Interreg
Austria-Hungary
European Union – European Regional Development Fund
REIN-Forest

The impact of climate change

on forests globally and in the Austrian-Hungarian border region

EDUCATIONAL MATERIAL FOR SECONDARY SCHOOL STUDENTS AND TEACHERS

Impressum

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Mitigating the negative impacts of climate change on forests is a pressing issue for humanity, for the future of the Earth. A wealth of knowledge is available on the subject. The scope of this teaching aid is limited to an overview of the most important facts. As a starting point, we have therefore compiled a short list of links for those who wish to gain more in-depth knowledge on the subject:

www.masfelfok.hu
www.karbonkalkulator.hu 01
www.karbonkalkulator.hu 02
ttk.elte.hu 01
www.met.hu 01
www.upmforestlife.com
ttk.elte.hu 02
www.met.hu 02
info.bml.gv.at 01
info.bml.gv.at 02
www.klimafitterwald.at
info.bml.gv.at 03
www.scientia.hu
www.opslagco2inhout.nl
www.wald.rlp.de
www.proholz.at
www.klima.erti.hu
www.klimavaltozas.oee.hu
nfk.gov.hu
publicatio.uni-sopron.hu
real.mtak.hu 01
real.mtak.hu 02
www.climate.nyme.hu
real.mtak.hu 03
erti.naik.hu
agrarklima2.nyme.hu

APPLICATIONS

Tree atimeter
play.google.com 01

Estimation of leaf area
play.google.com 02

Climate change
play.google.com 03

Carbon footprint calculators
play.google.com 04

Forest dynamics simulator
etools.tuzvo.sk

INTERESTING INFORMATION
Click on the links!

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Foreword

DEAR TEACHERS!
DEAR SECONDARY SCHOOL STUDENTS!

In our region-specific educational material on the impacts of climate change on forests, we believe it is important to inform secondary school students about the local-level impacts of climate change. This will raise awareness of individual responsibility as the negative consequences of climate change increasingly affect our daily lives.

We want to increase the awareness of secondary school pupils with interesting facts and figures about the Austrian-Hungarian border region and to provide teachers in the region with interactive and experiential exercises to supplement the compulsory curriculum.

This free standing 100 year old tree (linden, oak, chestnut, beech) is about 20-25 m high, has a crown diameter of about 12 m, covers a standing area of 120 m² and with its leaves increases tenfold the ground area to about 1.200 m² leaf area. Carbon dioxide (= CO_2) from the air enters the cells of the leaves through the countless breathing or stomata of the leaves, where carbohydrates (sugar, starch) are formed and oxygen (= 0%) is released with the help of photosynthesis using water and solar energy. The cell surface for the gas exchange has with about 15.000 m² the size of two soccer fields! At a level of 0.03% CO_2 in the air, about 36.000 m³ of air flows through the leaves, consuming about 18 kg of CO_2; this corresponds to the average CO_2 waste of 2½ single-family houses per day. The 13 kg of O_2 that the tree forms during respiration (= photosynthesis) as a waste product, as it were, cover the needs of 11 people per day. On a hot sunny day, our tree consumes about 600 L of water, which is 60 large, full buckets of water, and it evaporates about 400 L of this again through its leaves. The air flows through the leaves and filters the dust, exhaust fumes and other harmful substances (= poisons), most of which remain in the leaf. The tree filters up to 1 ton of dust and toxins per year. The most valuable function of a tree is therefore that of a climate regulator: the tree brings people fresh, clean, cool and moist air! For itself, the tree produces in a day about 12 kg of sugar, from which it builds its organic matter; a part it stores as starch, from the other it builds its wood. The wood value of a 100-year-old tree is with about 3 solid cubic metersof wood on the average 270 DM. If this 100-year-old tree is cut down,about 2.000 young trees would have to beplanted to fully replace it. Cost of such an action: ¼ million DM! Through additional services of a tree in the community of the forest, the tree even represents an economic value of about half a million DM air pollution. Poisons, cars, asphalt salts, gas pipes, acid rain, water and food shortages, pests, dirt above, dirt below the ground - all this makes the tree sick, but trees die quietly! - First the tree, then...?

Figure: Text-tree
Source: *Let's meet in the forest!* Forest pedagogy. A handbook with practical guidance, forest leadership ideas and examples

Introduction

n different geological periods, the Earth's climate has cyclically changed, but the rate of change has never been as rapid as it is today. Exploring the cause, extent and likely impact of the change will help us to understand how we can slow down and influence these changes.

Forests, as one of the most complex ecosystems on land, are crucial in the fight against climate change.

In the European Union, forests can neutralise around 8.9% of greenhouse gases (2018).

In addition to climate change issues, this educational material provides an overview of the potential of renewable natural resources through the forest-human relationship.

While we can do a lot to protect the climate by paying attention, we must also pay special attention to protecting our forests and planting new ones.

PROTECT OUR FORESTS!

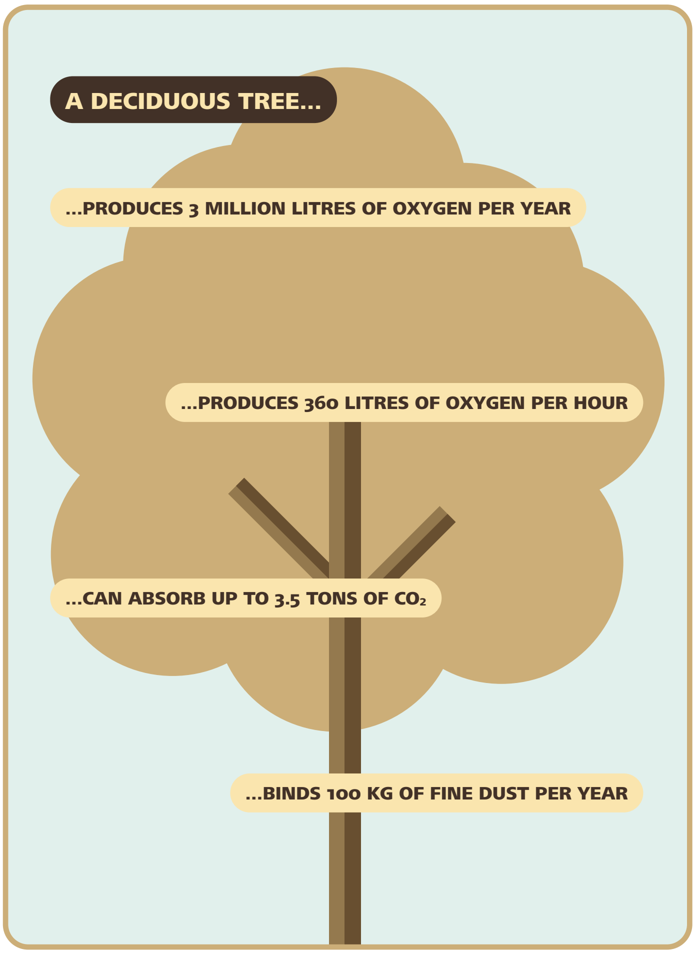


Figure: Characteristics of a deciduous tree

Climate change

CLIMATE AND THE CONCEP OF CLIMATE CHANGE

The climate of our planet is not stable. It is constantly changing, and has changed in the past, as exemplified by the shifting and changing climate belts. Climate is the set of long-term weather conditions on Earth that operate in a system, interacting with each other. Significant and permanent changes in long-term weather conditions at local or global scale are referred to as climate change.

