



WWU
MÜNSTER

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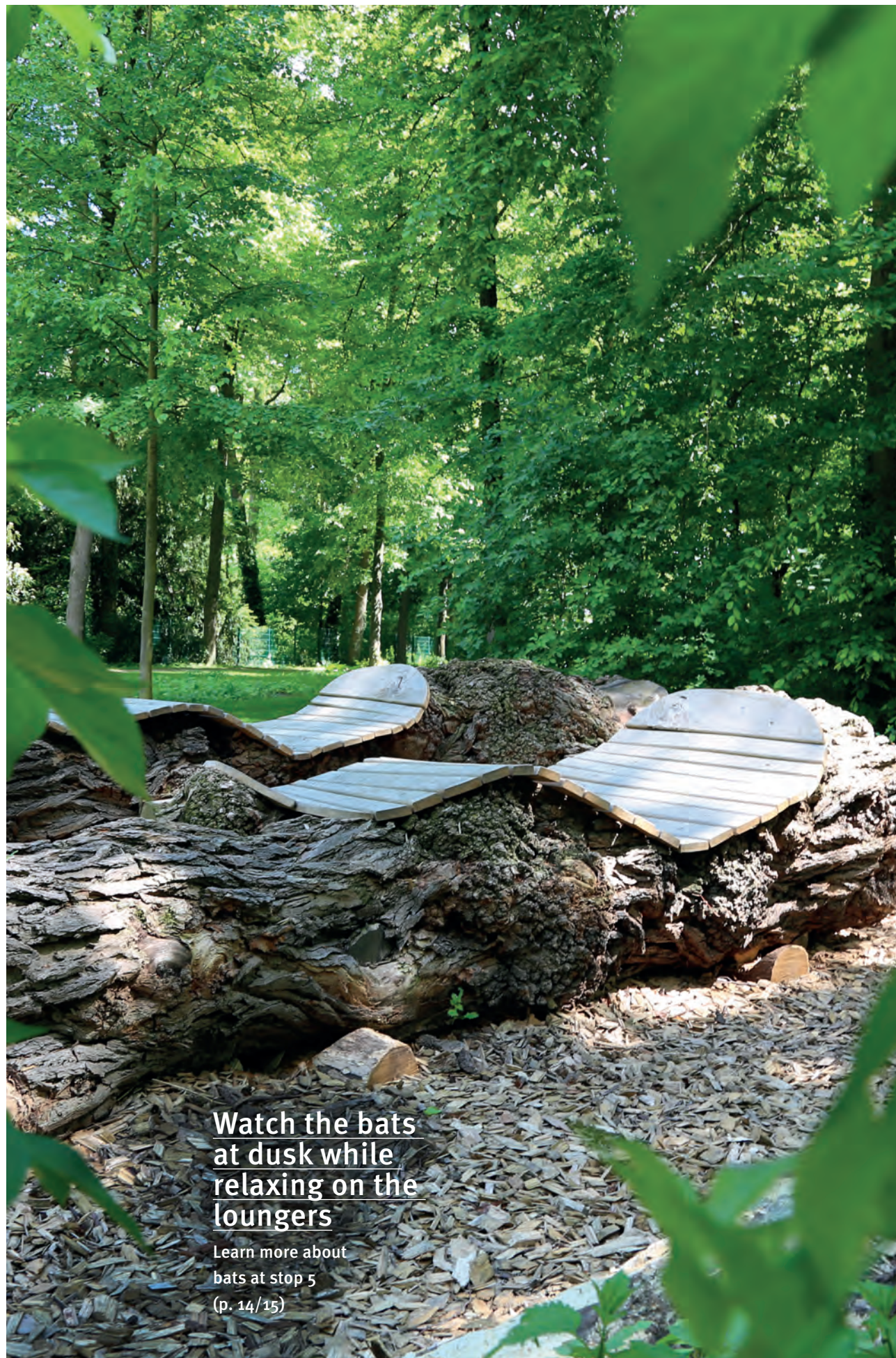
Why doesn't a woodpecker get headaches?

**Take a nature discovery
tour through the
WWU Schlossgarten!**

living.knowledge



**Tree
Discovery
Trail**



**Watch the bats
at dusk while
relaxing on the
loungers**

Learn more about
bats at stop 5
(p. 14/15)

Introduction

A big hello to all visitors of the Tree Discovery Trail!

We're delighted that you've made your way to the Schlossgarten – the Residence garden – here at the University of Münster (WWU). At each of the stops on our Tree Discovery Trail, you will find information about various topics of the “tree eco-system”. These include woodpeckers, deadwood and mushrooms, insects, the uses of wood, bats and tree varieties.

Texts and illustrations provide easy-to-understand information, and at the same time, challenge you to test your knowledge. There are also opportunities to try things out and experience them with your senses. Have we whetted your appetite for more? Then let's go!

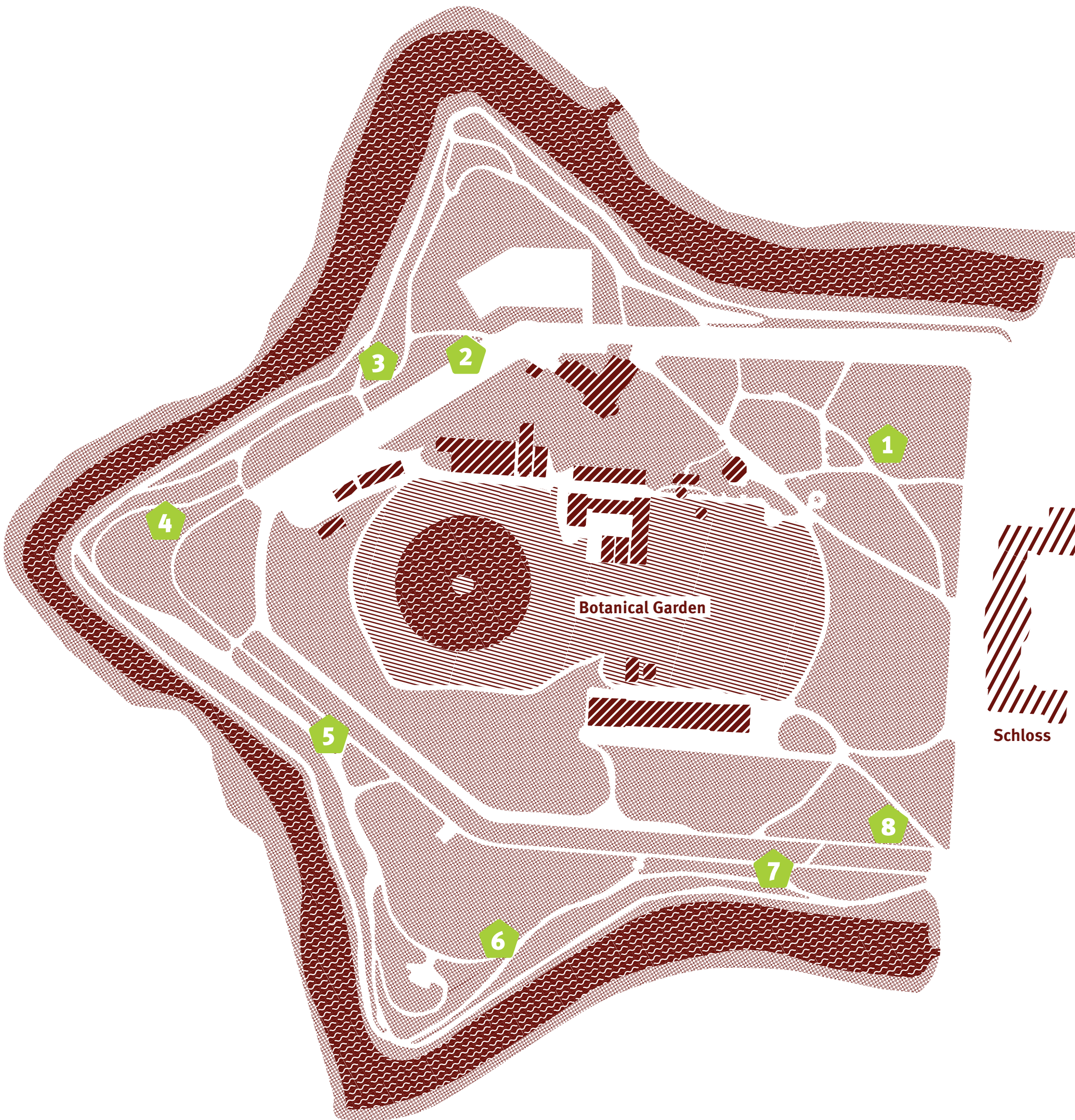
Being considerate

Dear Visitors,

Please show consideration for the plants and animals when you walk through the garden.

- › Keep to the paths. This will prevent the soil around the information stops from becoming too compact and the trees' roots from being damaged. It also means you won't accidentally tread on any plants or animals.
- › Don't leave any litter behind.
- › Don't be too loud – otherwise you might frighten or scare off any animals you want to watch.

Thank you!



Map and Content

Stops on the Tree Discovery Trail

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Legend

- Tree Discovery Trail
- Botanical Garden
- building
- lawn
- castle
- water
- paths

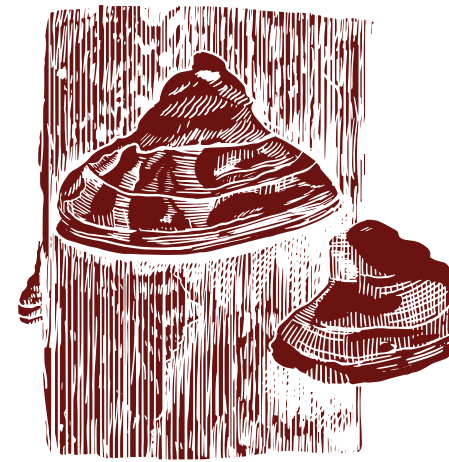
Veteran tree: The copper beech

A witness to history

Welcome to my stop! I was once a copper beech, and I'm a real old-timer for a tree. I lived for about 220 years, and I was already standing here at the time of Napoleon. For 15 years I was cared for while I was dying – until I had to be cut down for safety reasons. The University has planted a new copper beech on the spot where I used to be. Have a look at it – it stands at the end of my trunk. This is life's natural cycle: old things die, new ones are born.

I've been lying here since 2015 and can now decay. But I'm also making an important contribution to biodiversity in the garden here – even if it doesn't look like it at first sight. And how does that work? As dead-wood I provide an important habitat for lots of animals, plants and mushrooms.

