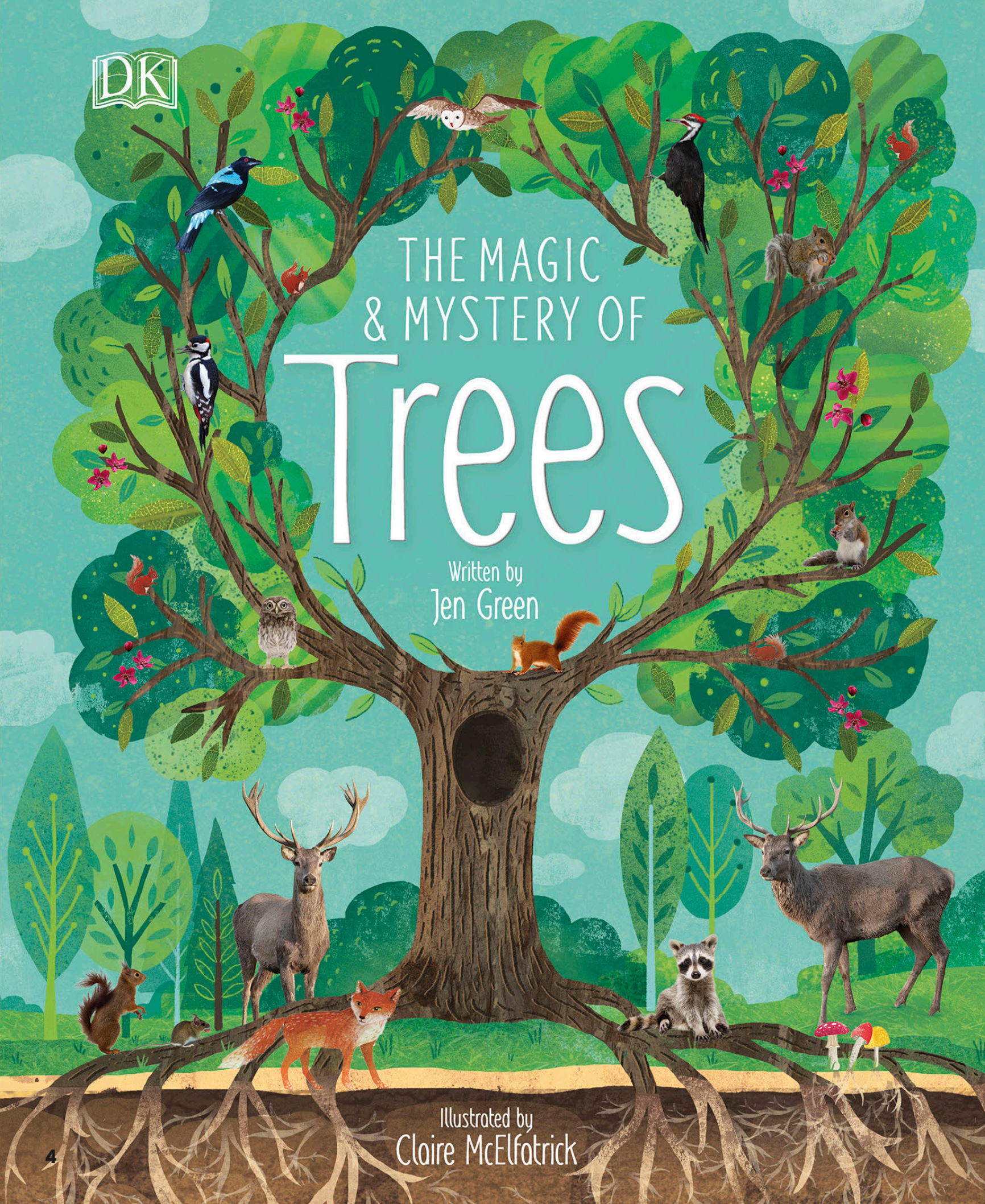
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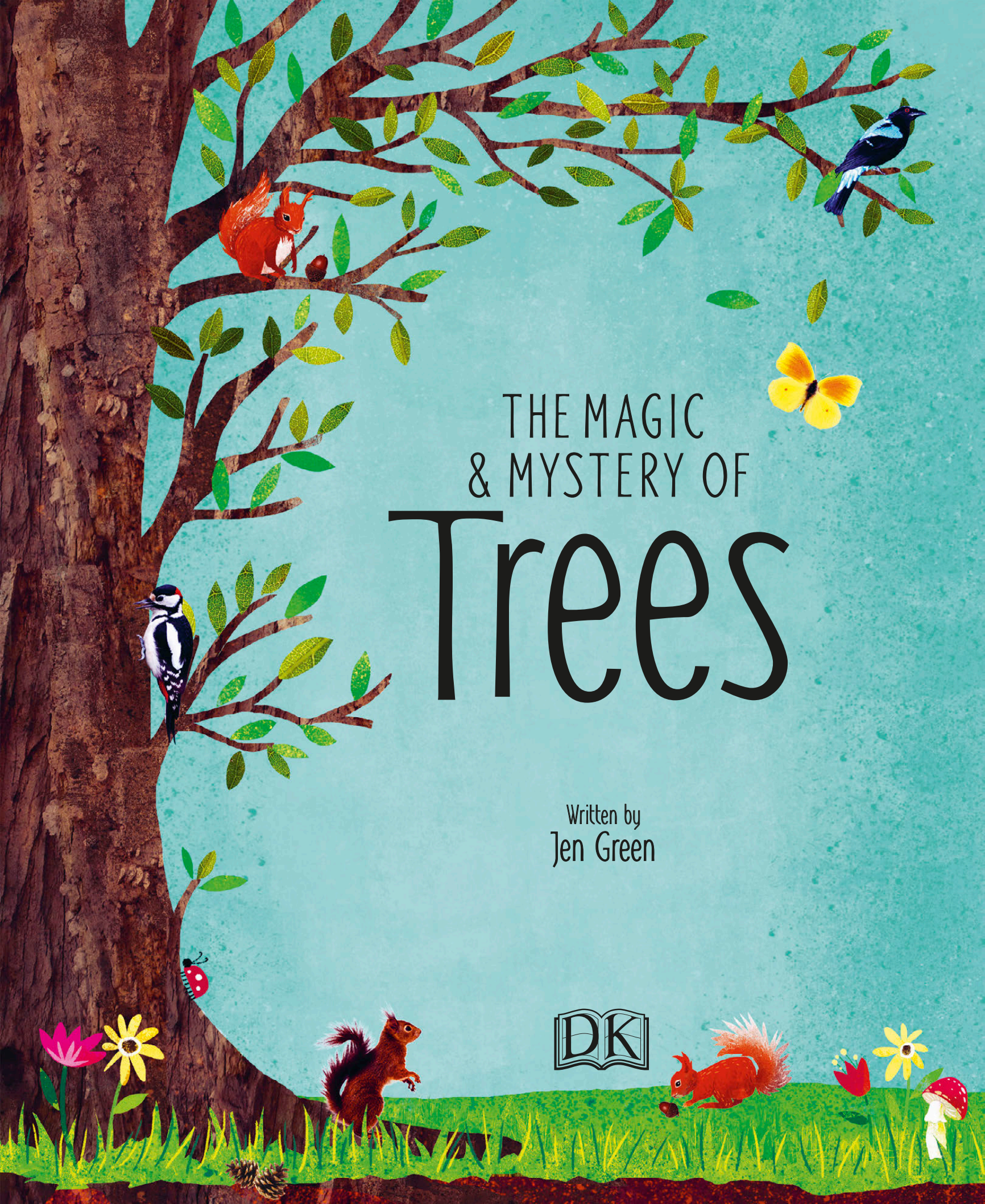

THE MAGIC & MYSTERY OF Trees

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Penguin Random House

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From the deepest, densest forests to our local towns and cities, trees are all around us.

We share our world with trees, living side by side with them but often overlooking them.

Wander through the pages of this book to discover the secret lives of trees.

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WHAT IS A TREE?

A tree is a huge plant that towers above us. You'll find trees standing alone in people's yards or clustered together in thick forests.

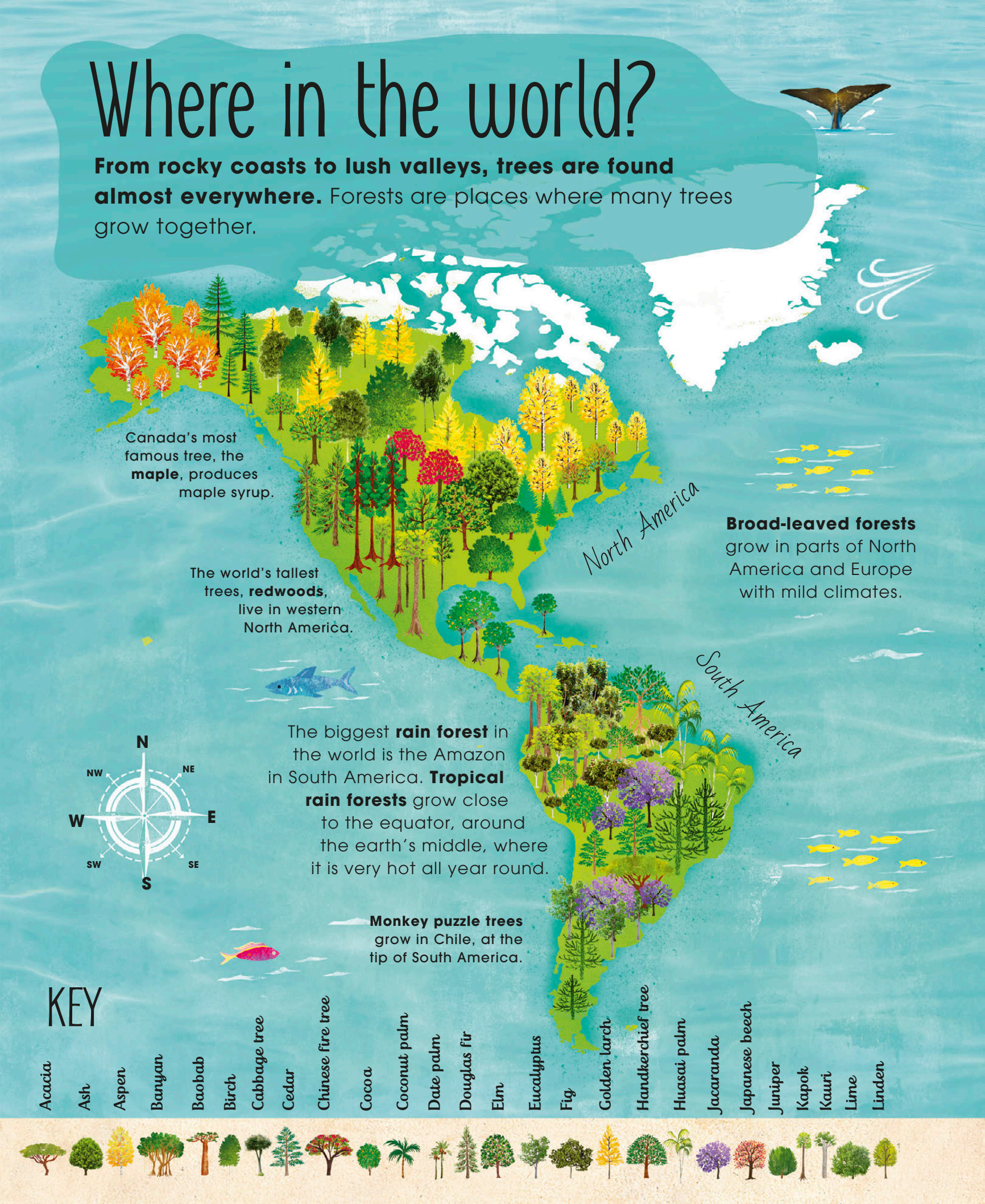
Trees are true wonders of nature. Some species can grow taller than 50 cars stacked on top of each other! Trees can live for hundreds of years, and the very oldest are thousands of years old.

Every part of a tree works together. From the deepest roots that burrow through the earth, to the smallest leaf on the highest branch, every part of a tree is working hard to help it survive.

When you get to know these silent giants, you'll never look at trees the same way again...

Where in the world?

From rocky coasts to lush valleys, trees are found almost everywhere. Forests are places where many trees grow together.



FOREST TYPES

There are three main types of forests: **broad-leaved forests**, **conifer forests**, and **rainforests**. Each of these forests is made up of different types of trees.

A huge **conifer forest** stretches across northern North America, Russia, and northern Europe. These places have long, snowy winters.

Europe

Asia

Africa

Australasia

Coconut seeds can float for miles before finding a place to grow.

Kauri pines live only in New Zealand. They can get very old and large.

Eucalyptus, or gum, trees grow in Australia's dry forests. They keep their leaves all year round.

Forests cover almost a third of earth's dry land.

Loblolly pine
Mahogany
Mango
Mangrove
Monkey puzzle
Maple
Norway spruce
Nutmeg
Oak
Olive
Pine
Poplar
Quaking aspen
Ramon
Redwood
Red maple
Rowan
Rubber
Sacred fig
Sausage tree
Silver birch
Spruce
Sitka spruce
Strangler fig
Teak
Umbrella thorn

How trees live

You've never seen a tree eat a bowl of noodles or a peanut butter sandwich, so what do they eat? As long as it has sunlight, water, and a gas called carbon dioxide, a tree can live, grow, and even make its own food!

The amazing food-making process of plants is called photosynthesis.

Trees are tough, but they must stay warm to survive. If the water in the tree's leaves freezes, it can't make food for itself.

Mealtime

A tree's green leaves soak up light from the sun. Then they use energy from the light to mix carbon dioxide and water. This makes a sugary liquid called sap, which is the tree's food.

Making oxygen

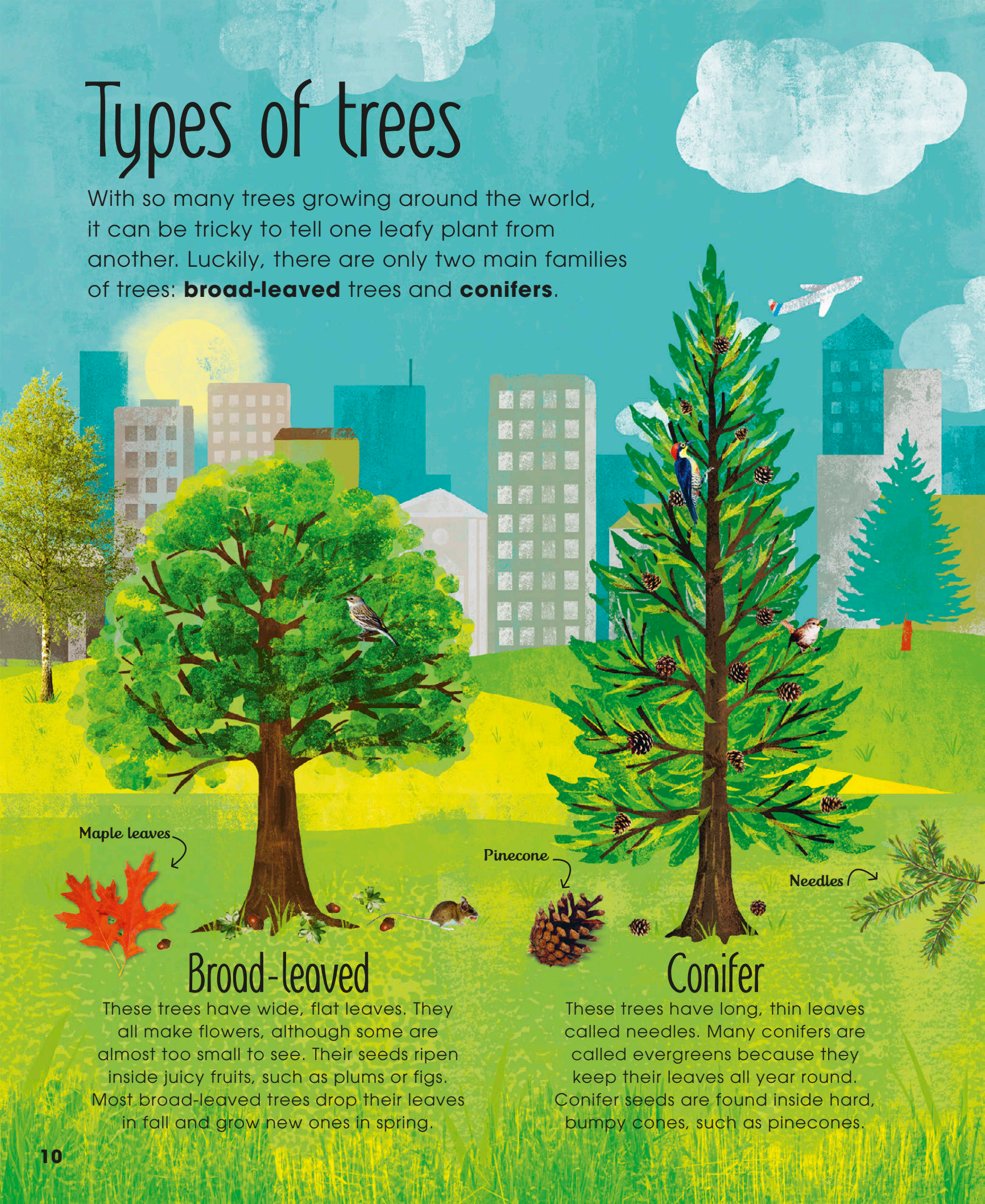
While they are busy making sap, the tree's leaves give off a gas called oxygen. All animals, including us, breathe in oxygen and breathe out carbon dioxide. If there were no plants such as trees, we wouldn't have air to breathe.

Summer days

Broad-leaved trees only make food in spring and summer, because there is more sunlight. They lose their leaves in the fall. Conifers can have leaves or needles. They keep making food throughout the winter.

Types of trees

With so many trees growing around the world, it can be tricky to tell one leafy plant from another. Luckily, there are only two main families of trees: **broad-leaved** trees and **conifers**.