Climate change is caused by a combination of internal fluctuations in the climate system (atmosphere, land, oceans, biosphere and surface solid water, i.e. the photosphere), solar activity, volcanic eruptions and anthropogenic influences, acting in parallel.

In addition to altering the structure of terrestrial vegetation, human presence affects the climate by releasing aerosols that reflect part of the solar radiation and greenhouse gases into the atmosphere. Human-induced climate change, i.e. climate change of anthropogenic origin, has also triggered natural processes that increase natural greenhouse gas emissions.

FACT *The oxygen production of an adult tree produces the annual oxygen needs of a human during a growing season. An average passenger car uses the oxygen needs of 20 people over a distance of 100 kilometres in about 1 hour.*

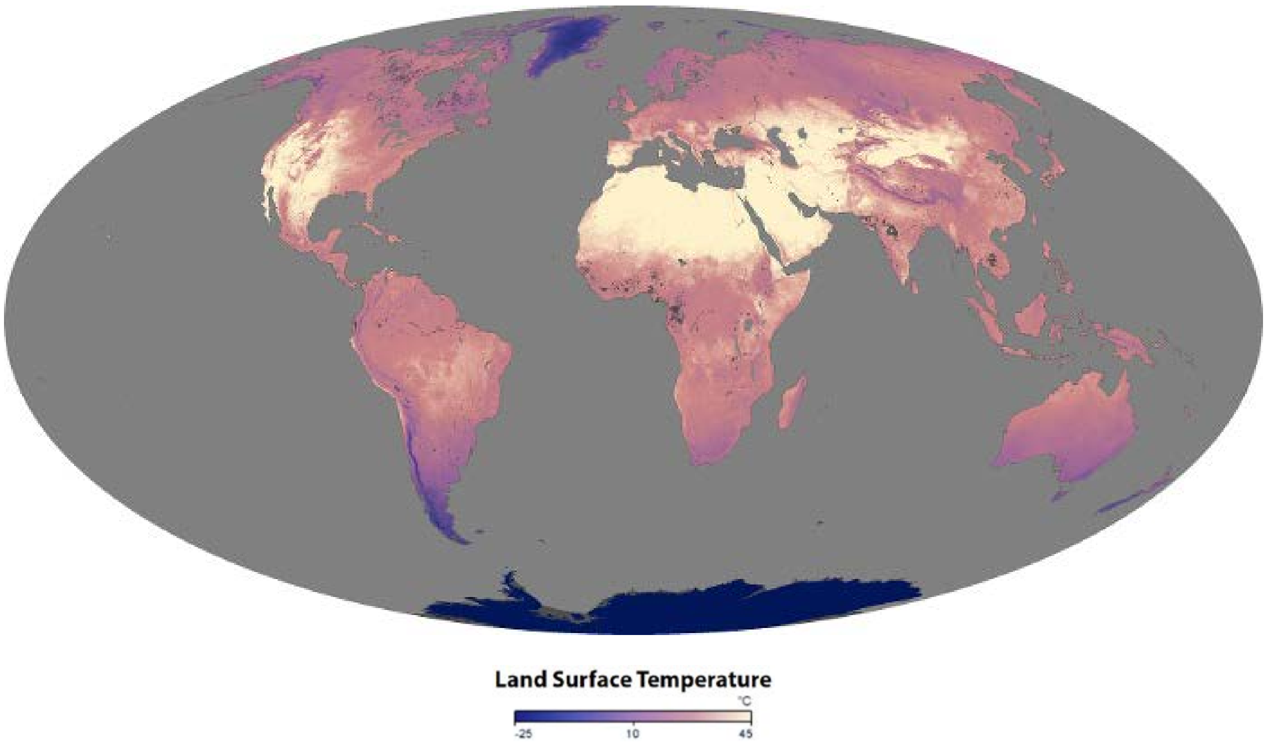


Figure: Average surface temperature trends over the Earth in July 2022
Source: earthobservatory.nasa.gov

CHANGES IN TEMPERATURE

Greenhouse gas emissions have increased significantly compared to the Pre-Industrial Revolution times. This has led to a 1°C increase in global surface temperatures today. The number of heatwave days in the Austro-Hungarian border region is increasing.

HEATWAVE DAY: *Heatwave days are days with daily maximum temperatures of 30°C or above.*

The seasons often merge, and the summers become hotter. Long periods of drought are becoming more frequent. Not only in winter, but also during the whole period from October to March, the number of frosty days is decreasing. The number of various pathogens and insect pests is not limited by the cold, moreover late frosts pose a serious threat to plants.

According to pessimistic forecasts, the last spring frost of the year will be postponed by an average of 20 days to the end of the 21st century. In addition, the growing season (the beginning of the vegetation period) of plants will be even earlier. Thus, the last spring frosts cause a serious setback in the development of already green/flowering plants.

FACT *In 2003, the heatwave caused around 70.000 deaths in 12 European countries, mostly among older people, as the body's ability to regulate heat weakens with age. It is estimated that by 2050, heat waves will claim around 120.000 lives if no further action is taken to mitigate climate change.*

CHANGES IN PRECIPITATION

Climate change is affecting the entire water balance on Earth. The acceleration of hydrological cycles is leading to very high or extremely low precipitation in some places. While heavy rainfall causes floods and **flash floods, longer periods of low rainfall** lead to drought and drinking water shortages.

In the Austro-Hungarian border region, one of the most pressing ecological problems associated with rainfall deficits and drought is the water level and siltation of Lake Neusiedl. In the Austrian municipality of Rust started a pilot project in 2022 to deepen the lake bed and will try to pump out the silt to increase the water depth.

