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**translated by Adria Mooney and James DiPadua**

# Thuringian Wood Species

## An Introduction to the Wood Exhibition at the Max-Planck Institute for Biogeochemistry Jena

**With Support of:**

Wolfgang Arenhövel, Thüringer Landesanstalt für Wald, Jagd und Fischerei
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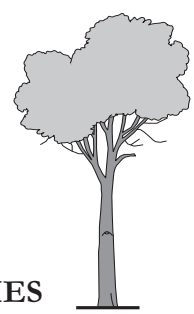
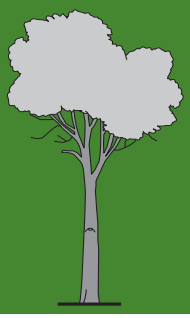
THÜRINGEN FORST





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## Tree Species, Arranged by Families

# Introduction



## Profile of the Institute

The Max-Planck Institute for Biogeochemistry researches the large biogeochemical cycles of the Earth and their interrelationships with the climate. The main focus is on the carbon, water and nitrogen cycle, in which other elements, depending on conditions, can play an additional role. The element cycles above the continents are controlled by human activities and by vegetation; their activity is in turn influenced by the soil fertility, which is determined by the soil type and parent rock. The use of land also plays an important role. In Europe, agriculturally used areas emit carbon dioxide into the atmosphere, i.e. they are a carbon dioxide source. Areas used for forestry, however, absorb carbon dioxide from the atmosphere, i.e. they are a carbon dioxide sink. This important function of forests is dependent on the type of tree stand, i.e. the kind and variety of the tree species in the stand. In a regional experiment, the Institute attempts to shed light upon the complicated interaction between soils, vegetation and atmosphere not only globally but also in the Thuringian region. This region is an excellent area, not only due to its diversity of soils, but also because of its diversity of tree species.

## The Wood Exhibit

The wood exhibit in the lecture hall foyer of the Max-Planck Institute for Biogeochemistry provides an impression of the diversity of tree species growing in Thuringia and their large variety of wood structure and colouration. At the same time, the 45 tree and shrub species represent only a portion of the approximately 100 ligneous plant species occurring in Thuringia. Thus, the common and chestnut oak and the summer and winter lime tree are not identified separately; also missing are a number of hedge ligneous plants most of which have diameters of less than 10 cm. Nevertheless, the exhibit provides an overview of the immense variety of species used for commercial forestry, the most important fruit trees, and a few hedge species; they are in their characteristics on par with tropical wood species. The exhibit reflects the variety and beauty of the native ligneous plants. The acquisition of the wood specimens would not have been possible without the help of the Jena Municipal Forest and the Thuringian Forestry Offices in Jena, Creutzburg and Kaltennordheim as well as the support of the Bavarian Forestry Offices in Weißenstadt and

Sawmill Uhlstädt, Oberkrossen

Bayreuth. Further agencies actively helped to complete the collection, especially the Stiftung Weimarer Klassik (Foundation of the Weimar Classical Period), as well as the Friedenskirche (Church of Peace) and the Nordfriedhof (North Cemetery) in Jena. The wood was cut in the Uhlstädt sawmill in Oberkrossen. The treatment and installation was carried out by the Dietrich Hüttig carpentry workshop in Thalbürgel.

Jena, May 2004

Ernst-Detlef Schulze
Annett Börner
Sebastian Weist

# European Beech

*Fagus sylvatica* L.

## About the Specimen on Display

Beech from the Forestry Office Stadtroda, District Bad Klosterlausnitz

Beech from the "Schloß Fantasie", Bayreuth-Donndorf Ø 170 x 150 cm, 133 years

### General characteristics of the wood

The beech tree has reddish wood with small, diffuse-porous vessels, clearly marked growth rings and noticeable pith rays. With age, the penetration of aerial oxygen can induce a secondary red heartwood to form. The red heartwood colouration pales under light exposure and turns grey with time.

### About the specimen on display

**The board** is a tangential cut taken from near the center of the tree. It is a uniform reddish wood without separation between sapwood and heartwood; it has clearly defined growth rings and wide pith rays. The board also has a prominent branch marking. The trunk was infested with Beech Beetles (*Agrilus viridis*), which bore paths under the bark and penetrated the sapwood in hook shaped formations. An example of such a beetle path is visible in the upper left-hand side*. The oval holes are the dissemination holes of newly hatched beetles. On the right side, dark wood discolourations are visible vertical to the growth rings. These markings are the ingrown trails of the beetles; they are induced by a bacterial infection which often follows the beetle infestation and remains visible as a wood discolouration.

**The large tree slice** (cross section: 170 x 150 cm, 133 years old: 6 mm average year ring width) comes from a free standing tree on the grounds of "Schloß Fantasie" ("Fantasy Palace") in Donndorf near Bayreuth. The tree slice has white rot on the bottom edge. The ligniperdous touchwood (*Formes fomentarius*) decomposes the lignin and leaves pure cellulose behind. Another fungus colonizes in the cellulose and induces a black colouration. The individual fungi are clearly enclosed by black lines parallel and perpendicular to the wood.

The middle of the cross section is a secondarily coloured red heartwood, induced by water and oxygen penetration through injuries in the wood. The streaked edges of the discoloured region are typical of a facultative pseudo heartwood caused by varied degrees of air and water penetration. In this case the injury originated from the ingrown bark on the right side. Bark residue in the form of stones and fine root strands can still be seen in this section. There are additional ingrown bark sections (bottom left) beginning to form white rot.

*Visible only at the exhibited board, not in the picture.

# Beech Family

# Fagaceae

Facts worth knowing

## Botanical characteristics

Beech grows straight up to 30 - 45 m in height when enclosed in a stand. Free standing, the crown starts quite low on the trunk. The bark is thin, smooth and silver-grey, and characteristic "moustaches" form laterally to established branches; outer bark (rhytidome) rarely forms. The fruits are small, sharp triangular nuts (beechnuts) in woody, soft prickly shells (cupules) that open with 4 flaps when ripe. Beeches can live up to about 300 years; however, they are felled for forestry at 100 - 140 years.

## Habitat

The beech's native range is central, western, and southern Europe. In central Europe it is naturally the most competitive forest tree species because of its shade tolerance. Historically, the beech has been less desirable lumber than pine. Since the middle of the 19th century and increasingly after the second world war, there was widespread plantation of evergreens on former beech sites. Nevertheless, the beech is still the most important native hardwood from the plains to the middle mountain ranges (up to 1400 m in the Alps), in moist climates with mild winters. The beech is sensitive to winter and late frosts and prefers moist, loose, nutrient and calcium rich soils.
In Thuringia, beech covers about 18 % of the total forest area.

## Cultivation

Beech stands are managed by selective felling or shelter-wood if rejuvenation occurs under the canopy of the thinned out old stand before felling is completed. Modern management attempts to establish the next generation of beech as diverse, uneven aged stands by harvesting valuable individual trees. Selection forestry occurs partly in montane beech/spruce/fir forests, as well as at lower elevation with high rainfall, e.g. the Hainich region. The growth reaches 6 - 12 $m^3$ per hectare and year.

## Use

Beech wood is very homogenous, hard and dense. It is easy to work, it warps more than other types of wood, shrinks significantly and tends to discolour and rip. Untreated, it is not very durable when exposed to natural climate conditions. It is an excellent fire wood. Red heartwood has no major technical disadvantages.

The wood becomes malleable when damp.

**Current:** Handcrafts (veneering, plywood for heavily used school and office furniture-mostly chairs, wood turning, woodcarving, tool and instrument handles, rulers, wooden soles, pianos), interior construction (wall and ceiling panelling, stairs, wood flooring), exterior construction wood (fences, woodblock paving), household (cutting boards, stirring spoons, bowls, ironing boards etc.), hobby (wooden toys), industry (palettes, crates, barrels, plywood boards, railroad ties), raw materials (wood pulp and paper production, charcoal).

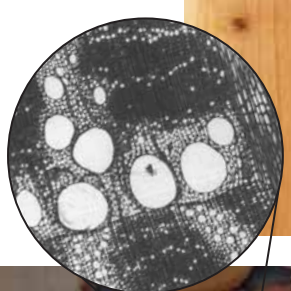
**Historic:** Handcraft (coach and ship building, shotgun stocks), raw materials (charcoal, fire wood, potash for glass blowing, paint), nutrition (oil), healing (tar as "Pix Liquida" for skin damage, twigs to prevent jaundice), traditions (adoration of individual trees to provide protection from storms, but they were also considered as the home of evil spirits).

# Chestnut and Common Oak

*Quercus petraea* (Matt.) Liebl. and *Quercus robur* L.

## About the Specimen on Display

Chestnut oak from the Municipal Forest Jena, Am Forstturm



Chestnut oak from Gemünden in the Spessart Ø 68 cm, 246 years

### General characteristics of the wood

Oaks have hard, light to dark brown wood with large ring-porous early wood vessels. This causes sharply contrasted growth rings. In a vertical cut, these marked growth rings produce the pronounced tangential grain markings of oak wood.

It is almost impossible to distinguish between chestnut and common oak by their wood anatomy. Intraspecific differences according to the habitat are larger than differences between the species.

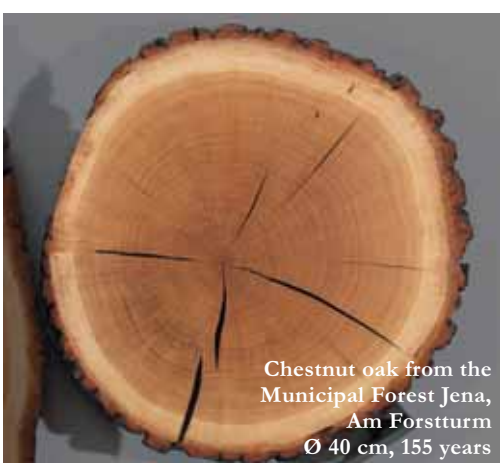
### The wood on display

All specimens on display are chestnut oak.

**The board** is almost a radial cut. It has a well ingrown branch*. The wood is course-grained in a vertical cut due to the large early wood vessels. The pith rays induced marked ray flecks.

**The large tree slice** (cross section: 68 cm, 246 years: 1.4 mm average growth ring width) originates from a different tree than the board, but the small, darker slice is from the same trunk. The large slice is a perfectly intergrown double trunk. The regular growth and the fawn brown colouration is characteristic of the expensive oak veneer wood.

**The smaller tree slice** (cross section: 40 cm, 155 years: 1.3 mm average growth ring width) shows courser growth and defined differences in growth ring width. The pith rays are also clearly visible.



Chestnut oak from the Municipal Forest Jena, Am Forstturm Ø 40 cm, 155 years

*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

Oaks grow up to 40 m tall. The trunk is straight when growing in a stand. It is almost cylindrical and does not form branches until high on the trunk. Free standing, the trunk is often gnarled with low branching. The bark is initially greyish green, smooth and faintly glossy, and forms a thick, deeply fissured grey-brown outer bark with age. The bark is rich in tannin. The leaves are alternating with indented lobes on the edges. The leaves of the chestnut oak have longer petioles than the common oak. Acorns, the oak fruit, are botanically considered nuts and grow in cupules. The acorns form densely and close to the pedicels (like a bunch of grapes) on the chestnut oak. The acorns of the common oak have long pedicels. Oaks live to be between 500 and 800 years old (max. up to 1000 years). Felling for commercial timber use occurs between 120 - 140 years for saw timber, and at 200 years for veneers.

Botanical characteristics of the Chestnut oak

## Habitat

The area of distribution reaches across western, central and southern Europe to the Caucasus. The oak is cultivated for forestry and as a park and street tree. Common oak grows preferentially in moist and wet environments with heavy, dense soils and stagnant water or flooded areas, while chestnut oak grows in drier conditions, in environments with medium to average water supply and well aerated soils.
Natural mixed oak forests are rare in Thuringia. The genus *Quercus* makes up about 5 % of the total forest area; this portion can for the most part be traced back to plantings[1)].

## Cultivation

Oaks were previously cultivated as standards in coppice forest. The oak is planted or sowed after clear cutting, or as afforestation or advance growth under the shelter of pine. Natural rejuvenation can occur after selective felling or under shelter-wood. Growth yields 3 - 4 $m^3$ per hectare and year on average, but may reach 6 $m^3$ per ha and year.

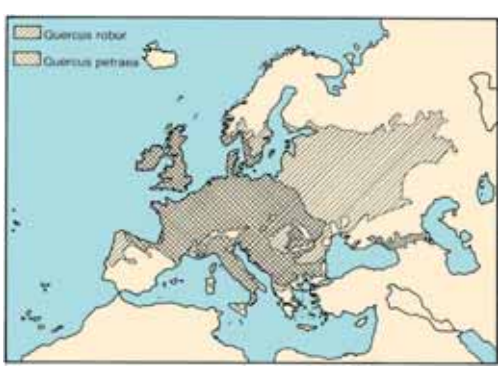
## Use

Oak wood is hard, heavy, elastic, shrinks moderately, has excellent solidity properties and a high resistance to wear and tear. The heartwood is very durable; under water influence it lasts almost permanently. It does tend to rip and warp, but is easy to work.

**Current:** Handcrafts (rustic furniture, turning and carving, tools) interior construction (wall and ceiling panelling, frames, doors, stairs, wood floors) exterior building timber (hydraulic construction, garden, park and landscaping structures: fences, play grounds), industry (boat and ship building, vehicle, wagon and container constructions, silo and mill construction, rail way ties), agriculture (instruments, barrels and tubs for wine, whiskey and cognac).

**Historic:** Handcrafts (wagon building, ladders, cog wheels, walking sticks), exterior building timber (foundations out of oak posts), raw materials (fire wood, tannin from bark for tanning leather, ink), agriculture (acorns as pig fodder), healing (bark for healing warts and intestinal illnesses, fluid from roots for strengthening nerves, powdered leaves for healing wounds, tar from wood charring for inflammations),nutrition (edible oil), customs (fate and weather oracle, individual trees considered by the Teutons as "holy oaks", this also caused them to be known as the "home of evil" in the beginning of Christian times).

The leaves of the common oak were displayed on the Deutsche Mark coins, from the penny to the one-mark piece. The so far not yet existing chimaera on the 1, 2, and 5 cent coins of the Euro now have leaves from *Quercus petraea* but the fruits of *Quercus robur*.




[1)] In the Jena area, in addition to the already mentioned species, the submediterranean downy oak (*Quercus pubescens*) also occurs; it is recognisable by the white felt on younger shoots and the inferior leaf surface, as well as the deeply dented leaf margins.

# Common Alder

*Alnus glutinosa* (L.) Gaert.

## About the Specimen on Display

Alder from the Forestry Office
Stadtroda, Hermsdorf

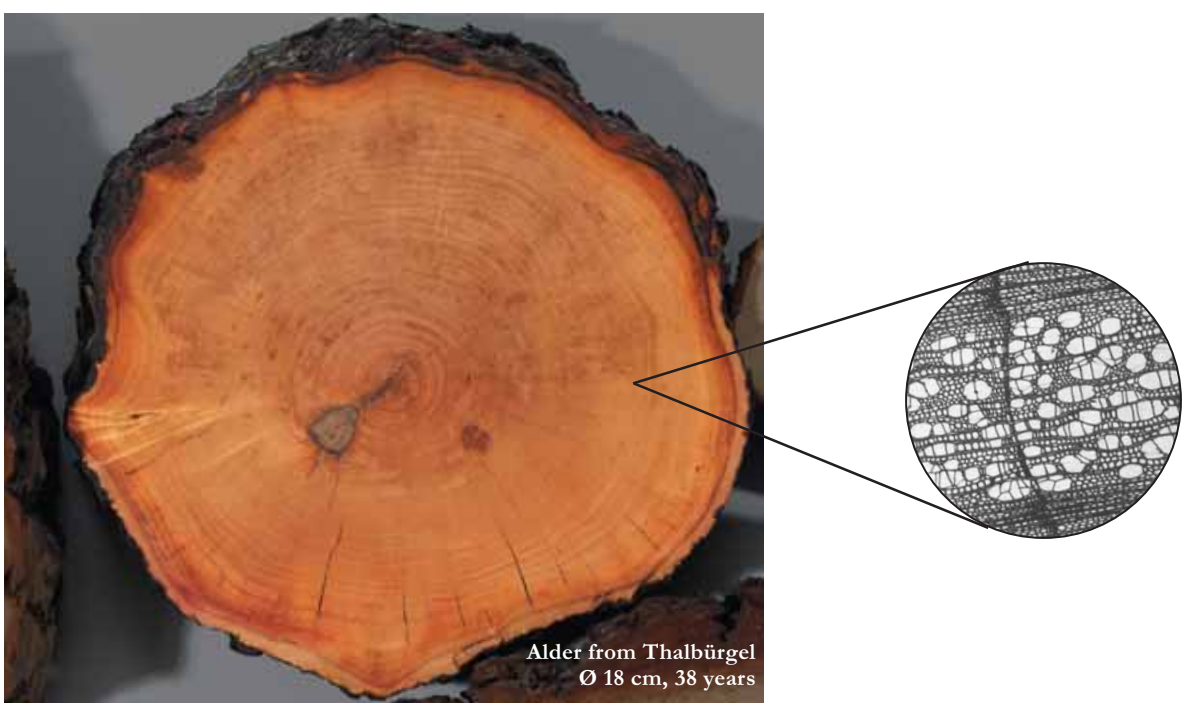
### General characteristics of the wood

The common alder develops a light to reddish, subtly marked, diffuse-porous hardwood with faintly marked growth ring borders, fine vessels and pith rays.

### The wood on display

**The board** is a tangential cut near the pith with a reddish heartwood. The faint tangential grain of the angularly cut growth rings is visible in the denser late wood. The pith rays are bundled into aggregate pith rays. The narrow sapwood is not clearly contrasted with the heartwood. Two dead branches occluded and induced a brown discolouration.

**The tree slice** (cross section: 18 cm, 20 years, almost 0.5 cm average growth ring width) is reddish, without a defined heartwood and the wood is not shrunken. The branch has been overgrown with no discolouration. Although the pith rays are not visible individually, they are indicated by fine grooves.



Alder from Thalbürgel
Ø 18 cm, 38 years

## Botanical characteristics

The common alder is a tree of 30 - 35 m height with 50 - 80 cm (max. 1 m) diameter. It often has multiple stems or trunks due to coppicing. The crown is recognisable by its horizontally growing branches. The bark is initially greenish brown with lenticels, with age it becomes dark grey with a deeply fissured outer bark. The blossoms are monoecious, male and female catkins on the same shoot. The small fruits (nuts) with winged edges develop into woody fruit conelets.

Common alders usually grow to be 80 - 100 years old, but may reach 300 years of age.

## Habitat

The common alder can be found in almost all of Europe to 63°N, in Siberia, the Caucasus and in northern Africa. It reaches its highest growth capacity in eastern Europe and the Baltic. It is a tree characteristic of moist locations, stream banks, lowland peat and alder swamp forests with stagnant water. The common alder is one of the few nitrogen-fixing tree species of our flora (symbiosis with actinomycetes).

Common alder is widespread in Thuringia in wet locations with shallow peat, as well as by ponds, rivers and streams, especially in the highlands.

## Cultivation

The common alder is often planted for protecting river banks. Alder stands are only cultivated as flood plain forest in headwaters with moist soils. Growth is between 8 - 10 $m^3$ per hectare a year. Common alders are also planted for biological soil improvement in poor, degraded locations or for the revegetation of mining trails.

## Use

The common alder has soft, but medium heavy, solid wood that shrinks minimally. It has little weight-bearing capacity and elasticity (comparable to linden wood) and hardly warps. It possesses little durability to weathering, but it is, like the oak, very durable for hydraulic engineering uses. In general it has good workability.

**Current:** Handcrafts (turning and carving wood, furniture, designer furniture, imitation cherry, nut, mahogany and ebony wood used for restorations, veneering, sliding tracks for drawers, lasts, picture frames, clock casings, cigar boxes, paint brushes, pencils, wooden shoes and soles), exterior construction timber (civil engineering), industry (casting moulds), raw materials (plywood rods, chipboards, special charcoal), agriculture (fruit crates, side parts of honeycomb frames), household (kitchen instruments, ironing boards), hobby (toys).

**Historic:** exterior construction timber (wells, bridges, foundations (the city of Venice!)), handcrafts (turning, furniture, shoes, staves), agriculture (fodder), healing (leaves used as gout medicine and in sickbeds to prevent bedbugs and fleas, incense sticks), energy source and raw materials (charcoal, ink produced from the buds, tanning, bark used as dye for silk).

Facts worth knowing

# Weeping or Common Birch

*Betula pendula* Roth

## About the Specimen on Display

### General characteristics of the wood

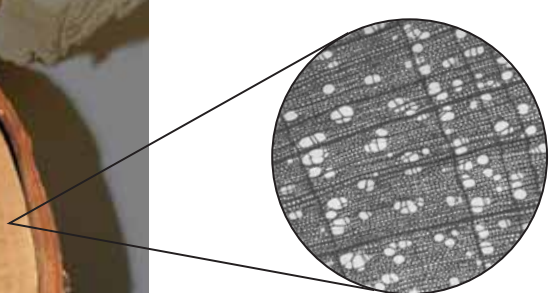
Birch wood is a light coloured, diffuse-porous wood with few clearly marked growth rings. The fine pith rays often generate ray flecks.

### The wood on display

**The board** is almost a radial cut. It shows two phases of heartwood browning. The cloudy phases of the heartwood are an indication of facultative heartwood due to water or air penetration. A branch occluded well. The growth rings are only vaguely recognisable in the diffuse-porous wood. The pith rays induced small ray flecks.

**The tree slice** (cross section: 26 cm, 94 years: 1.4 mm average growth ring width) has a dark brown, cloudy heartwood. This secondary discolouration was induced by oxygen and water penetration through the dead branch (i.e. a facultative heartwood colouration). Under normal circumstances, the wood is evenly coloured.

**Birch from the Municipal Forest Jena, Leutra riverbanks Ø 26 cm, 94 years**



# Birch Family

# Betulaceae

Facts worth knowing

## Botanical characteristics

The birch grows up to 30 m in height. The trunk grows straight when in a stand, but free standing it frequently grows crooked with sparse hanging branches. The characteristic bark is white because of the betulin pigment and peels off in horizontal sections. A black, hard and coarsely fissured outer bark forms on the trunk with age. The fruits form in catkins and disintegrate, leaving the columella behind. The fertile scale is trilobite, the seed kernels are winged on both sides. Birches in Europe rarely live over 150 years but in boreal forests they may reach 300 years.

## Habitat

The natural distribution reaches across all of Europe, Siberia, Asia Minor, the Caucasus and northern Persia. The predominate birch species in northern Europe and Siberia is the downy birch (*B. pubescens*). The weeping birch grows most often in lowlands, less often in the mountains (in the Alps up to 1800 m) as a light-demanding and pioneer tree of light deciduous and evergreen forests, at forest edges, on peat land, heather and non-tilled land. It is undemanding, frost-sensitive and adaptable; it is usually pushed to moist or dry, nutrient poor, acidic soils by competition with other species. Birch is also wide spread as a park and street tree.

In Thuringia, the weeping birch is most often found at nutrient poor sites. The downy birch is comparatively rare.

## Cultivation

The birch is most often used as firewood and it is known by foresters as the "weed of the forest." Currently the pioneer tree is valued in silviculture for its gap-filling and sheltering properties. With appropriate cultivation, birch wood is quite desirable by the timber industry. The birch reaches growth increases of 4 to 8 $m^3$ per hectare a year.

## Use

Birch wood is a heavy, tough wood and not especially hard. It has good mechanical properties; its solidity against breakage is higher than in oak. The wood warps heavily and has minimal durability, but it is easy to work and polish.

**Current:** Handcrafts (furniture, veneering, plywood, turning, musical instruments: piano hammers, guitar bottoms and ribs), interior construction (panelling, imitation nut, cherry and mahogany), household (brooms, brushes, paint brushes), hobby (sporting equipment: javelin, discus), energy source and raw materials (firewood, wood pulp, copper cleaner in the metal industry), cosmetics and medicine (bleeding sap (birch water) for hair cosmetics), customs (May trees, branches as Easter decoration).