Broad-leaved

These trees have wide, flat leaves. They all make flowers, although some are almost too small to see. Their seeds ripen inside juicy fruits, such as plums or figs. Most broad-leaved trees drop their leaves in fall and grow new ones in spring.

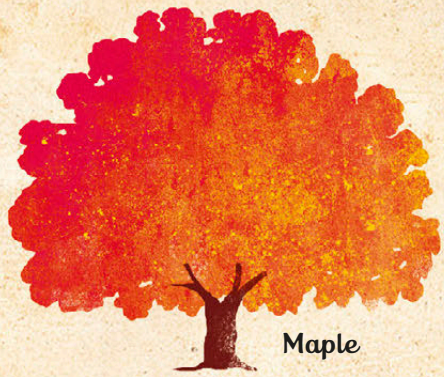
Conifer

These trees have long, thin leaves called needles. Many conifers are called evergreens because they keep their leaves all year round. Conifer seeds are found inside hard, bumpy cones, such as pinecones.

Oak

ROUND

The branches of a round tree spread themselves evenly upward and outward from the trunk.



Maple

BROAD

A broad tree has branches that spread farther to the sides than upward.

Banyan

SPREADING

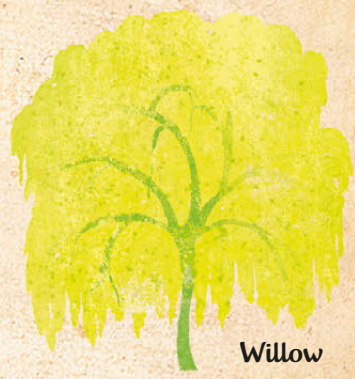
These trees have branches that grow up and out to create a wide, flat shape.

Hornbeam

OVAL

Oval trees have a rounded shape that is taller than it is wide.

The leafy part of the tree above the trunk is called the crown. It comes in different shapes. Many broad-leaved trees are wide and round, while conifers are often shaped like cones.



Willow

WEEPING

A weeping tree has branches that droop downward.

Coconut palm

PALM

Palms are broad-leaved trees that grow in hot countries. Unlike other trees, they don't grow side branches.

Cypress

TALL AND THIN

Some trees have closely packed branches that grow upward. Many conifers are tall and thin.

Spruce

CONE

A cone-shaped tree's branches get shorter as they go up the the trunk, ending in a pointy tip.

Parts of a tree

BRANCHES

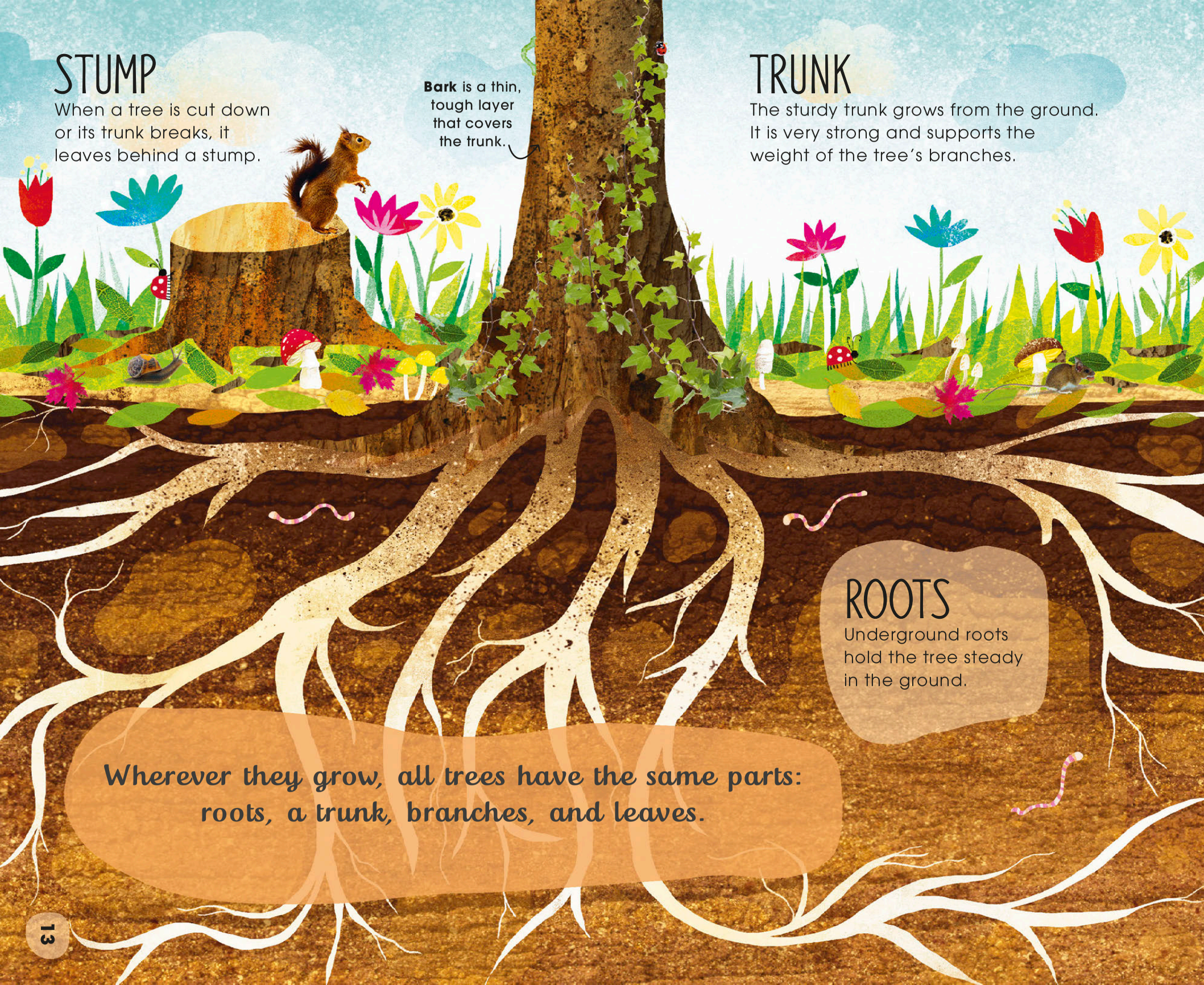
Branches grow from the trunk. They divide to form smaller branches, which end in twigs. Leaves sprout from twigs. Flowers and fruit grow from twigs at certain times of year.

CANOPY

High above the ground, twigs and leaves weave together to form a dense, dark blanket called the canopy.

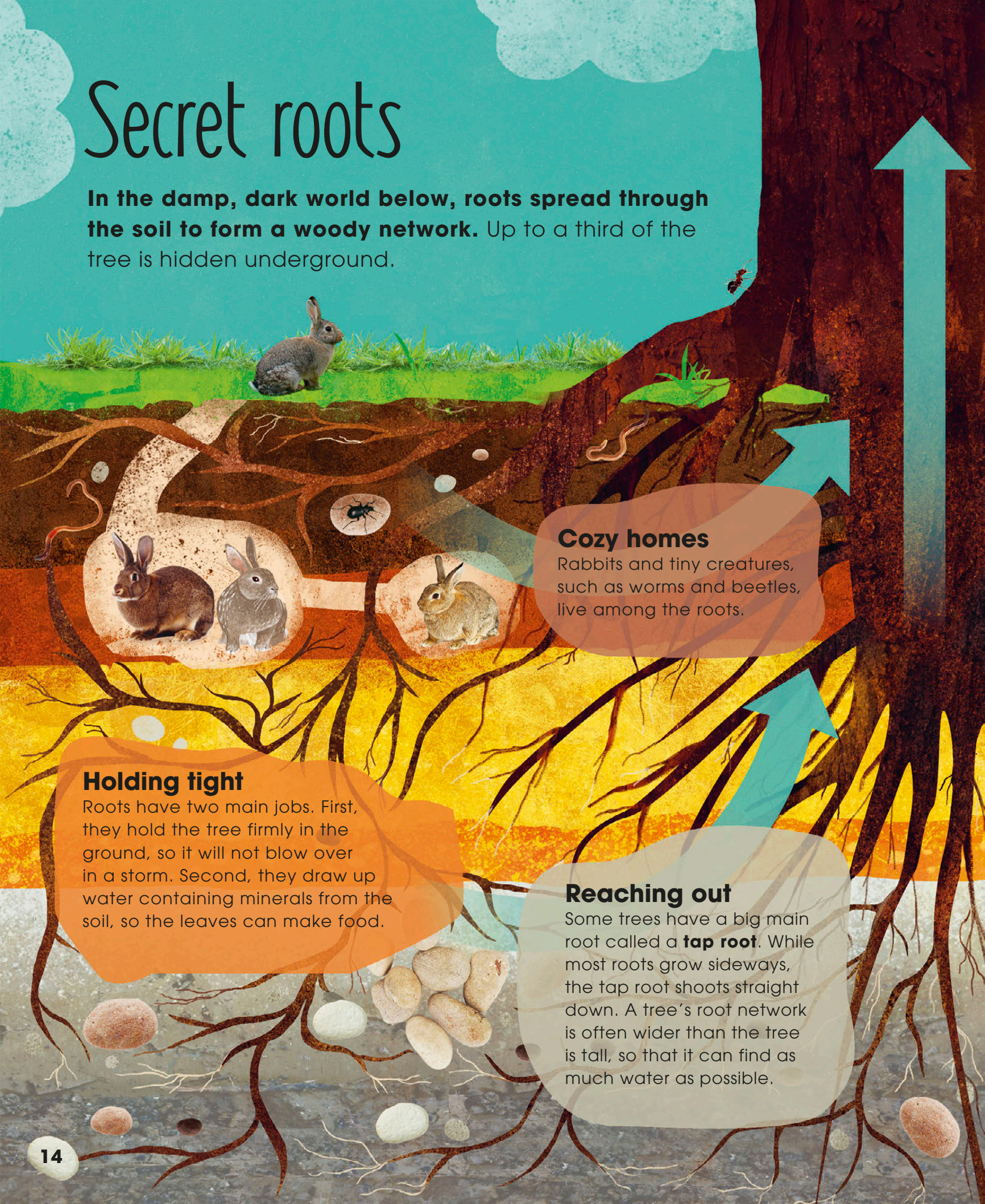
Bud

In spring, buds burst open, and leaves and flowers unfurl from them.


STUMP
When a tree is cut down or its trunk breaks, it leaves behind a stump.
Bark is a thin, tough layer that covers the trunk.
TRUNK
The sturdy trunk grows from the ground. It is very strong and supports the weight of the tree's branches.
ROOTS
Underground roots hold the tree steady in the ground.
Wherever they grow, all trees have the same parts: roots, a trunk, branches, and leaves.

Secret roots

In the damp, dark world below, roots spread through the soil to form a woody network. Up to a third of the tree is hidden underground.



Cozy homes

Rabbits and tiny creatures, such as worms and beetles, live among the roots.

Holding tight

Roots have two main jobs. First, they hold the tree firmly in the ground, so it will not blow over in a storm. Second, they draw up water containing minerals from the soil, so the leaves can make food.

Reaching out

Some trees have a big main root called a **tap root**. While most roots grow sideways, the tap root shoots straight down. A tree's root network is often wider than the tree is tall, so that it can find as much water as possible.

Trees do most things slowly, but they drink very fast! A big tree can suck in over 100 gallons of water from the soil every day.
Pollution
Tree roots are very sensitive. They can sense pollution in the soil and avoid it by growing in a different direction.
Trunk
Oil spill
Water seekers
The main roots divide into smaller ones. The smallest ones at the end of the root are called rootlets. They are covered in fine hairs that can sense water.
Rootlets
Water travels up the roots.
Big and tough
The main roots are strong and woody, like branches. Each root tip has a tough cap to push through the soil as it grows. These big roots can extend into the ground up to 5 feet (1.5 m).

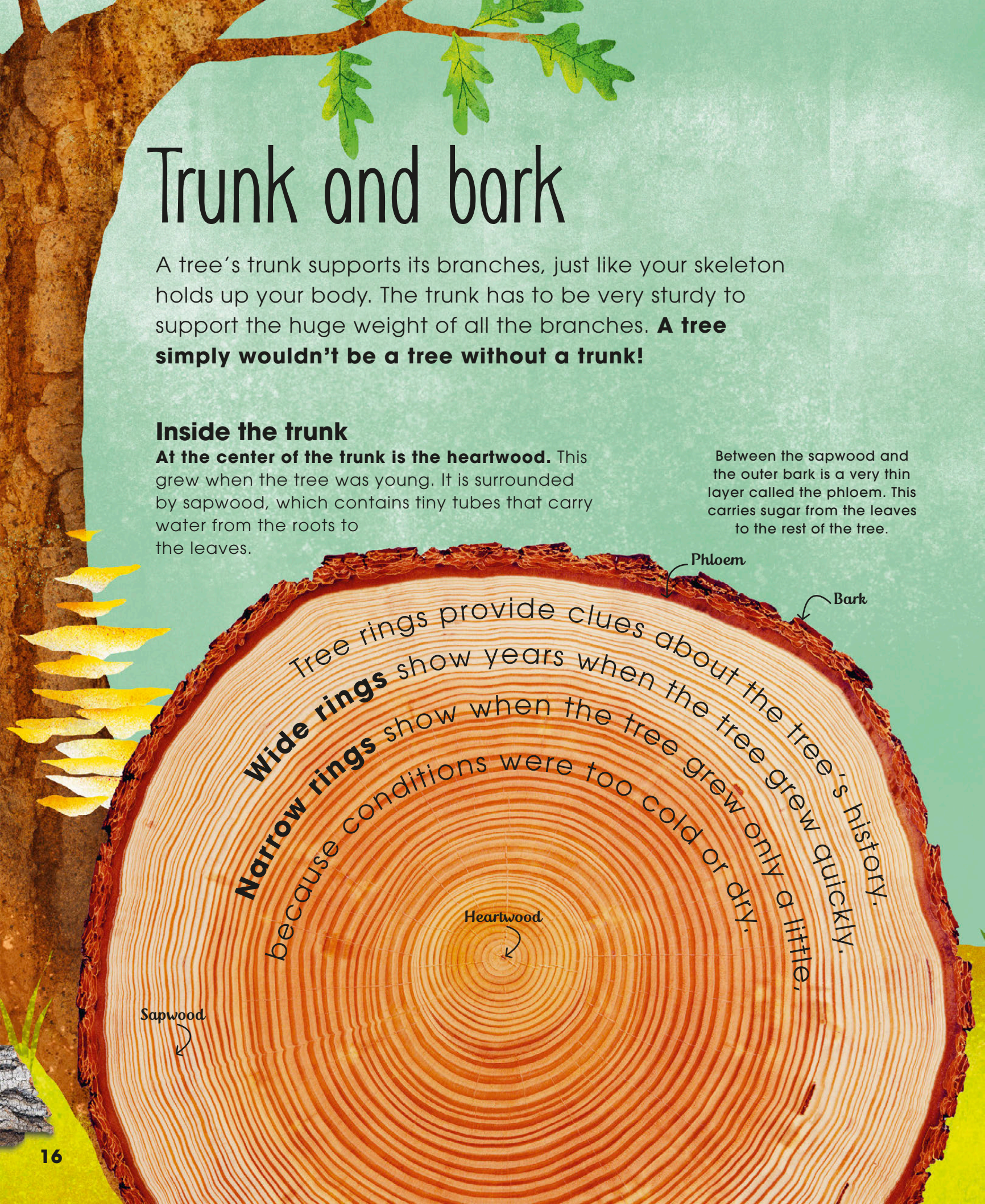
Trunk and bark

A tree's trunk supports its branches, just like your skeleton holds up your body. The trunk has to be very sturdy to support the huge weight of all the branches. **A tree simply wouldn't be a tree without a trunk!**

Inside the trunk

At the center of the trunk is the heartwood. This grew when the tree was young. It is surrounded by sapwood, which contains tiny tubes that carry water from the roots to the leaves.

Between the sapwood and the outer bark is a very thin layer called the phloem. This carries sugar from the leaves to the rest of the tree.



Bark, like this peeling birch bark, is the outer layer of the trunk. It stops the tree from drying out and protects it from insects and fungi.

Young trees have **smooth bark**. As trees get older, their bark cracks, peels, and becomes **more wrinkly**, like the bark of this scaly tree.

Different types of trees have different bark. Bark is also home to **lichens**, like the blotchy yellow ones here.

Try making **bark prints** by rubbing crayons onto a piece of paper placed on bark. The **texture** will come through.

Leaves

Next time you are outdoors, take a close look at a leaf. Leaves are very special, because it's in the leaves that the tree works its magic by making its own food.

Water pumpers

Veins are like tiny pipelines running through the leaf. They take in water from the tubes in the trunk's sapwood, and carry food made by the leaves to the rest of the tree.