Image: Desertification

***FACT** In early October 2021, the Italian province of Genova received half of its annual rainfall in half a day. This has never happened since the beginning of rainfall measurements.*

CHANGES IN CLIMATE ZONES

As a consequence of climate change, a significant shift in climate zones is expected in the future. If greenhouse gas emissions continue at the current rate, the area of the Arctic icecap, tundra and boreal taiga climate types will generally decrease, while the area of the temperate, arid and savanna climate zones will increase. The taiga climate, also known as the subarctic climate, is the most extreme temperate climate, with the greatest annual temperature variability, relatively warm summers and harsh winters.

Climate tipping points are critical, irreversible changes that occur after a certain warming level.

If the **melting of the Arctic ice cap** passes this point, the area will be largely ice-free in summer. Weakening ocean currents in Europe could increase the occurrence of extreme weather events. Fires in the boreal forests of warming northern regions may increase, turning forest areas with high carbon sequestration capacity into carbon dioxide emitters.

With a global rise of 3-3.5°C, **ocean circulation systems** (including the Gulf Stream) could slow down or even stop.

Human activity has destroyed 17% of the **Amazon rainforest** since 1970. The tipping point is estimated to be between 20-40%, which would ultimately mean the conversion of the rainforest into a savannah-like area with an apparent significant loss of biodiversity, further increasing the atmospheric carbon increase.

CLIMATE CHANGE IN THE AUSTRO-HUNGARIAN BORDER REGION IN THE LAST PERIOD

The Austro-Hungarian border region is currently part of the temperate zone with a continental climate. Due to anthropogenic (human-induced) climate change, the number of days with maximum temperatures above 35°C is increasing in this area. Increasingly frequent extreme precipitation events of more than 10-20 mm lead to flash floods, which can cause erosion of the natural ground cover and soil sliding on steep slopes. The uneven distribution of rainfall over time leads to more frequent periods of drought, making forest management and agricultural production more difficult. Average wind speeds are decreasing globally, but the likelihood of extreme windy weather events is increasing, and the number of storms associated with weather cyclone activity is increasing. In winter, the decrease in average wind speeds means that air pollution from industrial activity and heating will persist in the lower atmosphere.

***FACT** In the European Union, greenhouse gas emissions are showing a significant decline compared to the 1990s. Among the different land uses, forestry has the highest carbon sequestration.*

Climate change is expected to **shift and transform vegetation climate zones**. The proportion of forested areas will decrease significantly, the boundaries of closed forest stands (oak, beech) will shift westwards, and most of the flat (lowland) areas will become steppe.

The relationship between climate change and forests

As a community, as an ecosystem, a forest is highly dependent on its surrounding environment. Of course, this relationship is also true in reverse: the forest also affects its environment. The so-called abiotic influences are the conditions and factors that affect the elements and systems of the forest ecosystem as inanimate things. Changes in certain elements of the climate affect the forest ecosystem.

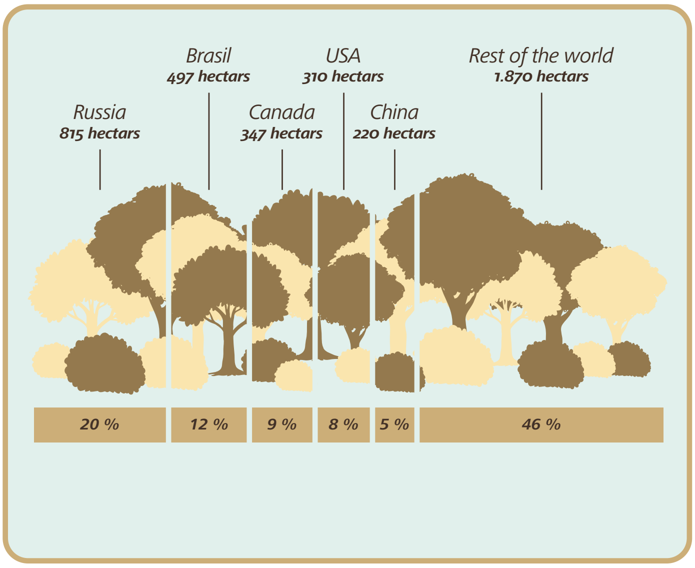


Figure: Distribution of the Earth's forest area
Source: cepf-eu.org

THE FORESTS OF THE AUSTRO-HUNGARIAN BORDER REGION

There are around 3 trillion trees growing on Earth, which is more than 400 trees per person for the world's population. Russia, Brazil, Canada, the United States and China have the largest forest areas. This is more than half of the world's total forest area.

The forest area of Hungary and Austria is increasing every year, thanks to afforestation. The forest cover of the Austrian-Hungarian border region is around 30% on both sides of the border.

	AUSTRIA	HUNGARY
Forest cover	~47 %	~21 %
Forest area	~ 4.015.000 ha	~ 2.063.659 ha
Growing stock	~ 1.172,6 million m³	~ 399.000.000 m³
Annual forest increments volume	~ 29,7 million m³	~ 13 million m³
Forest increment utilisation rate	~88 %	~50 %

