dandelion seed and stinking parachute fungus.

You'll also meet some more sizeable species. Like beavers who parachute jump. And mummy trees that never rot.

And if you're wondering why some blueberries are black or whether woodpeckers get headaches, you'll find the answers to those questions too.

Why is it smart to learn more about the forest? Mostly because it's fun! Suddenly you start spotting weird things you never noticed before.

Understanding more about how species work together isn't just fun, though. It makes it easier to take care of the forest too.

And if you make friends with the forest you can pass its secrets on to others. And more people will learn. Because the secrets of the forest are the kind it's cool to share.

WHAT IS A FOREST?

We can only call something a forest if it has trees. But no matter how big the trees are, they're still only a tiny part of the life in the forest.

Tens of thousands of other species apart from trees live in a forest. And they live in places we rarely see: Up in the trees, inside the trees or in the soil beneath them. Together, all these species and all the things they do make up the forest.

If you think it's a long time since the age of the dinosaurs, listen to this: Forests have been here for twice as long. And they've been changing all the time. No wonder there are so many different kinds of forests and so many species that need the forest in order to live.

THE EARTH'S GREEN SCARF

Today, almost a third of the Earth's surface is covered in forest. But if you look carefully, you'll see that no two forests are exactly the same.

First of all, it makes a lot of difference how much rain there is and how hot it is over the year in the place where the forest grows. Different trees and plants, fungi and bugs prefer different climates.

Around the centre of the planet it's always hot and the trees can keep their leaves all year round. We call these sorts of forests evergreen forests.

Further north and further south the seasons are more distinct. A lot of the life in the forest takes a break during winter. We call these summer-green forests, because the leaves turn yellow and fall off in the autumn.

Most of the forest in the north of the globe is conifer forest. Instead of having big flat leaves like broad-leaf trees, conifers have sharp narrow needles. These can deal better with cold than leaves. And that's why conifer needles can stay on trees all through the winter too.

Conifers like spruce and pine are typical of Northern European forests. We also have several kinds of broad-leaf trees like birch and oak.

You'll find rainforests in places where it rains a lot. An awful lot! If it's hot all year as well, the way it is in the belt around the centre of the planet, we get what we call tropical rainforests. They're lush and humid, and the plants and trees form a dense jungle.

We humans also alter forests. We can use trees to make houses, paper and lots of other things too. When we do that, we have to chop down the trees. We often plant new ones, but the forest has still been changed.

Because when we cut down forests, we usually fell the trees long before they've lived full lives. There isn't enough time in between each felling for the trees to grow really old.

And there's one thing that affects all the species in the forest. When we take the trees away, fewer trees die where they used to grow. And maybe it sounds odd, but dead trees are more alive than almost anything else you can find in a forest. Almost a third of all species in Northern European forests need dead trees. Either as homes or food or both. In a forest where we chop down lots of trees and do it often, many species will struggle to find what they need to survive.

A SMORGASBORD OF SPECIES

We humans like to sort and order things. At your school all of the pupils are in different classes depending on how old they are. The books in the school library are sorted alphabetically. And in the gym hall, maybe skipping ropes are kept in a one box and balls in another. We humans find it practical to have an overview and that's why we've also made a system for every living thing in nature.

Everyone can see that a tree is different from a coltsfoot. We say that spruce and coltsfoot are different species. But at the same time they have a lot in common.

Both species are firmly fixed to the ground with roots and get their food from air, water and sunlight: Both spruce and coltsfoot are what we call plants.

Then we have animals. Animals are species that eat plants or other animals. They can also move. They can have legs like a lizard, a swimmer's body like a fish or wings like a bird or an insect. Some animals are big like the elk. Others are so small that you can hardly see them, like tiny little spiders.

On top of plants and animals, we have a group we call fungi. Maybe you've seen toadstools in the forest, or button mushrooms in the supermarket's vegetable aisle.

Fungi are a bit like plants and a bit like animals, but are neither one nor the other. For example, a fungus can't feed off sunlight like plants can. Instead, it feeds off plants and animals, just like us humans.