Beech leaf

Veins

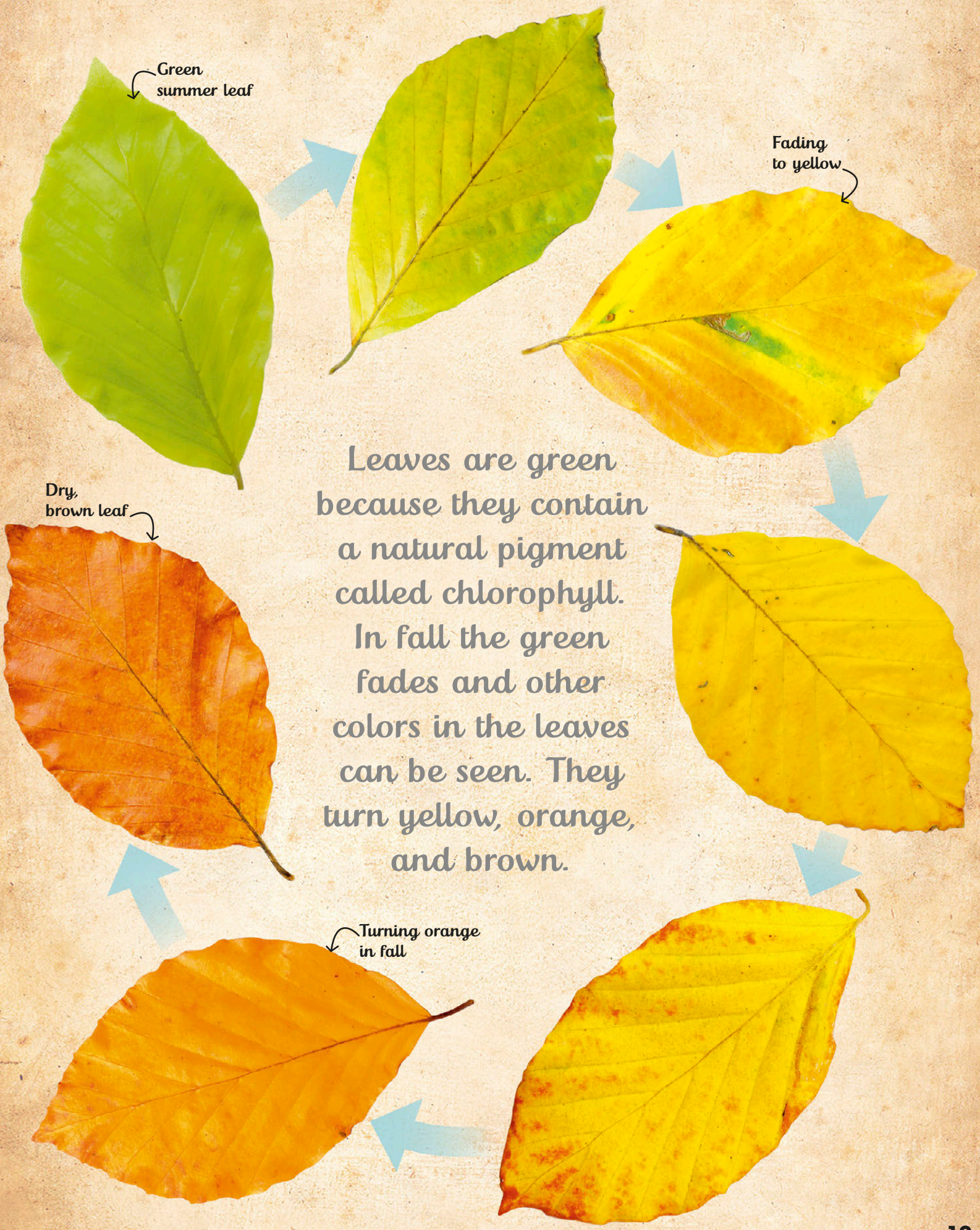
Light catchers

Broad-leaved trees spread their wide, flat leaves to capture as much sunlight as possible. Each leaf is like a miniature solar panel, soaking up energy from the Sun.

Leaf shapes

Each tree has leaves with a slightly different shape. They can be long and thin, or wide and round. Flat, round leaves are good at catching sunlight, but also lose more water.

Trees can't move from place to place, but they can very slowly turn their leaves to face the sun.



Leaves are green because they contain a natural pigment called chlorophyll. In fall the green fades and other colors in the leaves can be seen. They turn yellow, orange, and brown.

Follow one maple tree through the seasons...

SPRING

First shoots

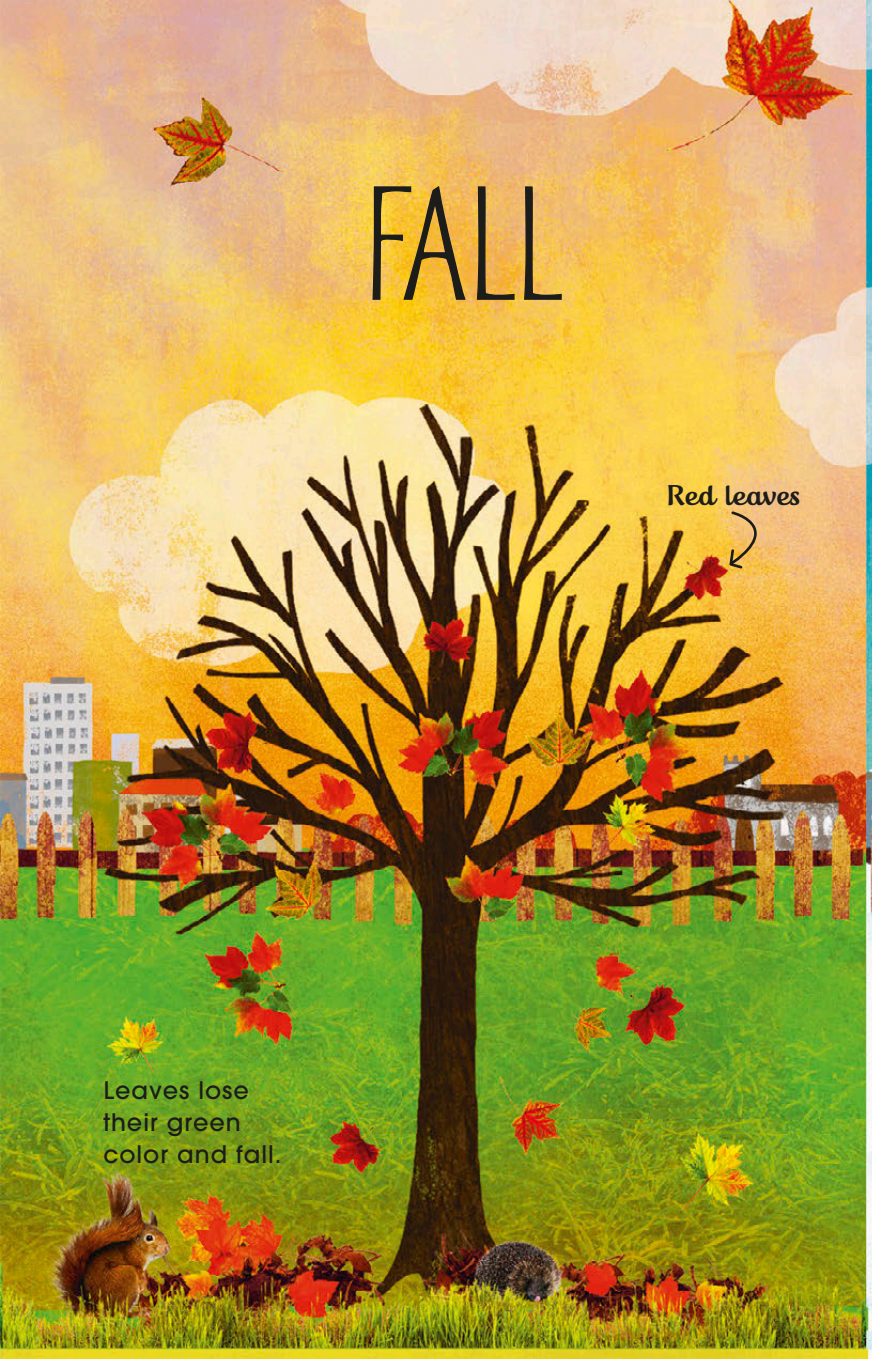
After the cold, dark winter, spring is the season of new beginnings. The weather gets warmer, and days grow longer. Trees know when the winter has passed. In spring, the tree grows green buds. The buds open, uncurling and spreading new leaves in the sunshine. The tree's flowers bloom.

SUMMER

Hot days

Like many humans, trees love the sunshine. Summer is the hottest season, with the longest days of the year, and the trees are ready to soak up the sunlight. Branches are covered with leaves that form a dense, shady layer. In late summer, the tree's fruits start to grow. Trees do most of their growing during the summer months.

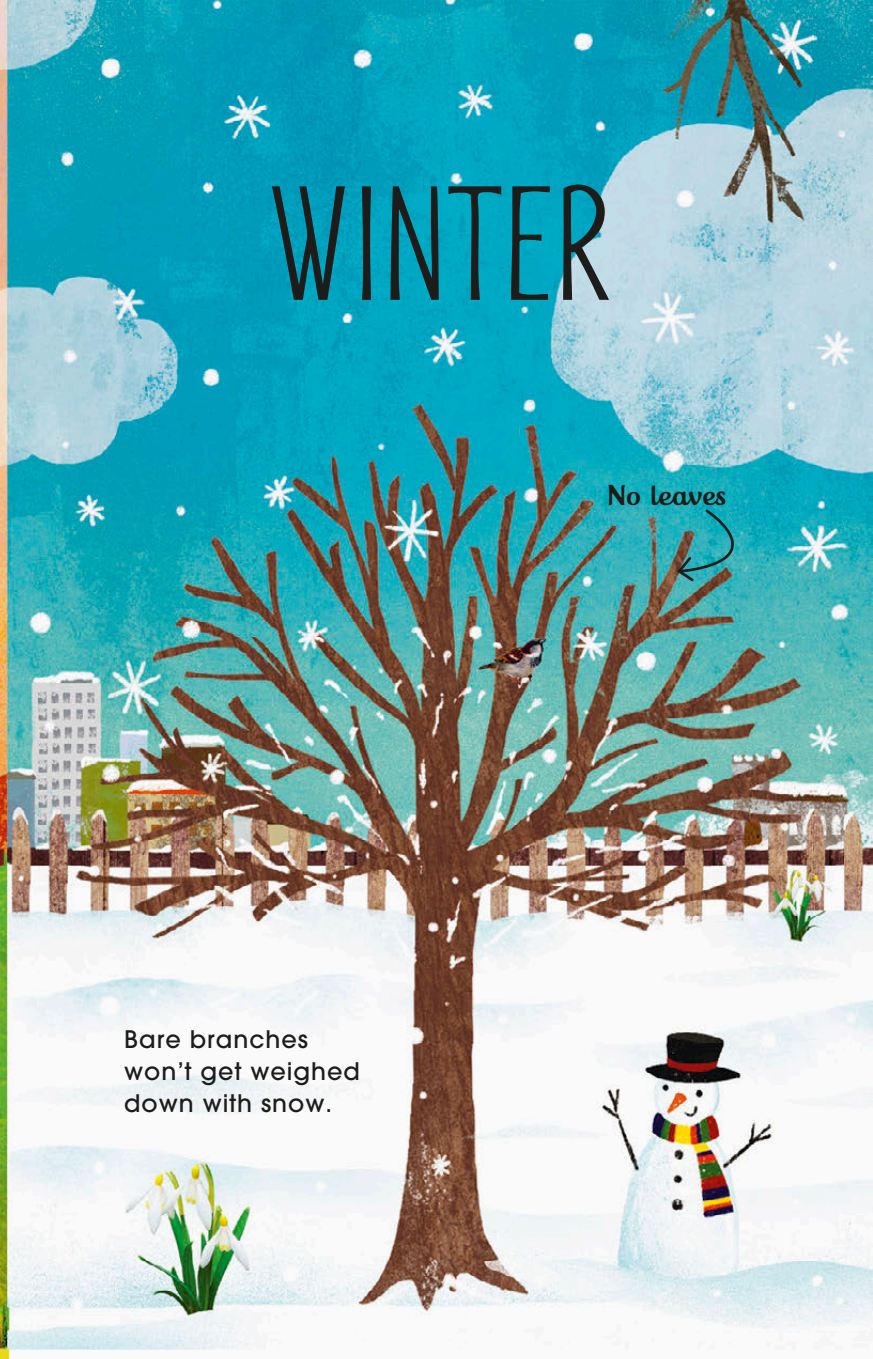
FALL



Changing colors

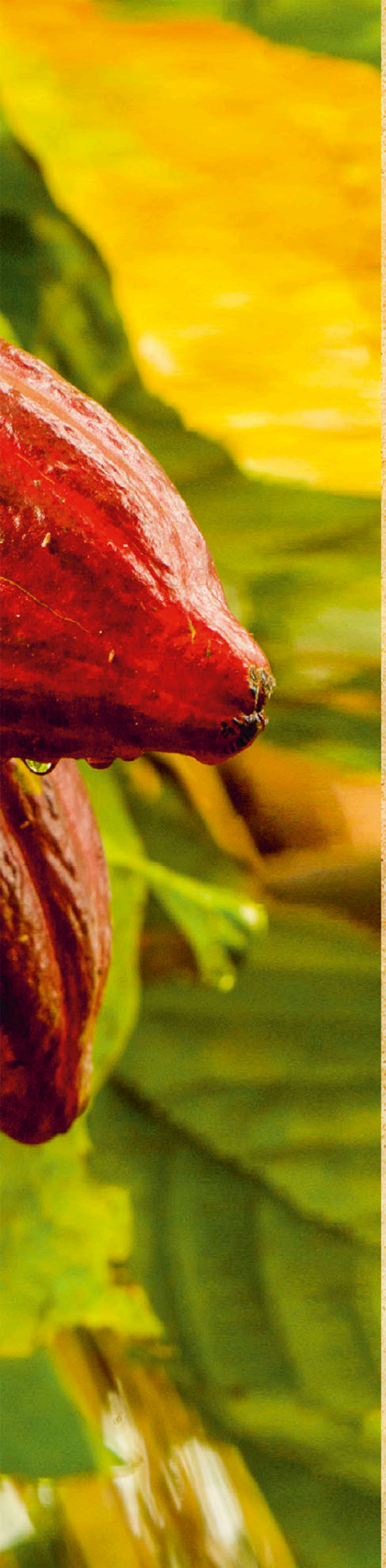
In fall, the weather turns cooler, and days get shorter. Fruits and nuts ripen, and trees spread their seeds. Flat, wide leaves can catch blustery autumn winds, so the tree sheds them to avoid damage to its branches. Its green leaves turn yellow, orange, red, and brown, then drift down to the ground.

WINTER



Frosty flakes

Winter is the coldest season, with the shortest days. The tree has shed its leaves. It may look dead, but it is only sleeping as it waits for spring. The tree has moved the stocks of sap it spent all summer making away from its branches and into its roots.



FLOWERS, FRUITS, AND SEEDS

Trees need to make new trees for the forest to stay healthy. That's why they grow flowers, fruits, and seeds.

The flowers bloom in spring. During the warm days of spring, bees buzz from tree to tree, visiting as many flowers as they can.

Seeds are little bundles that contain a whole new tree, ready to grow. They ripen in summer and fall. Each seed needs to find a good place to grow.

Trees, like all living things, are born, grow, and eventually die. But they leave behind the promise of new forests still to come...

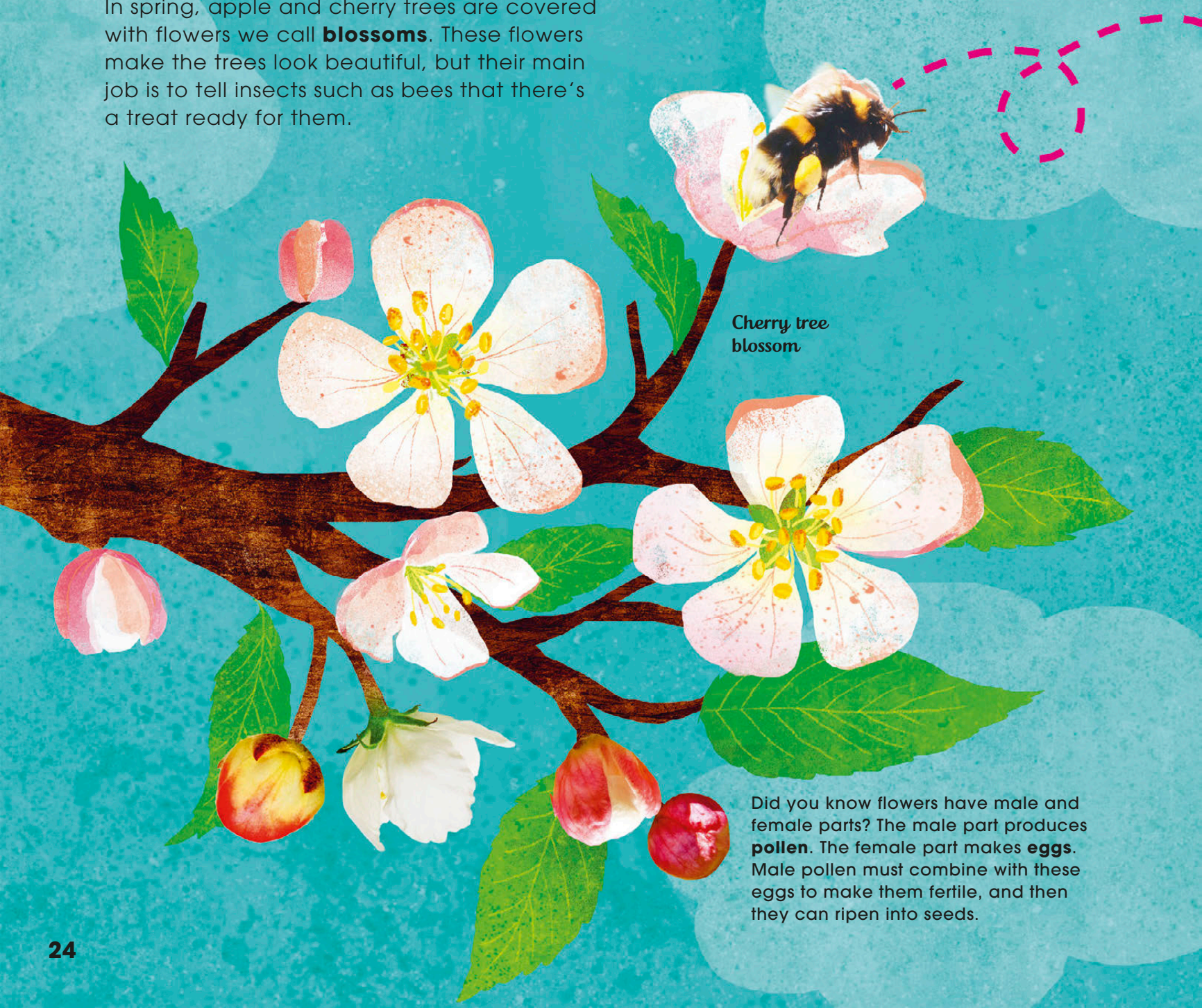
Left, cocoa tree pods containing seeds

Flowers

Trees that want to attract **insects** have large, showy flowers, while ones that spread pollen on the **wind** have tiny, delicate ones. Some tree flowers are so small that they can be tricky to spot, but they have vital work to do.