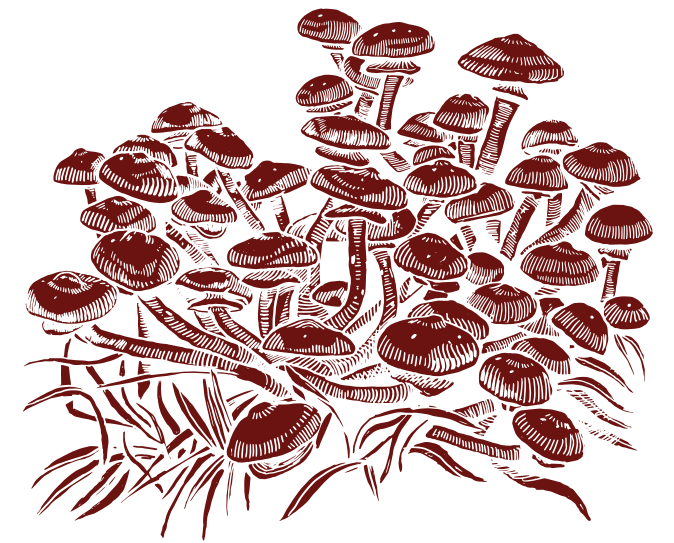
Old things
die, new ones
are born



Mushrooms

Mushrooms play an important part in the natural cycle of life. Walk around me and take a closer look at my trunk. I provide a home to the three types of mushroom shown in the pictures. Can you find them?

As you can see, mushrooms come in many shapes and sizes. The part of a mushroom that you can see above the ground is called the fruiting body. But the largest part of the mushroom is a network below the surface of the earth. Mushrooms, bacteria and lichens cause the wood to decay over a period of years, making it useful for other forms of life, such as insects. The humus formed provides fertile soil for countless plants.

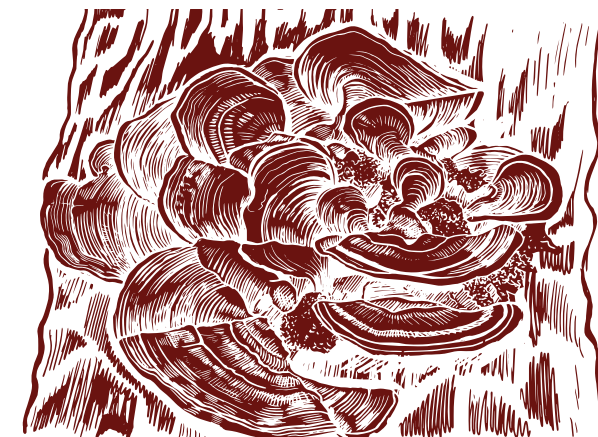


What's the answer?

(see p. 58)

1. Can you guess what people used the tinder fungus for in earlier times?
2. What's the biggest living thing in the world?
3. Do you know which of the three mushrooms is edible?

At stop 3 you can learn more about the life cycle of trees and their importance as deadwood in forests. But before you move on, let me tell you something about my neighbours here in the park: the great spotted woodpecker and the European green woodpecker.

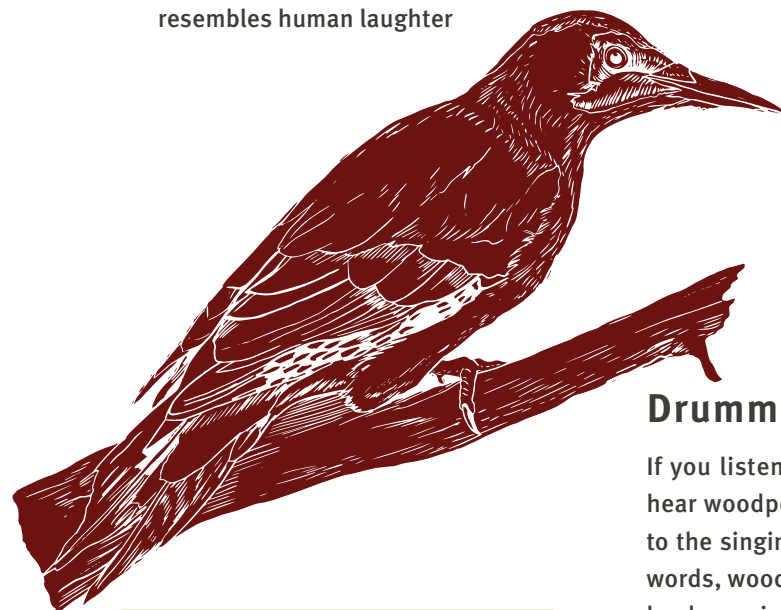


Woodpeckers

There are two species of woodpecker to be seen in the garden: the great spotted woodpecker and the European green woodpecker. If you look through the sight tube, you can see on the trees opposite the cavities they have made into their homes.

European green woodpecker

- › Is distinguished by its red crown and green coat
- › Is between 30 and 36 centimetres in size
- › Most of the time, you can see it on the ground, where it tirelessly seeks out its favourite food: Ants
- › It has the longest tongue of all the woodpeckers and is able to stick it out to a length of up to ten centimetres
- › Its characteristic call of »kyü-kyü-kyück« resembles human laughter



Nehmt den Schlägel und lasst ihn an der Holzvorrichtung herunter rattern, während ihr von 21 bis 22 zählt. Das klingt in etwa wie der Trommelwirbel des Spechts.



Great spotted woodpecker

- › Is the most common species of woodpecker found in Germany
- › Is 22 to 23 centimetres in size, about as big as a blackbird
- › Has bright black, white and red feathers. The male differs from the female in having a red patch on its nape
- › Feeds mainly on insects and their larvae, which it retrieves from under the bark of trees. Its diet also includes nuts, berries and seeds
- › Its most common call – a short, loud »kik« – can be heard all year round

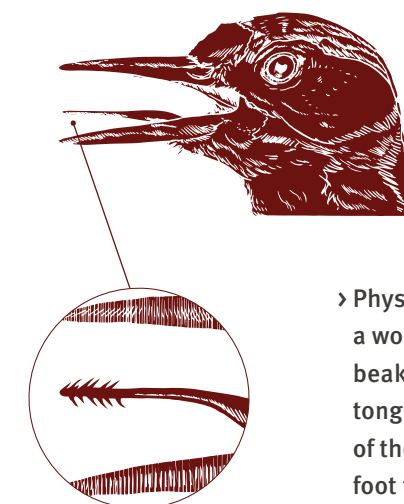
Drumming – the woodpeckers' language

If you listen carefully in spring, when the weather's fine, you can hear woodpeckers' drumrolls in the garden here. These correspond to the singing sound made by other birds – in other words, woodpeckers communicate with one another by drumming. They use it to mark off their territory or to attract a mate. Different species of woodpecker have different drumrolls all their own. The drumrolls differ in their rhythm and their length, as well as in the length of the gap between the beats in a roll. A drumroll in the greater spotted woodpecker lasts for about two seconds and consists of 10 to 16 beats. Quite a feat, Woody Woodpecker!

woodpeckers communicate with one another by drumming

Physical characteristics

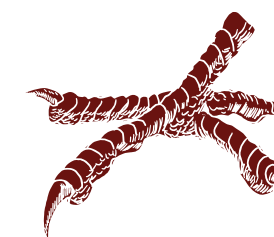
For building their nests, woodpeckers have the tools they need on their bodies. To chip away the wood, they use their strong, pointed beak. And in other ways, too, they are perfectly adapted to their habitat. The tongue is long and worm-like to enable the woodpecker to find and catch insects under the bark of trees or in crevices in the wood. The bird's zygodactyl feet, together with the strong stiffened tail, provide support and safety on tree trunks.



› Physical characteristics of a woodpecker: chisel-like beak with projectable tongue; bristles on the tip of the tongue, zygodactyl foot for climbing and a stiffened tail

Nest-building

To build their nests, woodpeckers mostly look for weakened trees in which the bark or trunk is damaged, e.g. by storms or frost. Then they use their powerful beaks to make a hole in the trunk, removing the wood, layer by layer. Woodpeckers don't spend all day building their nests, just for a few hours at a time – and the male and the female take it in turns. After the bird has been working for a while, it takes a beakful of chips and throws them aside. Gradually, the hole becomes bigger until finally it is deep enough for the woodpecker to disappear into the nest completely.



If you look through the sighting tube, you'll spot their carved hole in a tree across the way!

What's the answer?

(see p. 58)

1. Woodpeckers create an important habitat for other animals which use trees. Which animals do you think these might be?
2. How long is the incubation period for greater spotted woodpeckers? And when do the young birds leave the nest?
3. Why doesn't a woodpecker get headaches?



Deadwood

Deadwood means life and biodiversity

What we mean by “deadwood” is trees – either standing or lying on the ground – which have died. Deadwood results from several different causes: trees dying of old age, natural disasters, such as forest fires or hurricanes, lightning, snow and ice, or other environmental impacts. As you noticed at the veteran tree at stop 1, deadwood is anything but dead. Even after a tree has died, it provides a habitat for beetles, mushrooms and birds, for example. This means that deadwood is an important part of a forest, providing a basis for the existence of many living things.

Here you see a copper beech tree which lived for about 150 years. It was about 35 metres tall to the very top of the tree. It had to be cut down in February 2015 for safety reasons because it had become unstable. Why do you think the trunk was left standing on this spot? Exactly – so that it could continue to provide a home for other “residents”!

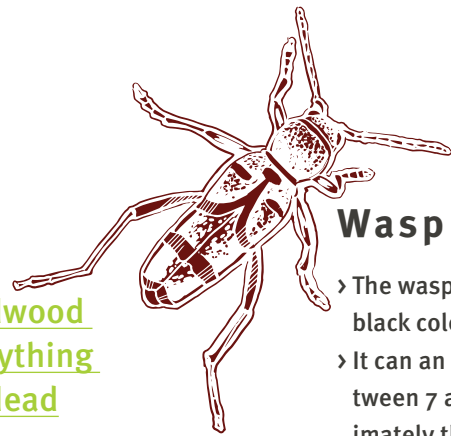
A habitat for insects

Many insects depend on deadwood in certain phases of decay and decomposition. Ants and butterflies find their habitat here, for example. Many of our species of wasps and bees also need old wood and deadwood for their survival. Wasps, for example, use wood as material for building their nests, and many bees live or hibernate in dead tree trunks.

Many types of beetle live on wood in various stages of decay. Here in this garden you can find the wasp beetle (Clytus arietis), the black-headed cardinal beetle (Pyrochroa coccinea) and the spotted longhorn (Rutpela maculata). Also, deadwood provides a winter home for a whole range of beetles – including many ladybirds. Have a look around – maybe you can discover one of the beetles!

Deadwood is anything but dead

Many bees live in dead tree trunks



Wasp beetle

- › The wasp beetle has a striking yellow and black colouring.
- › It can attain a body length of between 7 and 14 mm – which is approximately the diameter of a one-cent coin.
- › It belongs to the family of longhorn beetles (Cerambycidae).
- › It is the most commonly found member of its species in Central Europe.
- › It gets the name “wasp beetle” from its resemblance to paper wasps – camouflage that protects them from predators.
- › This form of camouflage is called mimicry. This occurs in some creatures when they imitate others in order to deceive their enemies or to attract prey.