Figure: Facts and figures on forests in Austria and Hungary

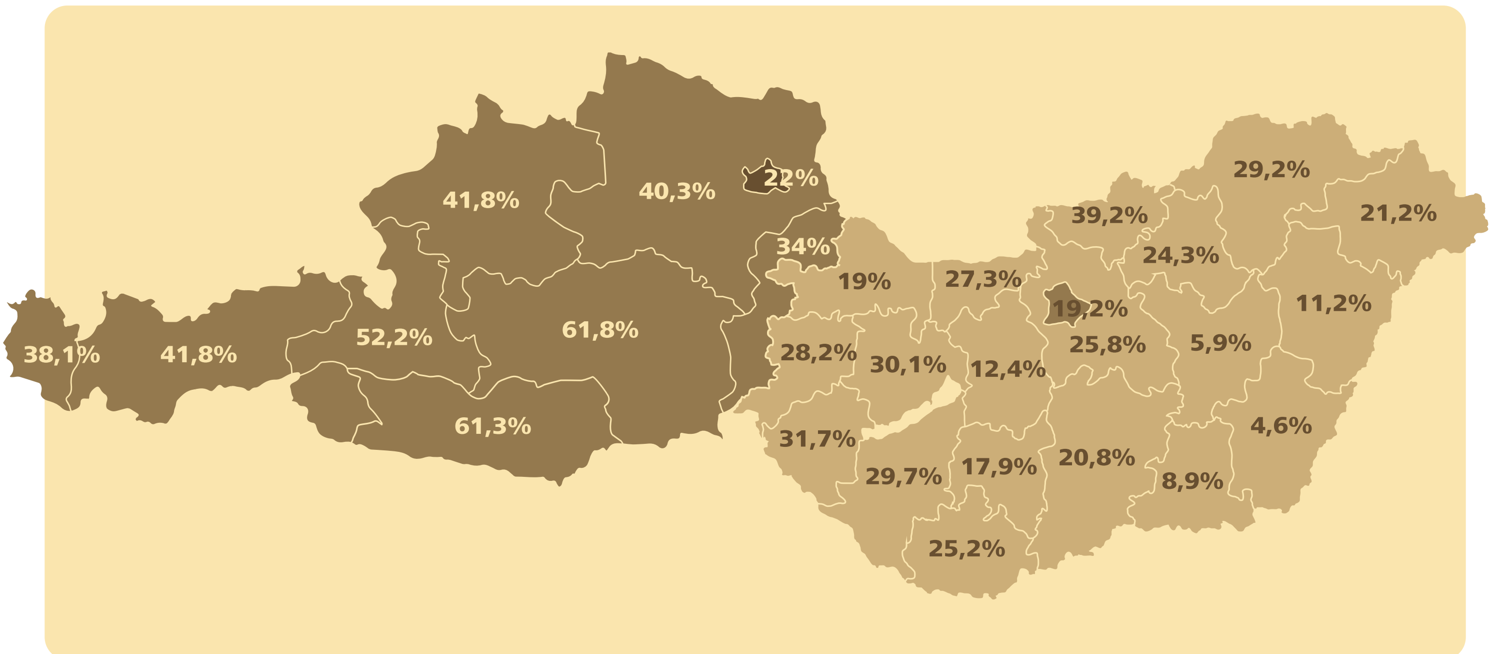


Figure: Austria and Hungary forest cover
Source: Based on data from www.nfk.gov.hu and www.geo.bfw.ac.at

Image: Forest image of Burgenland

In Hungary, the majority of forests are deciduous species, whereas in Austria, pine forests dominate, with spruce accounting for around 49%.

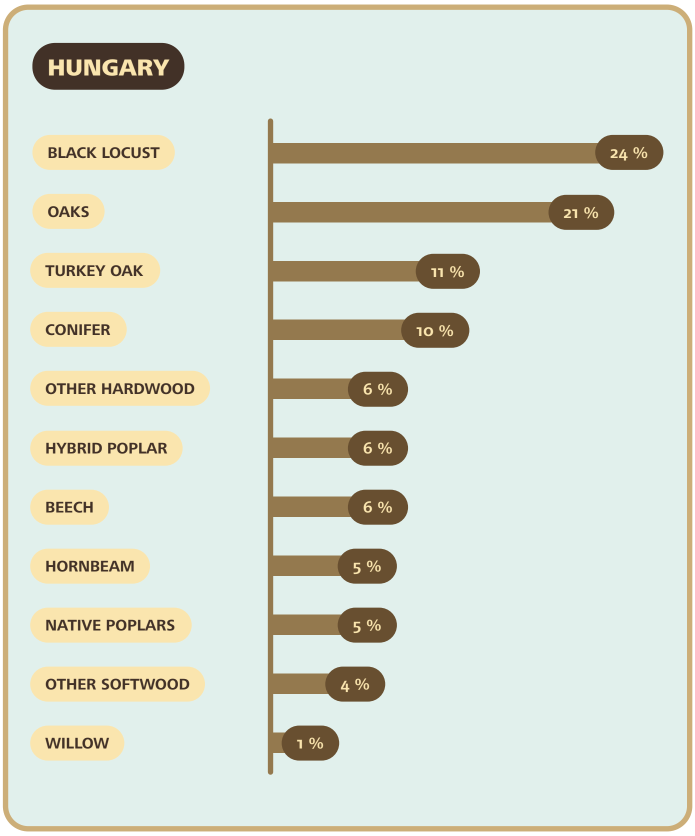


Figure: The proportion of tree species in Hungary
Source: Based on data from www.nfk.gov.hu

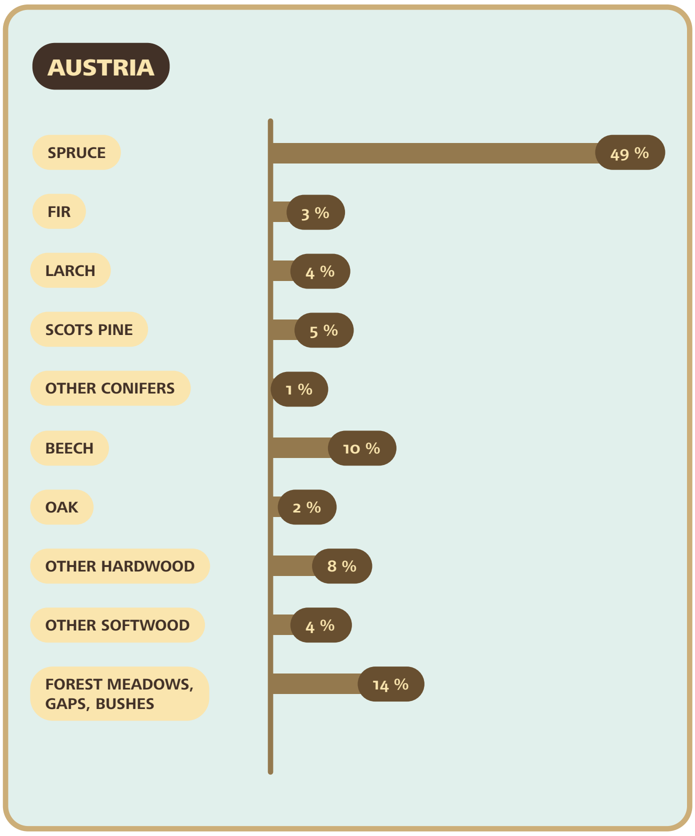


Figure: Proportion of tree species in Austria
Source: Based on data from info.bml.gv.at

TEMPERATE FOREST ZONING, ZONATION

Complex **forest communities** in Austria and Hungary **follow the zonal structure of temperate forests**. According to the forest climate classification, as the altitude increases, the average temperature decreases and the humidity increases, which basically determines which tree species thrive in which zone. With climate change, these two parameters are expected to change.

Hungary's forest communities are typically mixed stands of conifer and broadleaved species, living between lowland and mid-mountain levels. In contrast to Austria, zonal conifer forest communities do not occur here, but only in extrazonal form. In the high mountain areas of Austria, the conifer forest zone starts at an altitude of about 1200 m above sea level and then reaches the forest boundary through dwarf pine forests, above which there is no vegetation cover that can be described as forest communities.