But while we put food in our stomachs, a fungus sticks its stomachs straight into its food. Does that sound weird? Well, maybe it'll help to hear that the fungus has a body that is just made up of thin fungal threads that stretch through whatever it wants to eat, whether that's forest soil or a dead tree. Or a slice of bread you left in your lunchbox for the whole of the summer holiday. The fungus gobbles up the food through these threads because it doesn't have a mouth to eat with.

Plants, fungi and animals all belong to their separate main group or kingdom of species. But they all live together in the forests. It's a bit like the way your maths book is made of paper, your gym kit is made of fabric and your lunchbox is made of plastic. They're all different kinds of things but they can still hang out together in your school bag.

FOREST ELEPHANTS AND OTHER BIG BEASTS

Mirror, mirror on the wall, who in the forest is biggest of all? That question isn't as easy to answer as you might think.

I mean, African elephants are certainly big. So are gorillas and orangutans – the overgrown apes that live in tropical forests. In Northern Europe, the elk is often called the king of the forest because it's so tall and heavy.

Elephants, gorillas and elks aren't the only ones that tower over the rest of the species in the forest. Trees can be enormous and weigh a lot too. One tree that's definitely in line to take the trophy as the biggest species in the forest is an American aspen. The really special thing about it is that, although it's just one tree, it has masses of tree trunks. Tens of thousands of them in fact. And all these trunks have grown from the same root. This tree is so odd that it has a name all of its own. It's called Pando, which means something like 'I spread out'. Put together, all the trunks that make up Pando weigh more than forty blue whales!

But beneath the ground in the US, there's another living being that may be even bigger: Down there in the forest soil lives a humungous honey fungus. Scientists believe that if they could weigh all the underground fungal threads, this fungus would weigh four times as much as Pando.

NORWAY'S TALLEST TREE

This tree, which stands in Western Norway, is more than fifty metres tall – roughly the same height as an eighteen-storey building. The tree is a giant noble fir, an American tree type that was brought to Norway.

ALL THE LITTLE LIVES

The forest is full of fungi. Northern European forests are teeming with fungus species we haven't even discovered or named yet. Because fungi live a hidden life. Down in the soil or inside trees and other plants, for example.

Species that are big are obviously easy to spot in the forest. But there are always plenty of other species there at the same time. Much smaller ones.

If you lie on your stomach in a forest and peer down between the leaves and conifer needles, you'll probably see some of them.

Maybe you'll spy some springtails, tiny creatures the size of a full stop in a book that look like little insects. Springtails don't have wings. But they're really good at jumping – they can leap fifty times the length of their own bodies. If you could do the same thing, you'd be able to do the sixty metre in a single bound.

Springtails come in lots of different colours, and they can be striped or spotted or just one colour. I think they're incredibly cute.

If you lined up all the animals of the forest in one long row, almost the whole line would consist of the littlest critters – tiny species like insects, springtails, spiders and all their relatives.

Most of the species in both the world and the forest are much smaller than us humans. But together they all do an enormous job.

LINGONBERRY FUNGUS

Have you ever noticed that lingonberry plants sometimes have a few bright red leaves that are extra thick? That's because there's a fungus living inside these leaves.

WHERE THERE'S SOIL, THERE'S LIFE

Soil probably sounds a bit boring. No pretty colours, just brown and black and grey. And soil smells damp and strange. But don't be fooled – soil is exciting! And important.

In fact, it's down in the soil that you'll find most of the forest's species. More than half of them. In the forest soil, between the plant roots, live fungi, bacteria and all kinds of little critters.

Fungi are important for the forest soil. Some of them clean up dead leaves and dry tree trunks by eating them. Then the dead plants turn into soil. And that's great, because new plants can sprout and grow in that soil.

A lot of little critters also help clean up. The best known one is the earthworm, which likes living in broad-leaf forests. It digs tunnels in the earth and takes leaves down there with it from the surface. That makes the soil more airy and fills it with nutrients.