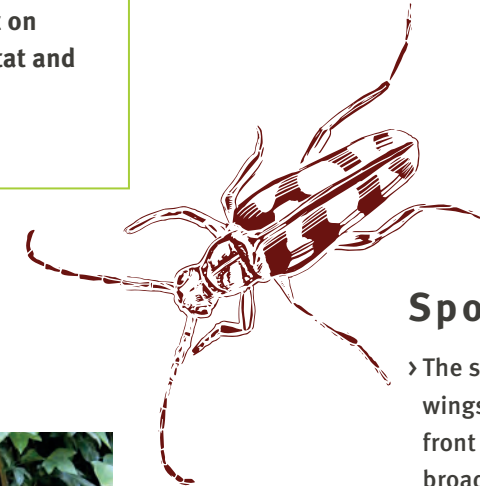
Black-headed cardinal beetle

- › The wing covers and the pronotum are bright red, while the rest of the body is a deep black.
- › It grows to a length of 14 to 18 mm.
- › It has a broad, flat body.
- › It can be found especially on blossoms and on deadwood.
- › The fully-grown beetle feeds on tree sap, nectar and the honey dew of aphids (greenfly).
- › The larvae live off other insects and these insects' larvae.

What's the answer?

(see p. 59)

1. Can you name any animals or insects that use “mimicry”?
2. How many species of animals and plants are dependent on deadwood for their habitat and as a source of food?



Spotted longhorn

- › The spotted longhorn is black with yellow wings which have black markings at the front and, towards the end of the body, broad black crosswise stripes. Its antennae are ringed black and yellow.
- › It grows to a length of 14 to 20 mm.
- › It can often be found sitting on umbellifers.
- › It feeds on nectar, as well as pollen and stamens.
- › The larvae delve deep into old trees that are rotting.
- › By rubbing its back legs against its wing covers, the beetle is able to produce chirping sounds.

Injuries

Take a close look at the trunk of the copper beech. Do you notice anything strange? The so-called tree-wound tissue is quite visible. Any idea what might have occurred here? About 20 years ago, a thick branch was sawn off. During the healing process, the copper beech sealed off this wound on the outside by means of this callus, the wound tissue. This process to protect against infection is very similar to how our skin forms scabs.

Do you notice anything strange?



A few steps further, you'll find the trunk of a chestnut tree. It shows you quite clearly all the things the tree has experienced.



Life cycle

Old things pass away, new things take their place. That's the natural life cycle. When weakened trees die off, this prevents a forest from growing unchecked and nutrients in the soil from becoming scarce. Mushrooms and insects see to it that the tree decomposes completely, which means that all its nutrients return to the earth. This process of decomposition is necessary for our environment. Nature is an expert at recycling – and is a role model for us as regards sustainability!

Nature is an expert at recycling

Both of these trunks have lain here for 15 years. As you see, they are now in an advanced state of decay. But do you know the phases which deadwood passes through?

Turn the disc and find out!

What's the answer?

(see p. 59)

1. How many years does it take for a dead tree to decay completely?
2. Why does deadwood sometimes look brown, and sometimes white?



> a healthy tree



The oak tree



› Oak leaves and acorns

The Queen of the Forest

Trees play an important role in our customs and traditions. In tree symbolism, the majestic oak – the “Queen of the Forest” – stands for strength, freedom, honour, vitality and immortality. The oak is a typical tree under which justice was dispensed for many centuries. The idea was that the properties attributed to the oak would have a positive effect on the justice of the judgements passed.

The fruit of the oak – the acorn – is a typical feature of the tree. Acorns are very nutritious because of their high content in starch, fat and proteins, but are inedible for humans because of the bitter substances they contain. Have you heard the saying “The best hams grow on oaks”? What is meant by this is that, for centuries, boars were fattened up on nutritious acorns, and so people said that pigs fed on acorns provided tasty meat and firm ham.

“The best hams grow on oaks”

As for its strength, oak is well-known for being a very hard wood, and this is why it is often used in the production of furniture and for parquet flooring. But that’s not all! Did you know that oak wood that has been stored for a long time is so hard that you can’t even hammer a nail into it? And oak wood doesn’t decay as long as it is kept under water without oxygen. This is why, in the Dutch city of Amsterdam, both the railway station and the houses along the historic canals are built entirely on oak piles.



What’s the answer?

(see p. 60)

1. How many different types of oak tree are there worldwide?
2. How many kilograms of acorns does an oak produce in a year?
3. What age can oaks live to?
4. Many people carry an oak leaf around with them every day. How can that be?
5. Can you guess how old this (common) oak is, how tall it is, and how much the circumference of its trunk measures?

Trees have lots of good properties! They...

› reduce noise

› produce wood

› provide fruit

› filter dust and other pathogens such as bacteria and harmful fungi out of the air

› improve the soil with humus from fallen leaves and deadwood

› create habitats for numerous species of animals and are a source of food for them

› provide shade

› make our towns and cities more attractive

› reduce wind speed



Trees – Nature’s air-conditioning system

- › Trees can transport water out of the ground up to a height of 100 metres – a spectacular physical achievement! Most of the water evaporates through the leaves, thereby contributing to humidity.
- › Trees consume more carbon dioxide (CO₂) than the oxygen (O₂) they produce. How much a tree can contribute to good air quality depends above all on the diameter of its crown and on how many leaves it has.
- › A 150-year-old beech tree, for example, produces around 11,000 litres of oxygen per day, which is the daily requirement for about 26 people. Every day around 500 litres of water evaporate through its leaves – the equivalent of four bathtubs.

Evaporates 500 litres of H₂O every day – the equivalent of four bathtubs



Produces 11,000 litres of O₂ every day for 26 people

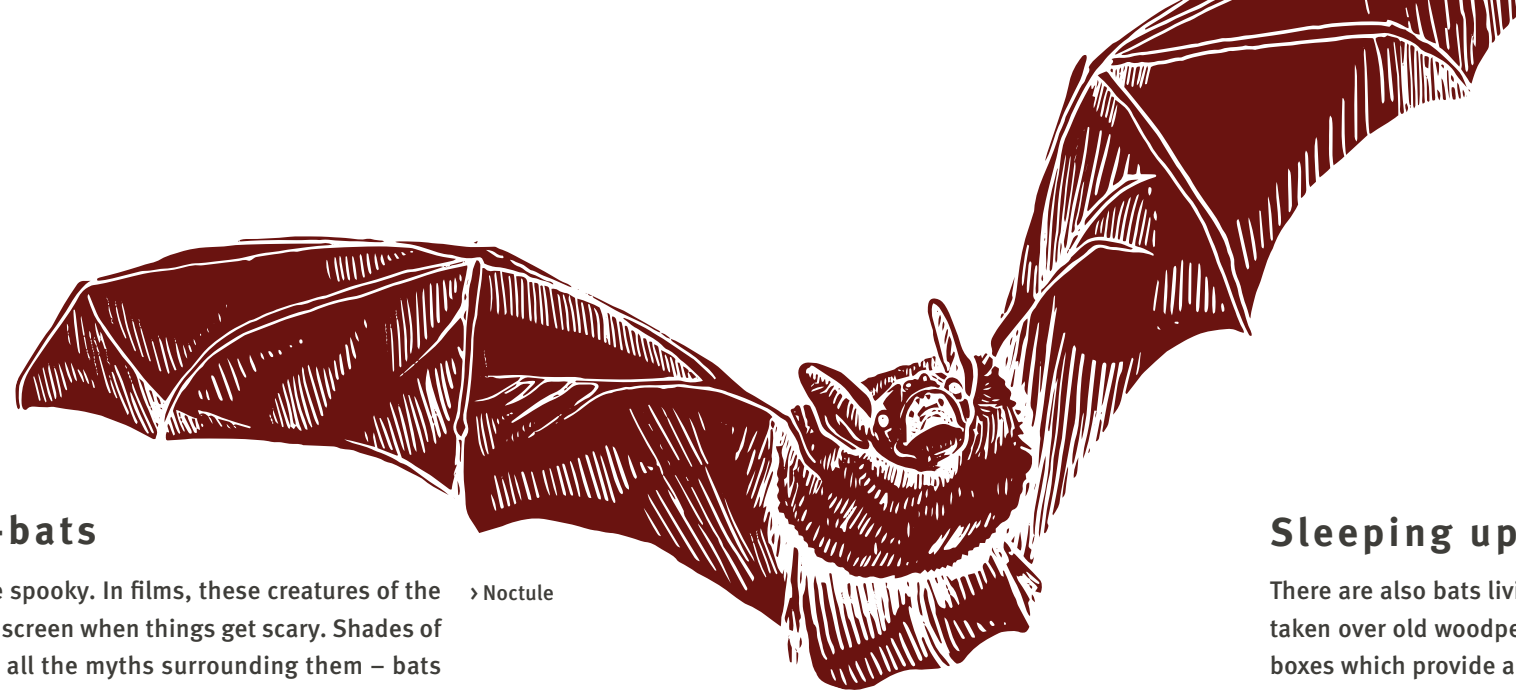


Bats

Nocturnal acro-bats

A lot of people think bats are spooky. In films, these creatures of the night often flutter across the screen when things get scary. Shades of Dracula! But – in contrast to all the myths surrounding them – bats are fascinating animals. They “see” with their ears and are the only mammals which can actively fly. Not bad, eh?

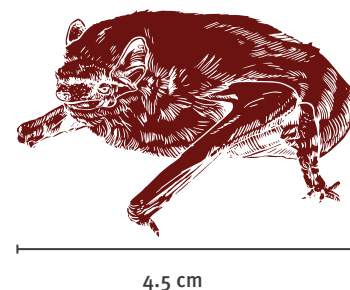
Do you know what it means when we say that bats can “see” with their ears? They are nocturnal animals, which is why they don’t use their eyes much. But they still need to navigate, so they have developed the ability to listen to their environment. This helps them to find the entrance to their cave, for example, or detect their prey. Bats emit high-pitched – so-called ultrasonic – sounds which we humans cannot hear with our ears. If the tone the bat produces hits an insect, it comes back as an echo. The bat picks up this echo and can navigate towards it. This happens instantaneously, which means that the bat can change the direction of its flight at any time. What’s special about this is that every echo is different! This means that the echo which comes back from an insect’s carapace sounds different from the one coming back from a person. So bats can recognise quite clearly what is in their surroundings. Thanks to this system, they can detect insects and obstacles and can even estimate how far away they are.



› Noctule

› Two species of bats found in the Schlossgarten

› Pipistrelle



4.5 cm

Breaktime

Before our last stop, you have earned a break! Relax on the loungers and, with a little luck, you’ll be able to watch the bats swarming out in the dusk as they set out to hunt for prey. When they fly out of their shelters, they take their bearings from structures with straight lines, so-called flight paths. From your lounger, you’ll have a perfect view of their flight paths.