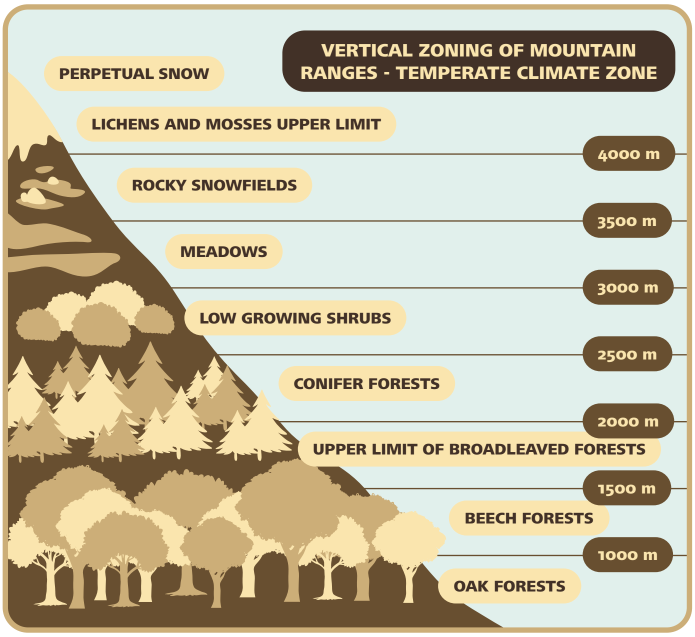


Figure: Vertical zoning of mountain areas

According to the forest climatic classification, the forest-steppe climate is typical of the lowlands, the turkey-oak climate of the lower hills and some lowlands (500 m), and the hornbeam-oak and beech climate of the mountains and hills (1000-1500 m). The names of the climate classes refer to the predominant tree species.

Image: Untamed beech in the Pre-Alps

In the Austro-Hungarian border region, the beech and sessile oak are indigenous. Native tree species are defined as any tree species that have not been introduced into their habitat by means of introduction/artificial intervention but have been present in the area for at least two thousand years.

Both the leaves and fruit of the **sessile oak** are distinctive and easily recognisable. The bark is grooved. Its wood is hard, a valuable industrial raw material. It can be damaged by high summer heat and early, late frosts and heavy winter frosts.
It prefers more evenly distributed growing conditions.
Pests: oak lace bug, Spongy moth, oak processionary moth, maybeetle, gall wasps, fungi, mistletoe.

Image: Leaves and fruits of sessile oak
Source: © Dr. Korda Márton

The picture of the **beech forest** is also typical. Among the smooth-barked straight trunks under the closed canopy, herbaceous plants are present in open patches in the spring. Beech is the most important tree in natural regeneration. Its wood has many uses in the timber and furniture industries. It is sensitive to extreme weather conditions like late frosts, long periods of drought and extreme stormy weather. Pests: beech flea weevil, wooly beech aphid, beech scale.

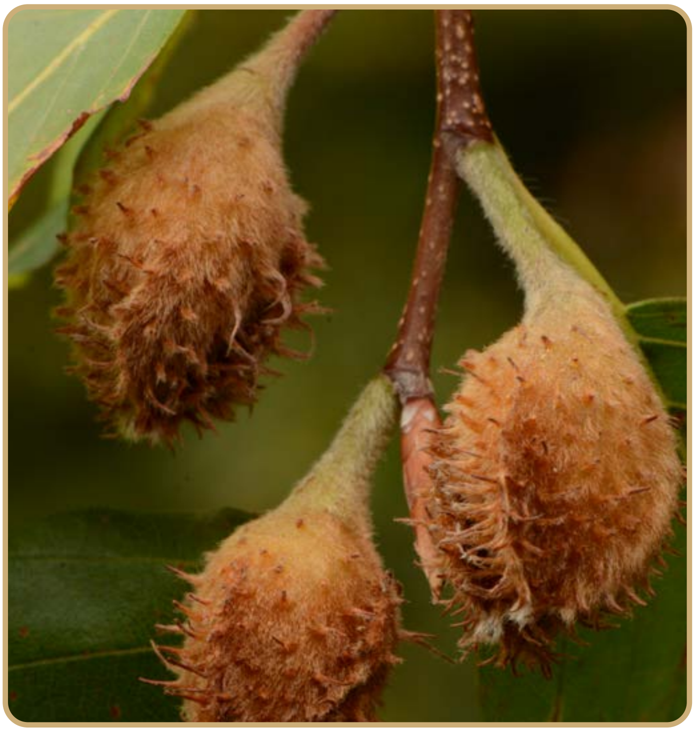


Image: Leaves and fruits of beech
Source: © Dr. Korda Márton

THE IMPACT OF CLIMATE CHANGE ON FOREST COVER

With decreasing elevation, the average temperatures rise and humidity falls. These two factors are the main determinants of which tree species thrive in which zones. It is the average temperature and humidity that change with climate change. In general, the forest cover is shifting northwards as a result of climate change. In the Austro-Hungarian border region, increasingly extreme weather conditions in recent years have already provoked sanitary felling in nearly half of the most threatened beech, spruce and oak forests due to the deteriorating health of the trees.

The changes of humidity affect the sensitive tree species most, like spruce, as a good example. As the humidity decreases, the tree becomes weaker as it evaporates more water than it absorbs. As a consequence, the overall health of the tree deteriorates. This is also reflected in the production of resin, which determines its defensive capacity. With less resin, it provides no protection against pests such as bark beetles, so the tree is further weakened and then dries out. This is so-called damage-chain. This is a serious problem for local experts in the Austrian-Hungarian border region. Where the spruce disappears, other tree species, especially beech, are expected to appear.

Image: The destruction of the spruce forest
Source: © Dr. Csóka György

Image: European spruce bark beetle
Source: © Dr. Csóka György

Forest trees grow continuously throughout their lives, but the rate of growth varies. Growth accelerates for a while after seedling age but slows down in older age. This growth variation is described by so-called growth curves, which are studied in the field of arboriculture. The growth rate is influenced not only by the age of the tree but also by its environment, such as climate and climate change. As the growth of individual tree species declines, there will be less annual increment - the amount of wood that can be used and exploited.

The various climate models show that with an average temperature increase of 2°C, the overall occurrence of the climate-sensitive beech species will be seriously threatened. Forest climate zones are shifting in response to climate change.