**Historic:** Handcrafts (shields and weapon shafts, cog and wagon wheels, furniture, shoe soles nails, staves, relief plates, roots as rope, woodwind instruments), exterior building timber (water wheels), household (moulds, spoons, sieves, brooms, baskets, panniers, sleds), agriculture (troughs, oxen yokes, threshing machines), healing (leaves for rheumatism and wound healing, bark for smoking out the plague, cosmetic powder made from dead wood), nutrition (beer from bleeding sap), energy source and raw materials (charcoal, fire wood, ash, white bark as kindling, leaves make light green dye), customs (like the current plus: for punishing children, protection against evil spells, popular charm for gout, cramps and ulcers).

# Purgatory Buckthorn

*Rhamnus catharticus* L.

About the Specimen on Display

## General characteristics of the wood

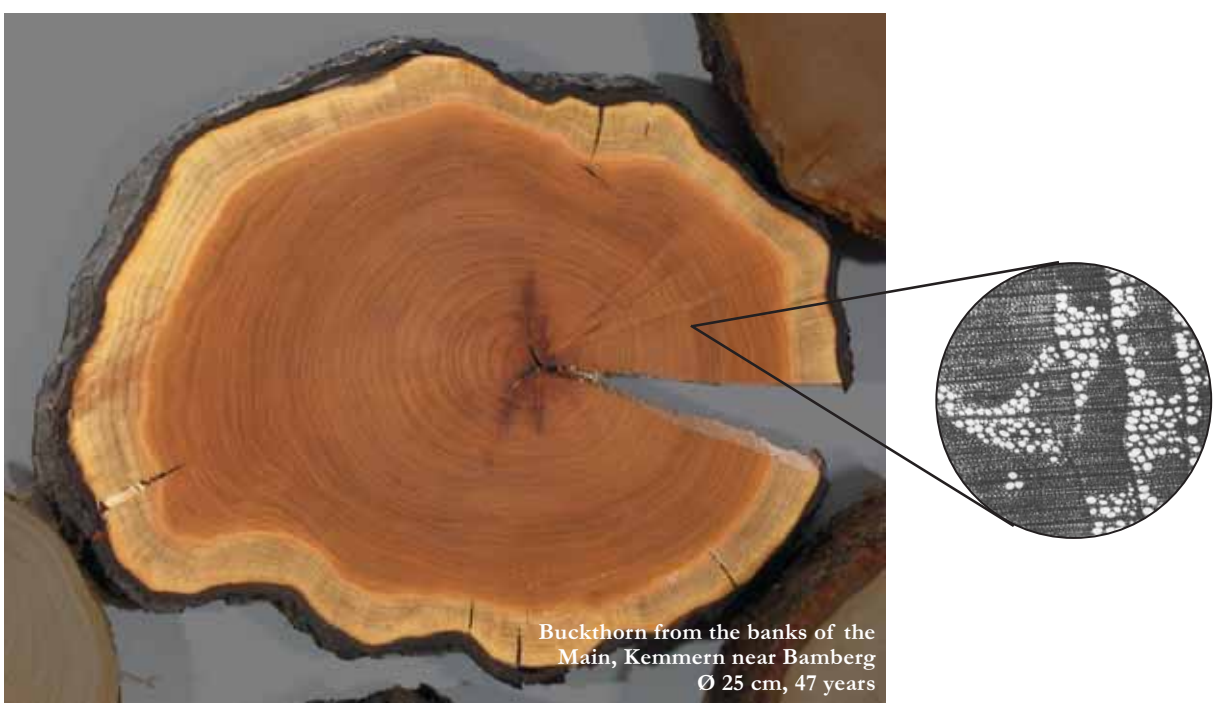
The buckthorn has a narrow, yellow-white sapwood and a shiny brownish red heartwood. The abundant small vessels are arranged diffuse-porous, almost flame like. The fresh wood has a characteristic bad smell.

## The wood on display

### The board

The buckthorn only rarely forms a trunk of such a large diameter. The cut leads precisely through the centre of the trunk, allowing the ingrown spines or lateral shoots to be clearly visible. The trunk branches out on the upper end. An occlusion area formed in the fork, where possible injuries occurred, allowing water and air to penetrate and inducing the discolouration. Such weak places on the tree often lead to a breakage of lateral branches. There was an occlusion of a dead lateral branch on the bottom area that did not completely close*.

**The tree slice** (cross section: 25 cm, 47 years: 2.7 mm average growth ring width) shows the typical green colouration of the sapwood. The heartwood is also greenish coloured after a fresh cut, and changes to brown tones under light exposure.



**Buckthorn from the banks of the Main, Kemmern near Bamberg Ø 25 cm, 47 years**

*Visible only at the exhibited board, not in the picture.

# Buckthorn Family

# Rhamnaceae

Facts worth knowing

## Botanical characteristics

The buckthorn grows to be a shrub about 2 m high or a small tree about 8 m tall. The trunk is often crooked and flute structured. The crown is irregular and loose. The tree branches are arranged crosswise and frequently have thorns on the ends. The bark is blackish, yellowish red on the inside and becomes finely cracked with age. The oppositifolious leaves are elliptical, with 3 - 4 pairs of veins arching towards the leaf apex. In contrast to the cornelian cherry, the buckthorn has lightly serrated leaves. The yellowish green blossoms are inconspicuous; the bluish black, berry-like stone fruits are poisonous.
The buckthorn can reach over 100 years of age.

## Habitat

The natural habitat reaches across Europe to western Asia and north-western Africa, from the plains to medium mountain ranges. As a light-demanding species, the buckthorn prefers sunny locations on calcium carbonate rich, rocky soils like thickets, hedges and forest edges.

The buckthorn can be found in Thuringia in hedges and in some places also along rivers in valley flood plains, but this is rare.

## Cultivation

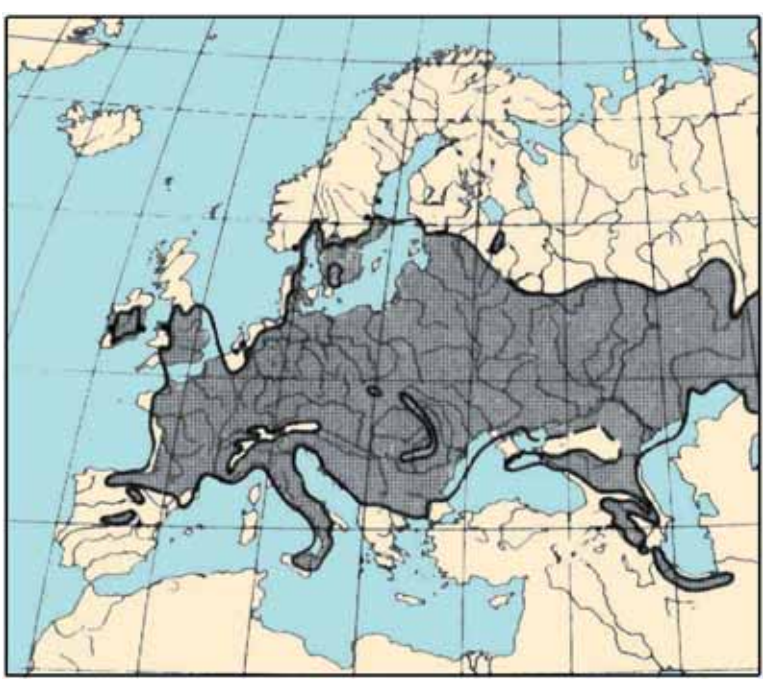
The buckthorn has medicinal uses and is occasionally planted for this reason.

## Use

Buckthorn wood is hard and is therefore desirable for small wood turning work, but this is, nevertheless, quite uncommon.

**Current:** Handcrafts (carpentry and wood turning).

**Historic:** Healing (extraction of laxative drugs; origin of the name: purgative), raw materials (green and red natural dyes produced from the bark and berries).



# Common Juniper

*Juniperus communis* L.

About the Specimen on Display

## General characteristics of the wood

The common juniper has a yellow, narrow sapwood, a brownish heartwood and defined growth rings. The wood possesses the typical "juniper scent".

## The wood on display

**The tree slice** (cross section: 14 cm, 100 years: 0.7 mm average growth ring width) has a greyish white heartwood. Two robust lateral branches can be seen. Thickening in the trunk during growth leads to a detachment of these branches from the sapwood. A more vigorous growth of the trunk took place on the side opposite to the thick branches. The bole slice is very irregularly formed with occlusions in places where the growth decreased for no apparent reason, and on which bark grew into the trunk itself. This almost liana-like growth leads to the high bending capacity of the juniper.

**Juniper from the "Franconian Switzerland" Ø 14 cm, 100 years**

## Botanical characteristics

The juniper is an evergreen, dioecy coniferous tree or shrub with slow growth, it may reach 12 m in height. Most often it has multiple trunks; the branches are short, grow densely next to each other and almost vertically upwards. They form a compact, column or cone-shaped crown. The flaky bark is grey to reddish brown. The prickly needles grow in triple whorls and live to be 3 - 4 years old. The male blossoms are small, spherical and yellow; the females are green and rather unnoticeable. Spherical, fleshy, blue-black (when ripe) "galbulus" develop out of the female blossoms, botanically considered a false berry. The seeds are spread via animals - mainly the fieldfare (*Turdus pilaris*) - who eat the fruit. The juniper can grow to be quite old.

## Habitat

The juniper is spread throughout Europe, large parts of Asia, North Africa and North America. It grows from the plains up to the mountains (up to more than 1900 m in the Alps), has little environmental requirements, but is a light-demanding species. It grows in pine forests with lots of light, on sunny cliff slopes, in scrublands and lean pastures. In Thuringia the juniper can be found spread across dry grasslands and is an indicator of former grazing.

## Cultivation

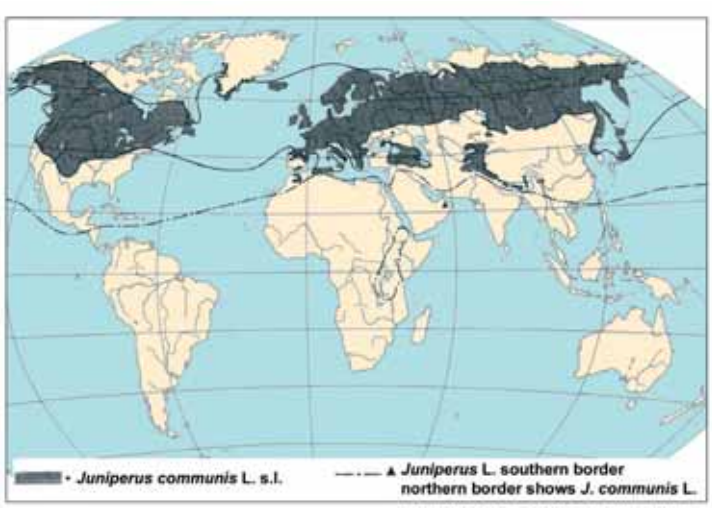
The juniper plays no role in forestry, but it is used now as it has been in the past for landscaping (in parks and gardens), ornamentation, embankment covering, and as a vestige for bird protection. The juniper and juniper heaths have been environmentally protected in Germany since 1936. These natural reserves need management to reduce the invasion of tree species that out-compete the juniper.

## Use

Juniper wood is finely-fibred, soft, medium heavy, tough, elastic, flexible and very durable. It hardly shrinks, is hard to split and has a high burning value.

**Current:** Handcrafts (wood turning, luxury furniture), nutrition (juniper berries used as a spice and for liqueur distilling, e.g. Gin).

**Historic:** Handcrafts (furniture, inlay, wood turning, lattice work, fencing, walking sticks, pipe bowls), healing ( essential rubbing oil for sciata pain and lumbago, tea, for baths and poultices, sore and wound healing, dried berries for blood cleansing and many other treatments), customs (whole plant as "tree of death/life", mostly in cemeteries. During the Middle Ages the juniper smoke was used against the Plague with its invigorating and "cleansing" powers,), nutrition (like above, juniper smoke for smoked ham, wood for food containers), energy source (fire wood).



# Cornelian Cherry

*Cornus mas* L.

About the Specimen on Display

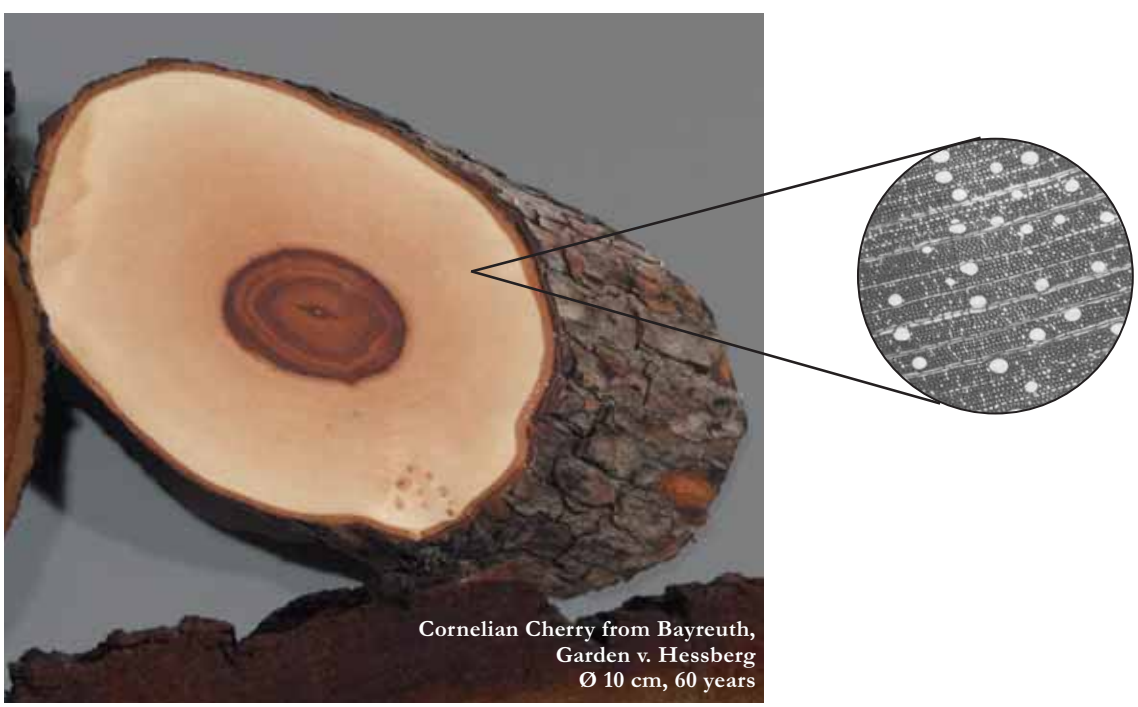
## General characteristics of the wood

The wood of the cornelian cherry has a reddish white sapwood and a red-brown, almost black heartwood. The small vessels are uniformly spread throughout the entire growth ring. The growth rings are lightly wavy and not clearly defined. The wood is very hard and dense, hence the genus name *Cornus* from the Latin *cornu* (horn) is an allusion to the tough, horn like, hard wood.

## The wood on display

**The board**
The cornelian cherry is a shrub; the leader is often bent. Despite monopodial growth, an actual trunk rarely develops. The brown heartwood is extremely hard and fine-grained. It is a rare and precious wood.

**The tree slice** (cross section: 10 cm, 60 years: 0.8 mm average growth ring width) is a very small and dark heartwood with a wide, lightly coloured sapwood.



**Cornelian Cherry from Bayreuth, Garden v. Hessberg Ø 10 cm, 60 years**

# Dogwood Family

# Cornaceae



## Botanical characteristics

The cornelian cherry grows as a shrub or a small, round crowned tree up to 8 m tall. The trunk diameter can reach up to 30 cm. The flaky bark is yellowish grey. The oppositifolious, elliptical leaves have 3 - 5 arched veins running to the leaf apex. The blossoms are small, yellow and arranged in lateral standing, spherical umbels. The cornelian cherry partially blossoms in February, long before leaf bud break. The oval, shiny red fruits are edible and taste sour.
The cornelian cherry can reach over 100 years of age.

## Habitat

The cornelian cherry can be found in central and southern Europe, Asia Minor and in the Caucasus. As a light-demanding to semi-shade tolerant species, it prefers warm, dry, light oak forests, forest edges and bushes in nutrient and calcium-carbonate rich soils. It has a large capacity for budding from both the stem and roots.
It is widespread in Thuringia as undergrowth in thermophilous deciduous forests, dry bushes on the upper rim of the "Wellenkalk" (wavy Middle Triassic limestone formations) or on forest edges. The cornelian cherry is regionally known as the "Herlitze" - a village south of Weimar is thus called Herlitzenberg.

## Cultivation

The cornelian cherry is a popular garden and park tree because of its striking, early blooming yellow blossoms.

## Use

The wood of the cornelian cherry is extraordinarily hard and heavy, very tough, uniform and solid. It is difficult to split, shrinks significantly. It tends to be used for turning, but also polishes well.

**Current:** Handcrafts (tenon-bases, wheels, handles for hand tools, ladder rungs, shoe nails, umbrella handles, walking sticks ("Ziegenhainer"), hoops), agriculture (vineyard posts, pitch forks), nutrition (fruits for jams and juices).

**Historic:** energy source and raw materials (fire wood, charcoal, the bark and wood produce a yellow dye).

# Black Elder

*Sambucus nigra* L.

About the Specimen on Display

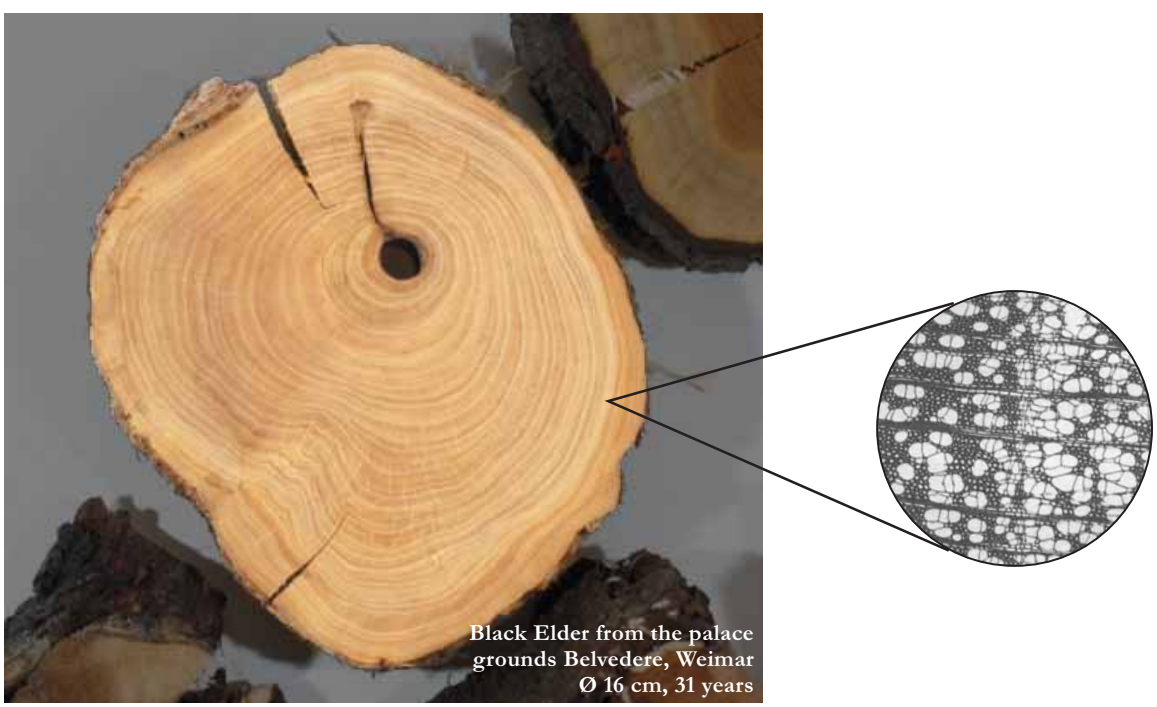
## General characteristics of the wood

Elder wood is yellowish white with no colouration of the heartwood; a vertical cut clearly shows that it is a coarse grained wood. The vessels are arranged semi-ring-porous to diffuse-porous. The growth rings are wavy and easily recognisable. Pith rays are clearly visible. The white pith in young shoots has circumferences of 3 - 10 mm, the pith lumen remains contained in the wood.

## The wood on display

**The board**
The elder is a uniformly yellow coloured, hard wood with a wide pith lumen, clearly visible on the lower end. The black secondary discolouration occurred due to fungus that penetrated through injured areas.

**The tree slice** (cross section: 16 cm, 31 years: 2.6 mm average growth ring width) is easily recognisable by the hole in the centre of the pith.



**Black Elder from the palace grounds Belvedere, Weimar**
**Ø 16 cm, 31 years**

# Elder Family

# Sambucaceae



## Botanical characteristics

The elder is a 10 m tall tree or large shrub with a trunk diameter up to 30 cm and arched overhanging branches. The branches are greyish brown with abundant, conspicuous lenticels. The bark is greyish brown with rough vertical grooves. The oppositifolious leaves are in unpaired pinnate leaves and bud break is very early in the season. The blossoms have an intense aroma. Located in multi-flowered cymes they develop edible, berry like, shiny black stone fruits on red fruit stalks. The edible fungus "Jew's ear" can be found on older trunks (interestingly, the German name for this fungus literally means Judas' ear, named after a saga in which Judas Ischarioth hanged himself on an elder).

While the first shoot, due to fungal attacks, often dies young (after a few decades), the rootstock can live to be over 100 years old.

## Habitat

The elder is spread throughout Europe to the Caucasus countries, from the plains to the mountains, also in the Alps up to 1200 m above sea level.

In Thuringia the elder grows in moist, nutrient-rich soils, in forest clearings and gaps and road edges, and in thickets. It has a high budding capacity. The elder is a nitrogen indicator. Its occurrence in hedges as well as in forests, especially in limestone areas, has grown due to increasing atmospheric nitrogen deposition.

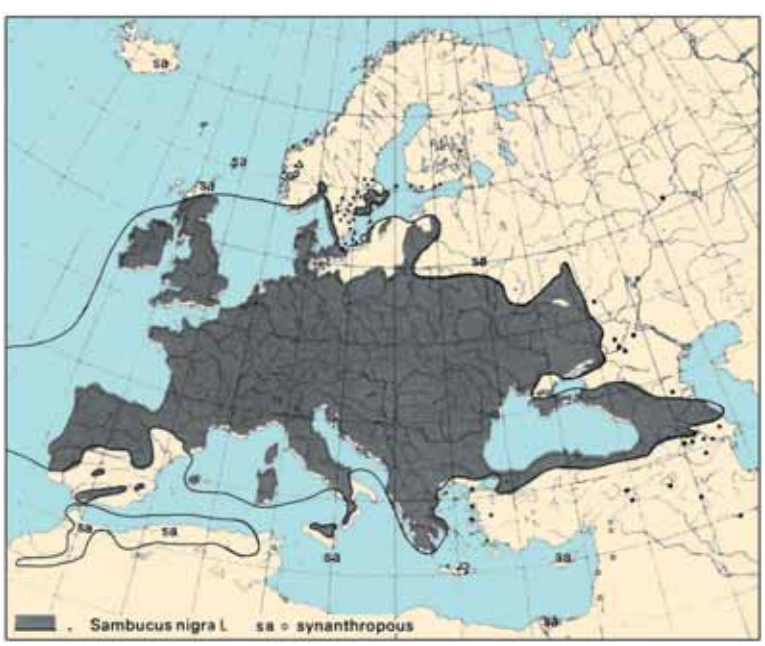
## Cultivation

The elder has been cultivated since ancient times for its blossoms and fruits.

## Use

Elder wood is dense, hard, tough and medium heavy, easy to split, yet hard to dry and rips easily. It does not have a high resistance to fungi nor insects and therefore not very durable.