Blossoms

In spring, apple and cherry trees are covered with flowers we call **blossoms**. These flowers make the trees look beautiful, but their main job is to tell insects such as bees that there's a treat ready for them.



Cherry tree blossom

Did you know flowers have male and female parts? The male part produces **pollen**. The female part makes **eggs**. Male pollen must combine with these eggs to make them fertile, and then they can ripen into seeds.

Little helpers

Insects visit flowers to drink a sweet liquid called **nectar**. Any pollen grains from the flower that get on the insect's body rub off inside the next flower the bee visits. This makes the next flower fertile.

Grains of pollen stick to the bee's **hairy body**.

The bright colors and sweet smells of flowers tell the insects the nectar is ready.

Pollen

Pine and fir trees spread their pollen on the wind.

Fruits and seeds

Once the tree's flowers have been made fertile by pollen, it is **time for seeds to grow**. They can develop inside fruits, cones, hard shells, or papery covers.

Conifer seeds

Conifer seeds

Most conifer trees make their seeds inside **cones**, not fruits. When the seeds are ripe, the cones open. The light, **papery seeds** tumble out and blow away on the breeze. Yew and juniper are unusual conifers. They make small, bitter berries. Birds love them!

Cherries

Fruits

If you've ever enjoyed a crisp apple or juicy cherry, you've eaten the fruit of a broad-leaved tree. Mangoes, peaches, and cherries contain just one large seed, called a **stone**. Apples, oranges, and lemons have many small seeds called **pips**.

The hard shells on these seeds look very different, but they all do the same job. They **protect seeds** and help them spread.

Acorns

Chestnuts

Hazel, chestnut, and walnut trees make seeds with hard shells—we call these **nuts**. Acorns are the seeds of the oak tree.

Sycamore seeds

Maple and sycamore seeds have a double wing. They spin like miniature helicopter blades, to land far away.

Blown on the wind

Tree seeds must be scattered far and wide so that new trees can grow. Some seeds are scattered by the wind. Sycamore, maple, and ash trees have light, **winged** seeds that spin through the air.

Carried by currents

Trees that live by rivers and oceans make seeds that float. The current carries them away. **Coconut palms** grow on the seashore in warm places. Ripe coconuts plop into the water. The tide washes them away to take root on distant coasts.

Unripe, green coconuts

Coconuts are light enough to **float**.

Animal assistants

Animals love the bright colors and mouth-watering smells of fruit. Trees get animals to **spread their seeds** for them by putting them inside delicious things.

ADVENTURE TIME

For children, the best place to grow up is near our parents, who provide everything we need. Trees are very different—they like their seeds to travel alone to distant places. Fast-moving animals provide a perfect transportation system.

Buried nuts

In fall, **squirrels** and **blue jays** prepare for winter by burying nuts and acorns. These nuts provide a handy source of food during the long, bleak months of winter—as long as the animal doesn't forget where its food is buried! Any forgotten seeds will sprout into new trees in the spring.

Monkey dung

Monkeys love to feast on figs. They can digest the juicy flesh, but the hard seeds pass right through the animals' bodies and come out in their poo!

As the monkeys wander from tree to tree, the seeds in their dung get scattered all over the forest. Monkey poo contains all the nutrients a seed needs to sprout and grow strong and healthy.

Tropical fig tree

From seed to tree

Trees are the tallest living things in the world, but they are born from tiny seeds. Growing to their full height can take 100 years. Here's how a young oak sprouts from a little acorn to grow taller than a house.

Seeds are full of food to keep the seedling going until it can make its own food.

A young tree is called a seedling, or sapling.

Sprouting

If a seed lands in moist soil in a warm, light place, big changes start to happen. The seed swells, and the case splits open. A tiny root pokes down to take in water.

Getting taller

A small green shoot pushes up through the soil. Once the first leaves unfurl in the sunlight, the young plant can make its own food. A new, little tree is born.

Growing older

Humans grow during their childhood, but we stop when we become adults. **Trees are different**—they continue growing. What's more, they can live at least five times as long as we do. At **100 years old**, many trees are still youngsters!

Oak trees keep getting wider for 500 to 600 years.

Taller and wider

As the tree gets older, its upward growth slows and finally stops when it reaches **full height**. But if there is space, its branches and trunk continue getting wider. The trunk of a big, old tree grows about 1 inch (2.5 cm) wider each year.

Life after death

No living thing goes on forever. Trees can live for hundreds of years, but in the end even they grow old and die. Winds shake the dead tree until its trunk cracks, and it comes crashing to the ground.

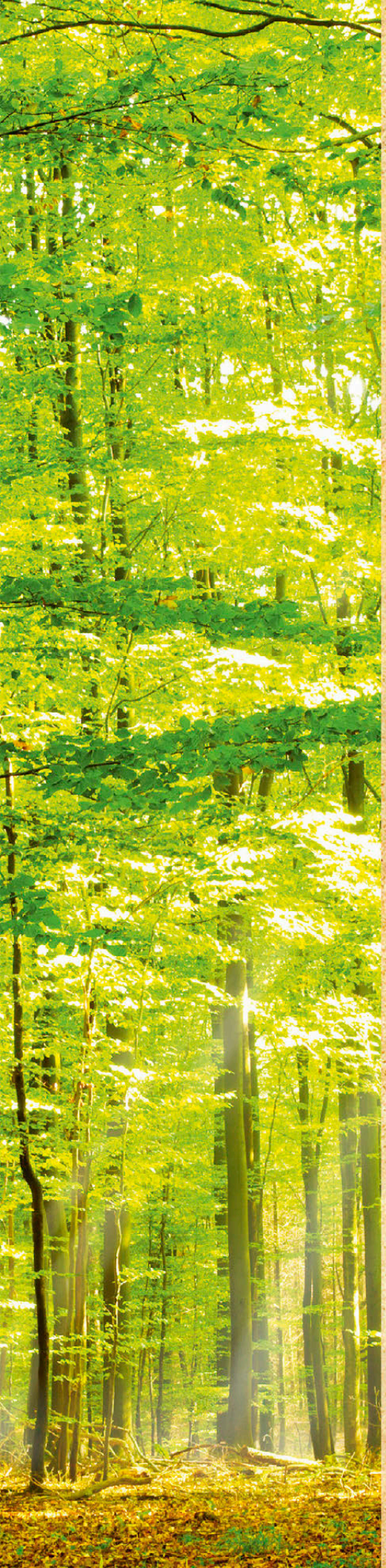
A new home

But that's not the end of the story. A dead tree becomes a home for thousands of small creatures that like damp, dark places. Little beasts such as slugs, worms, woodlice, centipedes, insects, and spiders move in.

Up to a third of all creatures that live in the forest like to live in, or eat, rotten wood.

Recycling nutrients

Small creatures and fungi feast on rotten wood and break it down. This allows the raw materials that formed the tree to return to the soil. These nutrients feed young trees and other plants, giving them a good start in life.



TREE PARTNERS

Trees grow and change so slowly that it's hard to tell how busy they really are. Year after year, trees stand still and silent, but there's a lot going on under the surface.

Trees are mysterious things. Recently, scientists have found out that the trees in a forest work together. They make friends and support one another. Trees look after their neighbors, and mother trees pass food to their children and older trees within the family.

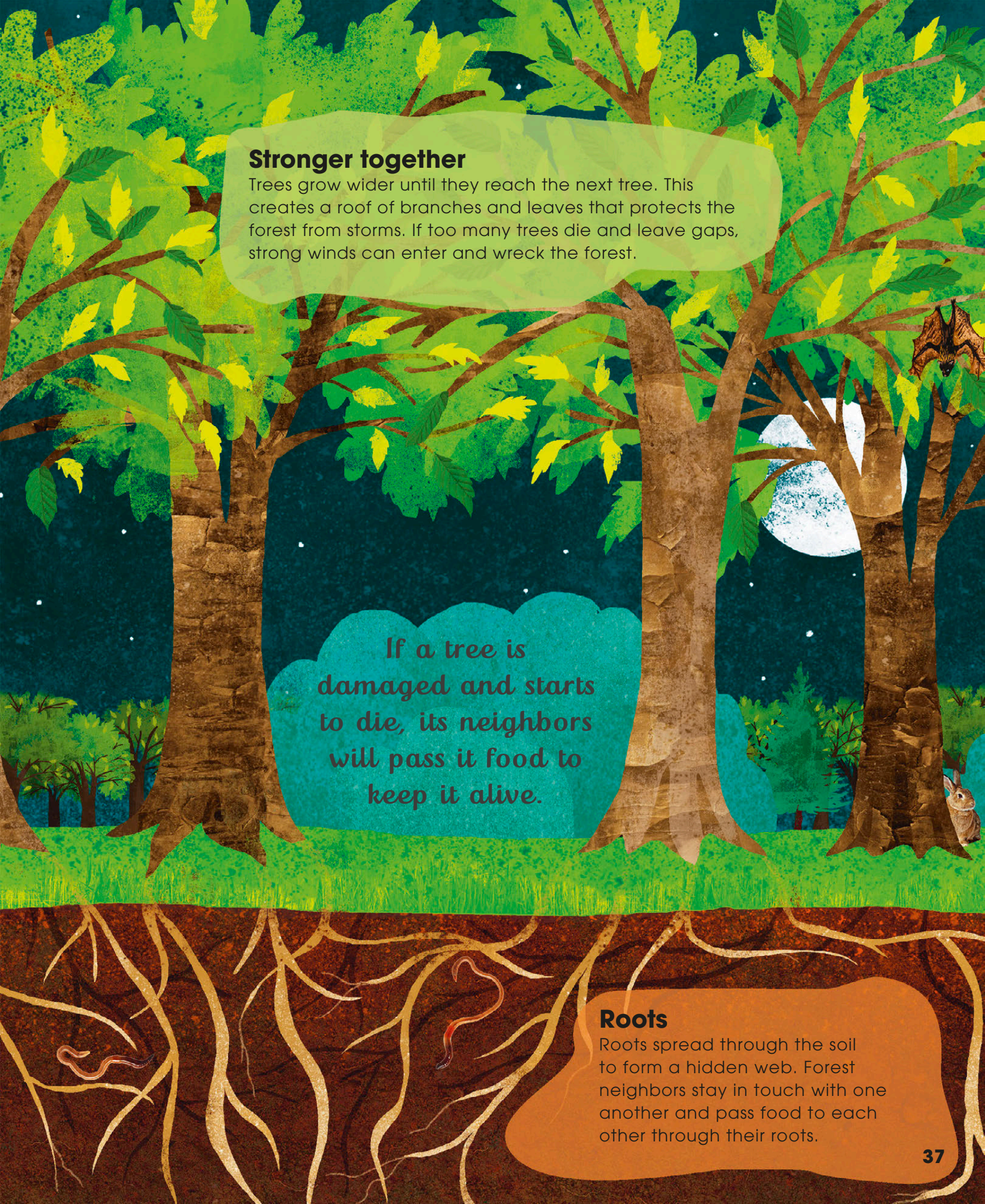
We now know trees have senses. They can smell, taste, touch, and feel pain, like we do. Trees can sense danger and defend themselves against enemies. **We are learning that there's a lot more to trees than we ever imagined.**

Living together

Life in the natural world is tough. It's easier for trees to survive when they help one another. Trees living in a forest grow best if all the trees are healthy. If one tree is in trouble, the others help it. Trees also work together to make the forest warmer and more sheltered in winter, and cooler, damper, and shadier in summer.

Family and friends

Trees of the same species look after one another. Oak, beech, and spruce trees like to share water and food with only their own kind. But in some places, trees of different types look out for one another too.



Stronger together

Trees grow wider until they reach the next tree. This creates a roof of branches and leaves that protects the forest from storms. If too many trees die and leave gaps, strong winds can enter and wreck the forest.

If a tree is damaged and starts to die, its neighbors will pass it food to keep it alive.

Roots

Roots spread through the soil to form a hidden web. Forest neighbors stay in touch with one another and pass food to each other through their roots.

Wood wide web

Trees like to keep in touch with each other. Experts have found out that it's not just **roots** that link the trees in a forest. They are also connected through **fungi**—the living things we know as mushrooms.

Helpful fungi like these are called **mycorrhizae** (pronounced my-cor-riz-ee).

The fungal network

Fungi are sort of like plants, but they cannot make their own food. Instead, they make a network of threads called **hyphae** (pronounced hi-fee), which break down food. The hyphae can swap food, water, and even messages with tree roots

Fungi help trees by cleaning up pollution and warding off other types of fungi that would make the trees sick.
Mushrooms and toadstools are the fruits of the fungus.
Douglas fir
Fungus
Nutrients
Food and water
Tree roots
In return for the fungal network, trees give **water** and **food** to the fungi.

Forest family

Trees of the same species act like a family. When a seedling is struggling, its mother steps in to help. Trees that are very old or damaged are not forgotten. Even the strongest trees can be attacked by disease or insects and need help every now and then. By helping each other, the trees make sure the forest as a whole stays strong.

CARING MOTHERS

Full-grown trees take care of younger and older trees. Many young trees sprout directly below the mother tree. But the youngsters don't grow well in her shade. The mother keeps them alive by passing them sap and nutrients until they are tall enough to find the light.

Tiny seedling

Older trees often block light from reaching younger ones. Far from damaging them, however, it turns out to be helpful, because growing slowly when they are young helps trees live longer.

Helping hand

This stump can't make food without leaves, but somehow it is still alive. The trees of the forest are feeding the old stump through their roots. This stump might even be the full-grown tree's mother.

Stumps can live for hundreds of years without leaves.

Tree senses

A tree doesn't have eyes, ears, fingers, or toes. Because they're so different from us, for a long time no one knew trees had senses. But now we know that they can tell what's going on around them.

They can sense the outside world...

HOT AND COLD

Trees can sense how hot or cold it is. Even tiny seeds know if the temperature has become warm enough for them to sprout and start growing.

TASTE

When an animal nibbles on a leaf, the tree can taste the animal's spit! Trees can even tell different animals apart from the taste of their spit.

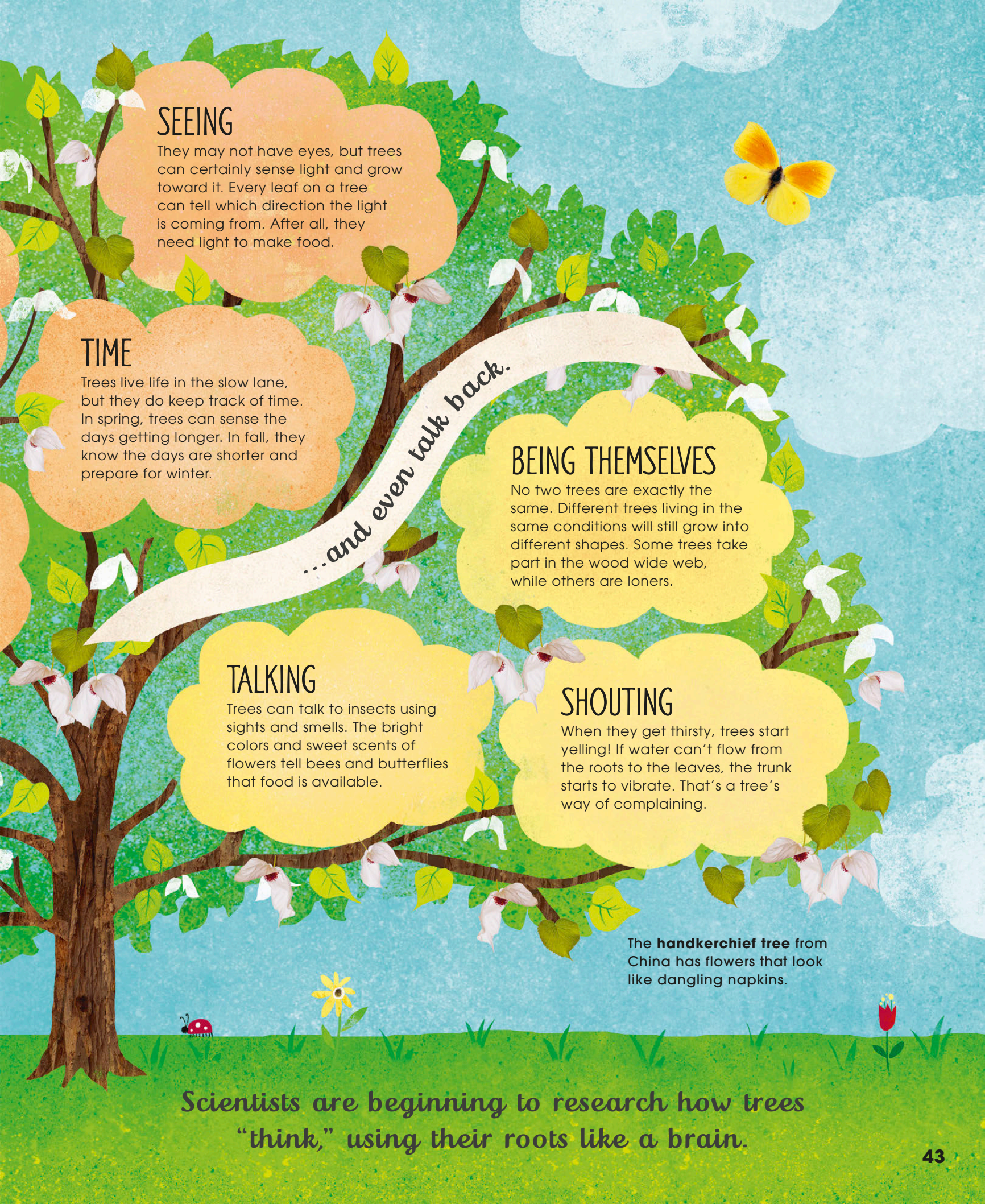
TOUCH

Tree roots are amazingly sensitive. A tree can tell which roots in the underground tangle are its own. It can also tell whether its neighbors are the same type of tree.