All tree species, including beech and sessile oak, have the genetic reserve to ensure their survival. The variability of their genetic material helps them to survive. Further adverse climatic conditions, however, will lead to a decline in the health of the tree population and eventually to its disappearance. It is thus replaced by other species. Experts are constantly monitoring the health of forests to ensure that the effects of climate change can be mitigated through appropriate forest management decisions.

THE CONSEQUENCES OF CLIMATE CHANGE IN THE AUSTRIAN-HUNGARIAN BORDER REGION

In the Austro-Hungarian border region, the **forest population is complex**: on the Hungarian side, beech, oak-hornbeam, and turkey oak-sessile oak climates are also found, while in the higher regions in Austria, coniferous species are also present. Spruce is probably not native to the Hungarian areas of the border region. Nevertheless, it is a widespread species in the forests of this region, as its wood is widely used. The health status of spruce has been significantly degraded due to the damage caused by the **European spruce bark beetle** in this area.

There are also forest reserves in the Austro-Hungarian border region. The forest area of the landscape has increased significantly in the last 10-15 years. The Alpine region is characterised by a high proportion of protection forests, which are mainly conservation forests. Another important category is forest areas mainly used for timber production.

The annual increment in the Alps is relatively low, indicating that the area is characterised by older forests. The adaptive capacity of old forests is lower.

The health of the area's tree population is characterised by significant so-called biotic and abiotic damage over the last 15 years.

ABIOTIC AND BIOTIC FACTORS: *together make up the natural environment. The abiotic, also known as nonliving factors, are the physical and chemical elements and phenomena necessary for life, such as light and temperature, air, atmosphere, wind, water, topography and natural disasters. Biotic factors include all living beings like animals (e.g., vertebrates, insects), fungi, viruses, but also evolution and symbiosis.*

In addition to the damage to spruce, the fungal damage to the sweet chestnut found in the area is also typical, and is now affecting specimens of pedunculate oak and sessile oak.

The border areas are characterised by frequent, sometimes gale-force winds, which cause significant damage to forests. Where large areas of spruce stands have been harvested as a result of bark beetles, accelerating wind currents on the ridges are causing considerable damage to young and middle-aged forests on the opposite side.

Image: Wild boar in the Austrian-Hungarian border region

The following figures shows the vulnerability of beech and sessile oak and the projected future situation of tree populations at the end of the century in the Austro-Hungarian border region. According to experts, beech stocks will become vulnerable in low-lying areas, while they will maintain their dominant position in higher altitudes. At the same time, sessile oak will be threatened in the plains and hills and is expected to expand at the expense of beech in the higher altitudes of Austria.

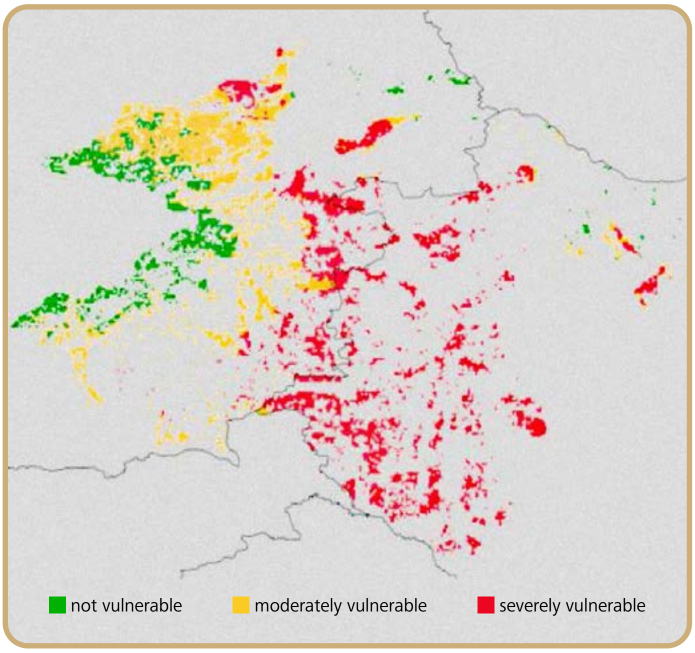


Figure: Vulnerability of beech (Fagus sylvatica) in the Austrian-Hungarian border region (2081-2100)c
Source: vasmegye.hu

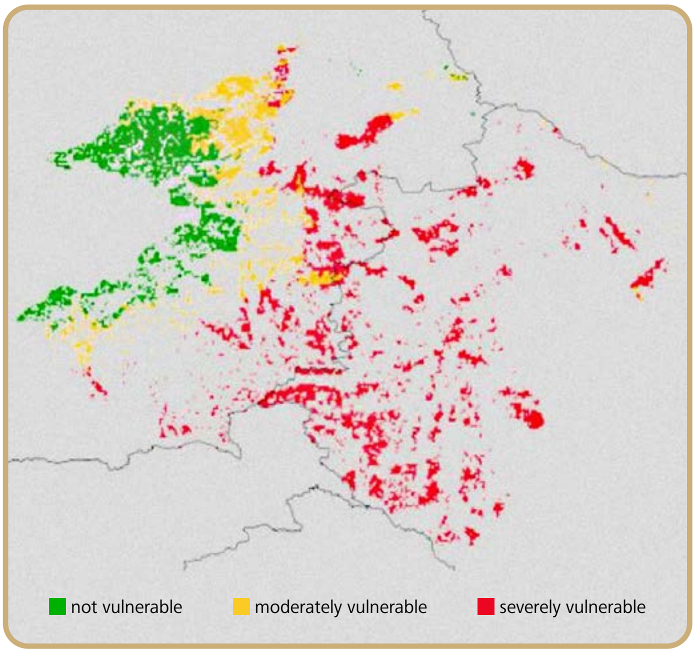


Figure: Vulnerability of sessile oak (Quercus petraea) in the Austrian-Hungarian border region (2081-2100)
Source: vasmegye.hu

Image: Beech in the Sopron Mountains

A LITTLE FOREST MATHS

In a nearby park, find a tree with a small crown that you can easily estimate how many leaves it has. Collect some fallen leaves! Measure the leaf surface area using graph paper or a mobile phone app (e.g., Leafscan - www.leafscanapp.com). Using the total number of leaves you estimate, determine the leaf area of the entire foliage in m^2.

1 m^2 of foliage sequesters 150 g CO_2 on average over the whole growing season. A human exhales 480 mg CO_2 per minute at rest. Calculate how many small trees would sequester the CO_2 exhaled by the class in one class period?

Role of forest management in combating climate change

Forest management is a conscious human activity. As well as producing timber, it is also a tool for climate protection, including the sequestration of atmospheric carbon. However, planned forest management offers many more opportunities for people.