**Historic and current:** Handcrafts (carpentry, carving, wood turning and inlay work; pipe bowls and simple flutes are easy to produce by removing the pith of young shoots), nutrition (blossoms are harvested for sparkling wine, berries are used in soup or berry wine), healing (the bark was previously used as a laxative and emetic, a tea from the blossoms is diaphoretic and induces sweating, warm juice from the berries consumed to fight colds and fevers), customs (the whole tree was once perceived as a "benevolent spirit" and served as protection against evil spirits and illnesses). The Teutons worshipped it as the home of the earth goddess, Huldana or "Mother Holle", but in Christian superstition it had rather negative connotations.



# Wych Elm

*Ulmus glabra* HUDS. em. Moss

About the Specimen on Display

## General characteristics of the wood

The elm is a ring-porous hardwood with a light brown to dark brown heartwood. The early wood vessels are visible as pore valeculae on vertical cuts. The defined growth rings lead to strikingly visible grain markings in a tangential cut. Pith rays are recognisable as dark ray flecks. The late wood vessels are surrounded by light storage cells and appear as wavy lines in cross sections and tangential cuts, a typical marking of the elm. The elm yields a very attractive wood.

## The wood on display

**The board** originates from a dead trunk, which fell victim to "Dutch elm disease" (see paragraph on habitat), so the sapwood is very narrow and hardly visible. The radial cut turns into a weak tangential cut on the lower end of the board. A grey heartwood formation is visible surrounding occluded branches. The heartwood is red-brown with clearly recognisable growth rings and defined ray flecks formed by the large pith rays.

**The tree slice** (cross section: 63 cm, 118 years: 2.7 mm average growth ring width) shows a light brown to dark brown heartwood with a very thin sapwood. The especially irregular growth of the growth rings is noticeable. The wood shrinks only minimally. There is an old branch visible on the left side.

**Wych Elm from the Forestry Office Kaltennordheim, Thuringian Rhön Ø 63 cm, 118 years**

# Elm Family

# Ulmaceae

Facts worth knowing

## Botanical characteristics

The elm grows to be a tree 40 m tall with a diameter of 50 - 150 cm (max. 300 cm). The trunks are cylindrical and the European white elm (*U. laevis*) is often heavily buttressed. The elm leaf is asymmetrical. This means the base of the lamina starts at varying lengths of the petiole. The blossoms are arranged in reddish-violet balls and appear before the leaf shoot. The fruits develop wide wings. Elms reach ages of 400 years.

## Habitat

The wych elm is the representative for the three elm species of Thuringia: *Ulmus laevis* (European white elm), *U. minor* (smooth leaf elm) and *U. glabra* (English elm). All elms are heavily threatened by Dutch elm disease. The cause of this illness is the fungus *Ceratocystis ulmi*, carried in by the elm sapwood beetle, *Scolytus scolytus*, the fungus later blocks the conduction of water to the tree. This causes the tree to rapidly dry out and die.
The elm grows in nutrient rich, moist locations. The smooth leaf elm and European white elm are typical of flood plain forests of the lowlands. The wych elm, however, is a tree of the mountain forests of medium altitude mountain ranges, in the Alps up to 1400 m. It prefers deep, moist soils.
The wych elm can be found in Thuringia in moist deciduous forests of lower elevations and montane land. The occurrence of mature trees has become rare due to Dutch elm disease.

## Cultivation

The elm is grown commercially as a valuable wood. It grows more rapidly during its youth than the beech, but rather slow with age. The harvesting takes place most often after 70 - 80 years.

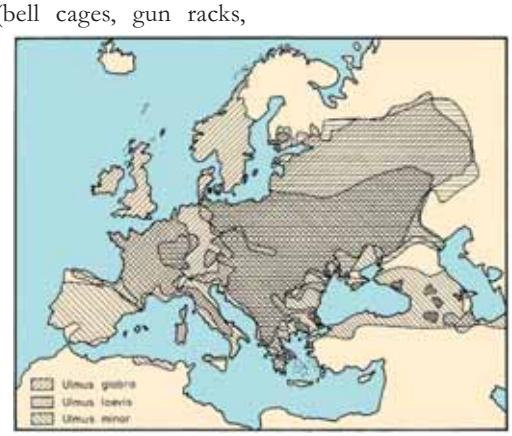
## Use

The valuable elm timber is a coarse, long grained, hard and heavy wood comparable to oak and ash. Elm wood is very elastic and tough with good solidity. The technical properties become more favourable as the growth rings widen because this denotes a higher portion of late wood. The wood shrinks and warps minimally but is not very durable to weathering. The heartwood is durable, however, in constructions in constant contact with water. It is difficult to

saw and plane, but good for turning. It is used as saw wood and veneering. The interestingly marked roots and trunk pieces (bud proliferation) are especially valuable for veneering and turning work.

**Current:** Interior (wall and ceiling panelling, stairs, wood flooring), handcrafts (furniture, musical instruments, turning: wooden pipe bowls), industry (used in vehicle and mechanical engineering because of its high hardness and capacity to withstand abrasion and impact, building timber in structural engineering, boat and ship building, also for bow forms, treads and casting models because of its ability to be shaped), hobby (sporting equipment: hockey sticks, toys), hydraulic engineering construction.

**Historic:** Handcraft (bell cages, gun racks, carriage building: rims, hubs, spokes and runners, rifle stocks, anvils, handles, pulley block), exterior building timber (bridge building), agriculture (vineyard posts, wine presses and barrels, leaves as fodder), raw material (bark used for yellow dye, bast as binding material).



# Common Hazel

*Corylus avellana* L.

About the Specimen on Display

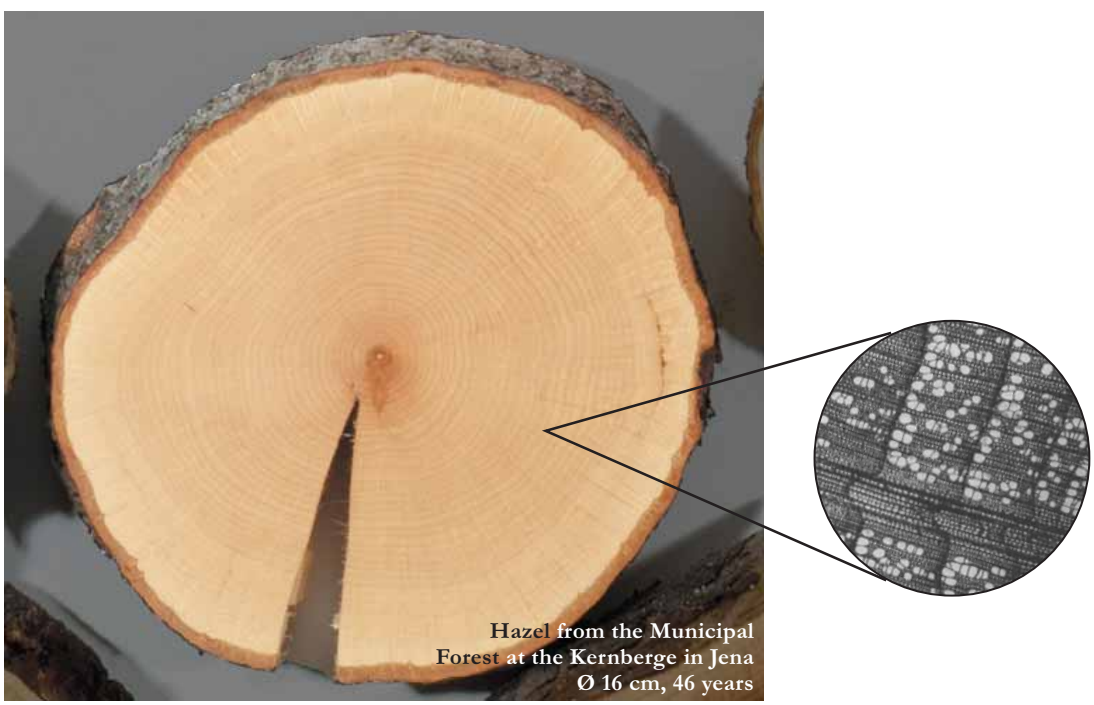
## General characteristics of the wood

Hazel is a reddish white to light brown wood, with no heartwood. The growth rings are circular and easily visible because of their sharp borders. Abundant small vessels are arranged in a diffusely porous way.

## The wood on display

**The board**
The hazel is an even, light coloured wood. Brown discolouration mostly occurred due to fungus penetration.

**The tree slice** (cross section: 16 cm, 46 years: 1.7 mm average growth ring width) shows an evenly formed, light-coloured wood. The narrow sapwood is difficult to distinguish.



**Hazel from the Municipal Forest at the Kernberge in Jena Ø 16 cm, 46 years**

# Hazel Family

# Corylaceae

## Botanical characteristics

The hazel reaches 6 – 8 m as a shrub or small tree, with diameters from 15 – 18 cm. The grey pergamentaceous, scaly bark is smooth during the youth of the tree and later lightly fissured. The alternating, doubly notched leaves are round to egg-shaped with a heart-shaped base and pilose on the lower side. The monoeceous blossoms appear in early spring, the males in hanging catkins. The small female inflorescences are similar to leaf buds, but with thread like, red stigmatic tufts. The hard shelled fruits are surrounded by a green casing which can be split open to obtain the one-seeded nuts, which are edible, oil rich seeds.

The hazel shoots can reach 60 - 70 years at most, but new leaders re-sprout from the rootstock. This can continue for several centuries.

## Habitat

The hazel is spread throughout Europe (except in the far West and far North) as well as in Asia Minor and Algeria. It is widely cultivated in central Europe, though the Asian variety *C maxima* is used more than the native *C. avellana*.

In Thuringia the hazel can be found outside of cultivation in deciduous and bush forests, on forest and road edges and in hedges.

## Cultivation

The hazel is cultivated for nuts. The German hazelnut production covers only a minor percentage of the hazelnut consumption. The major portion of the nuts for direct consumption and for industrial demands has to be imported from other countries.

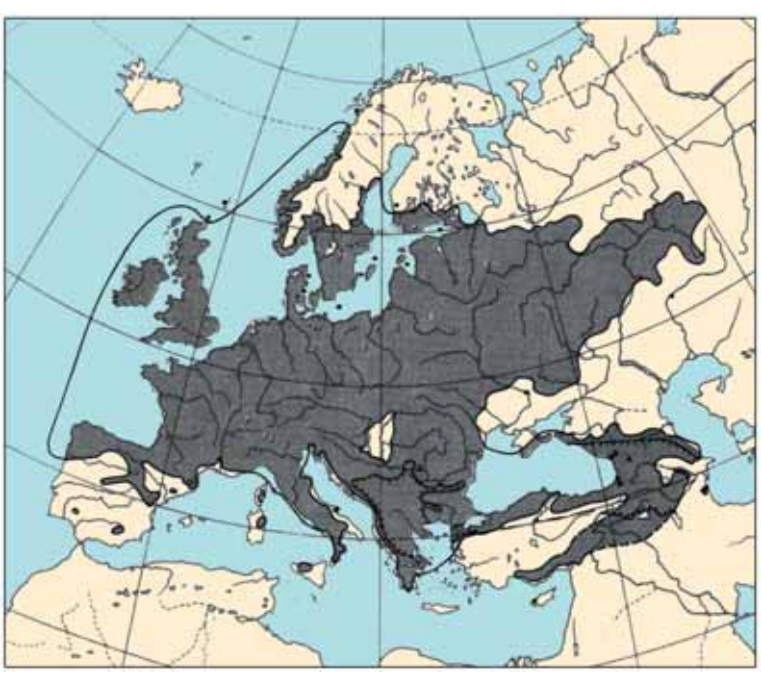
## Use

Hazel wood is medium hard, very tough, and splits well, yet not very durable as it is prone to insect and fungal damage. The thin rods are, like the willow, very elastic.

**Current:** nutrition (hazelnuts), handcrafts (walking sticks, tooth picks, basket weaving).

**Historic:** Handcrafts (thin rods for basket weaving, for binding or as hoops, as a strong interlace for fences and walls or for roofing, posts), energy source (fire wood), healing (for snake bites, cattle diseases), nutrition (nuts, nut oil), mysticism (year old shoots used as a dowser's rod, nuts as a death food (verified by finds in Weimar and Sömmerda).

## Facts worth knowing



# Hornbeam

*Carpinus betulus* L.

About the Specimen on Display

## General characteristics of the wood

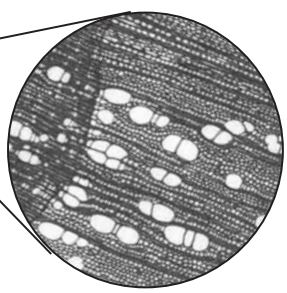
The hornbeam develops a simple, light coloured, diffuse-porous deciduous wood with faintly established growth ring borders and fine vessels but clearly defined false pith rays. It is a heavy hardwood, highly tough and solid.

## The wood on display

**The board** is a radial cut through the centre of the tree. This can seen from the ingrown, alternating small branches of the young shoot. The irregular tangential grains (growth rings viewed from a slanted cut) originate from the crooked growth and the flute-structuring. The whitish sapwood is relatively wide (5 - 6 cm), and the light grey coloured heartwood is not clearly set apart from the sapwood. There are discolourations above the established branches. The false pith rays are clearly recognisable as white stripes on thicker established branches. It produces fine ray flecks in a cross section.

**The tree slice** (cross section: 24 cm, 90 years: 1.3 mm average growth ring width) is clearly distinguished by the flute-structuring. This is induced by irregular growth patterns in the thickening of the trunk. The wide split shows that the wood shrinks significantly. The heartwood is clearly separated from the sapwood. The false pith rays are noticeable, distinguishing the area in which the fluting occurs. The false pith rays are formed by dense packing of individual pith ray strands. The occluded lateral branch with no colouration effect is noticable.

**Hornbeam from the Municipal Forest Jena, Am Forstturm Ø 24 cm, 90 years**



*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

Hornbeams grow to be 20 – 25 m (max. 30 m) trees with a 0.5 – 1 m diameter. The hornbeam is a half-shade tree causing the crown to be multiform and crooked as it searches for holes in the crown cover. The bark is smooth and grey with vertical knobs and grooves due to the flute-structuring. Later, the bark becomes lightly fissured. The leaves are typically doubly serrated. The blossoms and fruits are arranged in green catkins. The seeds sit in ribbed nuts at the base of a three-lobed winged scale.

The hornbeam reaches ages from 120 - 150 years; its use in forestry is best between 70 - 80 years.

## Habitat

The hornbeam is a tree typical of lower ranges of the hill country in all of Europe up to the Caucasus. It is a subordinate species of lightly acidic, clayey soils.
In Thuringia it is widespread in all deciduous forests.

## Cultivation

The hornbeam was indirectly supported in coppice and coppice-with-standards systems because of its high coppicing capacity (shoot regeneration from stumps). The growth of the hornbeam is initially more rapid than in beech, therefore it is highly competitive in coppice systems. It was also directly maintained because of its versatile use for farming tools and machinery.

## Use

Hornbeam is the heaviest native deciduous tree species, very dense (dry density 0.50 to 0.82 g/cm$^3$) and hard. It possesses a high degree of toughness and excellent solidity, but tends to warp and rip and is hard to split.

**Current:** Handcrafts and industry (speciality wood for many commodities with high mechanical demands and impact burden, therefore used for tools, instruments, machines, planes, chisels, straight edge, protractors, carpenters-benches, presses, tool handles (but slippery when wet), energy source (excellent fire wood).

**Historic:** Handcrafts (shuttles and cases for weaving, cogwheels, joint-baring, block and tackle, wagon wheels, wedges, butcher blocks, shoe lasts, billiard and bowling balls, umbrella handles, brush handles, musical instruments (pianos)), agriculture (harrows, flails, fodder), energy source and raw materials (fire wood, in lime kilns, ash (fluid for metal smelting, potash), dye).

# Horse Chestnut

*Aesculus hippocastanum* L.

About the Specimen on Display

## General characteristics of the wood

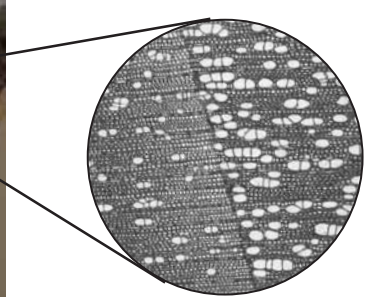
The horse chestnut yields lightly coloured, diffuse-porous, soft wood with a very homogenous structure and extremely fine vessels and pith rays. The growth rings are faintly marked. The horse chestnut is simple and plain except for the dark secondary heartwood.

## The wood on display

**The board** is a radial cut. It has a uniformly light-coloured wood with delayed heartwood formation. Note the dark lateral branch, which occluded rapidly and smoothly without discolouration in the surrounding wood. The growth rings and fine ray flecks are hardly visible. The 1 - 2 cm narrow sapwood is faintly contrasted against the light heartwood. The horse chestnut has a wide pith. The pith lumen fell out of this specimen and is visible as a groove. A secondary chocolate-brown heartwood, most likely induced by oxygen penetration, developed around the pith.

**The tree slice** (cross section: 37 cm, 115 years: 3.2 mm average growth ring width) is a lightly coloured wood without a defined sapwood. A secondary brown heartwood starts from the ingrown branch. The growth rings are easily visible, though the pith rays appear as radial cracks. The wood is shrinking very little, as the slice is hardly split.

**Horse Chestnut from the Municipal Forest Jena, Am Stern Ø 37 cm, 115 years**



# Horse Chestnut Family

# Hippocastanaceae



## Botanical characteristics

The chestnut can grow to be a magnificent tree with a dense round crown. It reaches 20 - 25 m (max. 30 m) in height and 0.5 - 1 m (max. 4 m) in diameter. Its leaves form in hand-shaped pinnate leaves with 5 - 7 pinnae. The blossoms stand in large, conspicuous upright panicles. The spiny fruit usually hold 3 shiny, reddish brown, spherical seeds with large, light coloured hilums.
Horse chestnuts reach ages of 150 - 200 years (max. 300 years).

## Habitat

The horse chestnut is originally native to the Balkan mountains, in the Caucasus, northern Iran and the Himalayas. By the time of the Romans, it was already spread throughout Asia Minor. In 1576, it was introduced to Vienna for the first time and in 1646 to Altdorf (Frankonia), after which it rapidly spread throughout Europe, Asia and North America, though primarily as street and boulevard liners and park trees. It is rarely found in commercial forests.

The horse chestnut is undemanding of soils and relatively insensitive to emissions, but susceptible to the horse chestnut leaf miner (*Cameraria ohridella*), which was presumably brought from southeastern Europe to central Europe during the early 1990's. The larvae of this small moth eat between the outer and inner epidermis of a leaf and consume the mesophyll of the leaf. The resulting damage is manifested in a brown discolouration of the foliage and - if heavily infested - in the early shedding of the affected leaves.

In Thuringia the horse chestnut is also spread in urban areas, as a street liner (for example on the Belvederer Allee in Weimar) and park tree.

## Cultivation

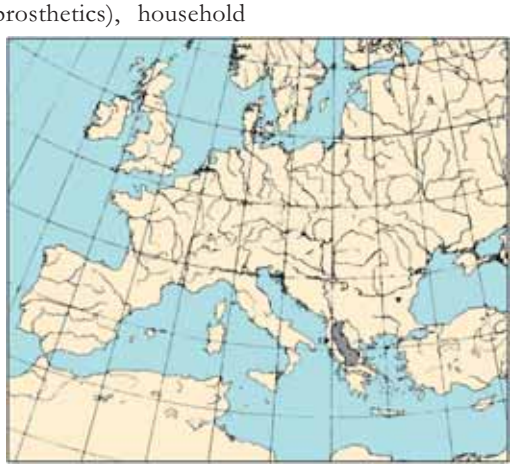
Horse chestnuts can most often be found growing individually or along streets and along forest paths because their seeds are a desired food source for animals. They are especially popular as shade trees in front of village inns and restaurants, in beer gardens and on park grounds.

## Use

The chestnut develops a soft, fine-grained wood with medium density; it is solid and not very elastic - similar to poplar; it has good workability and shrinks only to a medium degree. It is, however, susceptible to ligniperdous fungi and not suitable for exterior building because of low durability. It also has only limited uses because of frequent spiral growth, and it is not suitable for building timber.

**Current:** Handcrafts (blind wood in furniture and doors, carving and turning work, buttons), medicine (wood for prosthetics), household (cutting boards), industry (crates, ply wood).

**Historic:** Handcrafts (carving, inlay, shoe soles), agriculture (fodder), energy source and raw materials (tanning, dying, ash (flux promoter for metal smelting, potash), charcoal).



# Large- and Small-leaved Lime or Linden

*Tilia platyphyllos* Scop. and *T. cordata* Mill.

About the Specimen on Display

## General characteristics of the wood

The lime is a hardwood tree with lightly coloured heartwood. The wood is a simple light colour, diffuse-porous with abundant evenly arranged fine vessels, which are also visible in vertical cuts. The growth rings are only faintly marked, but recognisable. The pith rays are clearly visible as ray flecks.

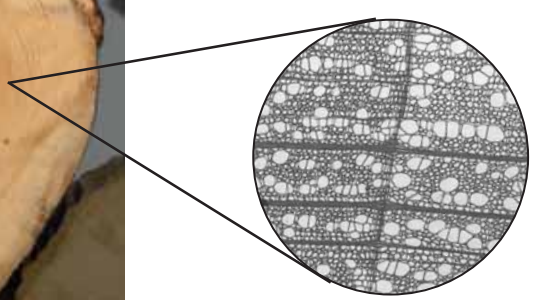
## The wood on display

The board and the tree disc are both large-leaved lime.

**The board** is a tangential cut with faint tangential grain markings (diagonal cut) of the growth rings. The sapwood is wide (4 - 5 cm), but hardly separated by colouration from the heartwood. The pith rays are visible as fine ray flecks, especially in the upper part of the board (right). The board shows imperfections in the wood in the form of a brown band induced by old wounds and bark damage.

**The tree slice** (cross section: 38 cm, 72 years: 2.6 mm average growth ring width). The tree is very eccentric, it most likely grew hanging sideways. The slice has not split, indicating that the wood shrinks relatively little. The growth rings are clearly visible. A faint grey heartwood that formed after felling is also recognisable.

Large-leaved Lime from the Forestry Office Jena, District Vollradisroda
Ø 38 cm, 72 years



## Botanical characteristics

The lime tree develops to be a 25 - 30 m (max. 40 m) tree with a diameter of often up to 1 m. Individual trees with diameters of more than 5 m are known. Free-standing, the crown formation is similar to the lime leaf (but round at the top). With age, the lime tree forms a dark grey, vertically fissured outer bark (rhytidome). The leaves are round to crooked heart shaped and pointed, and the small-leaved lime leaves are fuzzy. The pleasant smelling blossoms are arranged in false umbels. The fruits are nuts. The leaf-like bract of the blossom and the infructescence serve as a flight organ.
Lime trees reach old ages, it is not uncommon for them to reach 300 or 400 years, max. up to 1000 years.

## Habitat

The lime tree grows in northern, central and eastern Europe up to the Urals and the Caucasus. The large-leaved lime is more widespread in eastern and northern Europe, whereas the small-leaved lime grows more in southern and south-eastern Europe. In general, the large-leaved lime does not grow at as high elevations as the small-leaved lime. As a typical subordinate tree, the small-leaved lime is often cultivated next to the sycamore.
The lime tree is found in Thuringia most often in diverse deciduous forests on limestone mountaintops. It is also found frequently in village centres ("Dorflinde"), sometimes supporting a platform for dancing in the crown ("Tanzlinde").

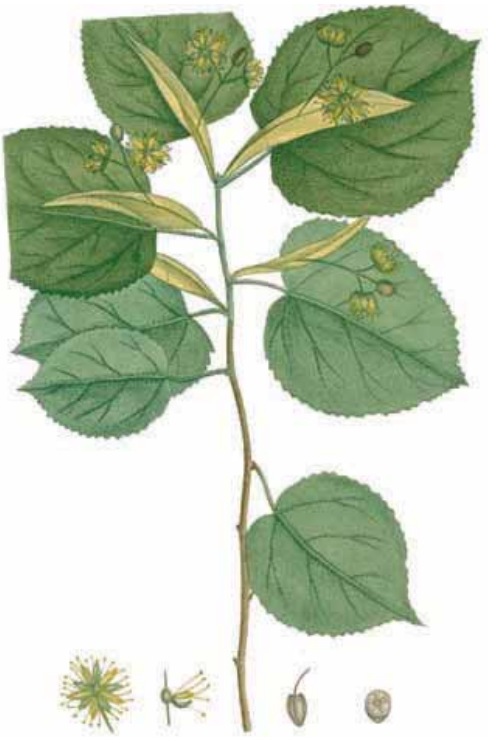
## Cultivation

The cultivation is by selective felling or coppice-with-standards forestry systems. The forest service is currently attempting to support lime trees in tall forest systems. Furthermore, single trees are cultivated in villages and on open fields. Lime trees are also frequently planted as street liners.