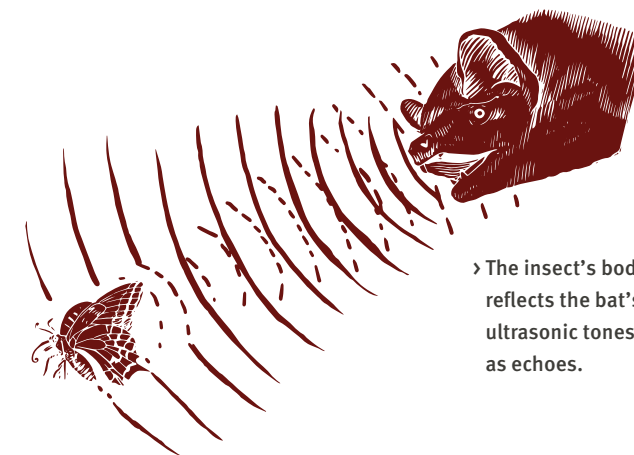
Sleeping upside down

There are also bats living in this garden here. The bats have not only taken over old woodpecker nesting boxes. There are also several bat boxes which provide a refuge and a home for them. The common and the lesser noctule bat and the common pipistrelle bat have made their home here. Can you imagine what the inside of such a bat box looks like? Bats don’t sit like birds do, in self-made nests or on branches: they hang upside down, perfectly relaxed! And what happens when they fall asleep? Even then, they don’t fall down. And why not? The claws on their feet curve automatically through the bat’s weight, enabling it to stay suspended while it sleeps. It only uses its muscles when it wants to release itself from this position.



Hibernation

Just like other native mammals, such as the common dormouse or the hazel dormouse, bats hibernate. During the cold season there are not enough insects for a bat to feed on. However, hibernation is not real sleep such as we humans know it. The bats fall into a kind of dormant state, but they still register what’s going on around them. In this state they wind down important functions such as their heartbeat and their metabolism. Their body runs in economy mode, enabling them to save energy and conserve their strength. As a result, bats can survive for around five months, living on just the reserves of fat they have consumed beforehand. Bats hibernate from late November to late March, seeking out tree cavities, rock caves or cellars for the purpose, and they often cuddle up close to each other.



› The insect’s body reflects the bat’s ultrasonic tones as echoes.

What’s the answer?

(see p. 60)

1. Take a guess: how small is the world’s smallest bat?
2. How big is the world’s largest bat?
3. Up to how many ultrasonic sounds can a bat emit in one second?
4. How many midges does a bat eat in a night?



The uses of wood

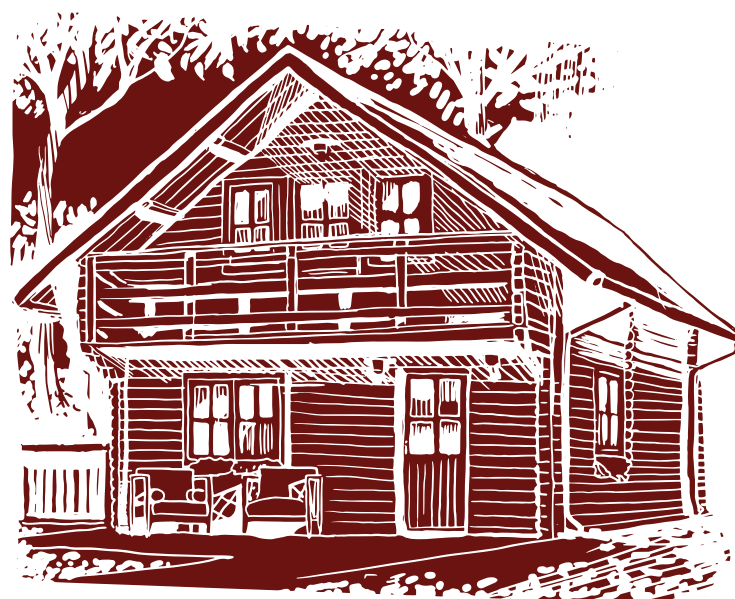
Wood – a raw material, from paper to parquet

Wood from a variety of tree types can be used for many different things. Furniture, flooring, musical instruments, houses or paper – all of these can be made from wood. As can other things which we can hardly imagine living without in our daily lives – coffee filters and tea-bags, for example.

This explains why wood is one of the most traded raw materials. Although trees grow again, this growth takes a long time – depending on the type of tree. This is why the idea of sustainability is important: for every tree which is felled, a new one should be planted. For more than 200 years now, this has been the principle underlying forest management in Germany.

What does sustainability mean exactly? Sustainable action means that we do not harm the environment, and that we behave in such a way that all living things, and future generations too, have a good life on our Earth. And every one of us can make his or her contribution to protecting the Earth. Take care of the environment around you in your everyday lives and help to protect it!

*Listen carefully...
The Schlosspark
is full of sounds.
Leaves rustle,
branches creak,
birds chirp.
Sometimes it's
loud, sometimes
quiet. Sometimes
the tones are
high-pitched,
sometimes low.*



What's the answer?

(see p. 61)

1. Guess how many people work in forest management and the wood industry in Germany.
2. Why do you think the wooden xylophone has different tones?
3. Where do you find wood used in your everyday lives?
4. Can paper be “wood-free”?

Musical instruments

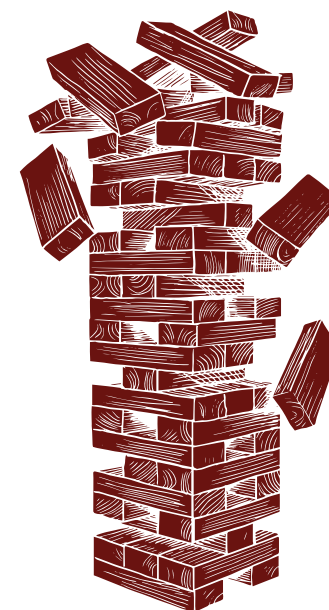
Some of the wood from trees which are cut down in Germany in line with sustainability principles is used for making musical instruments, such as violins and guitars. If you listen to the sounds these instruments make, what you hear are the vibrations of the wooden soundboard, which transfers the vibrations into the air. Any wood which is suitable for

*“The forest
prompts us
to listen.”*

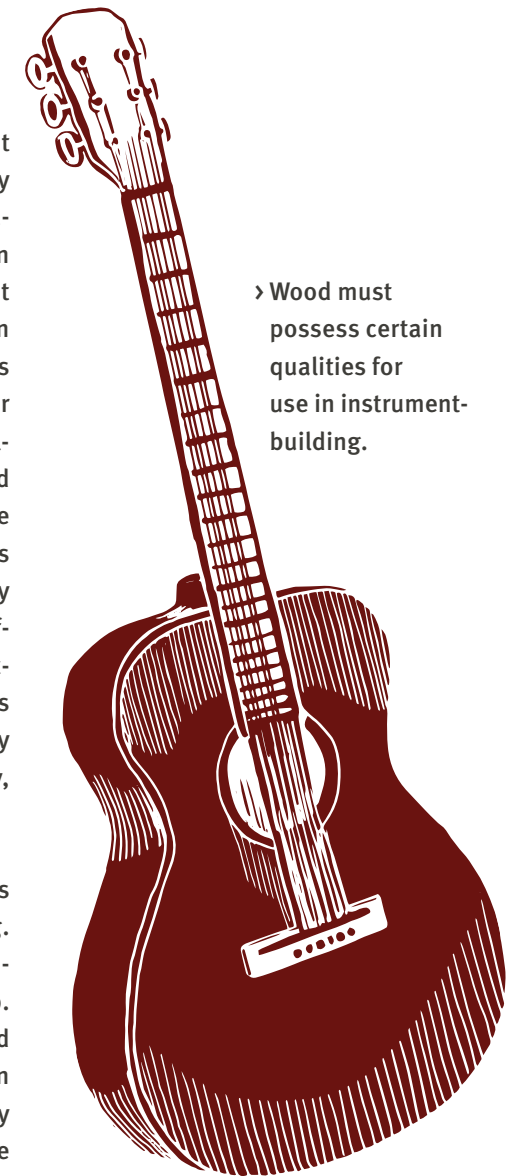
Hermann Hesse

making musical instruments is called tonewood. The ideal tonewood tree has regular tree rings, close together, which means that it was able to grow with a steady supply of water. The wood from spruce trees is often used to make string and keyboard instruments. In the case of idiophones, such as the xylophone, the wood has to be especially heavy to make the tones last longer. Mainly, tropical wood is used for these.

This garden is also full of sounds: leaves rustling, branches cracking, birds tweeting. Sometimes loudly, sometimes softly; sometimes the tones are high, sometimes deep. Now it's your turn to join in! Grab a mallet and play on our xylophone. Compose your own forest symphony and listen to how differently the tones sound which are produced by the various types of wood.



*Look around your
home – what things
are made out of wood?
You'll be surprised
how often wood is used
as a material!*



› Wood must possess certain qualities for use in instrument-building.



The Xylophone – an “idiophone”!

Our xylophone

All of a sudden, a heavy branch snaps in a gust of wind and falls onto the branches below. When wood knocks against wood, it can make many different sounds. And when tall trees sway back and forth in a storm, you can hear them creak and groan.

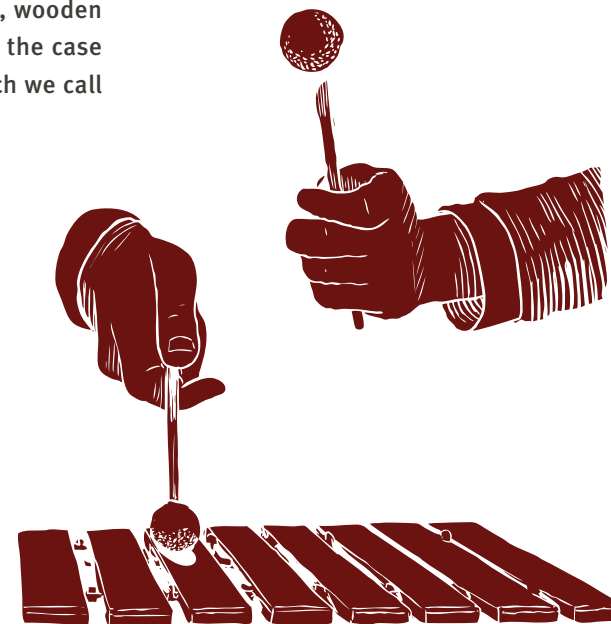
Depending on its composition, wood produces sound that can be higher or lower, louder or softer, and differ in tone and resonance. When you toss a piece of split firewood onto a pile, listen very carefully. Each piece makes a slightly different sound when it strikes the pile. And if you have a very good ear, you’ll be able to tell by its sound whether the piece was short or long, thick or slender, heavy or light. You might even be able to discern whether it was made of spruce, beech or fruit tree. This discovery and the joy of making sounds is what led humans to invent the xylophone – in Africa, Asia, Europe, in prehistoric times and any place where wood is used.