When it rains, you'll see lots of earthworms on the ground. In Danish, they're called 'rain worms'. Maybe you've heard people say that worms come up because they can't breathe. But earthworms can actually survive in water for weeks. They don't have any lungs, and breathe through their thin skin instead. So why *do* they come up out of the soil when it rains then?

Many scientists think it's because they want to move to a new place. And it's much quicker to wiggle over the wet forest floor than it is to eat your way through the soil underground.

By the way, did you know that all earthworms are boy *and* girl – both at the same time? After two earthworms have mated, the two of them lay eggs that eventually become new earthworms.

BLUE EARTHWORMS

In Australia they don't just have blue earthworms – they have earthworms that can grow to a length of three whole metres!

FRELOADERS AND BEST FRIENDS

A forest is actually one gigantic group project. Thousands of species do things together, arguing and helping each other out along the way.

Eating others may not sound particularly nice. But all animals and fungi need food. Us humans too. Whether from a plant, a fungus or an animal. Plants don't have to eat anyone because they can live off nothing but sunlight, water and the air that the rest of us breathe out.

What is maybe a bit odder is that many forest species steal food from others – while they're still alive. We call that freeloading. It isn't much fun for the species that gets eaten but it's what the freeloader needs.

Think of a mosquito that lands on an elk or on your hand to suck some blood. Or a little aphid sucking sugar water from a birch leaf. Or a freeloading parasitic fungus like the

honey fungus, which steals food from living trees. Just like athlete's foot steals food from our skin.

Other fungi are besties with the plants and trees. Let's call them fungi BFFs. Have you ever picked chanterelles or porcini mushrooms with grown-ups? These edible mushrooms are examples of fungi BFFs.

Because the part that we like to eat is only a small part of the entire fungus. The rest is made up of thin threads that are hidden down in the earth. Imagine if an apple tree grew underground with only the apples sticking up out of the earth where we could see them. That's the way these fungi grow.

Under the ground the fungal threads intertwine with the roots of trees and plants. It's almost as if they're holding hands. The fungus and the plant help each other to get food. The plant gives the fungus sugar and the fungus sends a kind of vitamin drink back. It's good to have pals, and trees and their fungi BFFs need each other to live.

Insects and plants also need each other. Bumblebees, hoverflies and many other types of insects move pollen – flower dust – from flower to flower. This removals job is called pollination. Plants need pollination in order to make fruit and berries, and the insects get nectar from the plant as a reward. If insects and plants didn't work together like this, you wouldn't be able to pick blueberries or raspberries.

FUNGI BFFS

All trees and almost all plants have fungus friends that help them to get hold of food.

Without these fungi BFFs, there wouldn't be any forests in Norway.

TREE TRUNKS

The tree trunk lifts the top of the tree, where the blossoms often are, up towards the sky.

That way, the tree can get light. The trunk is like a gigantic flower stalk.

The trees in a forest all compete to get the most sunlight. That's why it's often best to be a tall tree.

A tree trunk grows thicker with every year that goes by. Because between the bark and the actual wood, there's a thin layer that lets the tree grow bigger. Every spring and summer, this layer grows a little, making new wood on the inside and new bark on the outside.

If you see a stump in the forest where a tree has been sawn down, you can count how old the tree was. Every spring shows up as a pale ring and every summer as a darker ring. These annual rings are smaller and clearer in places where there isn't much of a difference between the seasons like in tropical forests.

But a tree trunk isn't just useful for the tree itself. It's also a home for other species, that either grow on the trunk or live inside the bark.

We humans also find tree trunks useful: After all, that's where we get the timber we've used for thousands of years to build houses and boats and countless other helpful things.

THE SKYSCRAPER TREE

Imagine a skyscraper. An enormously tall building with masses of floors and even more apartments. There are people living in every apartment. And the people who live in the skyscraper all look different and all have different, important jobs.

A big old tree is like a skyscraper for the species of the forest. But instead of people, it's filled with birds and little creatures and insects and fungi and lichen. Since most of these

species are really small, a lot of them can fit in. There can be just as many living creatures in one tree as there are people in the whole of a big city like Rotterdam!