## Use

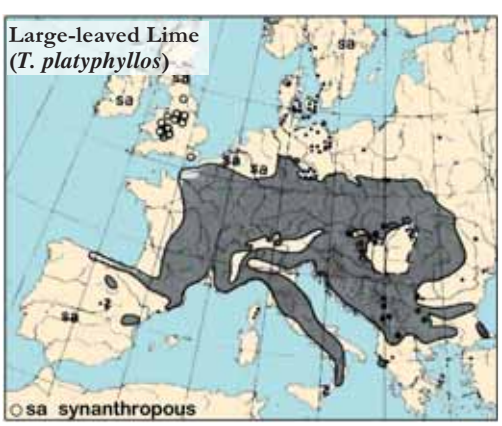
The lime tree develops a soft, medium heavy wood with even structure. It is tough but not very elastic or break resistant, it shrinks significantly and is easy to work . It is not very durable under weathering and is therefore used mostly for interior constructions.

**Current:** handcrafts (wood sculpture, carving, turning, furniture - for wooden blinds and barrier veneering - nut tree and ebony wood imitation, cuckoo clocks, drawing boards, hat moulds, wooden buttons, wig making, braces of carpenter saws, flat paint brushes, wooden shoes, carpenters' pencils, musical instruments-harps, piano keys, reed pipes on organs), industry (foundry models), household (kitchen appliances, spice racks, corks, tooth picks), hobbies (toys), agriculture (in bee hives as upper and lower strips of the frames, as bee food), medicine (wood for prosthetics, lime blossoms as tea), raw materials (wood-wool, drawing charcoal).



Botanical characteristics of the Large-leaved Lime

**Historic:** handcrafts (carving, turning, crates, baskets, pencils, raffia for weaving, with tin ash for sharpening tools), agriculture (fodder, bee food), healing (linden blossom tee for consumption, tumours and haematoma), energy source (fire wood, charcoal). Altar carvings in old churches are made of lime wood (the famous wood carver Riemenschneider was born in 1455 in Heiligenstadt, Thuringia).



# Sycamore

*Acer pseudoplatanus* L.

About the Specimen on Display

Sycamore from the Municipal Forest Jena, Leutra riverbank

Sycamore from the Municipal Forest Jena, Leutra riverbank Ø 27 cm, 56 years

## General characteristics of the wood

The maple species have lightly coloured, homogeneously structured, occasionally tiger striped wood with small diffuse pores, defined growth ring borders and reddish shiny ray flecks. A facultative greyish brown coloured heartwood often forms with age.

## Sycamore wood on display

### The Board

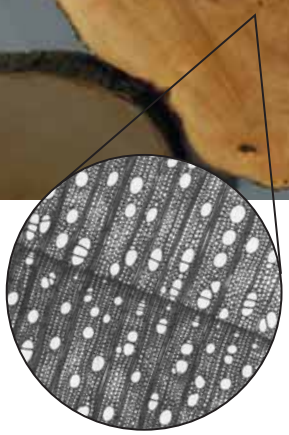
The sycamore (*Acer pseudoplatanus*) has the palest coloured wood of the native maple species. This board is a radial cut near the centre of the trunk, therefore only the first few annual growth rings were cut at an angle (tangential grain). The strong pith rays produce shiny ray flecks, most noticeably on the edge of the specimen. There is an overgrown injury in the middle of the board that caused a cancerous tumour in the wood. This area is especially fine and irregularly grained. Such tumours are typical of maple and are especially valuable, as they are sought out for special uses (pipe bowls). At the base of the bole there is another injury on the left side inflicted by a wood fungus*. In forestry industry, such damages can occur from the handling and moving of wood.

**The smaller tree slice, from the bank of the Leutra River** (photo on the left, cross section: 27 cm, 56 years: 2.4 mm average growth ring width) shows the opposite branching pattern of the maple. The two lateral branches opposite each other are recognisable by dark spots. On the trunk exterior there are several well occluded injuries, as indicated by the visible brown area.

**The larger tree slice from the Leutra River bank** (bottom photo opposite, cross section: 50 cm, 154 years: 1.6 mm average growth ring width) shows a significantly slower growth while the tree was young, but evenly spaced growth rings in the full grown tree. Water and air penetration of an injury to the trunk resulted in the formation of a brown, facultative coloured heartwood, in which the fungus growing there is delimited by black lines. The dark spots on the right side were also caused by injuries.

*Visible only at the exhibited board, not in the picture.

Sycamore from
Brotterode
Ø 85 cm, 145 years



**The tree slice from Brotterode** (photo above, cross section: 85 cm, 145 years: 2.9 mm average growth ring width) shows extremely rigorous juvenile growth with almost 1 cm wide growth rings which steadily reduced as the tree aged. The slice was cut off near the ground, where the buttresses caused an irregular formation of growth rings. The significant growth differences lead to tension in the wood, and penetration of air at the "Waldriss" (the centre "crack" that formed at a right angle to the main wind direction). This "crack" caused the narrow, brown secondary coloured heartwood. The pointy discolouration was originally caused by a chain saw cut, where wood staining fungus grew during storage of the wood.

Sycamore from the
Municipal forest Jena,
Leutra riverbank
Ø 50 cm, 154 years

# Common and Norway Maple

*Acer campestre* L. and *Acer platanoides* L.

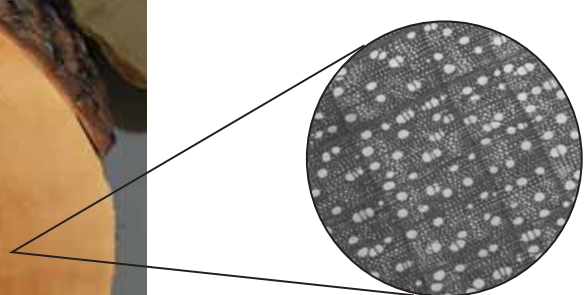
About the Specimen on Display

## Common maple wood on display

**The board**
The common maple (*Acer campestre*) is a reddish coloured wood. It is the darkest wood of the maple species. The bole has significantly more branching than that of the sycamore, which means it grew slower as a young tree. The remnants of the lateral branches are clearly visible and lead to an "iridescence" due to the wavy pattern of fibres and vessels in an axial direction. The ray flecks of the reddish pith rays on the top of the board are especially recognisable because it was cut perfectly through the middle of the trunk*.

**The tree slice** (cross section: 35 cm, 70 years: 2.5 mm average growth ring width) is a very uniform reddish colour with faintly delimited sapwood.

**Common maple from the Forestry Office Jena, District Heideland, Eisenberg Ø 35 cm, 70 years**



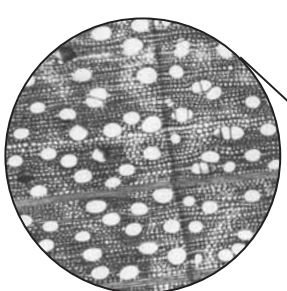
*Visible only at the exhibited board, not in the picture.

## Norway maple wood on display

**The Board**
The Norway maple (*Acer platanoides*) shows a yellowish sapwood and a reddish heartwood. This colouration can be intensified when the wood is steam-heated. The cut runs almost through the pith. There are recognisable black, ingrown dead branches in the heartwood. The sapwood is iridescent in colour. Lightly raised and sunken sections make these areas recognisable to the touch. The so called "burl grain" forms by a zigzag-like path of the xylem elements in an axial direction, especially around the branches.

**The tree slice** (cross section 30 cm, 64 years: 2.3 mm average growth ring width) has a large injury comprising about a third of the trunk diameter, which occurred during the youth of the tree (at approximately 10 years). It took about 10 years until the wound occluded and 5 more years until the bark in the centre of the occlusion was occluded as well. After 50 years the irregularity of the bark still shows the damage in the interior of the bole.

Norway maple from the Forestry Office Jena, District Rockau, Tautenburger Forst



Norway maple from the Forestry Office Jena, District Vollradisroda
Ø 30 cm, 64 years

# Sycamore, Common and Norway Maple

## *Acer pseudoplatanus* L., *A. campestre* L. and *A. platanoides* L.



Sycamore
(*A. pseudoplatanus*)

Common maple
(*A. campestre*)

Norway maple
(*A. platanoides*)

### Botanical characteristics

**The sycamore** grows to be 35 m tall and reaches a diameter between 60 - 100 cm, free-standing up to over 200 cm. The trunk can grow without branches for about 18 m, a length of 8 - 12 m is ideal. The bark is initially greyish brown and smooth, covered by a later growth of reddish, spotted outer bark which flakes off. The leaves consist of 5 lobed wedges with pointy edges, with golden yellow colouring in autumn. The greenish yellow blossoms hang in abundantly flowered clusters. The winged dehiscent fruits contain 2 ball shaped seeds, the wings form a pointed angle with each other.

**The common maple** often stays in shrub form. If the competition is not too strong, it can become a medium sized tree between 10 - 15 m high (in the Thuringian Forest District Creuzburg even 29 m) and reach a diameter of over 40 cm. The bark is light grey to brown, the outer bark forms in square sections, often suberised layers form on the branches. The leaves are smaller than those of the other species and have blunt lobes. The autumn foliage is yellow and red. The buds appear in haired upright corymbose cymes, the winged fruit stand almost horizontal.

**The Norway maple** is smaller than the sycamore, reaching only 20 - 30 m in height, but under good conditions the diameter can reach 60 - 100 m as well. The hard bark (rhytidome) forms earlier than on the sycamore, is blackish, strips off vertically and does not flake off. The lobes of the leaves are long and pointed with coarsely sinuate teeth and round notches in between. The autumn colouring is orange to bright red. The buds appear in upright corymbose cymes before bud break. The winged fruits form a blunt angle with each other and the seeds are flat.

The sycamore reaches at most 400 - 500 years of age, while the Norway and common maple only live to be 150 - 200 years.

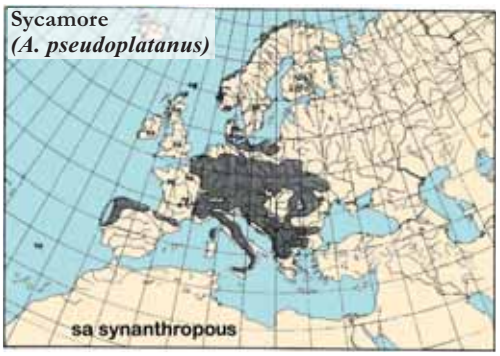
## Habitat

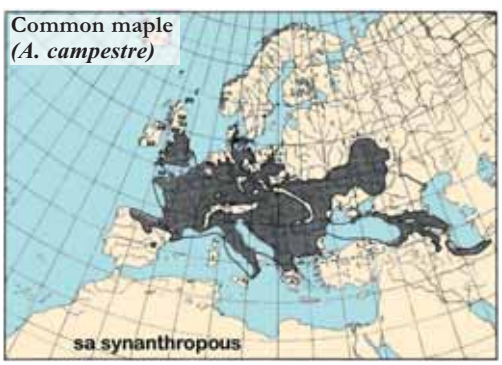
**The sycamore** grows in cool, moist climates, montane, beech abundant mixed forests and shady ravine forests. It prefers deep, fresh, nutrient rich soils and can be found in the mountains of central, southern, and south-eastern Europe as well as the Caucasus and in the Alps at up to 1700 m altitude.

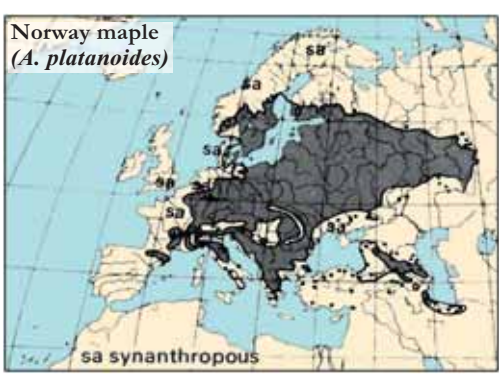
**The common maple** can be found in mixed deciduous forests in the flatlands and hills, on forest edges, hedges and bush land. It is dispersed throughout the largest area of all the maple species, including almost all of Europe, northern Africa, Asia Minor and the Caucasus.

**The Norway maple** grows more in the plains and lower mountains, it can rarely be found higher than 1000 m in altitude. It is spread throughout Europe, the Caucasus and Asia Minor, prefers fresh, nutrient rich, light loamy soils in mixed deciduous forests.

All of the three maple species can be found in Thuringia, but only the sycamore reaches the higher zones of the Thuringian Forest. The common maple is a hedge and field tree.




## Cultivation

Of the three maple species native to Germany, only the common and Norway maple are used in forestry and for commercial wood purposes; because of its smaller dimensions the common maple plays only a subordinate role. Maples are popular park and street trees, the common maple is also planted as a hedge tree.

## Use

Between the sycamore and Norway maple there are no large differences with regard to the wood. The sycamore is somewhat easier to work, while the wood of the Norway maple is heavier, more elastic and sturdy. The common maple is also very tough and sturdy. In general, maple wood is uniformly dense, elastic and tough. It has staying power, is resistant to abrasions and shrinks evenly. In comparison, it is not resistant to the elements, has less natural durability and is sensitive to secondary discolouration.

**Current:** Handcraft (furniture, veneering, marquetry, wood turning, carving and sculpting, musical instruments: string instruments, flutes and bassoons, curved parts, measurement and drawing tools, rifle stocks, whip and umbrella handles, pipe bowls), industry (rotary irons in the textile industry, model wood in metal foundry, metal and oil wood for machine and instrument building), interior building (wall and ceiling panelling, blinds, door filling, flooring), household (kitchen tools like cutting boards, spoons, meat pounders, rolling pins etc.), hobby (toys, sporting equipment), energy sources (fire wood).

**Historic:** Handcrafts (wagon and carriages, water mills, shoe soles, bows), industry (wall paper printing rolls, cogwheels), agricultural (wooden parts of harrows and ploughs, handles of rakes, shovels and flails), raw material (fire wood, charcoal kiln).

# Common Ash

*Fraxinus excelsior* L.

## About the Specimen on Display

Ash from the Forestry Office Rudolstadt, Uhlstädter Heide

### General characteristics of the wood

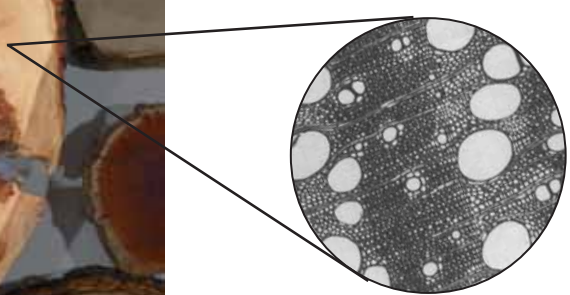
Ash wood is a ring-porous hardwood with wide, light coloured sapwood and a light heartwood. With old age, there is a possibility that a dark brown secondary heartwood might form. The growth rings are prominent and the early wood vessels are clearly visible as pore valleculae in vertical cuts.

### The wood on display

**The board** is a tangential cut near the middle of the trunk. It is a ring-porous wood with a light coloured sapwood and secondary coloured heartwood. The large vessels form in the spring and are visible as thick black stripes (pore valleculae). The light brown secondary heartwood is cut into in the middle. The growth rings of the ash can be felt by hand because the thicker late wood shrinks less than the large pored early wood.

**The tree slice** (cross section: 75 cm, 130 years: 2.9 mm average growth ring width) originates from a street tree on a country road. The slice is distinguished by the brown, significantly wavy and cloudy secondary heartwood formation induced by varied and repeated penetrations of air and water into the inner trunk. The wood shrinks, as shown by the wide split. The light area is quite wide for a ring-porous wood and most likely does contain non-discoloured heartwood. The pith rays are visible as dark stripes.

Ash from an Avenue near Brotterode
Ø 75 cm, 130 years



## Botanical characteristics

Ash trees reach a height of 35 m to a max. of 40 m with a diameter of 1 m (max. 2 m). Free-standing, it often grows heavily forked with a sparsely branched crown that begins low on the trunk. The bark is smooth and greenish grey in the young tree; with old age it forms reticular grooves in diamond shaped sections. The leaves are oppositifolious in unpaired pinnate leaflets. The large, black velvety winter buds are a good identifying characteristic of the tree in winter. The blossoms form in dark purple, dense tufts without chalice or corolla. The fruits are one-seeded, tongue-shaped, winged nuts.
Ash trees reach ages of up to 300 years and are ready for (forestry) felling after 70 - 80 years because the probability of forming the undesirable brown coloured heartwood increases rapidly with age.

## Habitat

Ash is the most important hardwood timber besides beech and oak. It is spread across all of Europe up to 61$^0$ N and in central Russia and the Caucasus, but its highest abundance is in the foothills of the Alps. It grows in nutrient-rich, moist locations ("water ash") as well as in dry, flat lime soils ("calcareous ash") and it is a popular street and boulevard liner.
The ash occurs in all deciduous forests in Thuringia.

## Cultivation

The ash often grows faster than other forest species during regeneration, but it is later overgrown by beech. The growth increase is between 4 - 6 m$^3$ per hectare and year.

## Use

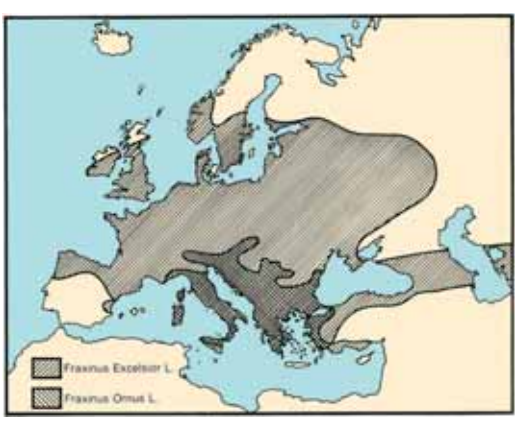
The ash yields a heavy, hard wood with a high capacity to tolerate pressure, tension and bending. It has high elasticity, is abrasion resistant, very tough and flexible. The wood shrinks and warps only minimally. It has good workability but tends to tear. It is minimally resistant to the elements.

The wider the growth rings are, the better the technical properties of the wood because solidity is dependent upon late wood. Therefore, the ash is heavily thinned. The brown heartwood does not affect the technical properties of the wood. With significant heartwood formation, ash

wood is similar to its relative, the olive tree; then referred to as the "olive ash", this wood is of high value.

**Current:** handcrafts (veneering (burls), chairs, turning, ladder rungs, lasts, sled runners, tool handles), interior building (wood flooring), industry (coach building and mechanical engineering structures, casting moulds, palettes), hobby (sporting equipment).

**Historic:** handcrafts (mills, water mills, coach building, weapons (bows and spears), skis), agriculture (wine presses, plugs, fodder), industry (weaving machines, threshing machines, used in the chemical industry because of resistance to chemicals, vehicle construction (street cars, trains), railway ties), healing (ash as diaphoretic, bleeding sap for a medicine, the Manna), energy source and raw materials (charcoal, bark for blue dyes).



# Common Lilac

*Syringa vulgaris* L.



## General characteristics of the wood

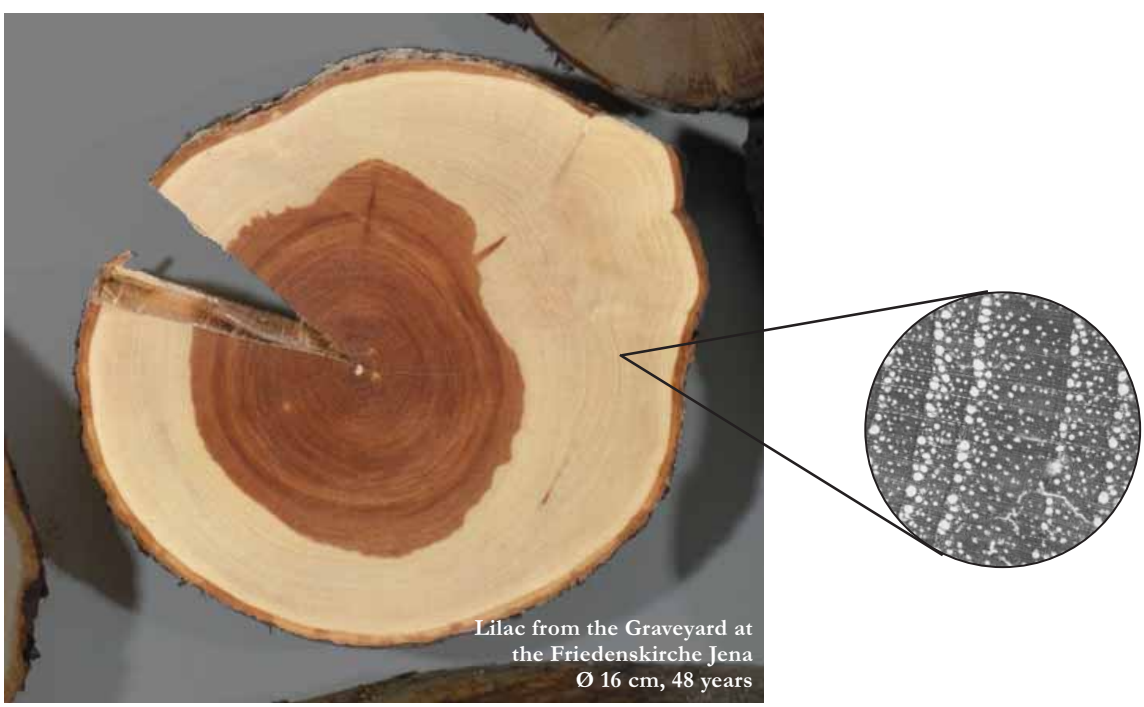
The wood has a brown to light violet heartwood that is clearly distinguished from the yellowish to reddish white sapwood. The vessels are arranged semi-ring-porous, the pores rapidly become smaller after the spring wood. The growth ring borders are clearly marked. Cell lineage with violet content is visible in a vertical cut on the border of the heartwood and sapwood.

## The wood on display

### The board

The lilac is the only wood that has lilac coloured deposits in the heartwood, visible as vertical stripes of violet. The rest of the heartwood is an inconspicuous light brown.

**The tree slice** (cross section: 1 cm, 48 years: 1.7 mm average growth ring width) shows a clear border between the dark heartwood with violet deposits and the light sapwood.



Lilac from the Graveyard at the Friedenskirche Jena
Ø 16 cm, 48 years

Facts worth knowing

## Botanical characteristics

The lilac grows as a large shrub or small tree with a broom shaped crown and reaches a height of up to 7 m. The bark is greyish brown and rough and develops vertical strips of thin, flaky bark. The oppositifolious leaves are oval to heart-shaped and bright green on both sides. The lilac is a popular ornamental shrub because of its pleasant smelling, mostly purple-coloured blossom panicles. There are diverse cultivars derived from the original wild species.

## Habitat

The original habitat of the lilac is in southern Europe and the Balkans, it has been known in Germany since the 16th century.

It was brought in to Thuringia in the 16th century as an ornamental plant; because of its high capacity to bud, it often develops into large bushes in gardens, hedges, parks and forest edges.