Xylophones belong to the class of instruments called “idiophones” which means they are made of a material that vibrates when struck and emits sound. In the xylophones you’ve seen at school, wooden bars are placed across an open wooden case. If you touch the case while playing, you’ll notice it vibrates. This vibration, which we call resonance, amplifies the sound.

What’s the answer?

(see p. 61)

1. Why does our xylophone make different sounds?
2. How is the one row of wooden bars different from the other?
3. In what way can you hear the difference?
4. When you tap the row of bars of the same length, can you tell which type of wood (or trees) is used?
5. What kind of wood sounds best to you?



How our xylophone works

Our xylophone consists of eight wooden bars arranged in a row, each approximately equal in length and made of different kinds of wood from our region. The result is a fascinating and completely new “musical scale”. Not only do the bars produce sounds at different pitches, but also different tones which is largely the result of their growth composition. You can see how they vary in colour and grain. With your fingers you can feel their different qualities – smooth or rough, hard or soft, cool or warm, light or heavy. And if you carefully strike them with the mallet – or even better, knock with your knuckles – you can hear their very unique sound which mysteriously changes depending on where you knock. In the second row, you will find eight more wooden bars. These are made of the same type of wood but are cut at varying lengths. Here you can discover how the different lengths affect the pitch.

Now it’s your turn!
Grab a mallet and play on our xylophone. Compose your own forest symphony and hear how different each wooden bar sounds.

Your concert is sure to delight the other visitors and the many animal residents of the park (as long as it’s not too loud).



Tree calendar

The diary of an oak tree

The trunk of this oak tree is a good example of how every tree writes a diary about its life. As the tree grows, new growth rings appear every year – in spring, a light-coloured ring, and in autumn, a dark one. This means that we can tell a tree's age by looking at its growth rings. Broad rings testify to good years with a lot of moisture. Narrow rings bear witness to bad years, when it was cold, for example, or dry. This oak here lived to an age of around 130. It had to be cut down because it had become rotten in old age and was in danger of falling down.

Our tree calendar shows you which historical events this tree experienced during its life. Pretty impressive!

Have you taken a look at the stump behind our tree calendar? It's gigantic! This is where a copper beech once stood, but had to be cut down because of a brittle cinder fungus. Its trunk measured 1.6 m in diameter one metre above the base, and not at ground level where you can see the roots radiating away from the trunk. At 35 m in height, this copper beech used to be one of the tallest trees in the Schlossgarten.

2017 Donald Trump becomes US president

2016 BREXIT. Great Britain votes to leave the EU

2010–2012 Euro crisis

2005 Angela Merkel becomes German chancellor

2002 Introduction of the euro

1996 Dolly the Sheep becomes the first cloned mammal

1990 German reunification

1989 Fall of the Berlin Wall

1983 Official opening of the "Bed Towers" of the University Hospital Münster (UKM)

1969 First moon landing

1965 The University of Münster appoints its first woman professor

1961 The Berlin Wall is erected

1957 The Soviet Union sends "Sputnik", the first satellite, into outer space

1954, 1974, 1990, 2014 Germany is the football World Cup champion

1952 First "Tagesschau" news programme is broadcast

1949 Founding of the GDR

1945 End of World War II

1939 Beginning of World War II

1935 Beginning of TV broadcasting in Germany

1930 The University celebrates its 150th anniversary

1927 Charles Lindbergh is the first pilot to cross the Atlantic non-stop

1919 The beginning of the Weimar Republic. Friedrich Ebert becomes President of the first Germany democracy

1912 The Titanic sinks during its maiden voyage. More than 1,500 people drown

1908 Women are allowed to study. The first six women students enrol at the University of Münster

1907 The WWU receives its name "Westfälische Wilhelms-Universität"

1893 New Zealand is the first country in the world to allow women to vote.

Germany follows in 1918 – and Switzerland only in 1971

1888 A new tree sprouts!





Now, at the end of the Discovery Trail, here's a challenge for you! If you want to become a proper tree expert, you need to know what's what. In our woodpile, you can test yourselves to see which trees you recognise from their wood, their leaves and their fruits.

Who am I?

Rotate the cube, feel, look and guess
before checking the answer under the lid!

1	3	5	7
2	4	6	8



Winter buds

- › green
- › upside-down, heart-shaped with dark-brown edges



Blossoms

- › radial
- › hanging cylindrical panicles
- › after leaf-burst

Who am I?

I am often planted at roadsides and in parks. My fruit looks like a pair of wings which spin like a propeller as they float down to the ground at about 16 revolutions per second. The wind can carry the fruit more than 100 metres.



Fruit

- › schizocarp with winged-nut fruits



Leaves

- › opposite
- › blunt 5-lobed
- › topside dark-green
- › underside grey hairs

1	3	5	7
2	4	6	8



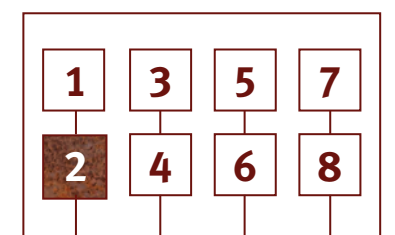
I am the sycamore!

***Acer pseudoplatanus* L.**

Family	Soapberry (Sapindaceae)	Age	up to 500 years
Species	approx. 110 species within the genus	Distribution	southern and central Europe, western Asia
Growth form	ovate, with a broad-curvature crown; up to 40 m tall and up to 25 m spread		
Bark	branches grey to olive-green; silvery to grey-brown scaly bark		



Rotate the cube, feel, look and guess before checking the answer under the lid!





Blossoms

- › monoecious
- › male blossoms in near-spherical, long-stemmed catkins
- › female blossoms radial



Leaves

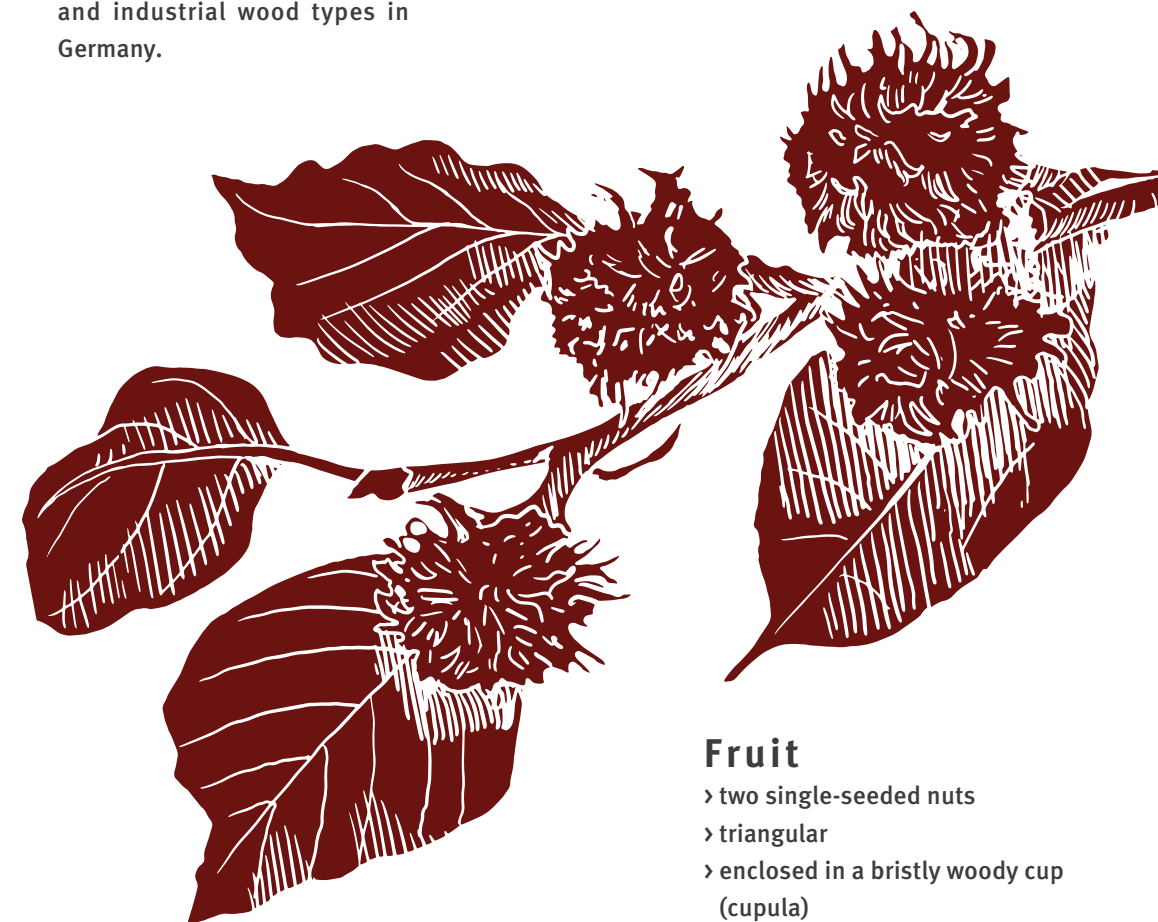
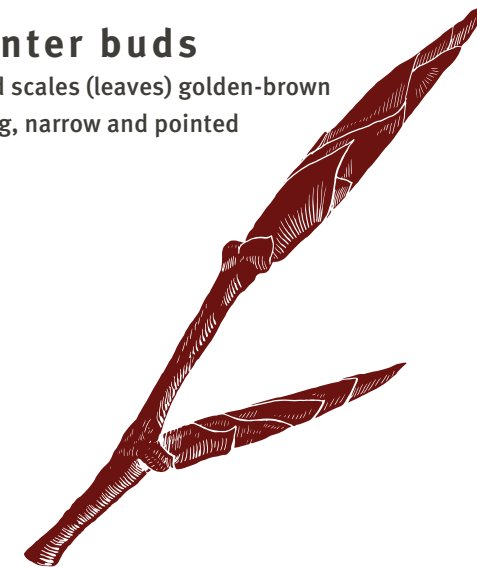
- › alternate
- › broad, elliptical to ovate
- › edge of leaf slightly undulate
- › downy after leaf-burst
- › dark green

Who am I?

I only begin to produce my fruits at the age of 40 to 60 years. They are edible and taste a bit like nuts. They are part of many animals' store of food for the winter. Not recommended for human consumption as the oxalic acid content can cause stomach upsets. My wood is one of the most important commercial and industrial wood types in Germany.