HEARING

Roots can hear the sound of running water and grow toward it. Even when the tree is completely sealed off, it knows the water is there. We don't yet know how they do this.

We are only just beginning to uncover all the mysteries of what trees can sense.



The **handkerchief tree** from China has flowers that look like dangling napkins.

Scientists are beginning to research how trees "think," using their roots like a brain.

Tree defenses

Imagine if you were a tree and an insect started to nibble on you. Ouch! Luckily, trees have lots of clever ways to stop insect invaders.

Lodgepole pine beetle

Sticky sap

Beetles attacking **lodgepole pines** often find themselves in a sticky situation! Before the yummy bark can be devoured, the pine tree imprisons the insect in a very sticky **sap trap**.

Bitter dinner

Beech, oak, and spruce trees can pump chemicals called **tannins** into their leaves to make them taste bitter. This spoils the insects' meal, so they move on to other trees.

A tree can tell what kind of bug is biting it and can send for the right helpers.

Oak leaf roller moth caterpillar

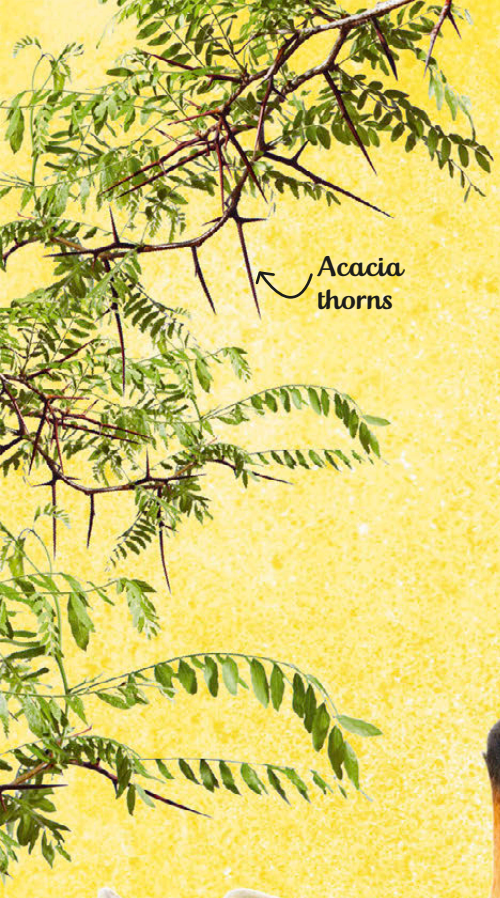
Insects to the rescue

Some trees use a different tactic to defend themselves against sap-sucking insects called **aphids**. They give off a special scent that calls **ladybugs**. These spotted insects hunt aphids and will eat them all day if they get the chance.

Ladybug eating an aphid

Under attack

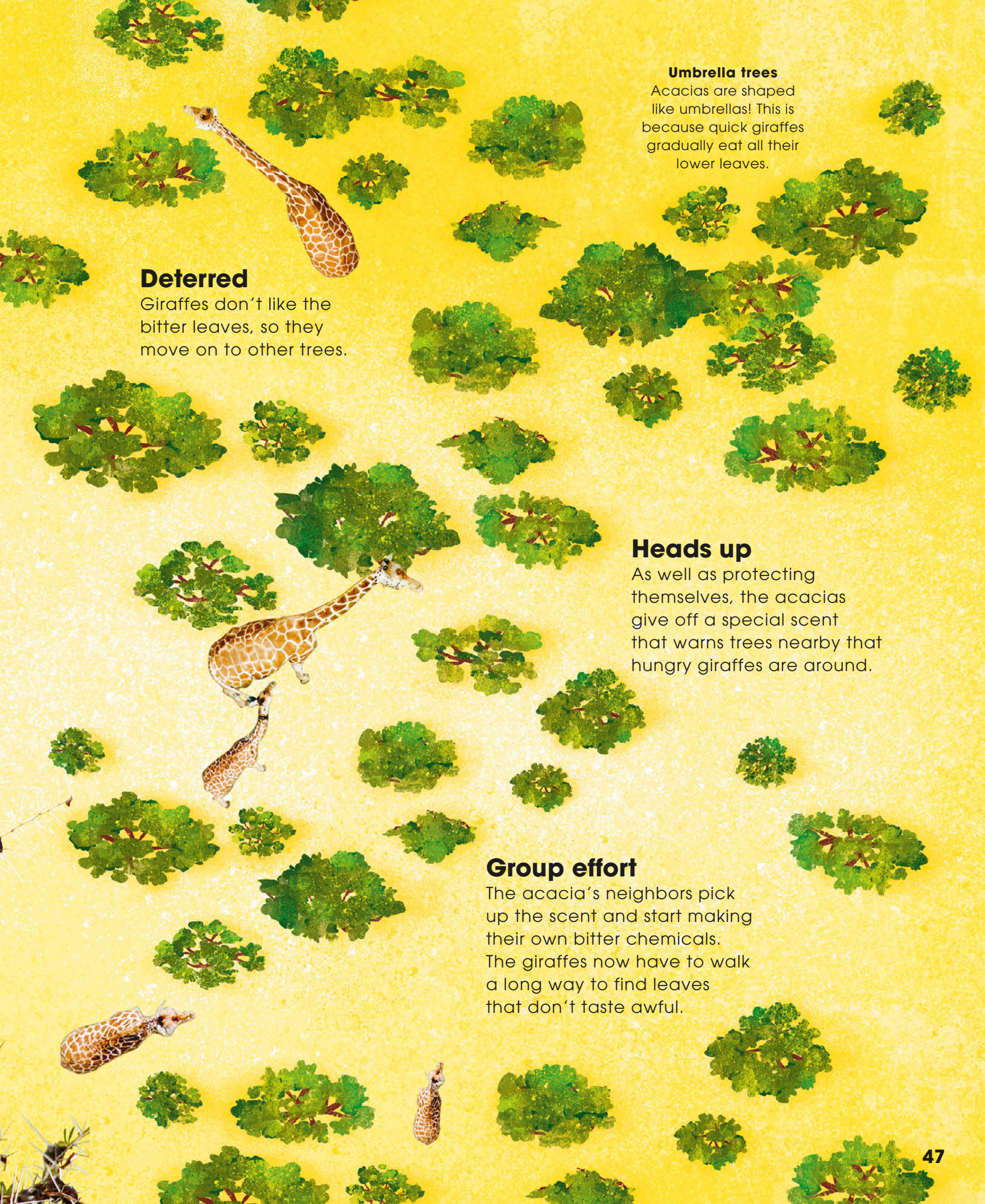
Giraffes are the natural enemies of the acacia tree. Luckily for the acacias, they have some clever defenses at the ready. Not only do they protect themselves, they also **warn other trees** of the danger.



Danger!

Acacia trees can sense giraffe spit. When the tree's leaves are being nibbled, it starts making chemicals that make the leaves taste bitter. Yuck!

Beware giraffes
Acacias have long, sharp thorns to ward off animals, but the giraffe's long, flexible tongue dodges the thorns to pluck tufts of green leaves.



Umbrella trees
Acacias are shaped like umbrellas! This is because quick giraffes gradually eat all their lower leaves.

Deterred

Giraffes don't like the bitter leaves, so they move on to other trees.

Heads up

As well as protecting themselves, the acacias give off a special scent that warns trees nearby that hungry giraffes are around.

Group effort

The acacia's neighbors pick up the scent and start making their own bitter chemicals. The giraffes now have to walk a long way to find leaves that don't taste awful.

Incredible trees

Trees are the biggest, heaviest, and oldest living things on the planet. They can live in the snowy heights of the Andes and even clone themselves.

The world's very tallest tree is a **redwood** growing in California. Named Hyperion, it soars 377 feet (115 m) high—the height of about 20 giraffes!

A **giant sequoia** named General Sherman is the world's largest individual living thing. It has a massive trunk 26 feet (8 m) across.

A **Montezuma bald cypress** called the Tule Tree stands in a churchyard in Mexico. It is the world's widest tree and measures 119 feet (36 m) around the trunk but is only 116 feet (35 m) tall.

The world's oldest known tree is a **bristlecone pine** named Methuselah. It grows high in the White Mountains of California and is 4,800 years old.

Trees can live for a long time in all kinds of places because they are good at adapting to different environments.

The roots of a **Huon pine** growing in Tasmania, Australia, are an epic 10,500 years old.

A group of **quaking aspen** trees in a forest in Utah are all identical sprouts of one tree, connected by roots. This makes the group the world's heaviest living thing. Together the trees weigh as much as 33 blue whales.

The tough **Polylepis** trees of South America can grow at heights of up to 17,000 feet (5,200 m) in the Andes Mountains, where it's too cold and windy for other trees to grow.

TREE HABITATS

Trees aren't that fussy about where they live. All they need is sunshine, water, and a little soil in which to spread their roots. That's why forests are found all over the world, and why such an amazing array of animal and plant life is found within their depths.

Trees are tough survivors. Scattered trees can take root on steep, stony mountains. They cling to life on storm-battered coasts and survive howling winds in the snowy tundra. They survive on the edges of dusty deserts and on busy streets in city centers. In fact, trees can get by almost anywhere.

This section explores habitats the world over. Read on to discover how trees provide a home for an incredible variety of mammals, birds, insects, and fish.

Tree homes

This great big oak tree is home to lots of creatures. From the topmost branches to the deepest roots, animals and plants live side by side, just like people in an apartment building.

Dig in!

An old tree like this provides food for everyone—sort of like a natural **supermarket**.

Carnivores, such as **owls and bats**, are keeping a look out for small animals and insects to hunt.

Herbivores, such as insects, birds, and deer, munch on every part of the tree. They nibble on its leaves, buds, fruits, and even bark.

Below ground, in the tree's basement, **worms**, **beetles**, and **fungi** feast among the roots.

Blackbirds build cozy nests high in the branches to lay their eggs. The nests keep the chicks warm and safe from **predators** such as foxes.

This **woodpecker** drums holes in the bark with its supersharp beak to find juicy grubs. Then it slurps up the insects with its sticky tongue.

In fall, **squirrels** bury nuts in the ground to save for winter.

Foxes use their sharp claws to dig snug **dens** among the tree's roots.

Tropical rain forest

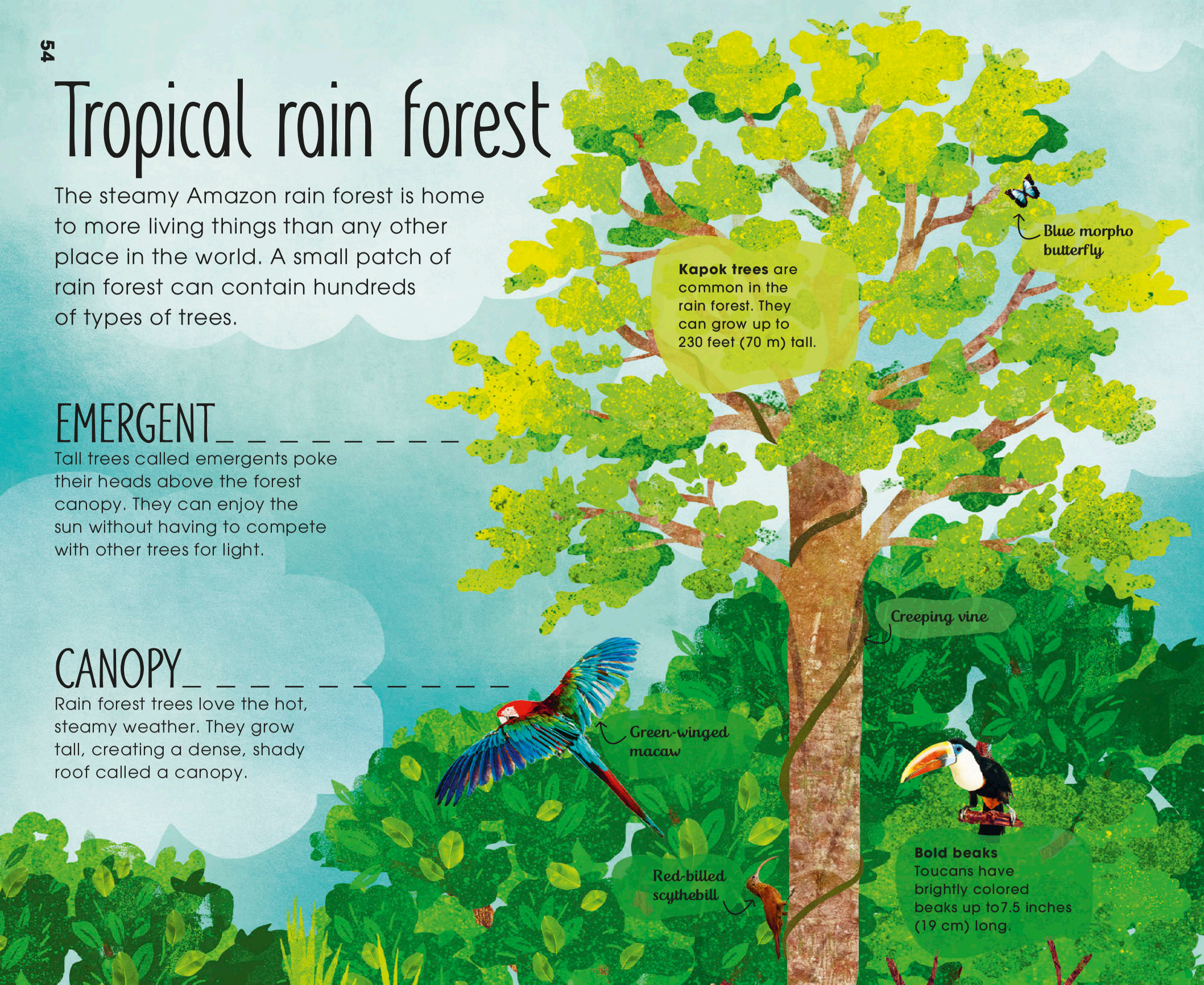
The steamy Amazon rain forest is home to more living things than any other place in the world. A small patch of rain forest can contain hundreds of types of trees.

EMERGENT

Tall trees called emergents poke their heads above the forest canopy. They can enjoy the sun without having to compete with other trees for light.

CANOPY

Rain forest trees love the hot, steamy weather. They grow tall, creating a dense, shady roof called a canopy.



Hoatzin
Two-toed sloth
At home on a tree
Epiphytes are plants that grow on other plants. Rain forest trees support many epiphytes.
Epiphyte
Long limbs
Spider monkeys swing through the trees using their long arms, legs, and tails.
UNDERSTORY
The understory is dim because the canopy above blocks most of the light.
Pygmy marmoset
Palm
FOREST FLOOR
The ground level in a rain forest is dark and dry because the higher levels absorb almost all the light and rain.
Tarantula
Pitcher
Anaconda
Golden dart frog
Bromeliad
Stealthy cat
The jaguar's spots help it hide among the speckled shadows cast by the leaves above. It slinks through the trees as it hunts.
Giant anteater
Emerald tree boa
Centipede
Purple harlequin toad

Temperate rain forest

Unlike tropical forests, **temperate rain forests grow in areas of mild weather**, where it is neither too hot nor too cold. Many of the trees are conifers. This misty forest is home to lots of animals that like to keep cool.

River beavers

Beavers build dams across forest streams. They gnaw through **saplings** (young trees) with their sharp front teeth. Timber! The tree crashes down to become part of the dam.

Giant redwood

Fireweed

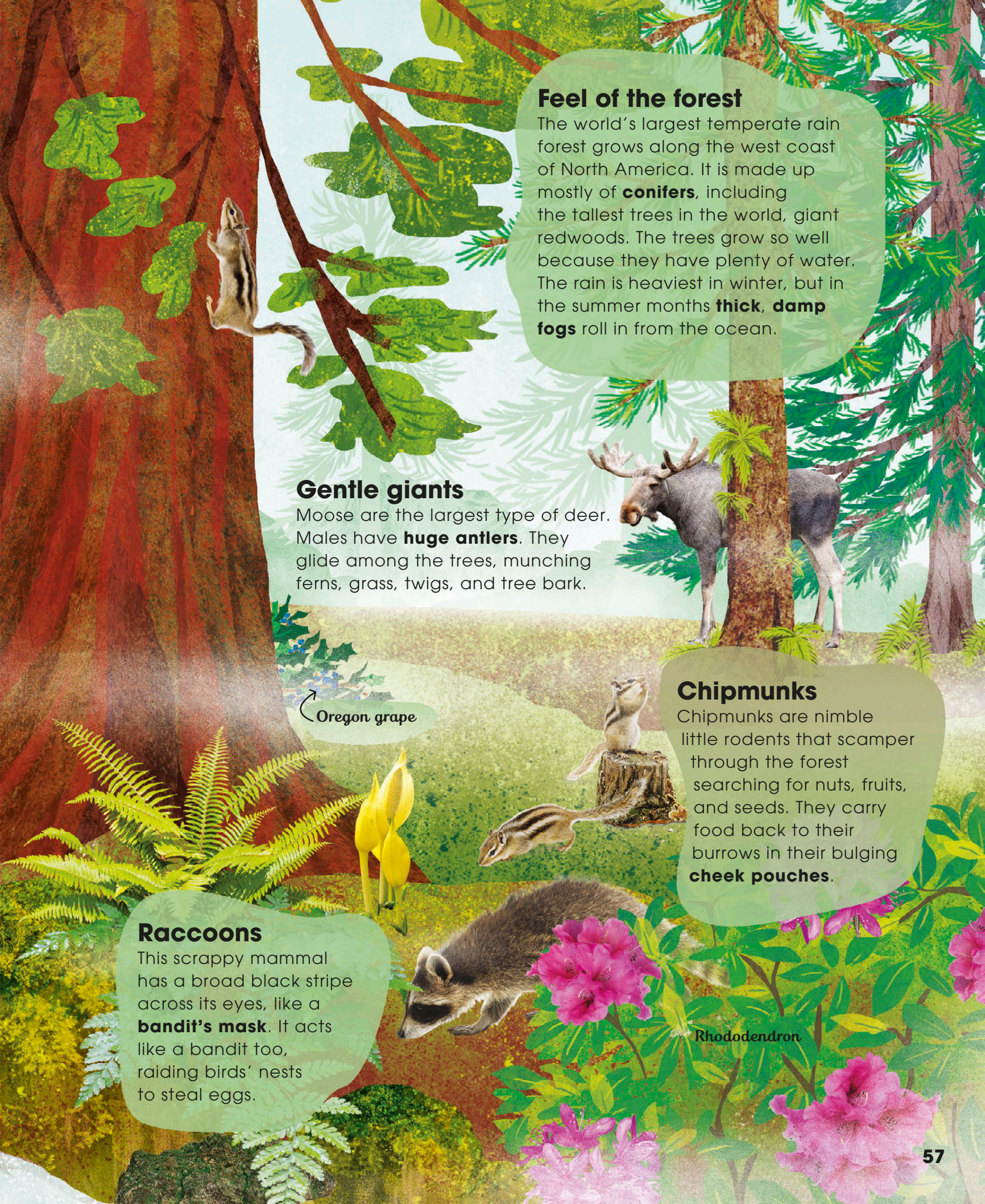
Big cats

Pumas are large cats that silently slink through the forest. They pounce on animals as large as deer and kill them by biting their necks.