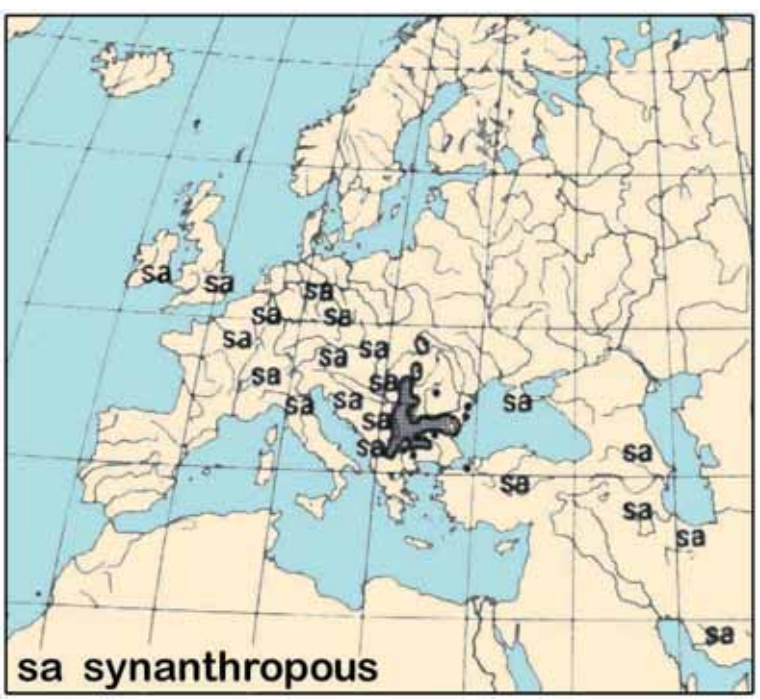
## Cultivation

Lilac is cultivated and maintained as an ornamental shrub. There are up to 900 different cultivars and variations.

## Use

Lilac wood is hard, dense, heavy and solid, hard to split and polish.

Historically as well as currently, lilac wood has been used for carpentry and wood turning.



# Common Bean Tree, Golden Rain Tree

*Laburnum anagyroides* Medik.

About the Specimen on Display

## General characteristics of the wood

The bean tree is the only wood with an almost greenish to black heartwood, sharply contrasted by the light yellow narrow sapwood. The heartwood is yellowish brown and becomes chocolate brown with light exposure, it is black veined or with a faint green tinge. The vessels are arranged ringed-porous. The growth ring borders are garland shaped and result in a grain marking in the tangential cut, whereas exact radial cuts have a decoratively speckled top surface induced by the pith ray tissue. The wood has a fine structure and shiny top surfaces.

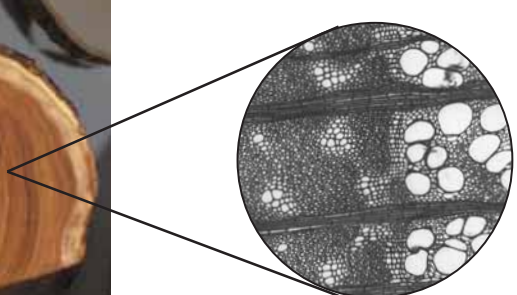
## The wood on display

### The board

The light yellow sapwood is clearly emphasized next to the heartwood. The original heartwood secondarily changed after light exposure into a blackish, almost ebony-like wood. In the cross section, the wave formation of the vessels and the growth rings cut at an angle induce a wavy pattern of the tangential grain.

**The tree slice** (cross section: 35 cm, 40 years: 4.4 mm average growth ring width) shows the decorative wood of the bean tree with greenish wood and a heartwood which later turns almost black.

Golden Rain Tree from the Forestry Office Bayreuth, Limmersdorfer Wald
Ø 35 cm, 40 years

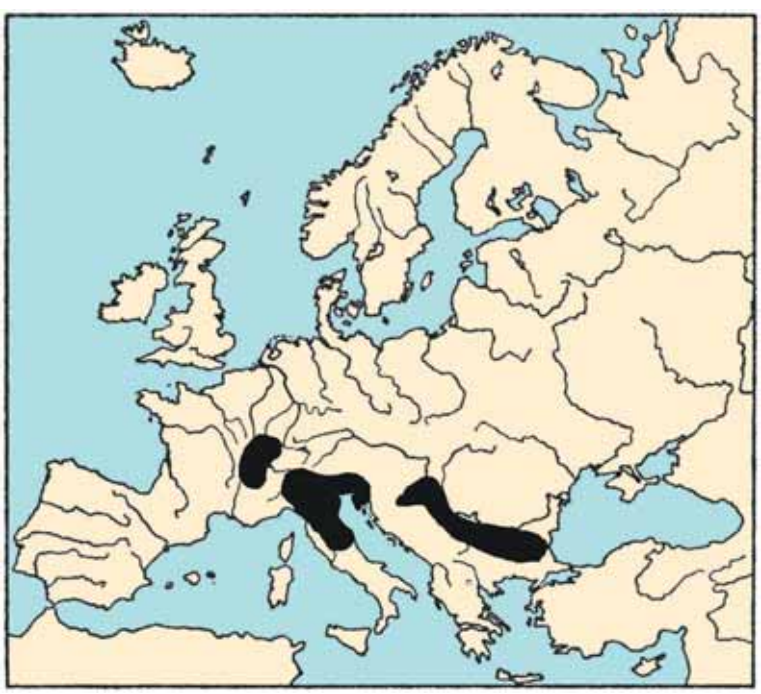


## Botanical characteristics

The bean tree grows to be a large shrub or tree up to 7 - 9 m, max. 15 m tall. The bark is smooth, olive brown or blackish, with abundant lateral lenticel bulges. The leaves are similar to clover leaves: they have three-sided pinnate leaves and the individual leaves are elliptical. The striking yellow papilionaceous flowers are 2 cm long and hang in clusters of 30 cm long. The blossoming season is from May to June. The dark brown to black seeds develop in a green, bean-like fruit pod, which grows to be about 6 - 8 cm long and later turns brown. The plant contains the poisonous alkaloid cytosine. The highest poison concentration is found in the seeds. The bean tree reaches 40 - 50 years of age.

## Habitat

The bean tree's natural range is in southern and south-eastern Europe. As a light-demanding species, it prefers sunny forests and thickets in calcium carbonate and nutrient rich soils.
The bean tree has been planted in Thuringia since the 16th century as an ornamental shrub in parks and gardens; it occasionally grows wild.



## Cultivation

The bean tree is planted as an ornamental shrub. Because of its toxicity, the bean tree should not be planted in gardens with small children or near playgrounds.

## Use

The wood is hard, heavy and dense. It dries easily, is difficult to split but good for polishing, though it is not especially durable.

**Current:** Handcrafts (delicate wood turning work, musical instruments (bagpipes), measuring sticks, knife handles, veneering for inlay work).

**Historic:** Healing (as an emetic, for neuralgia, and asthma). No longer used due to the danger of the toxic parts of the plant. Today, it is only occasionally used in homeopathic medicine for depression, dizziness and cramps, as well as stomach and intestinal illnesses.

# Robinia

*Robinia pseudoacacia* L.

About the Specimen on Display

## General characteristics of the wood

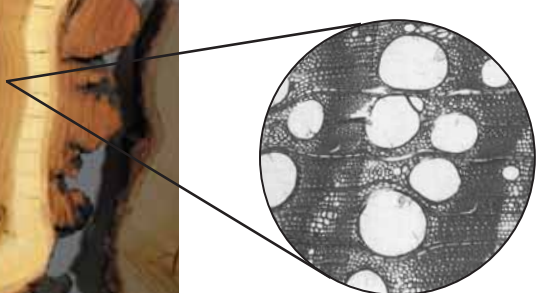
The robinia is a hard wood with a greenish brown to dark brown coloured heartwood and narrow sapwood. The wood is ring-porous with defined growth rings. The large vessels of the early wood are recognisable in a cross section as wavy white spots arranged in the growth rings and as coarsely grained valeculae in vertical cuts. The growth rings appear as defined tangential grain markings in a tangential cut.

## The wood on display

**The board** is a radial cut through the middle of the tree. Because of the crooked growth typical of robinia, the upper third part of this radial cut turns into a tangential cut, where the diagonally cut growth rings appear as tangential grain markings and the large vessels are clearly visible as white dots. The yellow sapwood is very narrow (app. 1 cm) and clearly contrasted from the chocolate brown heartwood. The robinia usually has heavy branching. Lateral branches are recognisable as irregularities in the growth ring pattern.

**The tree slice** (cross section: 29 cm, 45 years: 3.2 mm average growth ring width) originates from a free-standing tree (old brewery in Jena). Noticeable features are the thick outer bark, the narrow, yellow sapwood and the light to dark brown heartwood. The growth ring pattern is irregular and induces flute-structuring. The late wood vessels are clearly visible because they are arranged in clusters and form wavy bands in the tangential direction. They are surrounded by light storage cells. The wavy tangential lines look similar to those of the elm and are an important distinguishing feature of robinia wood. The pith rays are wide and clearly visible. The trunk slice shows a smoothly overgrown branch.

**Robinia from the old brewery in Jena Ø 29 cm, 45 years**



## Botanical characteristics

The robinia grows to be a 20 - 30 m tall tree with a diameter of up to 80 cm. The trunk tends to be crooked, often flute structured with forked growth. The bark is at first brownish and smooth, but early on it develops a thick, deeply fissured outer bark with rough, reticular arranged ridges. The robinia has a deep reaching tap root. The pinnate leaves have two large, crooked, tenacious thorns on the leaf base. The blossoms appear in white, hanging clusters; they are pleasant smelling and rich in nectar. The fruits are flat, hanging pods with irregular surfaces and 6 - 8 blackish brown kidney shaped seeds. The whole plant is poisonous.
The robinia reaches ages of about 100 years (max. 200 years), the vertical growth stops after 30 - 40 years and forestry harvest begins at 40 - 50 years.

## Habitat

The robinia (also "pseudo acacia") was brought in from North America[1]. Its natural habitat reaches from the eastern Appalachians to the Mississippi. Today it is spread in central and southern Europe, northern Africa, near and eastern Asia, Australia and South America.
The robinia owes its expansion, induced by people, to its rapid growth capacity even with poor nutrition (effective atmospheric nitrogen-fixer). It also spreads undesirably by seeds and especially root-sprouting in many locations, for example in endangered habitats like dry grasslands. Because of this sprouting, robinia stands can hardly be rooted out anymore[2].
The robinia is a light-demanding species that prefers loose, moist, warm soils; it is resistant to drought, but somewhat frost-sensitive.
In Thuringia it is widely planted for support along railroad tracks and greenery for succession in mining areas.

## Cultivation

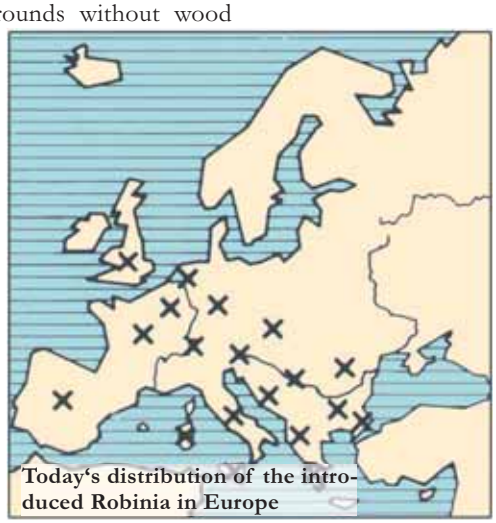
The robinia is generally not cultivated. It is suitable for support of rubble heaps, rail road embankments, drifting sand and deserted areas. It is also cultivated as an ornamental and street tree. With its affronting thorns it makes a good border tree. In southeastern Europe it is planted regularly as a forest tree. As a nitrogen-fixer, it grows rapidly during youth. Its growth increase is up to 12 $m^3$ per hectare a year.

## Use

The robinia forms a valuable, very heavy utility wood. It is hard, has a high degree of toughness, elasticity as well as solidity. Its resistance to breakage is higher than that of oak. Robinia wood tends to warp; it is good to work with and polish. It is extremely durable to weathering. As the "teak wood of Europe," it is increasingly used as a tropical wood substitute.

**Current:** Agriculture (vineyard posts, rickstands, hop-poles, barrels), exterior building timber (harbours, playgrounds without wood preservatives, fence posts), handcrafts (tool handles), industry (ship building, cog wheels).

**Historic:** Handcrafts (turning, cart-wright wood, carriage building, ship nails, planks, sterns, drum bearings, fence and gate framework), agriculture (wood plows, fodder, bee pollen source), healing (as medicine).



**Today's distribution of the introduced Robinia in Europe**

[1] First planted in Paris by palace gardener Jean Robin in 1601.
[2] Root sproutings still appear three years after the forest has been cleared despite intensive destruction of all emerging saplings.

# Austrian Pine

*Pinus nigra* Arnold

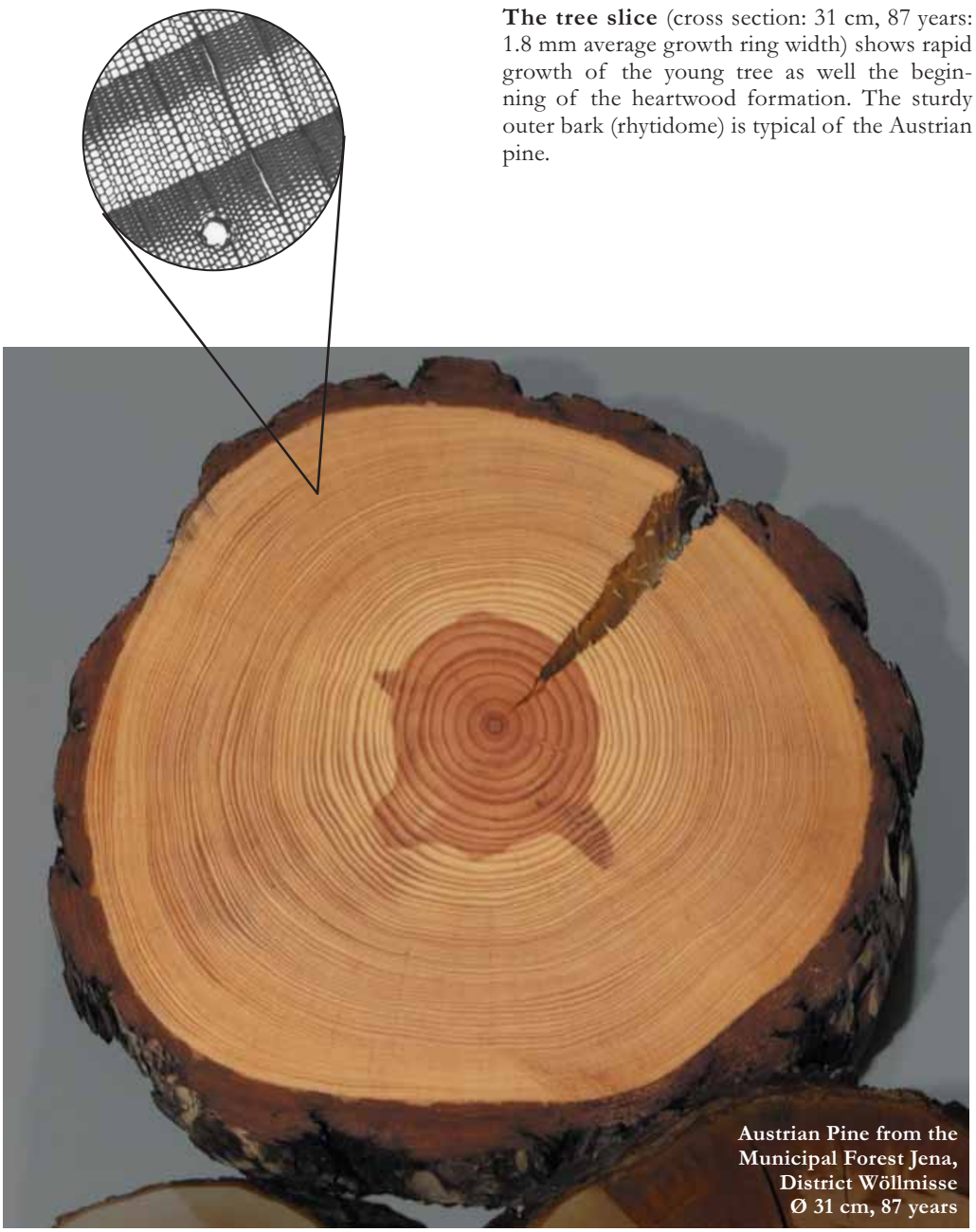


## General characteristics of the wood

The wood of the Austrian pine has yellowish or reddish white sapwood and reddish brown heartwood. The growth rings are prominent because of the clearly defined border between early and late wood. The wood is similar to Scots pine (*P. sylvestris*), but heavier and significantly more resinous.

## The wood on display

**The tree slice** (cross section: 31 cm, 87 years: 1.8 mm average growth ring width) shows rapid growth of the young tree as well the beginning of the heartwood formation. The sturdy outer bark (rhytidome) is typical of the Austrian pine.



**Austrian Pine from the Municipal Forest Jena, District Wöllmisse Ø 31 cm, 87 years**

## Botanical characteristics

The Austrian pine is up to 40 m tall and 1 m thick in its natural habitat. This conifer undergoes rapid early growth and has whorled, horizontally pointed strong branches that form an umbrella topped crown with age. It does not grow to its full height in central Europe because it is often planted in very dry areas. The bark is grey brown to greyish black, the flaky outer bark becomes thick and rough with age. The needles grow in pairs on short shoots, and live to be 4 - 7 years old. The buds are similar to those of the Scots pine. The egg formed cones stick out from the branches and open to spread winged seeds before they fall to the ground.
The Austrian pine can reach between 500 - 600 years of age.

## Habitat

The Austrian pine grows natively in southern Europe, the Balkans and Asia Minor. It grows on calcium rich soils, on flat to medium surfaces and in drier climates with warm summers. It requires little nutrients, is drought resistant, insensitive to winter and late frosts, sturdy during storms and relatively unaffected by air pollution. The Austrian pine has been planted in Germany since the 19th century.

In the second half of the 19th century it was planted in dry areas in Thuringia, especially for reforestation of former grazing land on the slopes of the Wellenkalk (a limestone formation) and on the plateaus. 2400 hectare in Thuringia are currently stocked with Austrian pine, making its portion of the total forest area twice as large as that of Douglas fir.

## Cultivation

The Austrian pine is often planted in parks and gardens in central Europe, and also cultivated for commercial forestry.

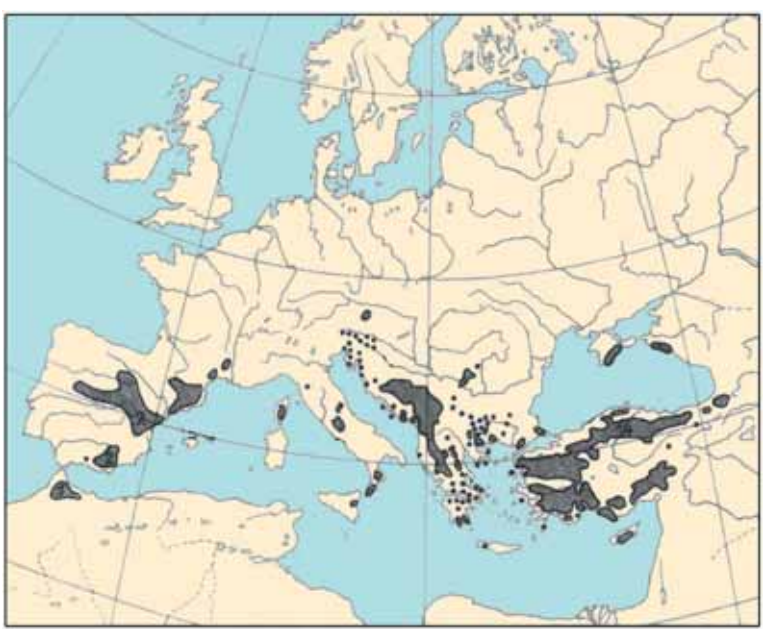
## Use

The wood of the Austrian pine is course-porous, soft, very resinous, difficult to split, durable, and undergoes little shrinkage.

**Current:** industry and construction (civil and hydraulic engineering structures: bridges, flood gates, bulkheads, well cavities, mining timber, ship building), raw materials (plywood, flake boards, paper, resin and turpentine).

**Historically**, the Austrian pine was not used in Thuringia, as it was only planted there recently.

Facts worth knowing



# Common Pine

*Pinus sylvestris* (L.)

About the Specimen on Display

## General characteristics of the wood

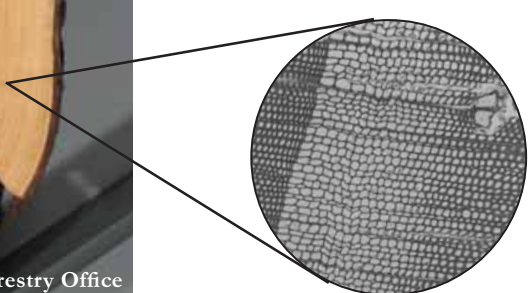
Pine wood is a softwood with a reddish brown heartwood formation and a marked contrast between early and late wood, inducing clearly defined growth rings. The wood has high resin contents and the resin ducts are usually clearly visible.

## The wood on display

The board is almost a radial cut. It has reddish-brown heartwood and light coloured sapwood. The sparse lateral branches are neatly ingrown and the heartwood formation follows the path of the branches.

The tree slice (cross section: 24 cm, 112 years: 1.1 mm average growth ring width) shows a markedly slow growth (i.e. the tree stood under heavy competition and/or in a poor location). The wood is infested by a blue-stain fungus as a result of improper or prolonged storage after felling. The tree slice originates from a different tree than the board.

**Pine from Forestry Office Rudolstadt, Uhlstädter Heide Ø 24 cm, 112 years**



# Pine Family

# Pinaceae

## Botanical characteristics

The trunk of the pine is straight and grows up to 40 m high. The bark is orange-red and finely flaky on the top portion of the trunk (smooth bark); the bottom portion of the trunk has thick, grey or reddish brown, roughly furrowed slabs of outer bark. The crown is initially a pointed cone formation with whorly branches, later it forms a multiform shape. On trees of the flatlands the crown is rounded, irregular with sparse branching, and on trees of higher elevations the crown is narrower, pointy with dense branching. The needles grow in pairs on short shoots. The cones have short stems and are egg-shaped. The seeds ripen a year after blossom, but do not shed from the cone until early spring of the following year. The whole cone falls after shedding the seed. Pines reach ages of up to 200 years (max. up to 600 years).

## Habitat

The natural distribution of the pine reaches many parts of Europe and northern Asia. Compared to other native forest trees, it has the widest area of distribution, ranging from the Atlantic to the Pacific Ocean. Located mostly on sandy soils or growing as a successional species after fire, there are isolated stands in the Alps of eastern central Europe up to 70° N in Siberia and Scandinavia.
The main distribution is at low elevation, but Scots pine can grow in the mountains at up to 2100 m in altitude. It is resilient, frost-resistant and insensitive to drought and fire. In central Europe, Scots pine grows in extreme habitats like dry, nutrient- and base-poor soils, sand, peat or on limestone outcrops as well as on heavy metal deposits (like Serpentine) and on mine tilts.
The forested area in Thuringia contains 20 % pine.

## Cultivation

Pines were, until recently, most often cultivated in rotation forests. Because the pine grows best in mineral soil, heavy tillage is necessary for plantation planting. In the future, permanent forest cultivation will be attempted, in which the portion of pine will significantly decrease. Cultivation of Douglas fir will further decrease that number. The felling for the forestry industry occurs after 100 - 120 years for building timber and after 120 - 160 years for veneer wood. The growth increment is between 3 - 8 $m^3$ per hectare and year.

## Use

Pine wood is relatively soft, medium heavy, moderately hard, has good elasticity and solidity properties, shrinks minimally and has good workability, except when the wood is very resinous. The heartwood is naturally durable, the sapwood is more susceptible to fungi and insects.

**Current:** Handcrafts (carpentry, furniture), interior construction (roof trusses, panelling, doors, frames), exterior building construction (wood plaster, fences, masts, ramming posts, playground equipment), industry (casting moulds, railway ties, crates, barrels, palettes), raw materials (wood pulp, wood-wool, chip and fibre boards), household (spoons, bread baskets, boards etc.), customs (Christmas trees).

**Historic:** Handcrafts (furniture, turning and carving work, musical instruments), exterior building construction (water drains), raw material and energy source (paper production, fire wood, charcoal kilns, dyes, resin for colophony rosin and other products).