THE CONCEPT OF ADAPTIVE, NEAR-NATURE FOREST MANAGEMENT

Near-natural forest management is an approach whereby forest managers can enjoy the products and services of the forest while respecting natural processes, sustainability and biodiversity.

Forests are essential for humans and typically have a triple function:

1. ***economic function:*** *for example: timber production, production of forest reproductive material,*
2. ***public welfare function:*** *for example: recreation forest, park forest, study forest, wildlife garden,*
3. ***protection function:*** *for example: water protection, nature conservation, soil protection, landscape conservation.*

Climate change has further increased the strategic role of forests in maintaining a liveable environment. This includes the filtering of air pollution, its beneficial effects on the microclimate, and the sequestration and incorporation of atmospheric carbon dioxide. The tree body, root system and foliage are composed of high carbon components.

We treat and manage forests as a renewable natural resource. Forest management must not lead to negative changes in the area, structure or quantity of timber, and the naturalness of the forest structure must not deteriorate.

As one of the most complex natural systems on land, forests are essential for humans. Cutting down a tree does not mean destroying the forest. Especially when the wood from the forest is used for permanent purposes, such as furniture and buildings. The use of firewood in combustion systems with appropriate filters does return carbon to the carbon cycle, but unlike fossil fuels (e.g., crude oil, natural gas) it does not add more carbon to the cycle, only releases the carbon that is sequestered. Biomass produced by forests can also be used for heat production under certain conditions.

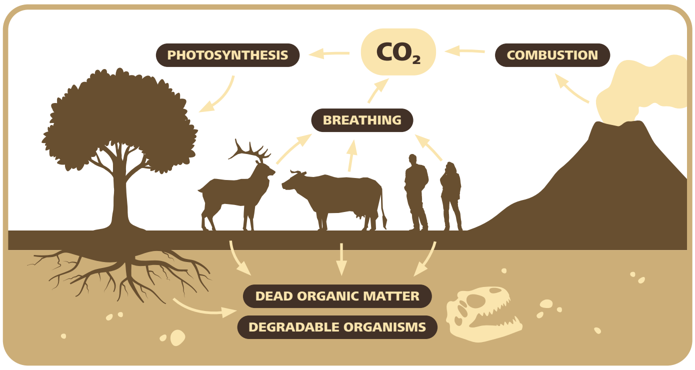


Figure: The carbon cycle

Forests can sequester large amounts of carbon. The carbon sequestration capacity of forests depends on the tree species, the age of the tree and the forest structure.

OPTIONS FOR MITIGATING THE EFFECTS OF CLIMATE CHANGE ON FORESTS

Near-natural forest management - whether in public or private forests - can help combat climate change in the future. Natural processes promote the development of an ideal tree species structure and ensure genetic diversity. Grouped, mixed forest structure improves forest resilience to extreme weather.

Natural regeneration maintains the genetic stock of trees. This can be facilitated by the introduction of more resilient native tree species. To some extent, foresters can also help a forest to develop a suitable structure by artificial regeneration with well-chosen seedlings or other propagating material (acorns, seeds).

A natural, natural forest structure and tree diversity can be achieved through close-to-nature sylviculture. This is the **continuous forest cover**. It is important to bear in mind that a forest is not just a collection of trees. The forest community also includes shrubs, herbaceous plants, soil-dwelling insects, fungi, and a sufficient number of wild animals that do not damage the growing tree seedlings.

In the Hungarian-Austrian border region, there are also forest areas that have been out of commercial forest management for several decades, i.e. foresters do not carry out felling or artificial forest regeneration. These areas are **forest reserves**. In forest reserves, experts periodically carry out surveys on the natural processes of forest structure change. The experience gained here is incorporated into forest management practice.

Forest reserves are **protected natural areas**, consisting of core area and protection zones. The core area is free from human interference and is subject to full economic restrictions, except for forest protection reasons or for hazard control. The **protection zone** surrounds the core area and has a protective function. Only forestry operations which do not restrict the protective function of the core area may be carried out in the protection zone.

FACT *There are around 200 forest reserves (NWR) in Austria, covering a total area of 8.603 hectares. Hungary has 63 forest reserves, covering a total area of about 13.000 hectares (of which 3.665 hectares are core area). An excellent example of a forest reserve on the Hungarian side is the Hidegvíz-völgy Forest Reserve.*

Image: Forest reserve at the HU-AT border with lying dead wood

The use of wood in various industries is an important factor in the fight against climate change. The primary objective is to use wood for as long as possible. For the construction and furniture industries, environmentally friendly wood is one of the most important raw materials.

In the future, there are many possible new applications where wood can be used as a substitute for currently used raw materials such as plastics, because of its favourable properties.

Wood is one of the most environmentally friendly industrial raw materials derived from renewable natural resources and its uses are expanding.

THE ROLE OF URBAN GREEN SPACES

In cities and built environments, green vegetated, overgrown, planted areas are called urban green spaces. Urban green spaces are dominated by urban trees. These green spaces **trap significant amounts of dust and absorb urban noise**. Plants evaporate heat from their surroundings, **cooling** them. They also **provide shade** and **alter thermal radiation patterns**. Shrubs and trees allow precipitation to infiltrate into the soil over a longer period of time, **thus improving soil water retention**. Green spaces can be public spaces with limited use (e.g., museum gardens) or private gardens. Their primary function may be public welfare - recreation, sports, or even (medicinal) plant production, etc.

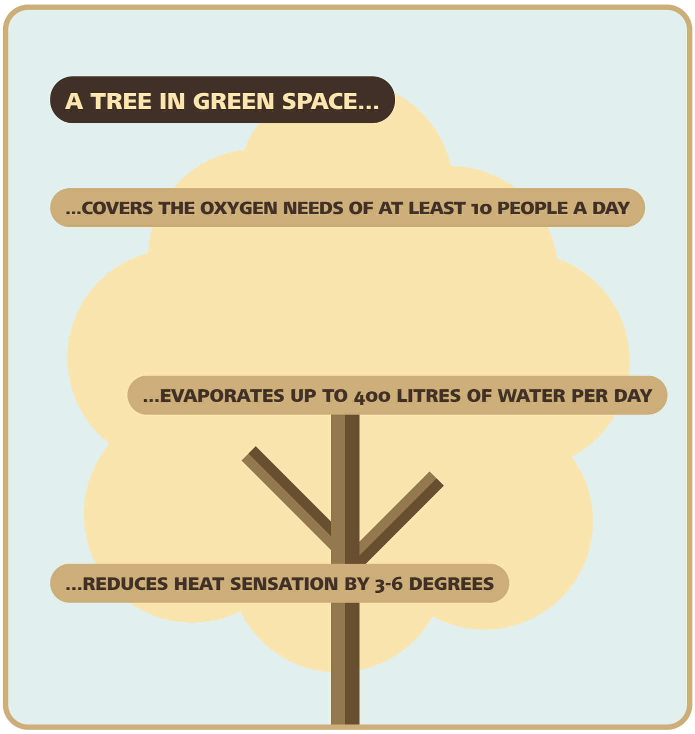


Figure: The role of trees in green spaces

***GREEN SPACE:** is a category of land use subject to special legislation, a priority area of green space. Green spaces can only be public spaces. These include public parks, public squares, playgrounds, etc.*