The longer a tree is left standing in the forest in peace, the more apartments there are, and the nicer they get. And all the living spaces are different. That's why old trees are super important for species that need really special places to live. And there are an awful lot of species like that!

The babies of a particular kind of marsh beetle can only grow to be adults if they get to live in a hollow filled with water up in an oak tree. It's like spending the whole of your childhood in a tiny little swimming pool. The larvae live off rotten leaves that have sunk to the bottom of the water hole.

The bark of an old tree is like a mini landscape, full of valleys and hills. Down in these bark valleys, you'll find tiny weeny lichens that look like pinheads.

Inside the hollows of old trees, some stuff we call wood mould slowly piles up. It's a kind of soil made of rotten wood and fungi. For many insects, it's the world's poshest restaurant. They love the soft, satisfying wood mould. Since these old hollow trees have become less and less common, the beetles that live in them are also getting rarer.

All the species that live in and on and around an old tree do different jobs in the forest. Some of the insects help plants to make fruit and berries and seeds. The Fungi BFFs in the soil help the tree to get enough food. A lot of fungi and little critters work as tiny janitors, clearing away dead leaves and branches. Sometimes they'll end up as dinner for hungry chicks in a bird's nest. Everything in the forest is connected.

TREES OLDER THAN THE PYRAMIDS

The oldest trees that are still alive sprouted before the pyramids of Egypt were built. The

very oldest is a Methuselah pine in the US which is more than five thousand years old!

LIVING LIKE LICHEN

In a dry pine forest, there's often a greyish-white wall-to-wall carpet of lichen on the forest floor. You'll also find lichen on tree bark or hanging from the branches. Lichen can look like leaves, little bushes, beards and threads or it can just be a thin crust. Like a patch of paint.

Lichen is strange stuff. A lichen is made up of two (or sometimes more) friends that help each other out. Usually a fungus and an alga. Algae are simple species that like to live in damp places. They make food using sunlight, just like plants. The fungus makes a home where the alga can live, and the alga helps the fungus by giving it food. A bit like a carpenter and a cook who live together. Together, the fungus and the alga form a lichen.

LICHEN OR MOSS?

Lichen and moss can look alike but they're two completely different things. Lichen is a mixture of a fungus and an alga, while moss is a plant.

If you're go hiking in a mountain birch forest in Norway, you'll often see a dark-brown lichen that grows part of the way up the tree trunks. That's a species called spotted camouflage lichen. It doesn't like being covered in snow during the winter. That's why you can use it to find out how far up the trunk the snow usually lies in winter.

Other lichens are rarer. In old spruce forests in Norway you can find the world's longest lichen. It's called old man's beard and looks a bit like the tinsel we use to decorate Christmas trees. A strand of old man's beard tinsel can grow enough to stretch from the third storey of a building all the way down to the ground!

Many people think that these strands of lichen were used to decorate Christmas trees in the olden days. Sadly, we can't do that any more. Old man's beard has now vanished from almost all the forests of Europe. That's because we usually chop down spruce forests before the trees grow old.

HACK YOURSELF A HOME

Many different birds and other animals use hollows in tree trunks as their home. A few hide away there to rest and shelter from rain and wind and enemies. Others move in with their entire family,

Woodpeckers can hack out their own hollows. Their name really suits them, because they can use their sharp beaks to peck a hole in the wood – a bit like us humans using pickaxes to make holes in the ground.

Hacking away at hard fresh wood is no job for wimps. Scientists have wondered why woodpeckers don't end up getting headaches. People used to believe the bird had a kind of cycle helmet on the inside of its skull that muffled all that clatter. But now scientists think that's wrong and believe the woodpecker's brain copes okay because it's small and very firmly fixed in place.

Woodpeckers use their tongues to fish insects out of cracks in bark and in trees. Their tongues are really long compared with the bird's own size. If you had a tongue like that, you'd be able to lick your knees without bending down!

What does the woodpecker do with all that tongue? After all, there's no room for it in the beak. It coils the tongue around the inside of its whole head when it isn't in use.