Facts worth knowing

# Common Silver Fir

*Abies alba* Mill.

About the Specimen on Display

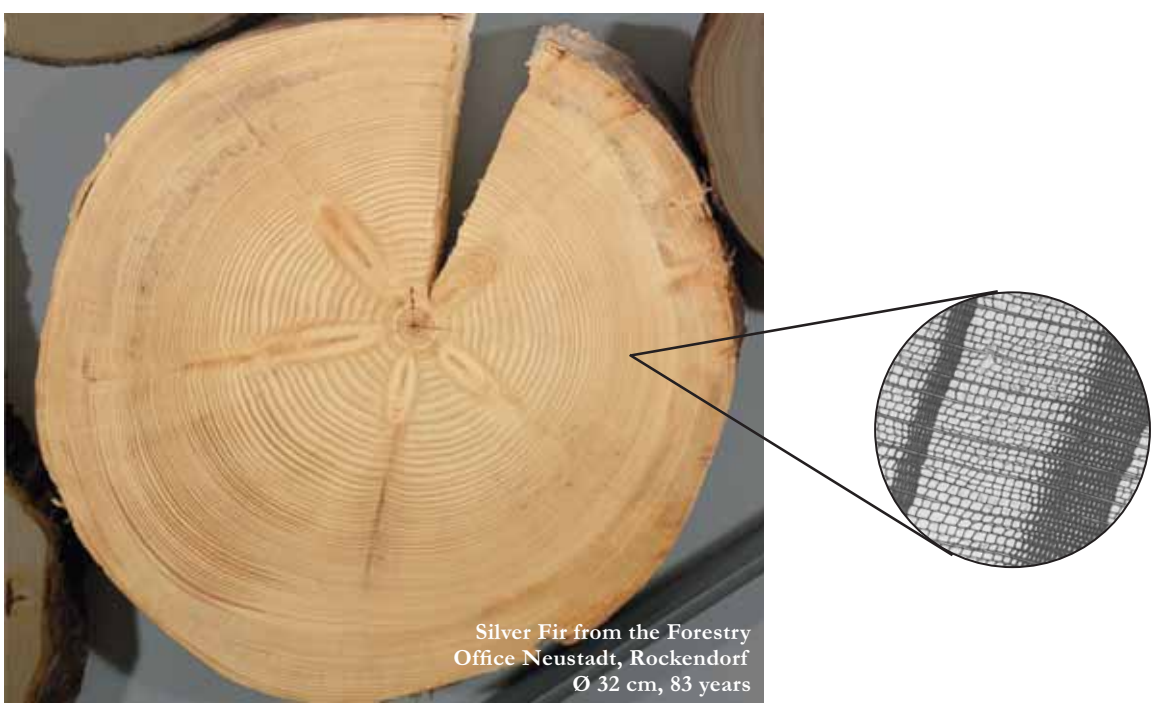
## General characteristics of the wood

The fir has a whitish wood without heartwood colouration or resin ducts (in contrast to spruce), with clear contrast between early and late wood, inducing marked growth ring structure.

## The wood on display

**The board** is a tangential cut near the centre, which means the tangential grains of the growth rings only formed in the centre of the trunk. It is a very light coloured wood with many ingrown dead branches and no resin ducts.

**The tree slice** (cross section: 32 cm, 83 years: 1.9 mm average growth ring width) has a defined whorl of branches in the centre, which is typical of coniferous trees. The growth rings are clearly visible due to light early wood and relatively wide, darker late wood. The 2 - 3 cm wide sapwood can hardly be contrasted from the heartwood. The tree grew rapidly in its first 30 years (i.e. this fir grew free-standing on a clear cut area). At the age of 65, the tree fell under significant pressure from neighbouring trees, thus forming only very narrow growth rings. The wide split in the slice demonstrates that fir wood can shrink significantly.



**Silver Fir from the Forestry Office Neustadt, Rockendorf Ø 32 cm, 83 years**

## Botanical characteristics

The fir grows to be 50 m tall and forms a straight trunk with silver grey, finely fissured and flaky outer bark. The crown is initially a pointy cone shape and later it forms into a column shape with a flat top (the so-called stork nest crown). The needles grow from a disc shaped needle base which falls off with the needle. This means the defoliated branch is smooth (opposed to spruce). The fir needle is notched at the tip with two white waxy strips on the lower side (opposed to the yew). The cones stand upright and disintegrate on the tree when mature and only the cone axis remains. For this reason, fir cones cannot be found on the forest floor.
Firs reach up to 600 years of age.

## Habitat

The fir is native to the mountain ranges of central and southern Europe as a subordinate tree and can be found growing with beech or spruce trees. The fir grows in the middle and upper montane forest zones (in the Alps up to 1600 m) independent of rock type. It prefers areas with high air and soil moisture; it is extremely shade tolerant but sensitive to late frosts. It is planted for forestry in moist locations even outside of its natural range. The silver fir is native to southern Thuringia. It is still migrating north from its refuges after the pleistocene.

Silver fir is endangered in Germany due to heavy game animal damage, lack of rejuvenation and exposure to sulphur emissions. In the growth area of the Thuringia mountains, the fir covers only 0.06 % of the total area.

## Cultivation

The fir is cultivated in mixed stands with beech and spruce. The ecological requirements of the common silver fir are best met in a vertically structured forest managed by selection cutting (Plenterwald). The growth increment is between 5 - 17 $m^3$ per hectare and year, felling occurs after 90 - 130 years.

## Use

Fir wood is soft, medium heavy, has a high solidity and elasticity, favourable shrinking properties and normally does not rip or warp during the drying process. It is not very durable to weathering without wood protectant. The fir has less workability than spruce wood, but is chosen

for uses in which the high resin content of the spruce has negative effects.

**Current:** interior construction (roof trusses, wall and ceiling construction, panelling[1)], doors, windows), exterior building timber (civil and hydraulic engineering structures: poles for securing ships in harbours, dams, masts, telegraph poles, posts), handcrafts (furniture (mostly as blind wood), material made of wood shavings: chip baskets, cheese packaging, musical instruments: sounding floor, organ pipes), industry (packaging: crates, palettes, wood-wool), raw materials (wood pulp, paper), medicine and cosmetics (essential oil used in cold medicine), customs (as Christmas trees[2)]).

**Historic:** building timber (hydraulic constructions: water mill blades, ramming posts for harbour construction[3)], roof shingles, masts[4)]), handcrafts (furniture), energy source and raw material extraction (fire wood, mining timber, charcoal, glass blowing, leather production), healing (resin from the bark used to produce "Strassburger Turpentine" for skin problems, essential oil for colds, rheumatism, gout, injuries).

[1)] In 2002 the interior panelling and pews of the Frauenkirche in Dresden were restored with 500 solid cubic meters of premium quality fir timber.
[2)] However, the silver fir sheds its needles sooner than the more popular Christmas tree, the Nordmann fir (*A. nordmannia*).
[3)] Venice was founded on fir boles from the southern Alps (Trentino).
[4)] The fir was rafted from the Thuringia Forest to Hamburg and Amsterdam to be used as ship masts.

# Common Spruce

*Picea abies* (L.) Karst.

About the Specimen on Display

### General characteristics of the wood

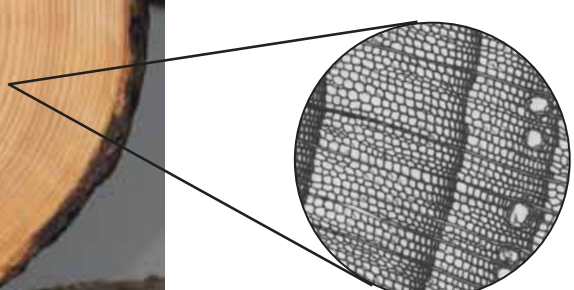
The spruce has a light coloured wood with no heartwood formation but well marked year rings and enclosed resin ducts.

### The wood on display

**The board** is an almost radial cut. It has a yellowish wood, which will darken (brown) under light exposure. The characteristic resin ducts are clearly visible as vertical brown stripes.

**The tree slice** (cross section: 27 cm, 4 years: 1.6 mm average growth ring width) has defined growth rings with light coloured early wood and darker, almost brown late wood. The sapwood is only faintly contrasted. The wood shrinks relatively heavily (wide split). A resin duct is visible on the left side.

**Spruce from the Forestry Office Rudolstadt, Uhlstädter Heide Ø 27 cm, 46 years**



## Botanical characteristics

The trunk of the spruce is straight with grey to reddish brown, thin flaky outer bark. Spruce trees grow up to 50 m tall. The crown is cone shaped, even with age (as opposed to the flat crown of the fir). The base of the needles remains after the needle shedding, leaving behind bare, rough looking branches (as opposed to the fir, which has smooth branches). The cones hang (as opposed to the fir) and fall as a whole on to the ground. Spruce trees reach ages of up to 300 years (max. 600 years).

## Habitat

The spruce is naturally distributed in central Europe at higher elevation of the mountain ranges and in northern Europe up to the boreal forest zone. The spruce prefers cool, moist mountainous areas between 800 - 2000 m in altitude, it is sensitive to dryness and soil acidification (Al-sensitive), however, it is adapted to require minimal nutrients. It has an increased susceptibility to red rot in calcium carbonate rich soils (induced by the root fungus *Heterobasidion annosum*), especially after bark damage from red deer.
Since the times of over-exploiting forests in the 18th century, spruce has been artificially planted in the lowlands even in deciduous forest sites. Spruce cultivation replaces beech in the long term. 48 % of the forest surface in Thuringia is stocked with spruce; it is the most important tree species for forestry.

In the 1980s, spruce was among the first tree species to show obvious pollution damages (needle yellowing and crown thinning). Despite reduction of the $SO_2$ burden, and as a consequence of the atmospheric nitrogen deposition, the forest damages have remained to this day, although to a lesser degree. The decrease of the damages is also a result of changes in cultivation (heavy thinning in younger stands) and the liming in most spruce stands to avoid Al-toxicity.

## Cultivation

The spruce has been cultivated in the past mainly as rotation forest. Today attempts are made to cultivate spruce in permanent forest of age-structured, close to natural mixed stands. The growth increment is between 6 - 15 $m^3$ per hectare and year, felling for forestry occurs between 80 - 120 years.

## Use

The spruce is a medium-heavy wood with high solidity and elasticity; it shrinks little and works well. It is not durable to weathering without wood protectant.

**Current:** Interior construction (panelling, doors, frames, roof trusses, saunas), handcrafts (carpentry boards, furniture, chip baskets, wood has good tone for musical instruments ("resonance spruce")), energy source and raw materials (paper, wood pulp, wood-wool, chip and fibre boards, fire wood), exterior building timber (masts, shuttering, scaffolding, ladders, wood plaster, fences), industry (crates, palettes), household (bread baskets, kitchen boards, etc., toys), customs (Christmas trees).

**Historic:** Exterior building timber (water mills), raw materials and energy source (fire wood, mining wood, resin), handcrafts (furniture, carriage building: shafts, ladders, stringed instruments[1]), agriculture (mulching, hay towers), healing (essential oils).

[1] **Stradivarius** searched for trunks in the mountains after the felling: In the southern Alps the trunks were slid down grooves along the mountainside and hit tree trunks already lying in the valley. The sound induced by the impact of the tree trunks was the deciding factor in using the wood for his violins.

# Douglas Fir

*Pseudotsuga menziesii* (Mirb.) Franco

About the Specimen on Display

## General characteristics of the wood

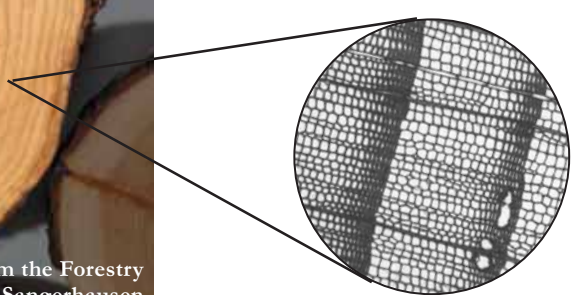
The Douglas fir is a conifer with wide sapwood, dark red coloured heartwood and a marked contrast between early and late wood.

## The wood on display

**The board** is almost a radial cut. It has a prominent red coloured heartwood with a yellow sapwood. The wood has especially coarse branching. The branches were ingrown without deformation or irregularity. The growth rings are especially wide and the differential shrinking of early and late wood can be felt by hand on the board.

**The tree slice** (cross section: 38 cm, 32 years: 5.9 mm average growth ring width) shows the red heartwood and a wide sapwood that grew 5 cm in width within 8 years. The thick outer bark is typical of the Douglas fir.

Douglas Fir from the Forestry Office Rossla, Sangerhausen
Ø 38 cm, 32 years



## Botanical characteristics

The trunk is straight and cylindrical with a sparsely branched crown. In its native environment, Douglas fir grows up to 100 m tall and almost 4.5 m thick in pristine forest, in Europe it usually grows over 50 m tall and over 1 m thick. The bark is initially smooth and dark grey with bubble shaped resin pockets, and forms a thick, red or grey-brown, deeply furrowed, soft outer bark with age. The needles are soft and pointy with two white vertical stripes on the inferior surface. After crushing or rubbing, the needles and branches exude the typical Douglas fir aroma. The cones hang, and tricuspid bract scales are clearly visible between the seed scales.

Douglas firs in North America reach ages of between 500 - 700 years.

## Habitat

The native distribution of the douglas fir is in North America along the Pacific Coast from British Columbia to California (var. *menziesii*) and inland from Alberta over the Rocky Mountains to northern Mexico (var. *glauca*). Douglas fir is sensitive to late frosts and prefers deep, moderately acidic, moist, sandy clay soils; calcium-carbonate deposits are unfavourable.

Douglas fir is planted in Thuringia in poor yielding locations as a subordinate tree species or in small pure stands, for example in the area of the southern Thuringian mountain range and the eastern, western and southern Thuringian Buntsandstein (variegated sandstone). The tallest tree in Thuringia is a Douglas fir which is 53 m tall (in the Thuringian Forest Authority Dietzhausen, forest property of Christian Truchseß from Wetzhausen).

## Cultivation

The commercial forestry use of Douglas firs started in Europe in the early 19th century with the plantations, since then it has become the most important non-native tree species to the lumber industry and territorially supersedes Scots pine as the second most important timber. It regenerates naturally. Felling occurs in Europe between 60 - 80 years of age. Douglas firs are especially fast growing; up to 18 $m^3$ pro hectare and year.


## Use

Douglas fir wood is medium heavy and relatively hard compared to other softwoods. It has good shrinking, drying, solidity and elasticity properties; it is resilient and resistant to weathering.

**Current:** Handcrafts (furniture), interior construction (wall and ceiling panelling, doors, window frames, balustrades, stairs, wood flooring), exterior building timber (half-timbered houses, balconies, playgrounds, hydraulic constructions: dike and breakwater constructions, masts, ramming posts, wood plaster, fences), agriculture (septic tanks, vine posts), raw material (fibre boards).

**Forestal distribution of the Douglas fir in Europe**

# European Larch

*Larix decidua* Mill.

About the Specimen on Display

## General characteristics of the wood

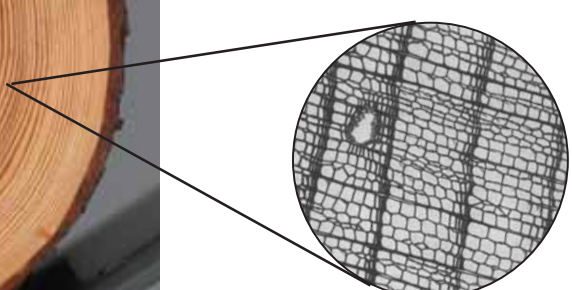
The larch is a conifer with narrow sapwood, reddish brown heartwood colouration and a marked contrast between early and late wood.

## The wood on display

**The board** is a tangential cut with prominently marked grains. The heartwood is clearly contrasted with the sapwood by colour differentiation. Many dark branches can be seen in the centre of the bole, which is typical of larch.

**The tree slice** (cross section: 26 cm, 64 years: 2.0 mm average growth ring width) has a narrow sapwood, which is only faintly differentiated by colour from the heartwood. The lateral branches are well incorporated. The wood is characterized by defined early and late wood and emphasized growth ring borders.

Larch from the Forestry Office
Rudolstadt, Uhlstädter Heide
Ø 26 cm, 46 years



## Botanical characteristics

Larches grow up to 50 m tall. The trunk is straight but often tends to grow one-sided. This crooked growth is genetically determined, but this property was originally thought to have been induced by environmental factors like pressure from snow and growth on inclines. The bark is initially smooth and greyish brown, with age it develops a dark reddish brown, thick and deeply fissured, flaky outer bark. The crown is initially shaped like a narrow cone, but later it becomes wider with a flattened top and thin branches. The green needles are arranged individually and spiral around the new, lateral shoots. Short, bumpy shoots develop on the branches with tufts of 30 - 50 needles. The cones are upright and stay on the tree for years after the seed shedding (in Siberia an adaptation to forest fires).
Larches reach ages of between 200 - 400 years (occasionally up to 800 years).

## Habitat

The larch is naturally distributed in four isolated areas: the Alps, the Sudeten, the Tatra and in Poland. It is also secondarily dispersed outside its native area in low and hill lands, for example near Schlitz in Hesse. The European larch was dispersed further during the pleistocene; its current distribution can be seen as a relic of its former range.
The main occurrence of the larch is the continental climate of the central Alps in subalpine larch (stone pine) forest near the timber line (up to 2400 m). It is adapted to harsh winters and short summers with high radiation and dry air. The nutrient demands of the larch are minimal, it prefers moist soils on limestone and primeval rock.

It is often planted as a subordinate species in Thuringia in lowlands.

## Cultivation

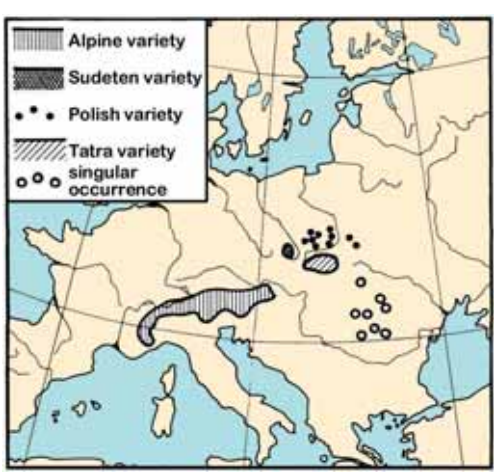
The larch is planted commercially as a subordinate tree as well as in small pure stands. The growth increase is similar to that of pine; 3 - 8 $m^3$ per hectare and year. The harvesting occurs after 100 - 140 years.

## Use

After the yew tree, the larch has the heaviest and hardest wood of all native coniferous species. It has high solidity, elasticity and toughness as well as good shrinking properties. The larch tends to be spiral grained and to rip and warp during the drying process. The wood is good to work with, except when it has high resin content. The heartwood is durable and weather-resistant.

**Current:** Handcrafts (furniture, turning), exterior building timber (civil, bridge and hydraulic engineering construction, masts, ramming posts, wood plaster, fences, noise protection walls, playgrounds), interior (roof trusses, wall and ceiling construction, panelling, doors, frames, balustrades, stairs, wood floors), industry (railway sleepers, barrels, cooling towers and silos).

**Historic:** Handcrafts (furniture, turning work, cog wheels), exterior building timber (mills, wind mill blades, roof shingles), energy source, raw materials (pit wood, fire wood, charcoal kilns, in the optical industry the resin was used as lens glue in the GDR up until the reunification).



# Apple

*Malus domestica* Borkh.

About the Specimen on Display

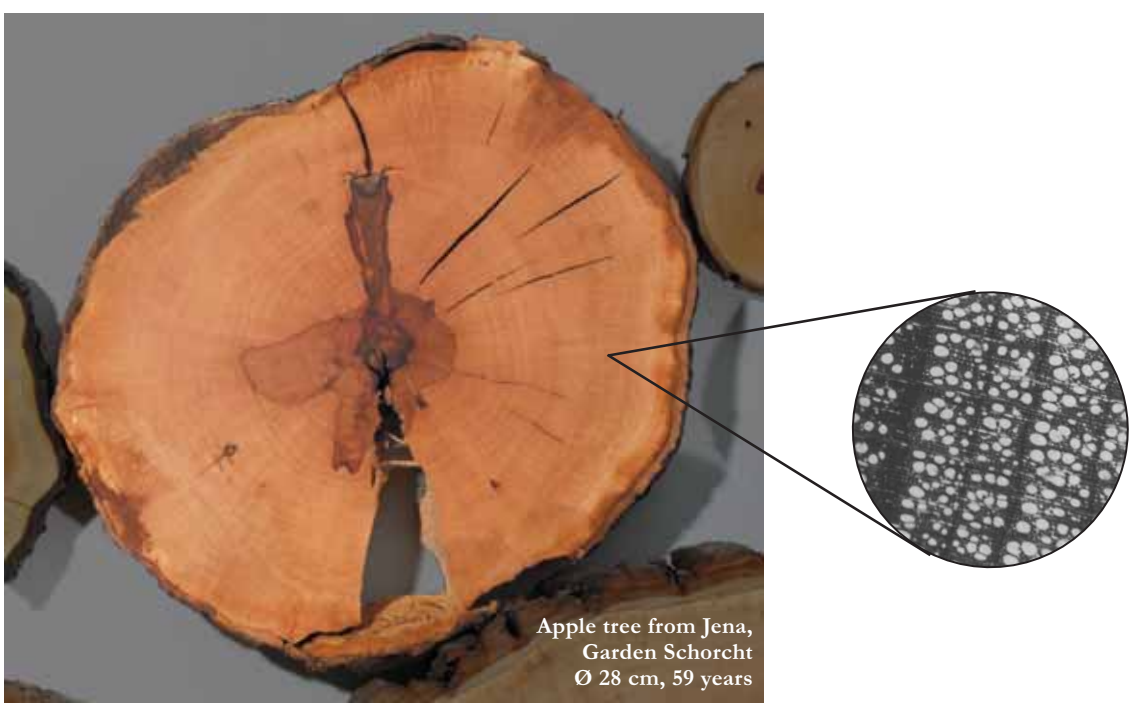
## General characteristics of the wood

Unlike the pear tree, the apple tree regularly forms coloured heartwood. The sapwood is most often wide and reddish white to light reddish brown in colour, the significantly darker heartwood is reddish brown to brown and often streaked with colour ("soaked"). The wood is diffuse-porous with abundant, very fine wood rays. The growth rings are subtle.

## The wood on display

**The board**
Apple trees most often have a short trunk, therefore the specimen on display is made of multiple parts of the same trunk joined together. The wide yellowish sapwood is only vaguely differentiated from the dark heartwood. The brown stripes originate from injuries during the youth of the tree (pruning)*. The white vessels in the heartwood (middle of the board) show the beginnings of decay*.

**The tree slice** (cross section: 28 cm, 59 years: 2.4 mm average growth ring width) has a very irregular heartwood, induced by the penetration of air in the direction of the "Waldriss" (the "crack" that formed at a right angle to the main wind direction).



Apple tree from Jena,
Garden Schorcht
Ø 28 cm, 59 years

*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

The cultivated apple is a sturdy, max. 10 - 15 m tall tree with a short trunk, wide protruding branches and a wide crown. The trunks can reach diameters of 30 - 40 cm and are often spiral formed and flute structured. The outer bark is red to greyish brown and falls off in thin flakes. The leaves are wide ellipses, serrated, and pilose on the lower side. The blossoms are white and pink with darker red on the edges in sparkly flowered corymbs. The fruits are different sizes, shapes and tastes according to cultivar.

## Habitat

The cultivated apple originates predominately from different wild apple species from Kirghizstan and Kazakhstan, whereas the native European wild apple (*M. sylvestris*) is often used as a grafting stock. The most important cultivation areas of the domestic apple in Europe are in the temperate zone as well as in between the mediterranean-subtropical zone. The species have different temperature requirements (frost-sensitive, cold temperature requirement of blossoms), individual trees can be found at up to 1500 m altitude in the Alps. Best performance is attained in deep, humic and moist clay soils.