Western skunk cabbage

Tree frogs

Pacific tree frogs live in forest ponds and damp ditches. They are brown, gray, or green but can **change color** to blend in with their surroundings.



Feel of the forest

The world's largest temperate rain forest grows along the west coast of North America. It is made up mostly of **conifers**, including the tallest trees in the world, giant redwoods. The trees grow so well because they have plenty of water. The rain is heaviest in winter, but in the summer months **thick**, **damp fogs** roll in from the ocean.

Gentle giants

Moose are the largest type of deer. Males have **huge antlers**. They glide among the trees, munching ferns, grass, twigs, and tree bark.

Oregon grape

Chipmunks

Chipmunks are nimble little rodents that scamper through the forest searching for nuts, fruits, and seeds. They carry food back to their burrows in their bulging **cheek pouches**.

Raccoons

This scrappy mammal has a broad black stripe across its eyes, like a **bandit's mask**. It acts like a bandit too, raiding birds' nests to steal eggs.

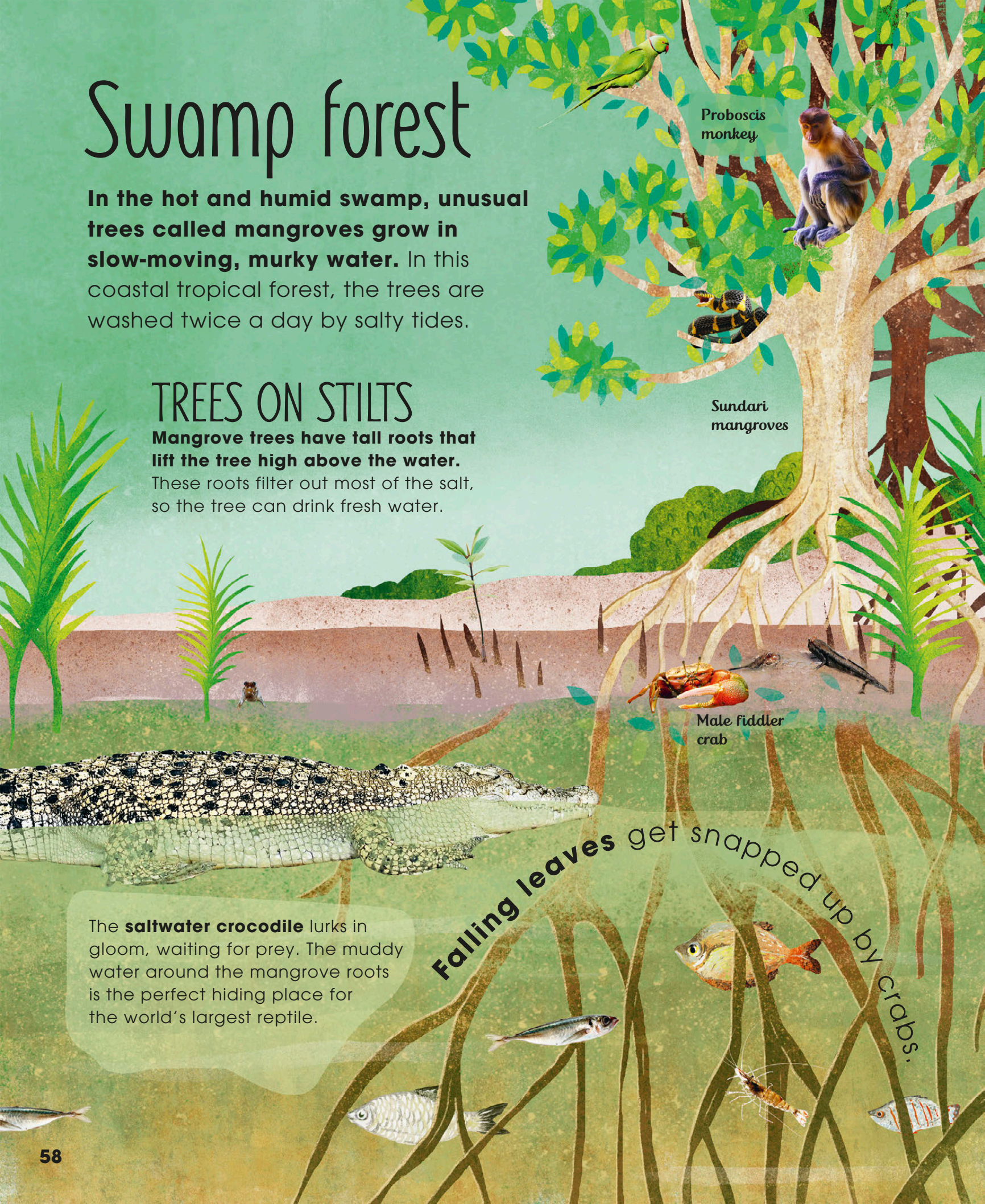
Rhododendron

Swamp forest

In the hot and humid swamp, unusual trees called mangroves grow in slow-moving, murky water. In this coastal tropical forest, the trees are washed twice a day by salty tides.

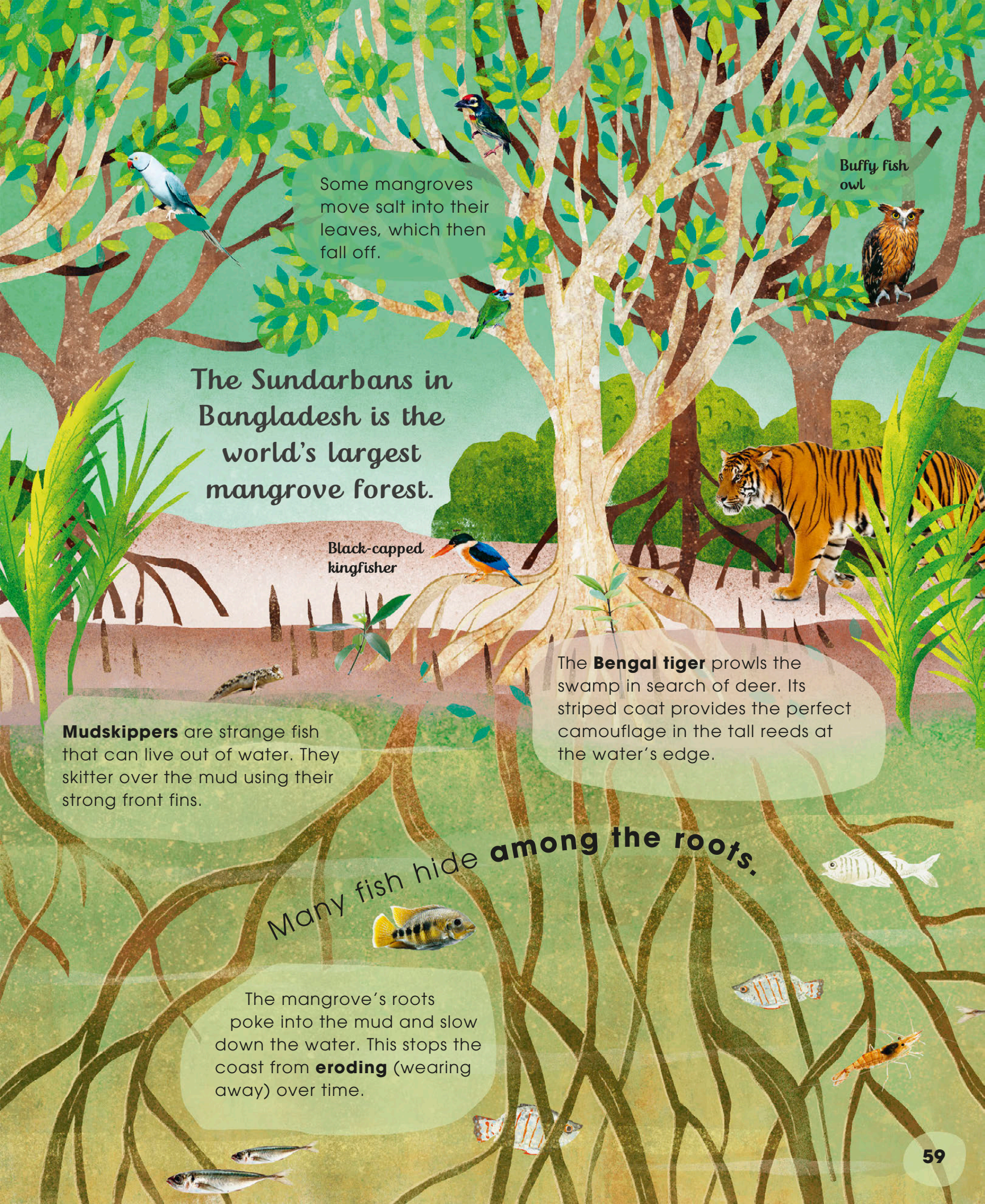
TREES ON STILTS

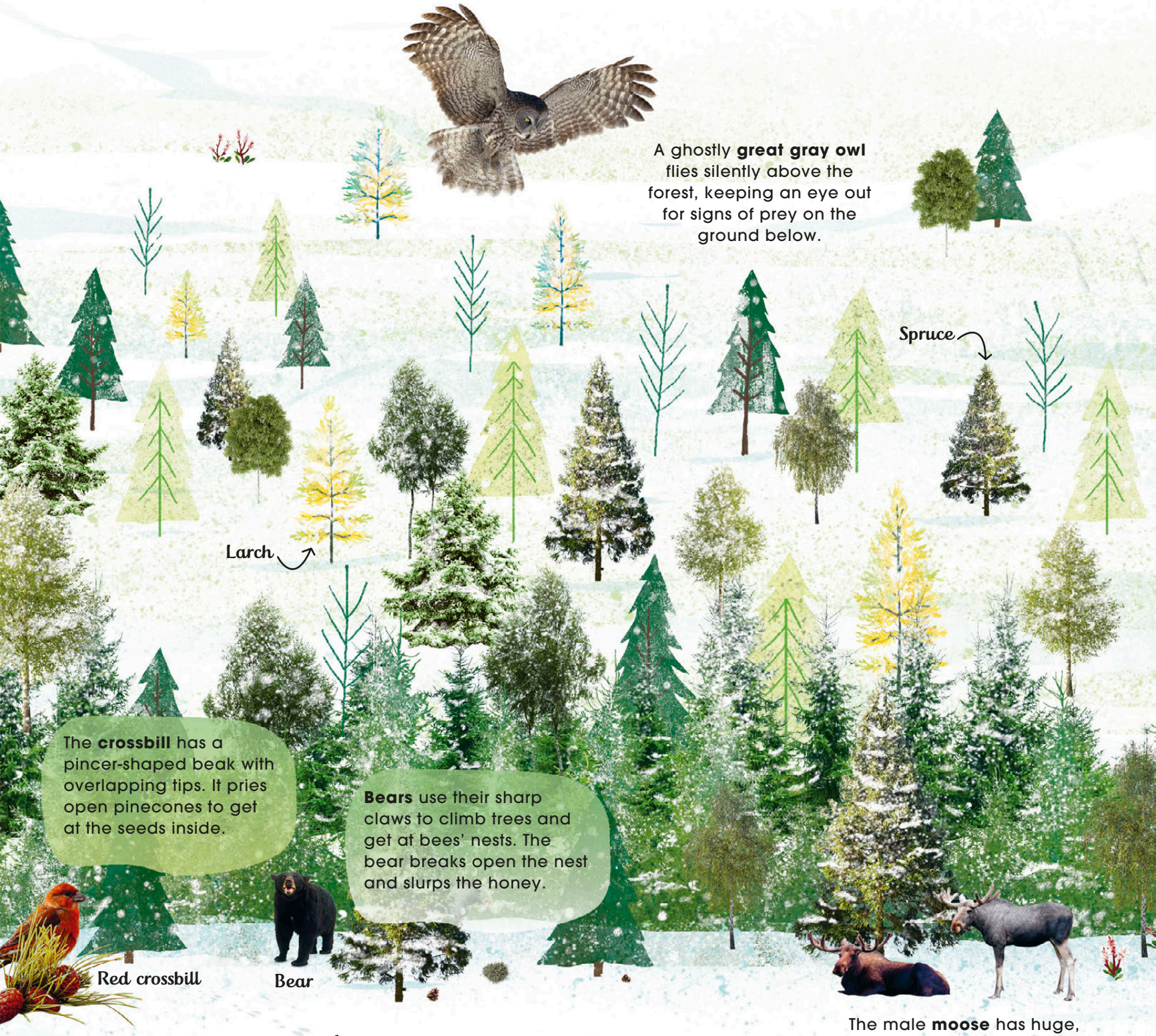
Mangrove trees have tall roots that lift the tree high above the water. These roots filter out most of the salt, so the tree can drink fresh water.



The **saltwater crocodile** lurks in gloom, waiting for prey. The muddy water around the mangrove roots is the perfect hiding place for the world's largest reptile.

Falling leaves get snapped up by crabs.


Some mangroves move salt into their leaves, which then fall off.
Buffy fish owl
The Sundarbans in Bangladesh is the world's largest mangrove forest.
Black-capped kingfisher
The **Bengal tiger** prowls the swamp in search of deer. Its striped coat provides the perfect camouflage in the tall reeds at the water's edge.
Mudskippers are strange fish that can live out of water. They skitter over the mud using their strong front fins.
Many fish hide **among the roots.**
The mangrove's roots poke into the mud and slow down the water. This stops the coast from **eroding** (wearing away) over time.



Snow forest

The dense, dark, **taiga** forest is covered with snow in winter. It grows across Canada, Russia, and northern Europe, wrapping itself around the world like an enormous green scarf.

Cool conifers

The taiga is made up mostly of **conifers** such as spruce and fir. Conifers' pointy shape and waxy, needle-like leaves help them shed the heavy snow.

The **taiga** covers more of the world than any other forest.

Reindeer spend the winter in these sheltered forests, eating lichens from branches and underneath the snow.

Silver birch

Reindeer

Pine martens dart along the snowy forest floor, sniffing out small animals to hunt.

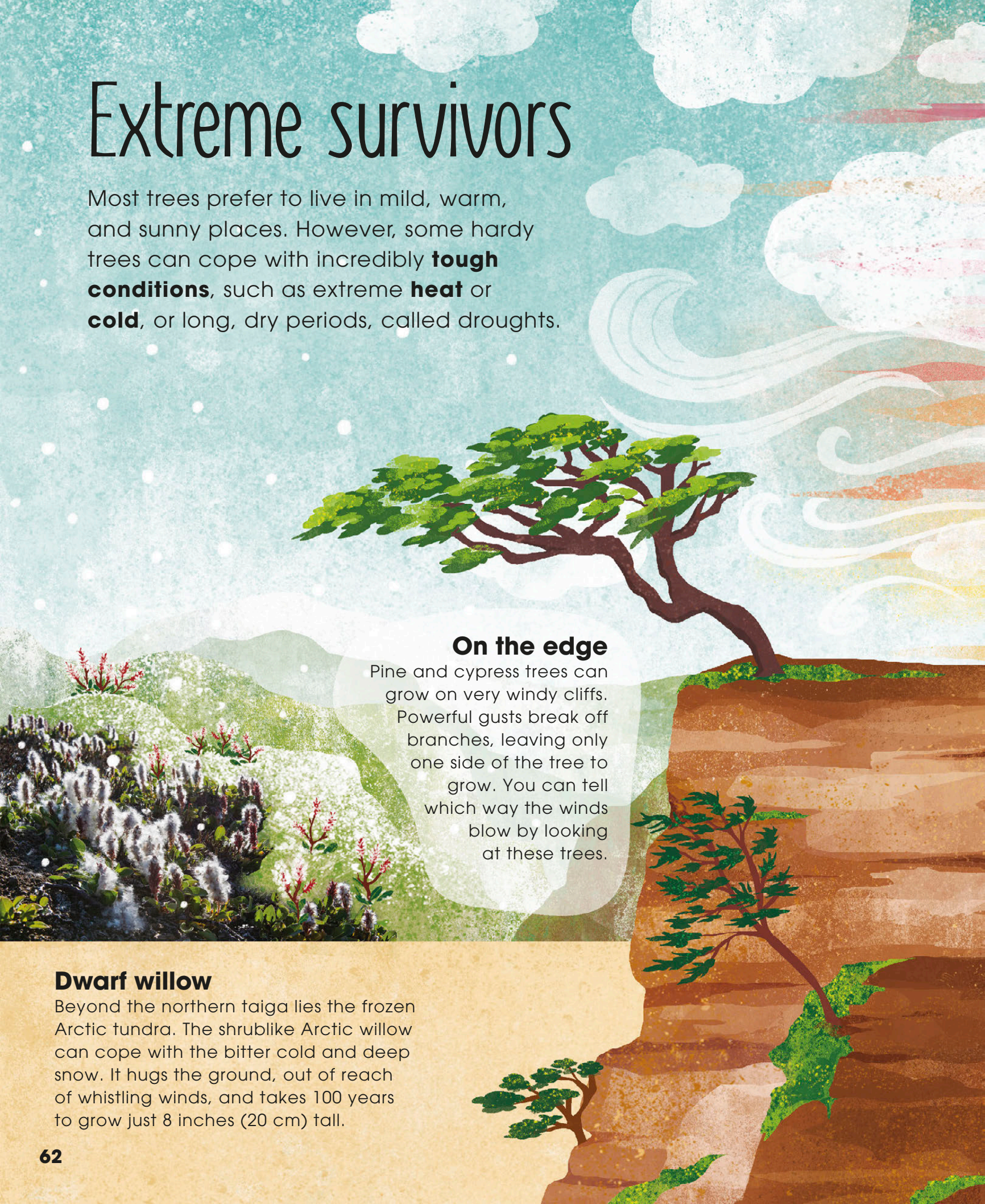
White world

Northern forests have short, cool summers and long, harsh winters. Snow often covers the ground for months on end.