Winter buds

- › bud scales (leaves) golden-brown
- › long, narrow and pointed

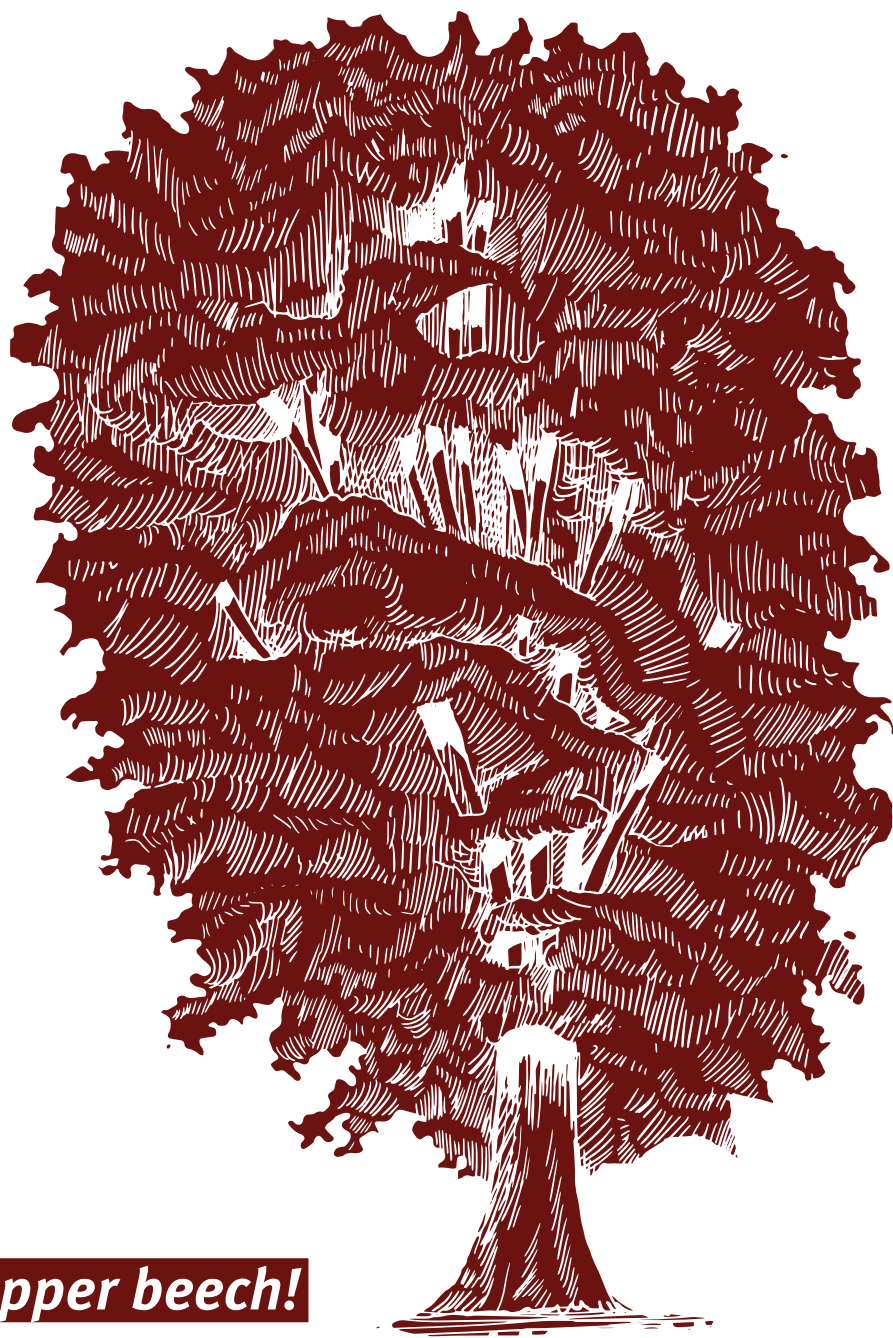


Fruit

- › two single-seeded nuts
- › triangular
- › enclosed in a bristly woody cup (cupula)



1	3	5	7
2	4	6	8



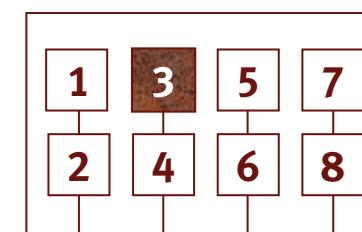
I am the copper beech!

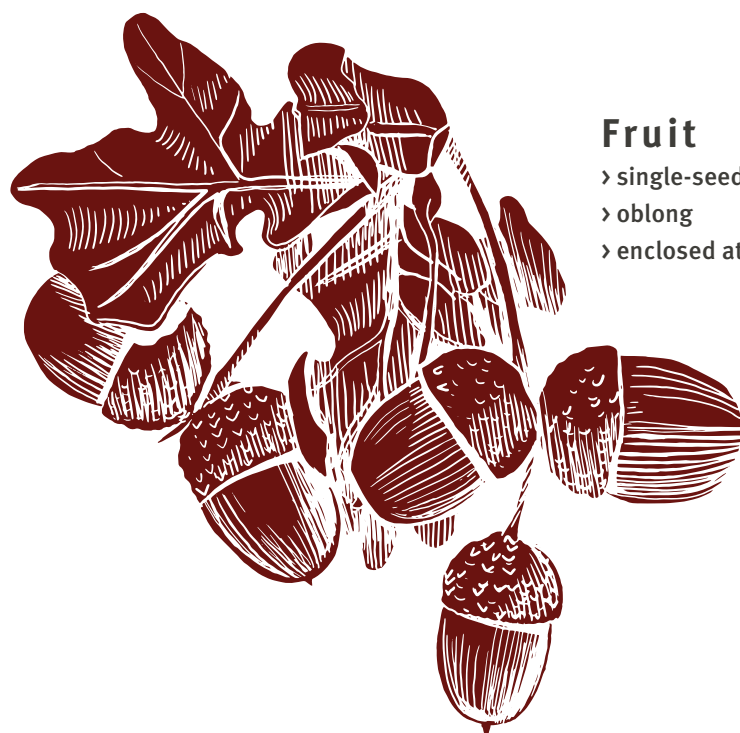
***Fagus sylvatica* L.**

Family	Fagaceae	Age:	300 to 400 years
Species	approx. 10 species within the genus	Distribution	Europe, from the lowlands to the Alps, to an altitude of 1,600 m
Growth form	broad, round growth; 25 to 30 m tall and spread just as broad when older		
Bark	branches grey-brown; bark brown; silver-grey bark formed only when older		



Rotate the cube, feel, look and guess before checking the answer under the lid!





Fruit

- › single-seeded nut
- › oblong
- › enclosed at its base by a cup (cupula)

Who am I?

My fruits contain up to 38 % starch and are an important source of food for wild animals. In many cultures in Europe, I am a symbol of endurance, wisdom, truth, loyalty and heroism. This is why my fruit and my leaves decorate coins, heraldry and insignia. My wood is hard, tough, very long-lasting and good to work with.



Leaves

- › alternate;
- › 3 to 6 round lobes
- › dark green
- › underside light green
- › short stem



Winter buds

- › golden-brown
- › pointed cupula



Blossoms

- › male blossoms in catkins, female blossoms in long-stemmed ears

1	3	5	7
2	4	6	8



I am the English oak!

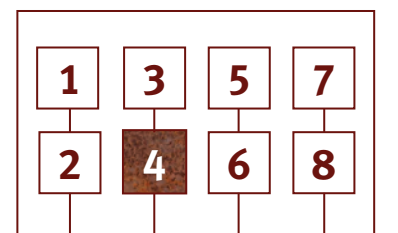
***Quercus robur* L.**

Family	Fagaceae	Age	800 to 1,000 years
Species	approx. 600 species within the genus	Distribution	Europe, northern Asia Minor
Growth form	broad, open canopy; mostly with short trunk; 35 to 40 m tall and 20 to 25 m spread		
Bark	branches olive-green to brownish; bark grey with deep vertical fissures		



***Who
am I?***

Rotate the cube, feel, look and guess
before checking the answer under the lid!



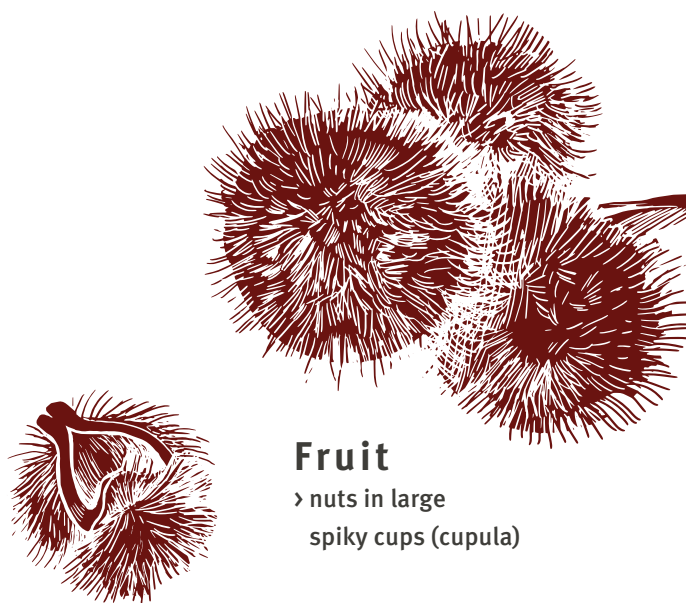


Leaves

- › alternate
- › oblong lanceolate
- › roughly serrated
- › dark green

Who am I?

My fruits – generally known as chestnuts – can be eaten by humans as well as animals. The nuts have a high content of carbohydrates, starch and sucrose. The high carbohydrate content distinguishes my fruits from most other nuts, which contain primarily fats. My fruits are disseminated by squirrels, dormice, crows and jays. The animals bury stores of food in the ground, and any forgotten fruits then germinate in the spring.