Apples were first planted in Thuringia in the 16th century. The wild apple can be found dispersed in light deciduous and pine forests, flood-plain forest, bush, forest edges, on sunny, cliffy slopes and rocky debris. Because of its strong decrease in numbers, wild apple is worth protecting.

## Cultivation

Apple trees are used intensively in plantations, or extensively in scattered fruit farming or in yards and small gardens. The propagation of the species succeeds vegetatively through grafting. The wood of the apple tree is of low economic importance. Cherry apples are planted because of their blossom display in the spring as well as their colourful fruit and leaves in the fall.

## Use

The wood of the wild apple is more valuable than that of the domestic apple, not because

of its better wood properties, but because fruit trees are only felled when they are no longer fertile enough, by which time they are most often beginning to rot in the core. The wood is dense, heavy, hard and sturdy as well as workable. It tends to rip and warp significantly during drying because of frequent deformities in the grain.

**Current:** Art handcrafts (table making, sculpting, wood turning and carving), handcrafts (veneering, knife handles), nutrition (fruit as table, cooking, and cider apples), raw materials (the gelling agent pectin made of pomace, oil from seeds), agriculture (apple silage as fodder).

**Historic:** Handcrafts (tool handles, screw spindles, cogwheels, carpenters plane bodies), agriculture (bee pasture, fodder), nutrition, healing (fruit prevents dysentery, gout, rheumatism, kidney and metabolic disturbances and warts as well as as a sleeping aid).

**Natural distribution of the Wild Apple (*M. sylvestris*) in Europe**

# Bird Cherry

*Prunus padus* L.

About the Specimen on Display

## General characteristics of the wood

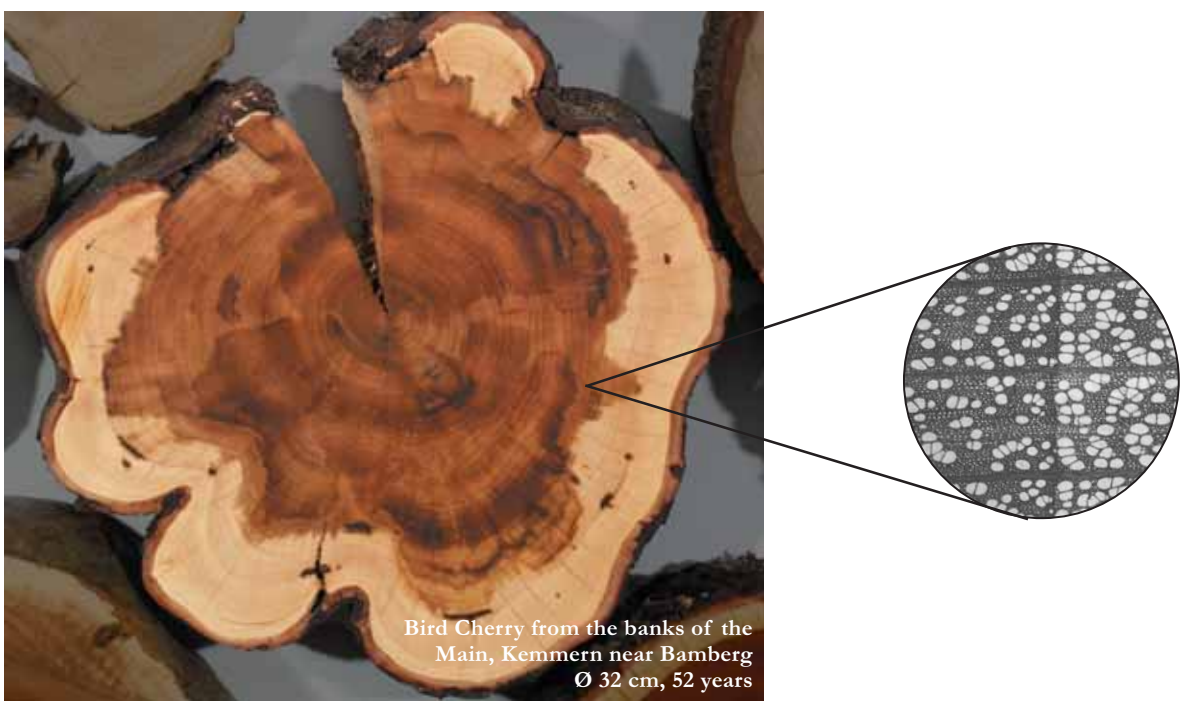
The bird cherry has a wide, yellowish to reddish white sapwood and vivid light brown to brown-yellow heartwood. The wood is diffuse-porous; the vessels are sparse and hardly visible. The growth rings appear as clear, fine lines.

## The wood on display

### The board

The wood is similar to the *Prunus avium* (wild or bird-cherry), but the young trunk is more heavily branched, which leads to a more defined structuring of the wood. The sapwood is especially narrow on the left side and the "blurry" border of the sapwood shows that air or water most likely penetrated the wood.

**The tree slice** (cross section: 32 cm, 52 years: 3.1 mm average growth ring width) shows a "diluted" heartwood with many brown tones and separations. The irregular colouration is an indication that the heartwood formation was caused by penetration of air and water through the surface of the trunk via injuries in the tree. This *Prunus padus* stood right on the bank of the Main river, and so it is possible that these wounds were caused by floating ice.



Bird Cherry from the banks of the Main, Kemmern near Bamberg
Ø 32 cm, 52 years

## Botanical characteristics

*Prunus padus* grows to be a shrub or a tree up to 10 m (max. 15 m) tall with vertically pointed branches and hanging twigs. It reaches a trunk diameter of up to 60 cm. The bark is blackish grey and forms a thin, foul smelling outer bark (rhytidome) that rips off in vertical strips. The wide lanceolate leaves are alternating, heart-shaped at the base and have 2 green glands on the leaf stem. The Prunus padus gets its name from the long, white, abundantly flowered blossom clusters. The shiny black fruits are edible, but do not taste very good and are indigestible in large quantities.

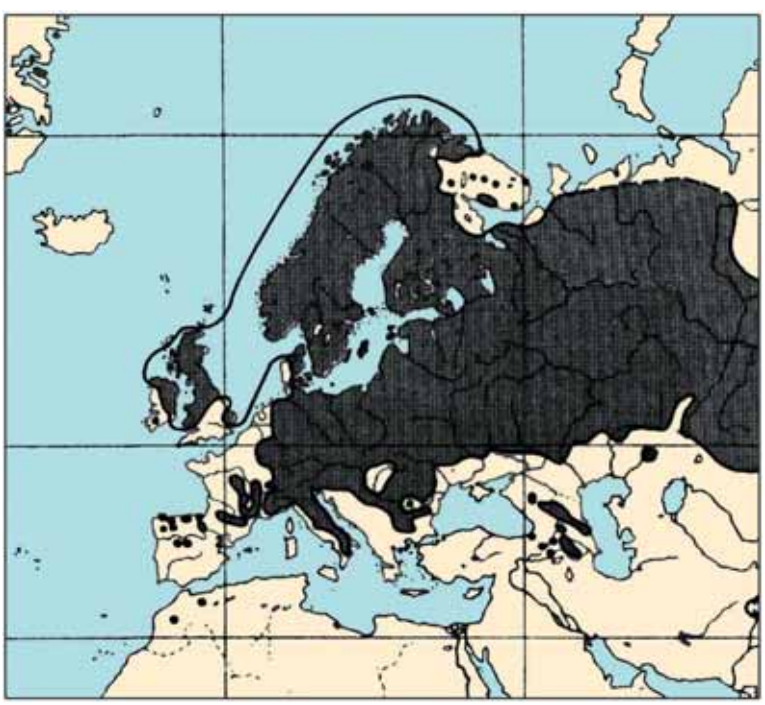
## Habitat

The species is spread throughout Europe and in many parts of Asia. It thrives in riverine, moist deciduous forests, flood plain forests and along inshore waters (lakes, rivers, ponds) as well as mountain valleys up to 2000 m in altitude.

In Thuringia, the *Prunus padus* can be found in flood plain forests and on the edges of moist deciduous forests.

## Cultivation

The *Prunus padus* is cultivated as an ornamental plant, but not for forestry. It is not to be confused with the late blooming *Prunus serotina* Ehrh., which came over from North America, and has recently become a forestry problem because of its massive tendency to spread, especially in Brandenburg.



## Use

The wood is soft, medium heavy, elastic, easy to split and bend, and shrinks only slightly. It is not very durable and has a low burning capacity. It has an unpleasant, bitter almond-like smell in its undried state, limiting its value as lumber.

**Current:** Handcrafts (wood turning, cabinet-making, furniture, musical instruments, young switches for basket-weaving material).

**Historic:** Handcrafts (carriage construction), raw materials (powder coal).

# Blackthorn

*Prunus spinosa* L.

About the Specimen on Display

## General characteristics of the wood

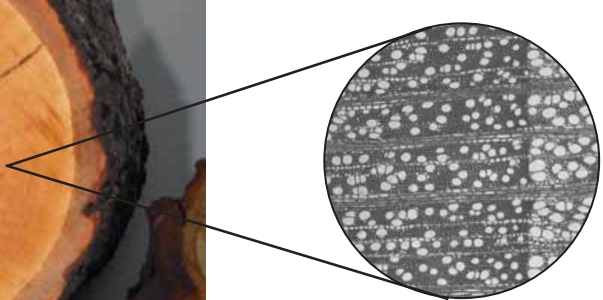
Blackthorn wood has reddish sapwood and brown-red heartwood. The abundant vessels are arranged semi-ring-porous to diffuse-porous, the growth rings are clearly visible.

## The wood on display

**The board** shows the growth pattern of the blackthorn, in which the leading shoot dies off on top of the crown and an auxiliary shoot continues to grow. This is clearly visible on the bottom end of the trunk. This causes the typical "zigzag" growth pattern. This branching pattern leads to an extremely spiral growth due to the rotation of the auxiliary bud. For this reason, the trunk had to be cut in the middle. This blackthorn has a narrow sapwood and a wide, brown heartwood, that was partially induced by injuries. The lateral branches are especially noticeable on the top end*. These are the remains of the typical spines or short shoots of the blackthorn.

**The tree slice** (cross section: 14 cm, 40 years: 1.8 mm average growth ring width) shows an irregular heartwood formation in which individual areas of the sapwood form heartwood-like, brown spots.

**Blackthorn from the banks of the Main, Kemmern near Bamberg Ø 14 cm, 40 years**



*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

The blackthorn grows to be a thick branched, thorny shrub with soot-black and brown barked stems and branches. It can grow up to 5 m tall. The leaves are elliptical and sharply serrated, dark green on the top and light green on the bottom. The snow white blossoms open up individually from clusters of standing buds. The blackish blue pitted fruits are about the size of cherries. They are edible after frost and taste extremely bitter.

The main trunk of the blackthorn grows to be about 40 years old, but spreads and regenerates through underground runners.

## Habitat

The blackthorn is spread throughout western and eastern Europe, but more so in Asia Minor and northern Africa. It is a typical pioneer species of hedges and bush ecosystems, in forests and forest edges, in ruderal areas and in open forests, in the Alps up to 1000 m in altitude. Other hedge row species can often only survive because the blackthorn provides protection from game animal damage.

The blackthorn can be found in Thuringia in hedges and succession areas (fallow land). It is typical of pastures, especially after they have ceased to be groomed.

## Cultivation

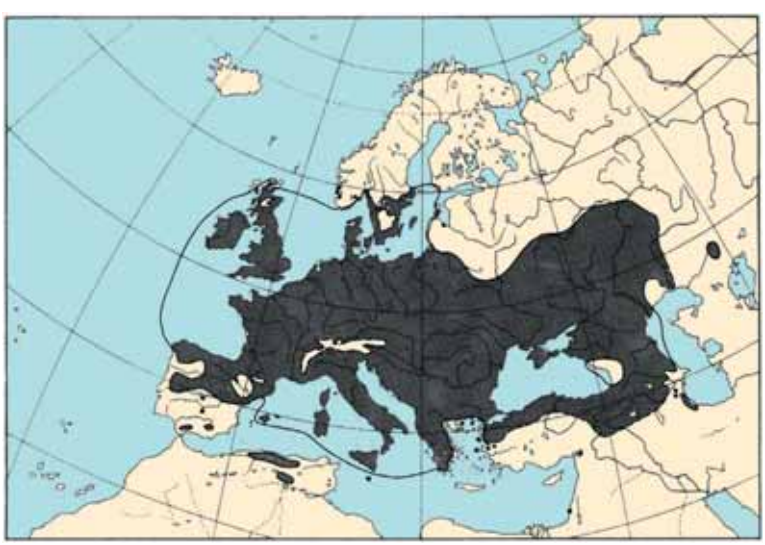
The blackthorn grows often on old ramparts, possibly used as thorn barrier in earlier times. In addition, varieties with larger fruits and sparser thorniness were cultivated. The blackthorn is also one of the shrub varieties often planted for nature conservation.

## Use

The wood is somewhat shiny, fine grained, tough and very hard, making it good for wood turning.

**Current:** Handcrafts (wood cuts, wood turning), agriculture (grafting stocks for plums, almonds, peaches and apricots), nutrition (also as liquor), ecology (bird protection shrubbery).

**Historic:** Agriculture (protective hedges, branches for the protection of young fruit trees, thorns as support during sausage making), handcrafts (wood turning), nutrition (fruits), healing and customs (bark, leaves, blossoms and fruits have medicinal properties), energy source and raw materials (fire wood, ink from the thorns, red dye from the bark, leaves as tobacco substitute).



# Dog Rose

*Rosa canina* L.

About the Specimen on Display

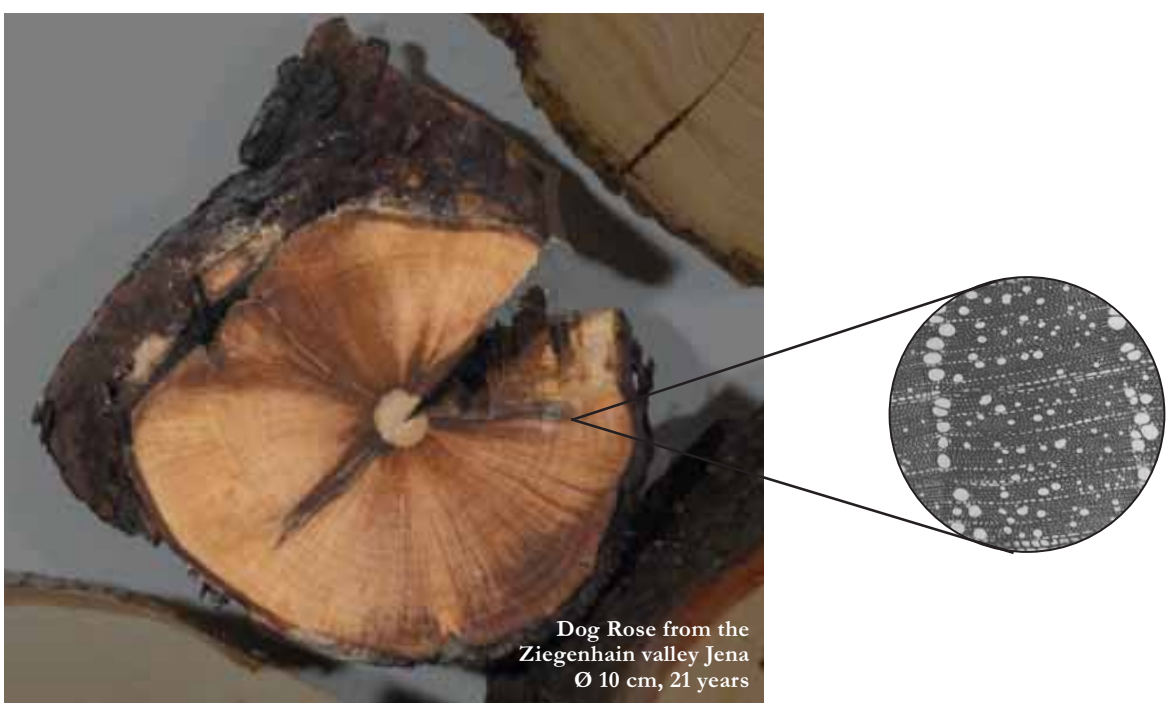
## General characteristics of the wood

The wood is light yellow, without coloured heartwood. The vessels are ring- to semi-ring-porous, mostly individuated and loosely dispersed.

## The wood on display

**The board**
The dog rose is a shrub that grows crooked bow-shaped shoots out of the root stock, which produce lateral branching on top. The main stem matures only rarely. Dog rose is a yellow wood with abundant and especially wide pith rays, which are most visible on a cross section. Pith rays are storage cells, which is one reason for the rose's strong ability to re-sprout after damage. An insect track is visible at the centre of the bottom branch piece*.

**The tree slice** (cross section: 10 cm, 21 years: 2.4 mm average growth ring width) does not have the typical yellow wood, but instead a rather black surface that occurred from discolouration after the felling. The characteristic pith rays are easy to see.



**Dog Rose from the Ziegenhain valley Jena Ø 10 cm, 21 years**

*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

The dog rose or briar rose is a prickly shrub between 1.5 - 3 m tall. It often grows considerably taller, because it can creep up trees as a woody climbing plant. The hearty stems stand straight up or hang bow-shaped like the abundant branches. The pink and white blossoms are characteristic of the dog rose and turn into scarlet-red rose hip fruits in autumn. They possess abundant hairy, single-seeded edible nuts.

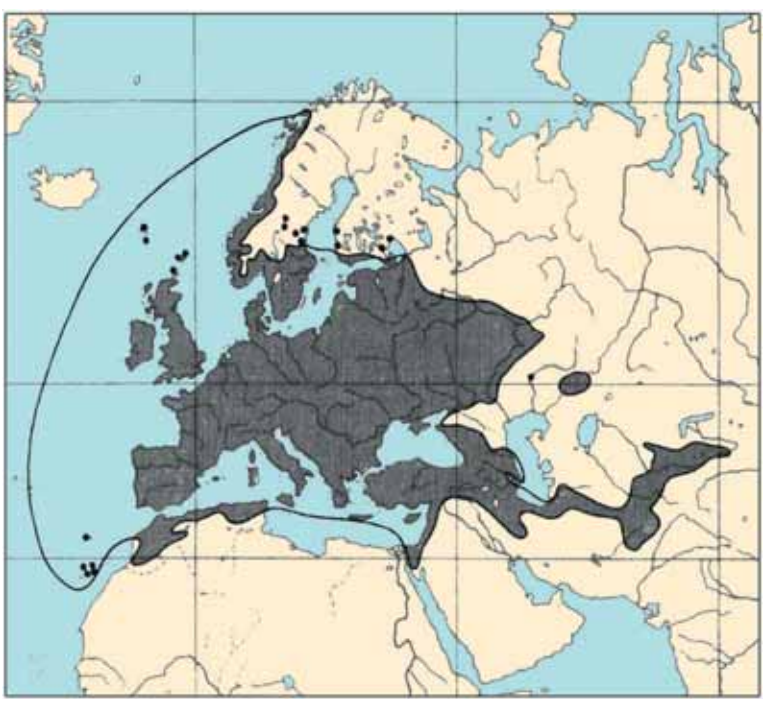
## Habitat

Many subspecies of dog rose are spread throughout Europe, North Africa and western Asia. The light-demanding pioneer shrub species prefers hedges, thickets, forest edges and light deciduous forests from the plains to hilly areas (up to 1500 m in the Alps). It is one of the most abundant wild rose species in central Europe. It grows frequently after the controlled burning of hedges (burning of the old grass in the spring).

The dog rose is widespread in hedges and bushes in Thuringia and an abundant pioneer species on dry grasslands and ruderal locations.

## Cultivation

The hedge rose is valued as a component of succession and semi-natural hedge structures. All biotypes of rose are the most frequently used shrubs for landscaping.



## Use

The yellow wood of the dog rose is very dense, sturdy and smooth and is characterised by the noticeably wide and densely arranged pith rays.

**Current:** Handcraft (custom cabinet making, small wood turning work, inlay work), nutrition (tea, jam from the fruits).

**Historic:** Agriculture (bee pasture, fodder, hedges), energy source (fire wood), handcrafts (walking sticks, rakes, wood turning work, dyes) food source and medicine.

# Hawthorn

*Crataegus* spec. L.

About the Specimen on Display

Hawthorn from the palace grounds Belvedere, Weimar

## General characteristics of the wood

The wood is light to delicate flesh-red colour with no heartwood. The reddish colouration indicates it is a close relative of the other members of the rose family. The hawthorn is often used as a grafting stock for fruit trees. The many, small vessels are arranged diffuse-porous and the growth rings are clearly visible.

## The wood on display

**The board**
The reddish board has a subtle heartwood beginning to decay (the white striped areas.) The unclear border between heartwood and sapwood proves that the discolouration was induced by oxygen penetration. The paths of wood boring insects can be seen on the bottom part of the board and overgrown branchlets are recognisable in the top part. These are the stem thorns, a typical feature of the hawthorn.

**The flute structured tree slice** (cross section: app. 40 cm, 62 years: 3.2 mm average growth ring width) shows a rather plain wood, in which the irregular trunk outline was induced by the buttresses in the ground.

**The small tree slice** (cross section: 15 cm, 83 years: 0.9 mm average growth ring width) shows rather typical "pear tree like", uniform structure.

Irregular shaped tree disc of a Hawthorn from the palace grounds Belvedere, Weimar
Ø ca. 40 cm, 62 years

Tree disc of a Hawthorn from the Municipal Forest at the Kernberge in Jena
Ø 15 cm, 83 years

*Visible only at the exhibited board, not in the picture.

### Native hawthorn species

The Flora of central Europe (Hegi 1995) designates three varieties, differentiated more or less by fixed combinations of characteristics, as well as three hybrid complexes in between. All species in central Europe can be crossed with each other. The most widespread species is the monogynous hawthorn (*C. monogyna*), a similar species is the common or distylous hawthorn (*C. laevigata*), whereas the English hawthorn (*C. curvisepala*) is very rare in Germany.

### Botanical characteristics

The hawthorn grows to be a thorny shrub or small tree with a flute structured stem that can reach up to 10 m in height. The leaves are ovate, more or less deeply sinuate and alternating. The blossoms form in abundantly flowered cymes, they are white (also pink to red in garden varieties) and smell unpleasant.
Like the name says, the distylous hawthorn has mostly distylous blossoms, which bloom about 2 weeks earlier than the monogynous hawthorn. The fruits are one (*C. monogyna*) and two-seeded (*C. laevigata*) respectively, shiny red, spherical pomaceaous fruits with whitish, mealy fruit flesh.
The hawthorn can live to be more than 100 years old.

### Habitat

The monogynous hawthorn is spread almost throughout Europe and is the most abundant native *Crataegus* species. It has the largest ecological amplitude and can be found in stagnant and swampy soils, in flood plain forests, forest edges, on vineyard hills, as well as flat grounds, humus poor, dry slopes and at up to 1500 m altitude in the Alps.
The distylous hawthorn occurs throughout Europe, but prefers natural, open deciduous forests and hedges in soils with high humus content and good water supply, often on heavy, base rich loam soils, from the plains up to 700 m altitude, max. 900 m in the Alps.
The hawthorn is wide spread in Thuringia in hedges and bushes.

### Cultivation

The hawthorn has been, and still is, a popular hedge plant. As an intermediate host for a smut fungus that attacks fruit trees, the hawthorn has rarely been planted in recent times, and

frequently must be rooted out and cleared for cultivation after being affected with the disease (in Thuringia only in intensive fruit orchards and nurseries). The "red thorn", planted as an ornamental shrub in gardens and parks, is a garden variety of the distylous hawthorn with red double flowers.

### Use

The wood is dense and suitable for wood turning.

**Current:** Handcrafts (wood turning), medicine (homeopathic heart healer from the leaves, blossoms and fruits).

**Historic:** Handcrafts (handles, walking sticks, cogwheels), agriculture (fruit as pig fodder, hedges, bee pasture), raw materials (dyes, ink), healing (leaves, buds and fruit to fight heart and circulation problems, tea from the blossoms has dehydrating effect).

# Medlar

*Mespilus germanica* L.