A woodpecker family only lives in its hole for a year. The next year, the parents make a new one to get away from any predators that have found out where they live.

A lot of the commonest small Northern European birds, like the great tit, live in holes and rely on woodpeckers as homebuilders. We can also help them out by hanging up bird boxes.

In Australia, there are no woodpeckers to peck holes in trees. Luckily, there are lots of ways for trees to become hollow: in Australia, fungi and insects do the job of making hollow spaces.

When a branch breaks off, it leaves a hole in the bark. A kind of wound. That's fantastic for fungi that survive by eating trees. Tiny spores, the fungi's seeds, land in the wound and stretch their fungal threads into the tree, which makes the timber softer. Various different insects turn up and eat the soft rotten wood.

In this way, the fungi and insects slowly build splendid hollow spaces. But building an apartment like this in a tree can take a long time – several hundred years. That means it can only happen if the trees are left to stand there and grow old in peace.

TROLL FOAM AND FROST BEARD

In the autumn you can spot some strange things in the forest. Suddenly, you might find a dollop of foam the size of your hand at the bottom of a tree trunk. And these foamy dollops can be even bigger in streams, making them look like bubble baths.

People used to think these bubbly blobs were left behind by trolls. They said the trolls had washed their troll kids so energetically that the soap suds had splashed all over the place. But the foam in the stream or at the bottom of tree trunks has nothing to do with trolls. It's made perfectly naturally and nowadays we know why.

When it rains a lot, like it often does in autumn, the rain sloshes a kind of soap out of rotting bark and leaves. This soap can be whipped into a foam by running water, whether it's trickling down a tree trunk or swooshing in a stream. That's where the troll foam in the forest comes from.

When it gets colder in the autumn, you may also find something we call frost beard — long thin strands of ice that ooze out of rotting wood on the ground. The 'hair' can grow long and curly, making it look as if Santa has given his beard a hefty trim.

But frost beard is quite natural too. It just isn't very common. The threads form when a particular fungus lives inside the rotten stick. The fungus turns into a kind of glue that holds the frozen water together, turning it into long, frozen hairs.

TREES OF DEATH AND DRAGON'S BLOOD

Some trees have bark that's especially useful for us humans. Willow tree bark contains a substance that eases pain. People have known about this and used it for thousands of years.

An evergreen conifer called the yew contains an important cancer medicine. It's used at hospitals every single day.

And the spice we call cinnamon is the bark of the cinnamon tree, which is ground up so you can sprinkle it on your rice pudding. Or chow down on a cinnamon roll.

But there are dangerous trees too, especially in tropical forests. One of them is called the dynamite tree, sometimes known as the sandbox tree. Its trunk is thickly covered in big hard spikes. And everything on the tree is poisonous. Especially its sap, the juice that seeps out of a tree when it is hurt. The sap will burn your skin, causing cuts and blisters.

But the seeds of the dynamite tree are even scarier. They're all stored together in something that looks like a pumpkin. When the seeds are ripe and the weather is dry enough, the whole thing explodes with a loud bang. The seeds, which are about the size of a 20p coin, whizz off. Fast. In fact, twice as fast as the maximum speed limit on UK motorways. It's hardly surprising that the seeds can injure any animals and people they happen to hit.

The tree of death is another species you won't want to get too close to. If you burn wood from the tree on a campfire, the smoke can blind you. This tree also has sap that causes blisters and headaches, and even standing under a tree of death is enough to make you feel dizzy and sick. That's why it's known as the world's most dangerous tree.

HUGE LEAVES

The gigantic leaf tree in the Amazon has only four or sometimes five leaves. But every leaf is as big as a dining table!

Other trees are just weird. Like the dragon's blood tree. From a distance it looks like an umbrella. There isn't much rain where the dragon's blood tree grows. But there's a lot of fog. The fog settles in the tree's canopy as small drops of water so the tree can drink the rain straight from the leaves.

People used to believe the dragon's blood tree was magic. Because if you make a tiny cut in the bark, blood oozes out. Well, not really – it just looks like it. The tree's juice or sap is red as blood.