Fruit

- › nuts in large
- spiky cups (cupula)



Blossoms

- › male blossoms in long catkins
- › female blossoms small and inconspicuous



Winter buds

- › brownish-red
- › round

1	3	5	7
2	4	6	8



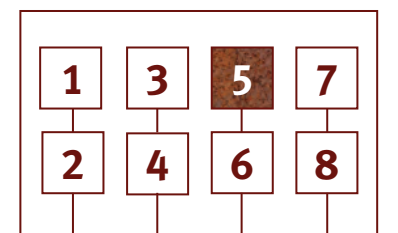
I am the sweet chestnut

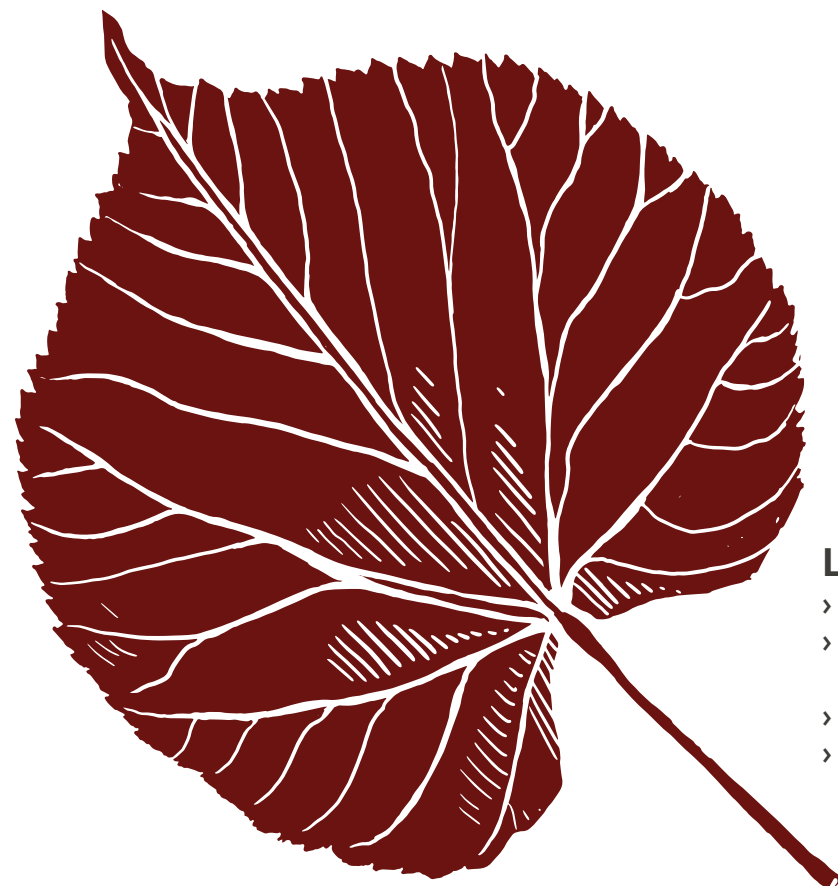
Castanea sativa Mill.

Family	Fagaceae	Age:	up to 500 years
Species	approx. 10 species within the genus	Distribution	southern Europe, northern Africa, Asia Minor
Growth form	short, spiral-grained trunk; wide spreading crown; 35 m tall and 25 m spread		
Bark	branches red-brown; bark dark-grey, smooth with vertical fissures		



Rotate the cube, feel, look and guess before checking the answer under the lid!





Leaves

- › alternate
- › asymmetrically heart-shaped up to roundish
- › dark green
- › grey-green on the underside

Who am I?

My blossoms can be used for making tea to help against colds. It reduces high temperatures, is expectorant, induces sweating and has a diuretic effect. In the olden days, I was often known as the Tree of Justice, under which cases of arbitration and mediation were heard and justice was dispensed – with the sentence occasionally being carried out straight away from a strong branch. This was known as *judicium sub tilia* (“The Court under the...”). Among the Germanic tribes I was considered sacred and was dedicated to Freya, the goddess of fertility, prosperity and love.



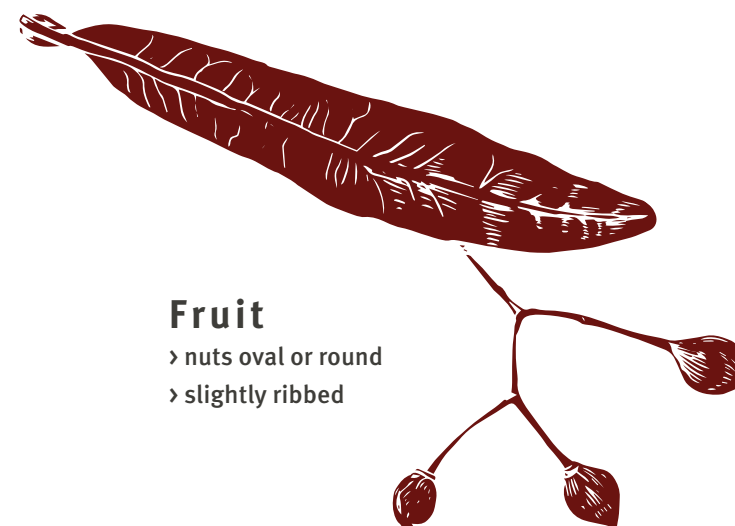
Winter buds

- › shiny red-brown
- › two unequal ovate bud scales



Blossoms

- › radial
- › 5 to 11 cymes
- › blossoms joined to the bract



Fruit

- › nuts oval or round
- › slightly ribbed

1	3	5	7
2	4	6	8



I am the small-leaved lime

Tilia cordata Mill.

Family Mallow (Malvaceae) **Age** up to 1,000 years

Species approx. 15 species within the genus

Distribution Europe

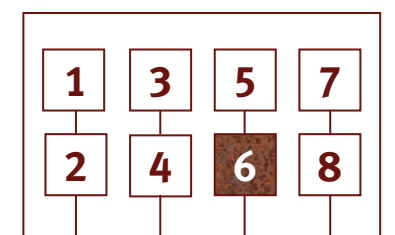
Growth form broad, thick, cone-shaped growth; 30 m tall and 20 m spread

Bark branches red-brown to olive-brown; bark brown-grey with vertical fissures and ridges



Who am I?

Rotate the cube, feel, look and guess
before checking the answer under the lid!





Blossoms
› small round heads

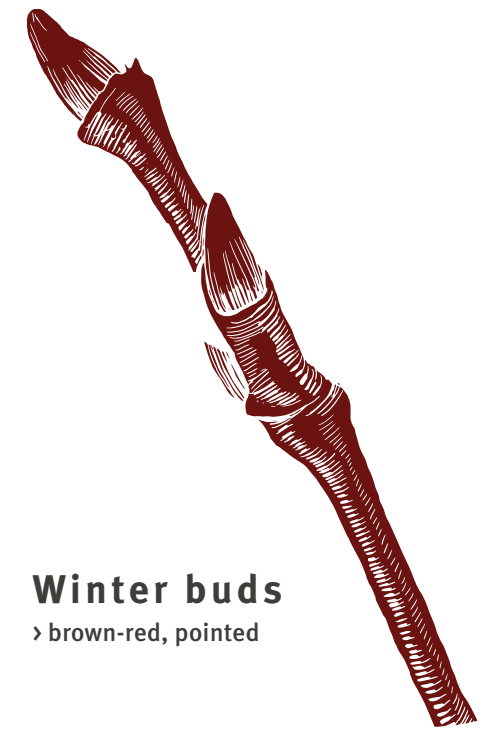
Fruit
› nut with hairs to aid flight

Who am I?

In earlier times, I was used for medicinal purposes. The juice of my fruit, drunk as wine, was an effective remedy for snake-bites, while my bark was used to combat toothaches and my leaves were used to treat eye diseases. As I am only rarely the victim of pests or disease, I am highly suitable for providing shade in parks and beer gardens. My bark is striking, as it peels off in large, irregular sections in the late summer/autumn, giving my trunk a patchy appearance.



Leaves
› alternate
› maple-like
› 3- to 5-lobed
› triangular



Winter buds
› brown-red, pointed

1	3	5	7
2	4	6	8



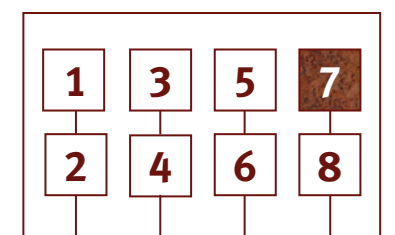
I am the London plane

***Platanus x hispanica* Münchh.**

Family	Platanus (Platanaceae)	Age	150 years
Species	approx. 9 species within the genus	Distribution	cultivated hybrid created from crossing the Oriental plane (<i>Platanus orientalis</i>) with the American sycamore (<i>Platanus occidentalis</i>)
Growth form	broad-domed crown; 30 m tall and 25 m spread		
Bark	branches light brown; bark yellow-green to grey-brown; peels off in large pieces		



Rotate the cube, feel, look and guess before checking the answer under the lid!





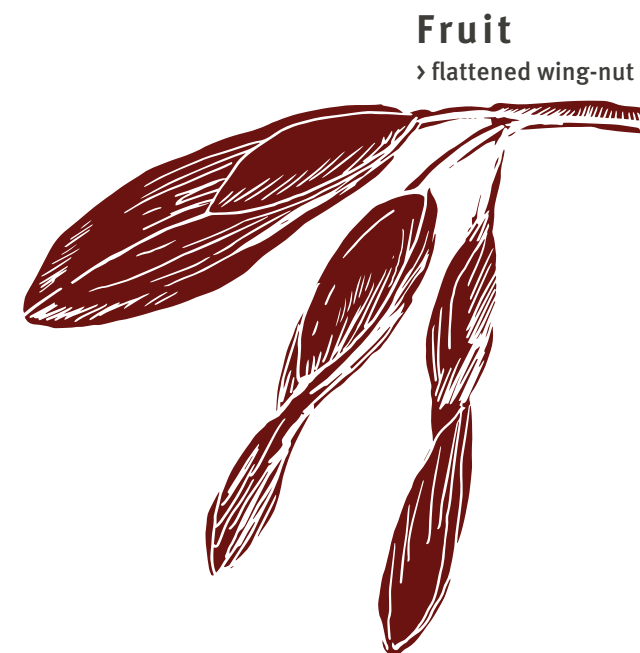
Blossoms

- › radial
- › in leafless panicles, before leaf-burst



Winter buds

- › black



Fruit

- › flattened wing-nut

Who am I?

I am one of the tallest deciduous trees and can reach a height of 40 metres. My wood is particularly hard, but at the same time elastic, which means that it can be used as an unbreakable shaft for a spade or for sports and gymnastics apparatus. The tensile and bending strength displayed by my wood is greater than that of oak wood.



Leaves

- › opposite
- › odd pinnate
- › leaves ovate to lanceolate

1	3	5	7
2	4	6	8



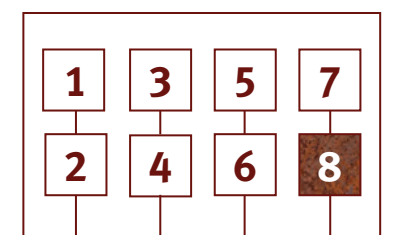
I am the common ash

***Fraxinus excelsior* L.**

Family	Oleaceae	Age	up to 200 years
Species	approx. 65 species within the genus	Distribution	Europe, Asia Minor, Transcaucasia and northern Persia
Growth form	oval to round; open canopy; 40 m tall and 30 m spread		
Bark	branches olive-green; bark grey; smooth with slight fissures		



Rotate the cube, feel, look and guess
before checking the answer under the lid!