Mountain hare

Extreme survivors

Most trees prefer to live in mild, warm, and sunny places. However, some hardy trees can cope with incredibly **tough conditions**, such as extreme **heat** or **cold**, or long, dry periods, called droughts.



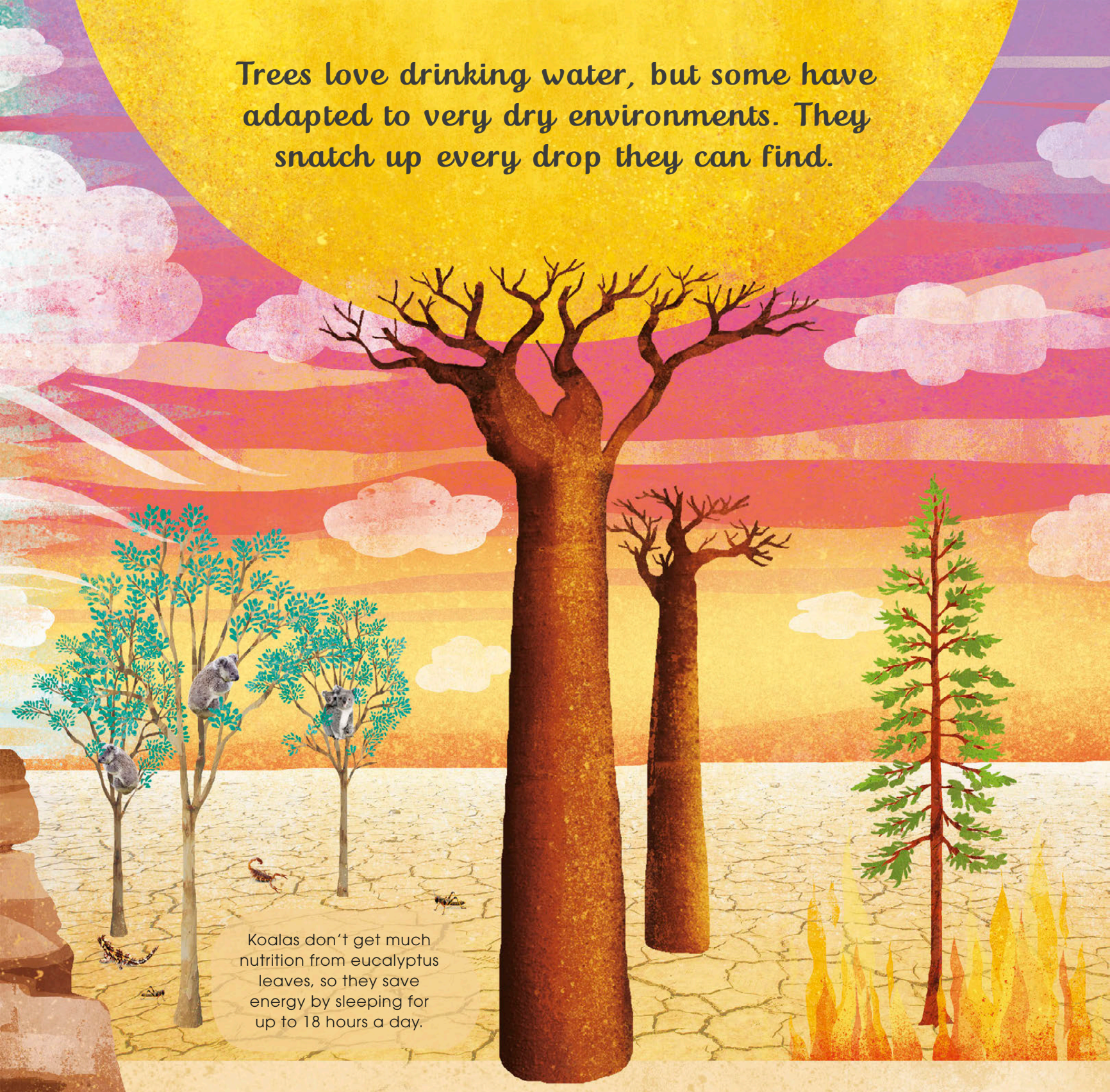
On the edge

Pine and cypress trees can grow on very windy cliffs. Powerful gusts break off branches, leaving only one side of the tree to grow. You can tell which way the winds blow by looking at these trees.

Dwarf willow

Beyond the northern taiga lies the frozen Arctic tundra. The shrublike Arctic willow can cope with the bitter cold and deep snow. It hugs the ground, out of reach of whistling winds, and takes 100 years to grow just 8 inches (20 cm) tall.

Trees love drinking water, but some have adapted to very dry environments. They snatch up every drop they can find.



Koalas don't get much nutrition from eucalyptus leaves, so they save energy by sleeping for up to 18 hours a day.

Koala home

Tall eucalyptus, or gum, trees grow in dry areas of Australia. Koalas will eat only eucalyptus leaves.

Water tank

Baobab trees grow on the dry, grassy plains of Africa. In the rainy season, baobabs store water in their trunks to survive the dry season.

Fireproof

Ponderosa pine trees can survive fires. They have extra-thick protective bark that can grow up to 4 inches (10 cm) thick.

TREES AND ME

Trees help us in a hundred different ways. They provide food, wood, and many other useful products. They make the air fresh and healthy by creating oxygen and help make our planet a clean place to live.

Trees take good care of us and other living things. Yet all over the world, people are harming trees. We cut forests down for timber and to make room for farms and cities. We also cause pollution that is hurting trees.

Trees do a lot to keep our world green and healthy. They provide a home for the countless plants, animals, and people who live in forests around the world. In turn, it's up to each and every one of us to take good care of trees.

Harvest time

From a piece of juicy fruit to spicy guacamole, trees provide us with so many mouth-watering meals. Without trees, there would be no chocolate, mango yogurt, or avocado toast! They even produce powerful medicines that help us get well when we're feeling ill.

Crunchy nuts

Lots of nuts come from trees, including brazil nuts, which come from one of the tallest trees in the Amazon rainforest. Coconut palms produce the largest nuts of any tree.

Apples

Almonds

Aspirin

Tree doctor

The headache medicine aspirin originally comes from the bark of the willow tree. Another helpful tree is the cinchona, which creates a medicine called quinine that helps treat malaria.

Brazils

Cashews

Plums

Coconut

Spicy flavors

Without trees, our food would be very bland. Cinnamon and nutmeg can really spice up a meal! Kola nuts are used to flavor fizzy cola. Beans from the cacao tree give chocolate its unique taste.

Cinnamon bun

Nutmeg spice on a custard tart

Cola

Maple syrup

Chewing gum

Sap from the chicle tree is used to make rubbery chewing gum.

Chocolate

Sweet syrup

The maple syrup on your pancakes is made from the sap of the sugar maple. It is collected by hammering a metal tap into the tree's trunk and catching the sap that drips out.

Paper goods

Paper and cardboard are made from tiny chips of soft wood mixed with water. This makes a mushy pulp, which is then rolled flat and dried.

Wooden world

Take a look around your home. How many objects can you find that are made of wood? From pencils made from cedar to pine furniture, wood is all around the home.

It takes **at least 30 years** to grow a pine tree for wood.

Made from trees

Wood is a super-material. It's strong, beautiful, and can be grown in an eco-friendly way. We use this incredible material to build our houses and to make all kinds of objects.

The bark of cork trees is used to make bulletin boards, corks for wine bottles, and place mats. It's so light it can float!

Hardy wood

Trees such as oak and maple make strong hardwood that is used for roof beams and furniture. Tropical hardwoods such as mahogany and rosewood are used to make guitars because they create a clear sound. Hardwood is strong and tough, but the trees grow very slowly.

Rubber

Rubber trees ooze a milky sap, which is turned into car and bicycle tires. Rubber boots, party balloons, and rubber bands are also made from rubber.

A type of incense called agarwood, which comes from aquilaria trees, is worth more than gold!

Trees and the planet

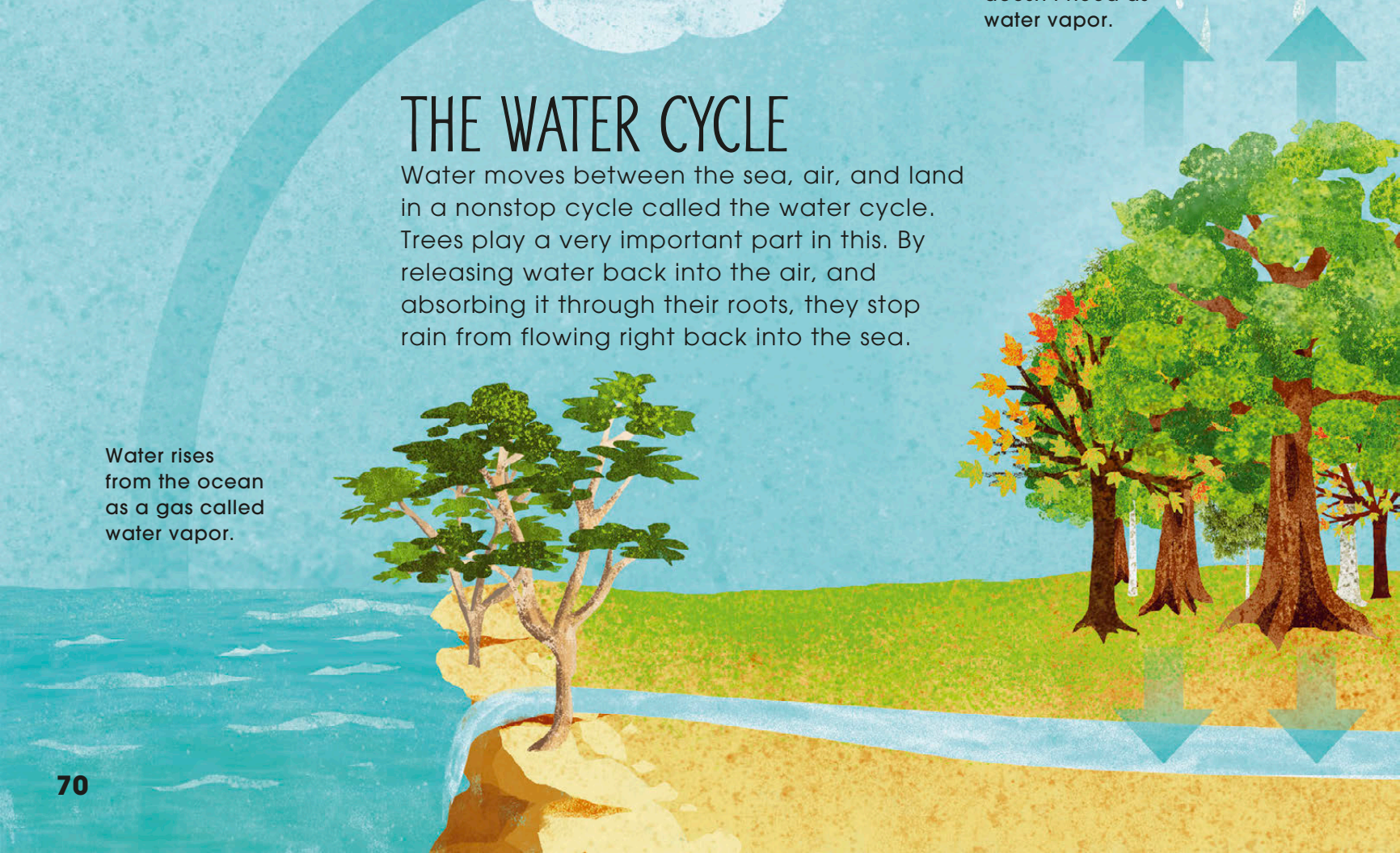
Trees are vital to every single person on the planet. They keep the earth cool and moist, which makes it a nice place to live. Trees love to soak up water, but don't worry. They are willing to share it with the rest of us. They even help to create clouds. This process is called the water cycle.

THE WATER CYCLE

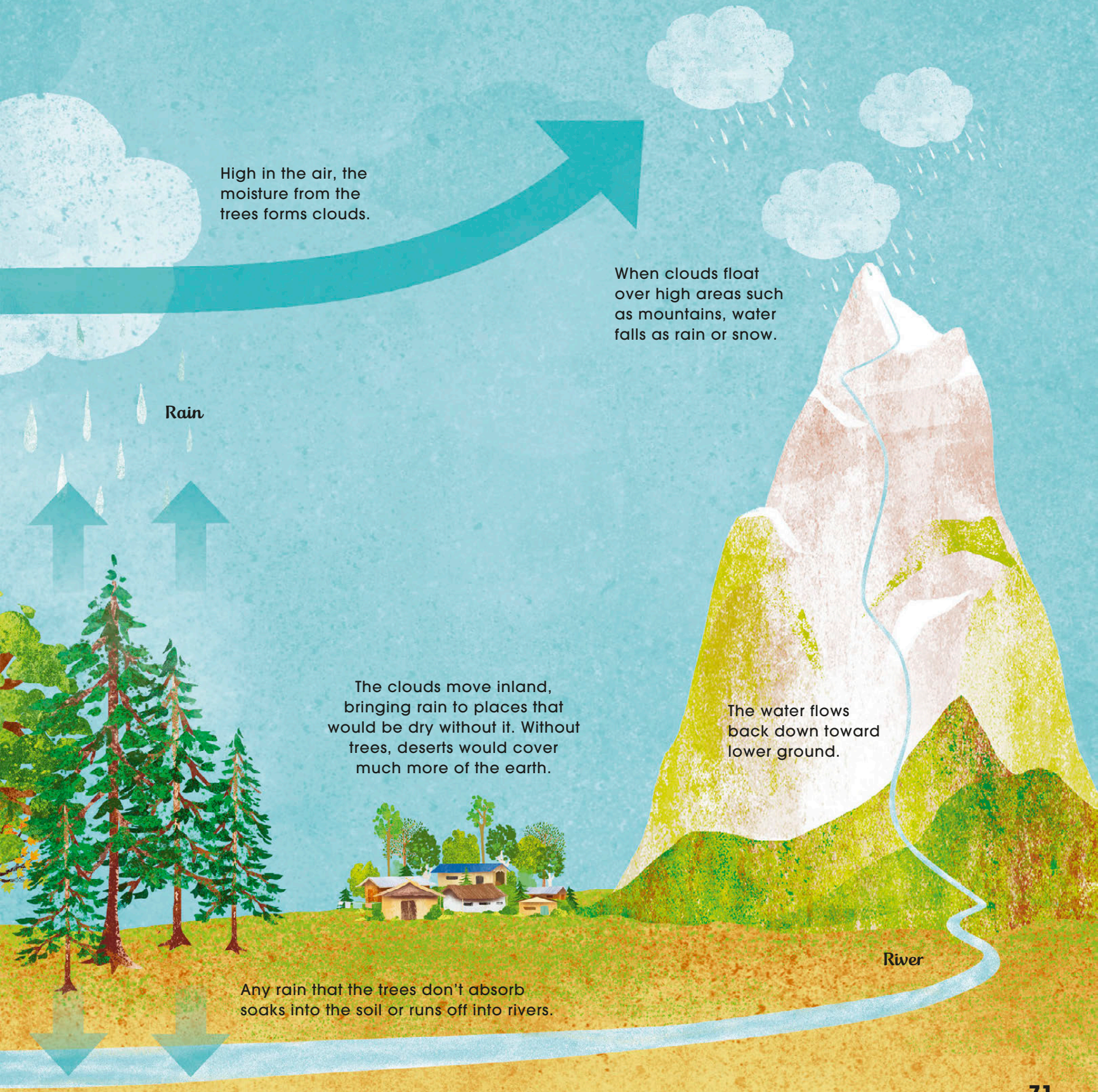
Water moves between the sea, air, and land in a nonstop cycle called the water cycle. Trees play a very important part in this. By releasing water back into the air, and absorbing it through their roots, they stop rain from flowing right back into the sea.

Leaves catch rain and give off extra moisture the tree doesn't need as water vapor.

Water rises from the ocean as a gas called water vapor.



Forests help cool the air around the earth. The planet is already warmer than it should be, but without trees it would heat up even more.