Image: Urban green space

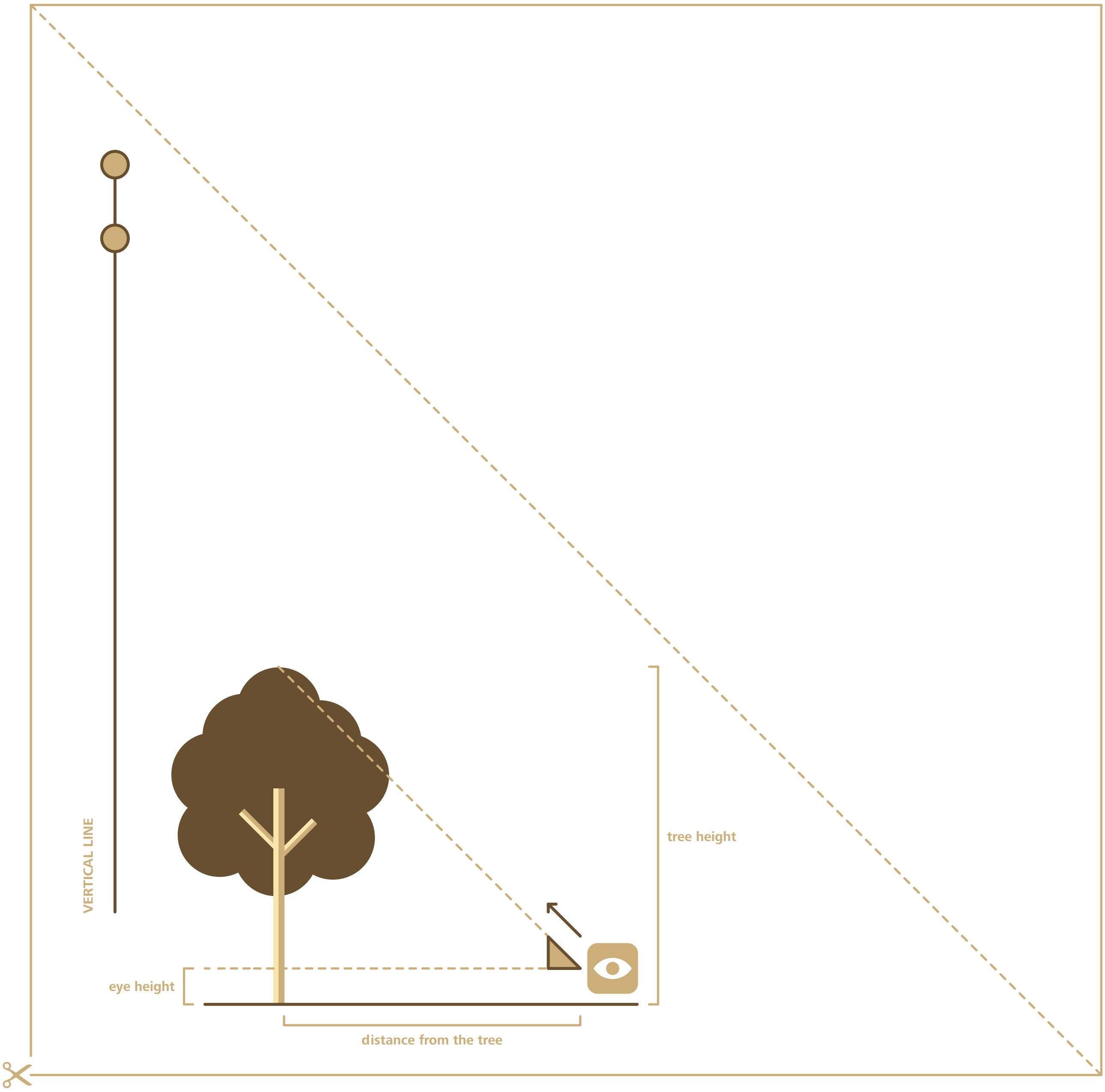
The trees in green spaces are usually very old. When they are older, they can be attacked by many species of fungi and other pests. The branches of diseased trees may break off and their trunks may twist in storms. It is advisable to inspect these trees from time to time.

The visual inspection is complemented by instrumental measurements, which can be used by the tree assessors to detect any rot in the wood without damaging the wood. This is done using an acoustic tomograph, which measures the speed of sound propagation in the wood. It is also possible to determine how much wind gusts can uproot the tree. Such tests are static or dynamic root tests. The crown of a dangerous tree must be fixed, if necessary, cut back or even the whole tree felled to allow the planting of a suitable species.

Image: Leaf photosynthesis measurement instrument

Image: Instrumental tree examination

The green spaces associated with the city are home to many species, including protected animals. Various songbirds, bat species, insect species find a home in our parks, but one of the best-known protected species, the Northern white-breasted hedgehog, is also associated with these areas. The maintenance, protection and proper management of urban green spaces is therefore not only important for city dwellers, but in some respects also a conservation task.



MAKING A TREE ALTIMETER

Make the following tree height measuring device. Find the tallest tree you know in your area. How many times bigger than your tallest classmate?

Materials needed

20-25 cm cord length, small weight (larger bead or button), thick straw, tape or glue, pencil to punch holes into the paper

Preparation of the tree height measuring tool

Cut the square along the lines, then fold it in half along the diagonal to make a triangle. Punch a hole into the paper at the two points on the vertical line, then rewire and tie the string so that you have the small weight on the end of the string. Glue the two triangles together, then tape the straw to the fold line.

How to use the tool

Hold the triangle up to your eye so that you can see through the straw and the string is parallel to the vertical line. The tool is on level. Walk backwards or forwards from the tree until you can see the top of the tree through the straw. Measure how far you are from the tree with a step or tape measure, then add your eye level and you get how tall the tree is!

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