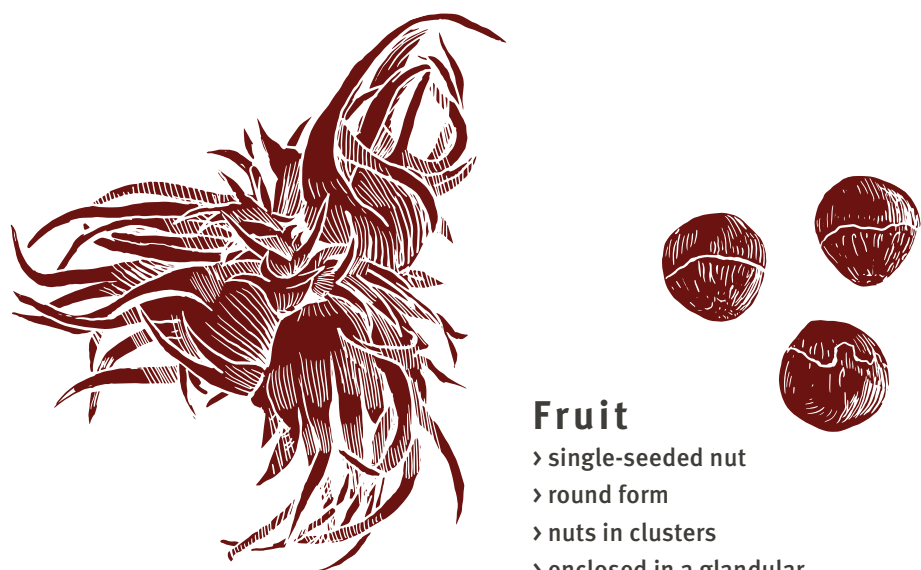
Blossoms

- › male blossoms in catkins
- › female blossoms inconspicuous on the sides of branches, before leaf-burst



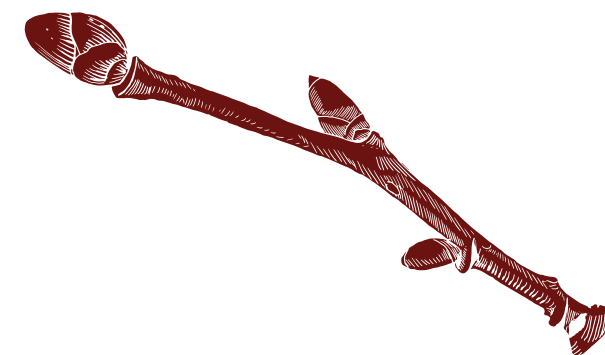
Fruit

- › single-seeded nut
- › round form
- › nuts in clusters
- › enclosed in a glandular husk with incisions



Winter buds

- › greenish-brown
- › ovate buds



Who am I?

My nuts – smaller than hazelnuts – are edible and can be used commercially as a by-product in the manufacture of sweets. My wood is highly regarded in the furniture industry. As it is almost completely insusceptible to rot, it is used especially in hydraulic engineering. As my wood is very sturdy, I am also often found at roadsides in towns and cities.

Leaves

- › alternate
- › broad and ovate
- › doubly serrated
- › some short-lobed



1	3	5	7
2	4	6	8



I am the Turkish hazel

Corylus colurna L.

Family	Birch (Betulaceae)	Age:	up to 200 years
Species	approx. 15 species within the genus	Distribution	south-eastern Europe, Asia Minor, Transcaucasia, Caucasus to Himalaya
Growth form	broad, cone-shaped growth; 20 m tall and 8 to 16 m spread		
Bark	branches grey to yellow-grey; bark grey to brownish; corky with vertical fissures		



What's the answer?

STOP 1

The copper beech – a witness to history

1. Can you guess what people used the tinder fungus for in earlier times?
 - › Exactly – these mushrooms were actually highly sought after for making fire. That's where the saying "It burns like tinder!" comes from.
2. What's the biggest living thing in the world?
 - › It's the giant armillaria in a forest in Oregon, USA – known locally as the "humongous fungus". It covers an area of 3.4 square miles in the earth, which is the equivalent of about 1,200 football pitches. It has a total weight of about 600 tonnes, which is as heavy as three blue whales. It is estimated to be about 2,400 years old.
3. Do you know which of the three mushrooms is edible?
 - › Young fruiting bodies of the armillaria are edible when cooked. It is also used for medicinal purposes in natural medicine, as well as in traditional Chinese and Japanese medicine.

STOP 1

Woodpeckers

1. Woodpeckers create an important habitat for other animals which use trees. Which animals do you think these might be?
 - › There is a range of animals which benefit from using the nests abandoned by woodpeckers, converting them into nests of their own. These include tits, nuthatches, pigeons and jackdaws, as well as bats, hornets, squirrels and dormice.
2. How long is the incubation period for greater spotted woodpeckers? And when do the young birds leave the nest?
 - › As a rule, the greater spotted woodpecker lays between five and seven eggs which hatch after ten to twelve days. The young birds leave the nest after 20 to 23 days but continue to be fed for a further eight to ten days.
3. Why doesn't a woodpecker get headaches?
 - › Good question! To prevent headaches, there is a shock-absorbing connection between the beak and the cranium. Also, the woodpecker's cranium is more developed than in other birds, and so prolonged hammering is not a problem.

STOP 2

Deadwood

1. Which animals and insects do you know of which use "mimicry"?
 - › Many living things camouflage themselves or imitate others in order to deceive their enemies or attract prey. Here are some examples:
 - › The bush cricket looks like a leaf, making itself invisible to its enemies.
 - › Frogfishes have a small piece of skin on their dorsal fin which wriggles back and forth, imitating a worm or a small fish. This enables the frogfish to attract prey towards its mouth when it then pounces extremely quickly.
 - › With its black and yellow colouring, the harmless hoverfly looks like a wasp and is therefore avoided by predators.
 - › Caterpillars and butterflies often have large markings on their wings which, from a distance, look like eyes. This deters birds, for example, which assume they're seeing a different – and larger – animal.
2. How many species of animals and plants are dependent on deadwood for their habitat and as a source of food?
 - › Over 6,000 species! These include around 1,200 beetles and 2,500 mushrooms.

STOP 3

Life cycle

1. How many years does it take for a dead tree to decay completely?
 - › It varies, depending on the type of tree. All that's left after 20 years of a fallen poplar tree in an alluvial forest is humus. An oak tree, by contrast, still might not be completely decayed after 100 years.
2. Why does deadwood sometimes look brown, and sometimes white?
 - › Wood-rotting fungi can be classified into different types. These types include brown rot and white rot. In the case of brown rot, the light-coloured cellulose is decomposed. If you rub the deadwood between your fingers, what remains is a fine, dark-brown wood powder. White rot, on the other hand, decomposes the brown lignin. In this case, a whitish cellulose is left over. You can't rub this deadwood into a powder; it remains fibrous. Brown rot and white rot occur in the phases when a tree becomes weak, is colonised and then decays.

STOP 4

The oak tree

1. How many different types of oak tree are there worldwide?
 - › Around 600. This means that there are more types of oak than of any other species of deciduous tree.
2. How many kilograms of acorns does an oak produce in a year?
 - › Around 150 kilograms, which is about the weight of two men.
3. What age can oaks live to?
 - › They can live to over 1,000 years. In Germany, that's the combined average ages of 13 people. On Johns Island in South Carolina (USA) there is an oak called Angel Oak which is reckoned to be up to 1,500 years old.
4. Many people carry an oak leaf around with them every day. How can that be?
 - › Oak leaves are depicted on the reverse of the German 1, 2 and 5 cent coins. Have a look! These oak leaves have a long history: the Munich Coin Treaty of 1837 created a unified economic area out of a number of individual German states. In order to emphasise this new unity and strength, the symbol of the oak leaf was used on the coins. And it's still used today!
5. Can you guess how old this (common) oak is, how tall it is, and how much the circumference of its trunk measures?
 - › Age: about 230 years old
 - › Height: 30 – 35 m
 - › Diameter of trunk: about 1.8 m; circumference about 5.6 m

STOP 5

Bats

1. Take a guess: how small is the world's smallest bat?
 - › The world's smallest bat is Kitti's hog-nosed bat. It lives in Thailand, weighs only two grams and is three centimetres long. This makes it lighter than a sugar cube, and it would fit inside a matchbox.
2. How big is the world's largest bat?
 - › The world's largest bat comes from Australia and is called the "ghost bat". It can grow to a size of 14 centimetres and it weighs between 130 and 220 grams – which is more than a big bar of chocolate.
3. Up to how many ultrasonic sounds can a bat emit in one second?
 - › Bats emit up to 200 sounds per second in order to navigate. That's 12,000 sounds per minute. We humans say between 90 and 120 words per minute.
4. How many midges does a bat eat in a night?
 - › One single common pipistrelle bat can devour between 1,000 and 2,000 midges per night, and the species known as Daubenton's bat eats over 60,000 insects between April and October!

STOP 6

Wood

1. Guess how many people work in forest management and the wood industry in Germany.
 - › Around 1.2 million. That's roughly equivalent to the population of Cologne, the fourth largest city in Germany.
2. Why do you think the wooden xylophone has different tones?
 - › The tones depend on the type of wood used, and on the diameter and length of the wooden bars.
3. Where do you find wood being used in your everyday lives?
 - › Have a look around at home: what's made of wood? You'll be surprised how often you come across it!
4. How can paper be "wood-free"?
 - › It can't. The description "wood-free" stems from the fact that a certain substance that is found in wood has been filtered out. This substance is lignin. Chemicals have to be used to remove this component from the wood. Without lignin, paper doesn't turn yellow so quickly – but the chemicals used are not good for the environment. So the term should really be "lignin-free". Nowadays, practically all conventional paper is lignin-free. In other words, trees are also cut down for lignin-free paper. Therefore, please buy only recycled paper if at all possible!

STOP 7

Xylophone

1. Why does our xylophone make different sounds?
 - › The sounds depend on the type of wood and its growth traits, as well as the length and diameter of the wooden bars.
2. How is the one row of wooden bars different from the other?
 - › The bars in front are all the same length but are made of different types of wood. The ones in back are made of the same kind of wood but have different lengths.
3. In what way can you hear the differences?
 - › The differences in pitch are not so pronounced in the bars of the same length made of different wood. That's why the scale might sound unusually "tight" and strange to you. But the sound quality is quite interesting. The bars of different lengths, on the other hand, produce tones we're familiar with – the "major scale". The bars have been precisely cut to produce these sounds. You won't be able to recognise any other differences in sound quality because all the bars are made of the same type of wood: robinia.
4. When you tap the row of bars of the same length, can you tell which type of wood (or trees) is used?
 - › From left to right: oak – maple – beech – pine – birch – walnut – spruce
5. What kind of wood sounds best to you?
 - › That's a secret between you and the trees...

A big thank you!

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We also wish to thank everyone who was involved in developing and creating the Tree Discovery Trail:

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What has this oak tree experienced in the past 130 years?

Visit our tree calendar at stop 7 (p. 20/21)