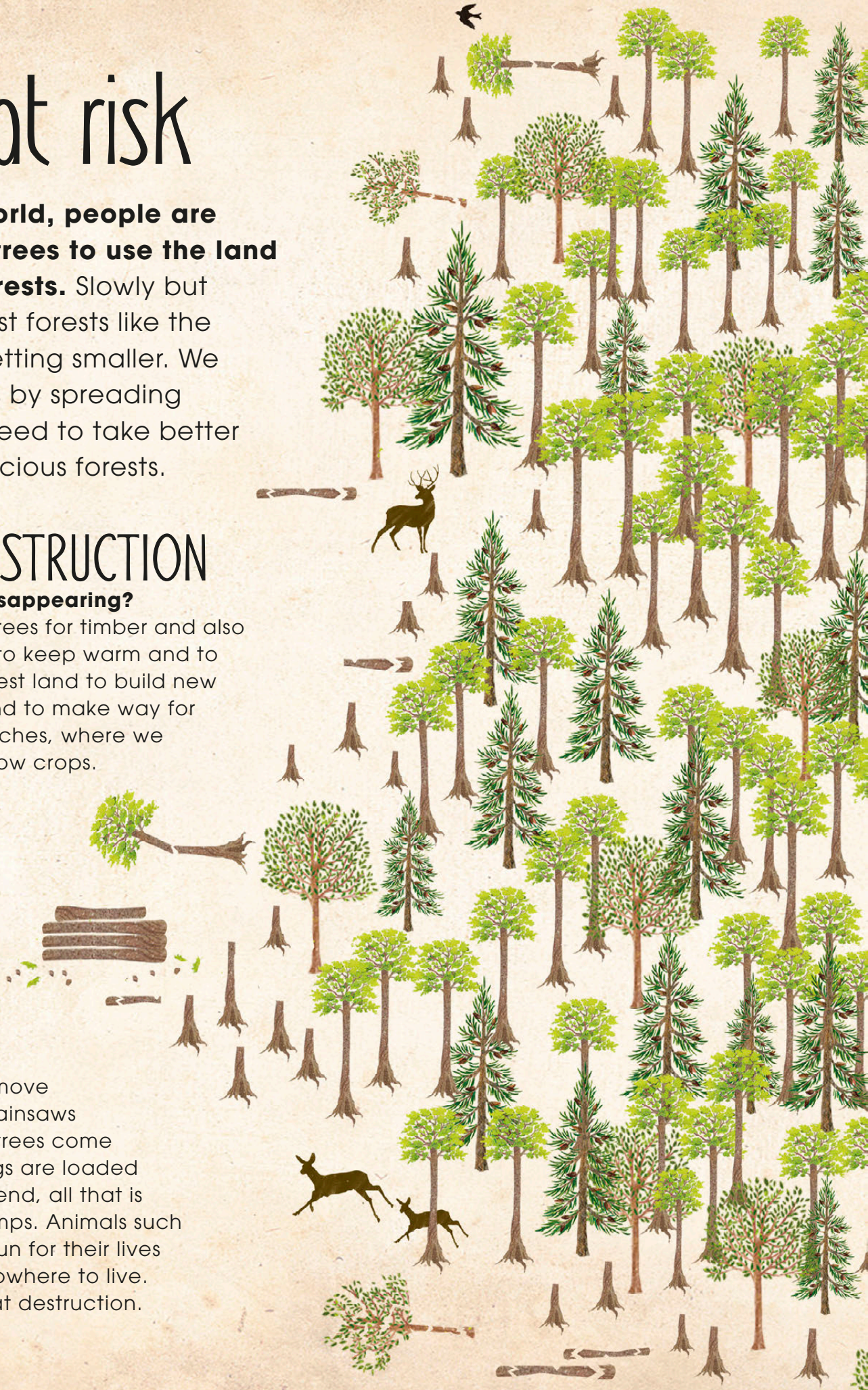
Trees at risk

All over the world, people are cutting down trees to use the land covered by forests. Slowly but surely, even vast forests like the Amazon are getting smaller. We also harm trees by spreading pollution. We need to take better care of our precious forests.

FOREST DESTRUCTION

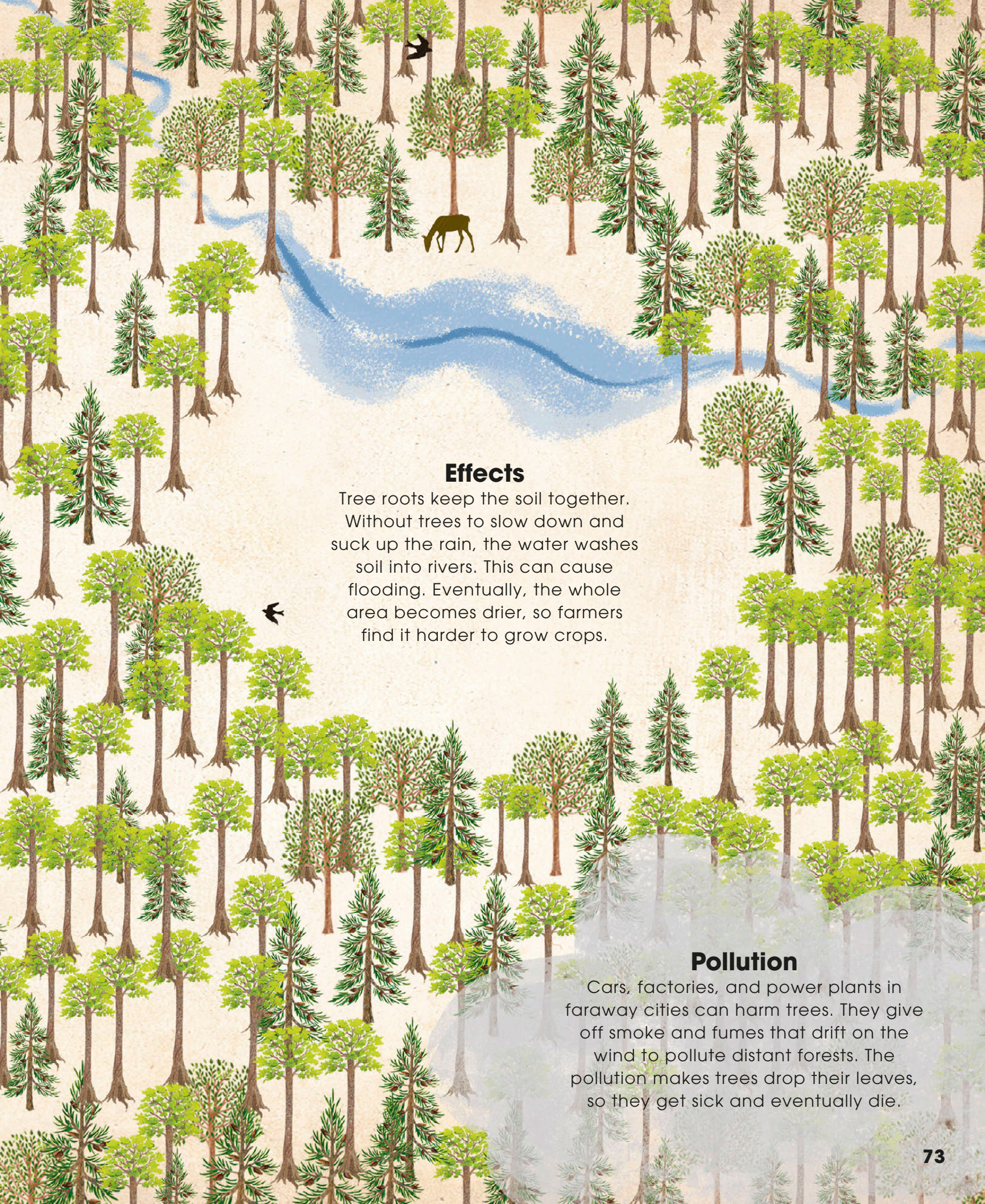
Why are forests disappearing?

People cut down trees for timber and also to light wood fires to keep warm and to cook. We clear forest land to build new roads and cities and to make way for new farms and ranches, where we raise cattle and grow crops.



Lost homes

When the loggers move in, the whine of chainsaws fills the air. Mighty trees come crashing down. Logs are loaded onto trucks. In the end, all that is left are broken stumps. Animals such as birds and deer run for their lives and are left with nowhere to live. This is called habitat destruction.



Effects

Tree roots keep the soil together. Without trees to slow down and suck up the rain, the water washes soil into rivers. This can cause flooding. Eventually, the whole area becomes drier, so farmers find it harder to grow crops.

Pollution

Cars, factories, and power plants in faraway cities can harm trees. They give off smoke and fumes that drift on the wind to pollute distant forests. The pollution makes trees drop their leaves, so they get sick and eventually die.

Helping trees

Trees deserve our love and care. After all, they do a lot to keep our world healthy. In turn, it's up to all of us to take better care of the world's trees. We can use recycled paper, or even plant a new tree.

PLANT A TREE

Make space in your garden, park, or other open space for a brand new tree. Buy a young tree (sapling) and make a home for it to grow.

Dig

Dig a deep hole in the ground. Make sure the hole is twice as wide as the roots of the tree and the same depth. Different trees like different soil, but most like loose, moist ground where their roots can grow.

Plant

Plant a sapling that you have bought from a plant nursery. Put a piece of wood across the soil around the top of the tree's roots. This will show you where the roots come up to. They should be just at ground level.

Some forests, such as national parks and reserves, are protected. Workers called foresters look after the trees and plant ones when needed.

Fill

Shovel earth into the hole, making sure it is not packed in too tightly. The sapling's roots should be completely covered but with room to grow. Tie the tree to a stake to help it stand up in the wind.

Water

Water your tree to give it the best chance to grow. Remove any weeds around it, and keep an eye out for pests. In two to three years, you'll be able to remove the stake, and your tree will stand proud on its own.

National and state trees

Different species of trees thrive in different parts of the world. People grow to love the trees they see around them as they grow up. Over time, a particular tree can become connected with a region. Many of the world's people love one tree so much they want it to represent them and have made it their **national or state tree.**

(U) = unofficial

Afghanistan Mulberry (U)
Albania Olive
Algeria Date palm (U)
Andorra Pyrenean willow (U)
Angola Mangrove (U)
Anguilla White cedar
Antigua and Barbuda Whitewood
Argentina Jacaranda
Aruba (Netherlands) Divi-divi (windblown tree) (U)
Australia Eucalyptus (gum tree)
Azerbaijan Iberian oak
Bahamas Lignum vitae
Bahrain Thorn tree (U)
Bangladesh Mango
Barbados Bearded fig tree
Belarus Birch (U)
Belize Mahogany
Benin Palm
Bermuda Bermuda cedar
Bhutan Bhutan cypress
Bolivia Breadfruit (U)
Botswana Baobab (U)
Brazil Tabebuia (Ipe-amarelo)
Brunei Mangrove (U)
Bulgaria Oak (U)
Cambodia Palmyra palm
Canada Maple
Cayman Islands Silver thatch palm
Central African Republic Baobab
Chile Monkey puzzle tree
China Chinese pine
Colombia Wax palm
Comoros Ylang-ylang (U)
Cook Islands (New Zealand) Flame tree (U)
Costa Rica Guanacaste
Croatia Beech (U)
Cuba Royal palm
Cyprus Cypriot oak
Czech Republic/Czechia Lime
Denmark Beech
Dominica Banana and palm
Dominican Republic Mahogany
El Salvador Maquilishuat
Equatorial Guinea Kapok
Eritrea Olive (U)
Estonia Oak (U)
Fiji Coconut palm (U)
Finland Silver birch
France Yew
Gabon Torchwood
Gambia Oil palm
Georgia Tree of Life (U)
Germany Oak (U)
Ghana Cacao
Greece Laurel
Grenada Banana
Guadeloupe (France) Nance (U)
Guatemala Ceiba
Guinea-Bissau King palm
Haiti Breadfruit (U)
Honduras Honduran pine
Hong Kong (China) Bauhinia orchid tree
Hungary Hungarian lilac (U)
India Banyan
Ireland Sessile oak
Israel Olive
Italy Oak and olive
Ivory Coast Palm (U)
Jamaica Blue mahoe
Japan Cherry
Kiribati Breadfruit
Kuwait Royal palm (U)
Laos Dok champa
Latvia Oak and linden
Lebanon Lebanon cedar
Liberia Palm
Lithuania Oak (U)
Macedonia Macedonian pine (U)
Madagascar Traveler's tree
Malawi Mulanje cedar
Malaysia Rose hibiscus
Maldives Coconut palm
Malta Gharghar
Marshall Islands Palm
Mauritania Palm (U)

Mauritius Earring tree
Mayotte Ylang-ylang (U)
Mexico Montezuma bald cypress (U)
Micronesia Coconut palm
Moldova Oak
Montserrat (UK) Calabash
Morocco Argan tree (U)
Mozambique African blackwood (U)
Myanmar/Burma Rosewood
Namibia Acacia (U)
Netherlands Elm (U)
New Zealand Kauri
Nicaragua Madrono
Nigeria Albizia (U)
North Korea Ginkgo
Norway Norway spruce (U)
Pakistan Deodar cedar
Palau Temple tree
Panama Panama tree
Papua New Guinea Strangler fig (U)
Paraguay Lapacho
Peru Cinchona
Philippines Narra (rosewood)
Poland Weeping willow
Portugal Olive and cork oak
Puerto Rico (US) Kapok
Romania Oak (U)
Russia Birch
Rwanda Acacia (U)
Saint Kitts and Nevis Coconut palm
Saint Lucia Calabash
Saint Vincent's and the Grenadines Breadfruit and soufriere tree (both U)
Samoa Coconut palm
Sao Tome and Principe Coconut palm
Saudi Arabia Phoenix palm
Senegal Baobab
Serbia Oak and serbian spruce
Seychelles Coco-de-mer palm
Sierra Leone Coconut palm
Slovakia Small-leaved lime
Slovenia Tilia (lime/linden)
South Africa Real yellowwood
Sri Lanka Ironwood
Sudan Palm
Suriname Suriname cherry (U)
Sweden Ornäs birch
Switzerland Murten lime (U)
Taiwan Camphor tree (U)
Tanzania African blackwood
Thailand Golden rain tree
Trinidad and Tobago Palm tree
Turkey Fig (U)
Turks and Caicos (UK) Caicos pine
Ukraine Viburnum and willow
United Arab Emirates Date palm
United States of America Oak
Uruguay Yellow poinciana
Uzbekistan Plane tree (U)
Venezuela Araguaney
United Kingdom Oak (England), Scots pine (Scotland), Sessile oak (Wales)
US Virgin Islands (US) Yellow cedar
Yemen Coffee tree
Zambia Mofu mahogany (U)
Zimbabwe Baobab (U)

UNITED STATES OF AMERICA STATE TREES

Each state of the US is represented by an official state tree.

Alabama Southern longleaf pine
Alaska Sitka spruce
Arizona Paloverde
Arkansas Pine
California California redwood
Colorado Colorado blue spruce
Connecticut White oak
Delaware American holly
Florida Sabal palmetto
Georgia Live oak
Hawaii Kukui
Idaho Western white pine
Illinois White oak
Indiana Tulip tree
Iowa Oak
Kansas Cottonwood
Kentucky Tulip tree
Louisiana Bald cypress
Maine White pine
Maryland White oak
Massachusetts American elm
Michigan White pine
Minnesota Red pine
Mississippi Magnolia
Missouri Flowering dogwood
Montana Ponderosa pine
Nebraska Cottonwood
Nevada Single-leaf pinyon and bristlecone pine
New Hampshire White birch
New Jersey Red oak
New Mexico Two-needle pinyon
New York Sugar maple
North Carolina Pine
North Dakota American elm
Ohio Ohio Buckeye
Oklahoma Redbud
Oregon Douglas fir
Pennsylvania Eastern hemlock
Rhode Island Red maple
South Carolina Sabal palmetto
South Dakota Black Hills spruce
Tennessee Tulip tree and eastern red cedar
Texas Pecan
Utah Quaking aspen
Vermont Sugar maple
Virginia Flowering dogwood
Washington Western hemlock
West Virginia Sugar maple
Wisconsin Sugar maple
Wyoming Cottonwood

Glossary

BROAD-LEAVED
Tree with wide, flat leaves. Broad-leaved trees produce fruit containing seeds.

CARBON DIOXIDE
Gas in the air, which plants use to make food.

CHLOROPHYLL
Green color in a tree's leaves, which absorbs (takes in) sunlight.

CLONE
Identical copy of an animal or plant.

CONIFER
Type of tree that produces cones containing seeds.

CROWN
Leafy part of a tree.

DROUGHT
Long period without rain.

EQUATOR
Imaginary circle around the earth's middle.

FERTILE
When a plant or animal is able to have young. Trees make seeds when their flowers become fertile.

FUNGUS
Group of living things that includes mushrooms, toadstools, and molds. The plural of fungus is fungi.

GRUB
Young insect that looks like a worm.

HABITAT
Natural home of plants or animals, such as a forest or meadow.

HEARTWOOD
Wood at the center of a tree trunk, which grew when the tree was young.

HYPHAE
Tiny, branching threads that allow a fungus to feed.

MANGROVE
Tree that grows in a coastal swamp.

MINERALS
Natural substances that plants get from the soil.

NECTAR
Sugary liquid produced by flowers to attract insects.

NUTRIENTS
Nourishment. Plants get nutrients from the soil.

OXYGEN
Gas in the air, which all living things need to live.

PHLOEM
Layer under a tree's bark that transports food.

PHOTOSYNTHESIS
Process by which leaves turn sunlight and carbon dioxide into food and oxygen.

POLLEN
Tiny grains that combine with a plant's eggs so it can make seeds.

PREDATOR
Animal that hunts other animals for food. Also called a carnivore.

PREY
Animal that is hunted for food by other animals.

REPRODUCTION
When plants or animals have young.

ROOTLET
Tiny root covered with fine hairs.

SAPWOOD
Outer rings of wood in a tree trunk, which have grown in the last few years.

SEED
Part of a plant that is able to grow into a new plant.

SEEDLING
Young plant or tree.

TAPROOT
Tree's main root, which grows straight down into the soil.

VEINS
Tubes that carry water around a leaf and help it keep its shape.

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