About the Specimen on Display

## General characteristics of the wood

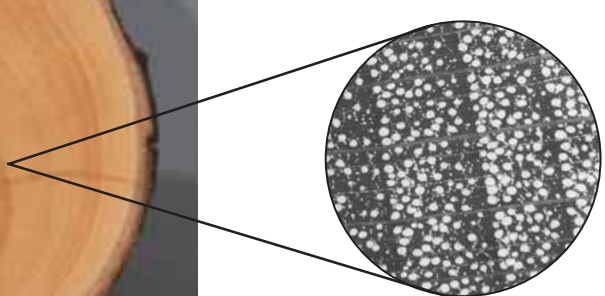
The medlar has reddish white to flesh-red wood with brown coloured heartwood. The wood is diffuse-porous and shows defined growth rings and abundant pith rays.

## The wood on display

**The board**
The medlar is a bush or smallish and often crooked tree (as seen here). The specimen is made up of two sections joined together, which means the actual trunk was only approximately 1 m long. The wood indicates a brown, very dense heartwood with a well healed branch callus.

**The tree slice** (cross section: 11 cm , 34 years: 1.6 mm average growth ring width) shows an irregularly formed, narrow heartwood and a wide sapwood.

Medlar from Jena,
Garden Schulze
Ø 11 cm, 34 years



## Botanical characteristics

The medlar grows as an occasionally thorny tree or shrub up to 6 m tall. Very old trunks reach 20 - 30 cm in diameter. The outer bark is grey and irregularly fissured. The leaves are lanceolate, up to 12 cm long, and pilose underneath. The decorative, white blossoms form individually. The fruits are spherical, brown when ripe, patelliform (dish shaped) at the vertex and crowned by the sepal. They become starchy after frost or extended periods on the ground and are only edible raw when in this state. They then taste pleasantly sour.
Medlars grow between 30 - 50 years, in extraordinary cases up to 100 years old.

## Habitat

The medlar originates, despite its name "*germanica*", from Near Asia (see map). It was brought through Greece and Italy to central Europe, where it was a popular fruit tree in the Middle Ages. Today it can be found wild on sunny slopes, rocky land, in bush land, well lit deciduous forests and on medium dry and base rich soils; it prefers warm climates and is frost-sensitive.
It can be found in Thuringia in old orchards, hedges and castle grounds.

## Cultivation

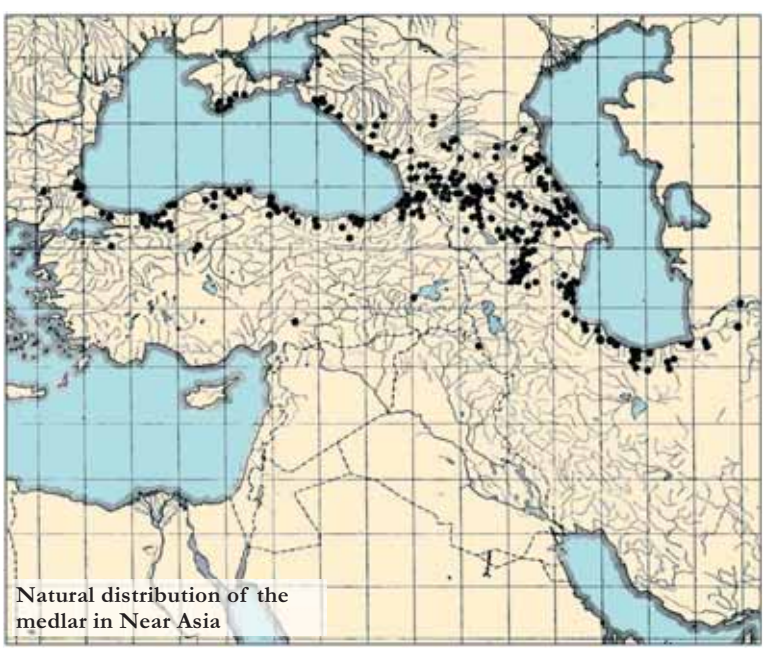
In central Europe the medlar has been more or less forgotten as it is rarely planted and hardly used. The propagation of the species succeeds vegetatively through grafting on the *Crataegus* (hawthorne). Because of its large, decorative, aromatic blossoms, the medlar is also a good ornamental plant.

## Use

The wood is very hard, sturdy, tough, and treasured for all uses that require a high capacity for resistance. The wood however, is only workable after considerable effort.

**Current:** Handcrafts (wood turning).

**Historic:** Weapons (spears), nutrition (fruits, also as puree, marmalade or fruit wine), energy source and raw materials (charcoal, tannin), healing (bark, leaves and fruits used for healing haemorrhages, kidney stones and sore throats).



**Natural distribution of the medlar in Near Asia**

# Mountain Ash, Rowan

*Sorbus aucuparia* L.

About the Specimen on Display

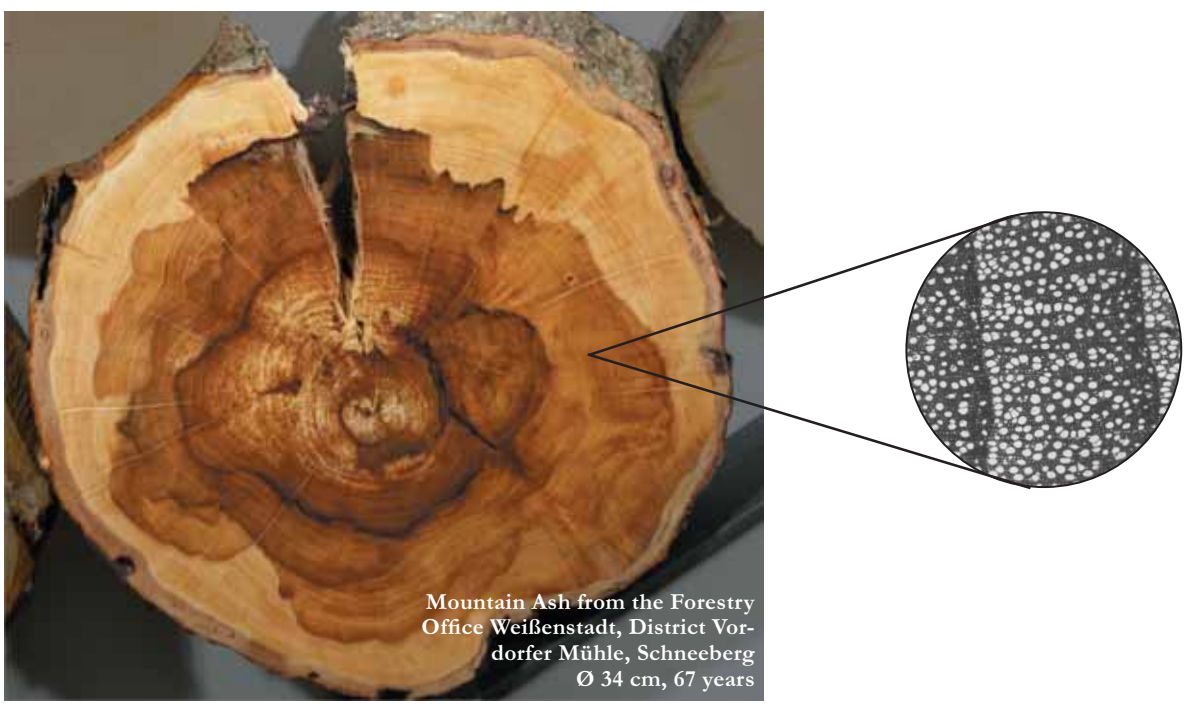
## General characteristics of the wood

The mountain ash is a diffuse-porous hardwood with light coloured sapwood and light to reddish brown heartwood. The vessels and pith rays are particularly fine. The growth rings are clearly visible due to few pores in the late wood, therefore a decorative graining appears in a tangential cut.

## The wood on display

**The board** is an almost perfect radial cut with well ingrown branches. The 3 - 4 cm wide sapwood turns smoothly into the heartwood, where two levels of heartwood formation are visible. The board shows a row of small bark injuries in the heartwood, which led to short, elongated brown discolouration. It is unclear what induced these injuries, possibly a woodpecker or other birds.

**The tree slice** (cross section: 34 cm, 67 years: 2.5 mm average growth ring width) has a dirty brown heartwood. White rot is beginning to form in the middle, spreading outwards like a cloud. This was induced by an old bark injury which has slowly occluded (over 15 years) and stands out as a darker area. The lighter sapwood, only about 1 cm wide, is clearly contrasted from the heartwood. The wood is shrinking heavily. The fine pith rays are visible as stripes.



**Mountain Ash from the Forestry Office Weißenstadt, District Vordorfer Mühle, Schneeberg Ø 34 cm, 67 years**

## Botanical characteristics

The mountain ash grows to be a tree 10 - 20 m tall (max. 27 m) with a narrow cylindrical trunk 40 - 50 cm in diameter. It has a roundish, loose crown. After the terminal bud dies off, it often grows shrub-like and forms runners. The bark is smooth and light grey, with large crosswise running lenticels when young. With age it forms blackish grey, vertically cracked outer bark on the base of the trunk. The leaves are separated into unpaired pinnate leaves that turn vivid red in the fall. The blossoms form yellowish white upright false umbels and smell unpleasant. The berries are coral red with three seeds and grow in dense bundles. They taste bitter due to the parasorbic acid (the cultivated variety *moravica* is not as bitter).
The mountain ash lives to be 80 - 100 years old, max. 200. With age, it often develops rot in the heartwood.

## Habitat

The mountain ash is spread throughout almost all of Europe to 70 degrees N, except in southern Greece and southern Spain. Its spread reaches to western Siberia and northern Africa and up to 2400 m in the Alps. The mountain ash is an undemanding pioneer tree in open space, it is hardy and resistant to air pollutants.

It can be found in Thuringia especially in low elevations and montane areas on soils with a medium to moderate supply of nutrients, for example in the Schiefergebirge mountains after clear cutting.

## Cultivation

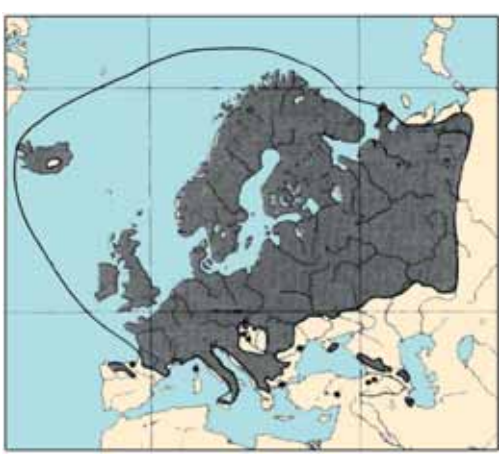
The mountain ash has long been considered a "forest weed" by foresters and not especially valued, but today it is planted as a pioneer species in crops after forest damage, as well as bird food along forest paths. More than 60 bird species have been observed eating mountain ash berries. The mountain ash has a rapid growth in its youth but with age it grows slowly.

## Use

The mountain ash forms a dense, finely structured, medium heavy, hard wood with good elasticity and solidity properties, similar to the oak. It has high toughness and solidity against splitting, shrinks only moderately and hardly rips.

**Current:** Raw material (fire wood), handcrafts (veneering and furniture, decorative wood for instruments and toys), medicine (fruits as a natural healer for cough, hoarseness, urinary problems, gout, rheumatism, laxative, sorbitol for diabetics), nutrition (fruit, especially the sweet mountain ash varieties for fruit pulp and jam, spirits etc.), ornamental and street tree (because of its decorative autumn foliage).

**Historic:** Handcrafts (coach building wood, turning, carving, carpentry, weaving shuttles (with boxwood), models and forms, wooden screws, tool handles), household (wooden cutlery), nutrition (fruit spirits as well as barrels for spirits), bird attraction (because of the fruits), raw material (for gun powder, bark for tannin).



# Pear

*Pyrus communis* L.

About the Specimen on Display

Pear tree from Jena,
Garden Peters

Pear tree from Jena,
Garden Peters
Ø 43 cm, 103 years

## General characteristics of the wood

The pear tree has significantly variable wood colouration. There are uniformly reddish coloured woods without heartwoods, or woods with yellowish sapwoods and red to brown-violet, facultatively coloured heartwood. The wood darkens under light exposure. It is diffuse-porous, finely-fibred, and uniformly structured. Due to dark late wood areas, the growth rings are clearly separated from one another and the wood has tangential grain markings in a tangential section; occasionally the wood is also strongly flamed or striped (the so-called "colourful pear tree").

## The wood on display

**The board** has red-brown heartwood. The irregular "diluted" edge of the heartwood indicates that it is a secondary coloured heartwood, induced by oxygen penetration. Indicated by an injury in the middle, air was the primary cause of the wood discolouration. The heartwood formation results in a significant change of the wood, which means the heartwood can be felt as a bulge because it is not planed in the same way as the softer sapwood. The typical spiral grain leads to tension in the wood, causing rips even when sturdily anchored (see bottom end)*.

**The tree slice from the "Peters Garden"** (cross section: 43 cm, 103 years: 2.1 mm average growth ring width) is a pear with red heartwood; contrast this with the **tree slice from the "Schorcht Garden"** (cross section: 27 cm, 48 years: 2.8 mm average growth ring width) which has no heartwood, and is a specimen of "typical" pear tree wood. This pear has a sharp edged injury reaching to the pith, presumably caused by an axe or a mower. Despite this wound, no heartwood formed[1].

Pear tree from Jena,
Garden Schorcht
Ø 27 cm, 48 years

*Visible only at the exhibited board, not in the picture.

1) This means that the particular variety of pear tree accounts for the presence or absence of heartwood formation.

## Botanical characteristics

The pear tree grows to be a wide pyramid shaped tree up to 15 m tall, rarely up to 20 m, with squarrose standing, and seldomly thorny branches. The trunks grow to be over 80 cm thick, are often spiral growing and have smooth bark at first, then cubic rhytidome (outer bark) sections rapidly form on the soft bark. The leaves are egg shaped to elliptical, pointed at the tips, notch-edged and shiny on the top side. The white blossoms form in sparsely flowered corymbs and can be distinguished from the apple tree by the red stamen; they have an unpleasant odour. The yellowish green, often rosy cheeked fruits of different varieties are variable in size, shape, grittiness of fruit flesh (stone cells) and taste. Pear trees live to be 150 - 200 years old.

## Habitat

Cultivated pear trees originate from Persia and Armenia, from which they were brought through Greece and the Roman Empire to western Europe. A wide range of varieties were cultivated through selection and cross breeding. The wild pear (*P. pyraster*), one of the original forms of the cultivated pear, is more often found in southern and central Germany, because it likes warm climates and is not very winter tolerant. It grows in deciduous forests, hedges and dry thickets in warm summer areas, up to 850 m altitude in the Alps. These temperature requirements strongly dictate the cultivation of the domestic pear tree.
The wild pear occurs in Thuringia in hedges and bushes in dry locations. The pear tree requires active measures to be taken for its preservation.

## Cultivation

Pear trees are intensely cultivated in gardens. The propagation of the species is through grafting. The "pear tree" sold commercially originated from fruit cultures. The wild pear requires a lot of light, grows slowly, and is not considered very important to forestry. It is for this reason that the pear tree has been almost entirely pushed out of commercial forests and is considered protected in a few German states.

## Use

There is no difference between the woods of the wild and domestic pear. It is uniformly dense, fine-grained, hard and heavy, tough, yet not very elastic. It is hard to split, shrinks considerably

and tends to rip and warp but has good staying power, high capacity to keep its shape when dry and is good to work. Exposed to outside conditions, the wood is not very durable. The burning value is high.

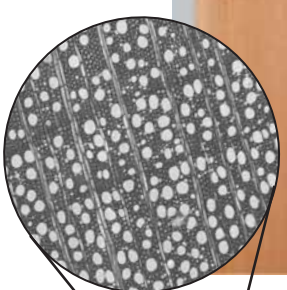
**Current:** Handcrafts (furniture, veneering, precise drawing instruments and tool parts because of its high capacity to keep its shape, cabinet making, wood turning and carvings like ornamental containers, ornamental boxes, plates, lamp bases, inlay, musical instrument parts - for example, recorders, small organ pipes, string instruments, and imitation ebony for piano keys), interior design (wall and floor panelling and parquet flooring), general household (kitchen utensils such as baking moulds, brush handles, wooden toys), food (fruits, liquor distillation).

**Historic:** Handcrafts and industrial (for heavily strained machine parts, wheels for transfer belts, small gear teeth and axles, fruit and wine presses, shuttles, ironing rollers, spinning wheels, sled skids, oar blades, printing press lettering and moulds, forms and rollers, balls, skittles and wood screws), nutrition (fruits), agriculture (pig fodder) energy source and raw material (fire wood, dye from the bark), healing (fruit are diuretic, leaf extract has soothing properties).

# Trueservice Tree

*Sorbus domestica* L.

About the Specimen on Display



Trueservice tree from Wiesentheid near Kitzingen

Tree disc taken from the lower part of the trunk Ø 35 cm, 149 years

## General characteristics of the wood

The trueservice tree is one of the heartwood trees. The sapwood is most often reddish white to brown; the heartwood varies from pale to darker depending on exposure to light. The heartwood often has coloured stripes, as if it were "soaked". The very fine vessels are arranged diffuse- to semi- ring-porous. The wood rays are narrow, but contain a significant amount of different secondary plant compounds and are therefore recognisable on radial sections as fine, reddish brown ray flecks. The growth rings are clearly defined by a band of dark late wood.

## The wood on display

**The board** is made up of two board pieces placed together. Like a pear tree, the wood is reddish brown, with even, narrow growth rings and pale ray flecks. The dark vertical lines are discolourations established during the growth of the tree.

**The tree slice** (cross section: 35 cm, 149 years: 1.2 mm average growth ring width) has a very spotted pattern due to wood-rot. The tree was severely damaged at the base of the trunk approximately 30 years ago. It is presumably a damage caused during harvesting activities, and the tree has not succeeded in occluding the wound. The deformity of the bole outline is caused by root buttresses.

A **60 year old tree slice** is from the upper end of the same trunk. Here there is a narrower strip caused by an insect, visible in the heartwood.

Tree disc taken from the upper part of the trunk Ø 22 cm, 60 years

## Botanical characteristics

The trueservice tree is 15 - 25 m tall with an oval crown; hearty specimens can reach a trunk diameter of more than 130 cm. Free-standing, the crowns protrude widely and are often wider than they are tall. The bark is at first smooth and grey but the formation of a greyish brown, fine-surfaced rhytidome begins early. The leaves are similar to those of the mountain ash (*Sorbus aucuparia*); they are alternate, unpaired pinnate leaves with yellow autumn colouring. The white buds form in abundantly budded, semi spherical corymbose cymes. The trueservice tree differs from the mountain ash however, due to its fruit. The trueservice tree bears pear formed, rosy coloured small pomaceous fruits. They are edible, yet only soft and sweet after extended, off-the-tree ripening. The trueservice tree reaches ages of 350 - 400 years, the age for harvesting is between 120 - 140 years.

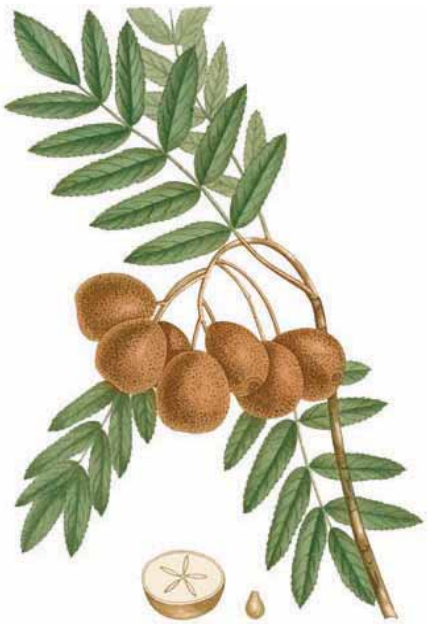
## Habitat

The trueservice is spread throughout the submediterranean climate areas of central-southwestern Europe, southern Europe, Asia Minor and North Africa. They grow on sunny, warm slopes in oak abundant forests in evenly dry, nutrient and base rich, mostly calcareous, stony clay and loam soils. It is unclear whether it is native to central Europe or was introduced by the Romans as a fruit tree, then grew wild and took on a place in the natural vegetation.

In Thuringia the trueservice tree is an extremely rare tree species, the total stock is estimated to be approximately 60 - 100 specimens. It can be found principally on Keuper sandstone or shell limestone. The most hearty trueservice tree has a diameter of 55 cm and a height of 24 m (in the forest territory Schweickershausen), an even taller trueservice tree is 26 m tall and can be found in the territory of Stadtilm.

## Cultivation

The trueservice tree is threatened and worthy of protection, partly because it hardly regenerates itself naturally even though it develops abundant seeds. Also because the earlier coppices have been transformed into standard forest almost without exception, the competitively weak trueservice tree cannot assert itself against more shade tolerant tree species. The forestry utility of this slow growing tree has only been discovered in recent years.



## Use

The wood is fine-fibrous, hard and sturdy, very tough, elastic and difficult to split. It shrinks significantly and shows a strong tendency to rip and warp, it possesses a good staying power when dry and a good workability. Under weathering, the wood is not very durable. Because of its small quantity, it is associated with serviceberry and the pear tree as "Swiss pear tree", rather than as its own species.

**Current:** Handcrafts (veneering, cabinet-making, wood turning and cutting, musical instrument construction: bagpipes), nutrition (tannin rich fruits are an important addition to apple wine (Frankfurt area), liqueur distilling, for example "Sorbette" in Elsass).

**Historic:** Handcrafts and industry (speciality wood in mechanical engineering for heavily used parts like rollers, axles, cogwheels, rolls for block and tackle and screws, wine presses, rolling irons, in mills, looms, coach building, billiard balls, cues, bowling balls, pins, rulers, rifle stocks, pistol handles, keg taps), nutrition (tannin rich fruit for purifying wine, also as a fruit), healing (fruits prevent vomiting and diarrhea).

# Whitebeam

*Sorbus aria* (L.) Crantz

About the Specimen on Display

## General characteristics of the wood

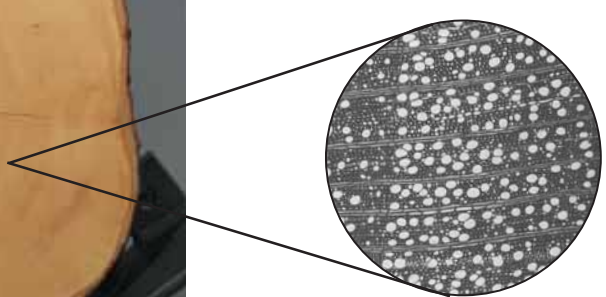
Whitebeam wood usually has wide, light coloured sapwood and brown heartwood. It is diffuse-porous, with small vessels and fine pith rays.

## The wood on display

**The board** shows a radial cut through the centre of the trunk with irregular brown heartwood along ingrown branches. The irregularity is a result of typical crooked growth. The discolouration on top of the ingrown branches is darker. This shows that the discolouration was induced by the penetration of oxygen and water. The sapwood (app. 2 cm) is visibly separated from the heartwood. The pith rays are visible as fine ray flecks. The growth rings are visible on the darker portion of the late wood.

**The tree slice** (cross section: 40 cm, 102 years: 2 mm average growth ring width) shows rapid growth rates during the youth of the tree but extremely slow growth of the mature tree. The last growth rings are hardly visible. The wavy formation of the trunk outline shows the typical fluted structure of the whitebeam. The cloudy brown heartwood indicates varying penetration of air and water. The individual pith rays are hardly visible, but recognisable as dark stripes. The wood is shrinking to a small degree (split).

Whitebeam from the Forestry Office Creutzburg, District Ifta, Heldrastein
Ø 40 cm, 102 years



## Botanical characteristics

The whitebeam is a large shrub or small tree, often with a flute structured, crooked trunk. The bark is black-grey, often white speckled, and remains smooth until the tree is quite old, after which it forms vertically fissured, outer bark. The tree is easily recognisable by the leaves, which are firm with white "felt" on the underside. The blossoms are in upright false umbels and develop scarlet red berries which are mostly eaten by birds, because the mealy fruit is only enjoyable by humans after the frost.
The tree can reach 200 to max. 300 years of age.

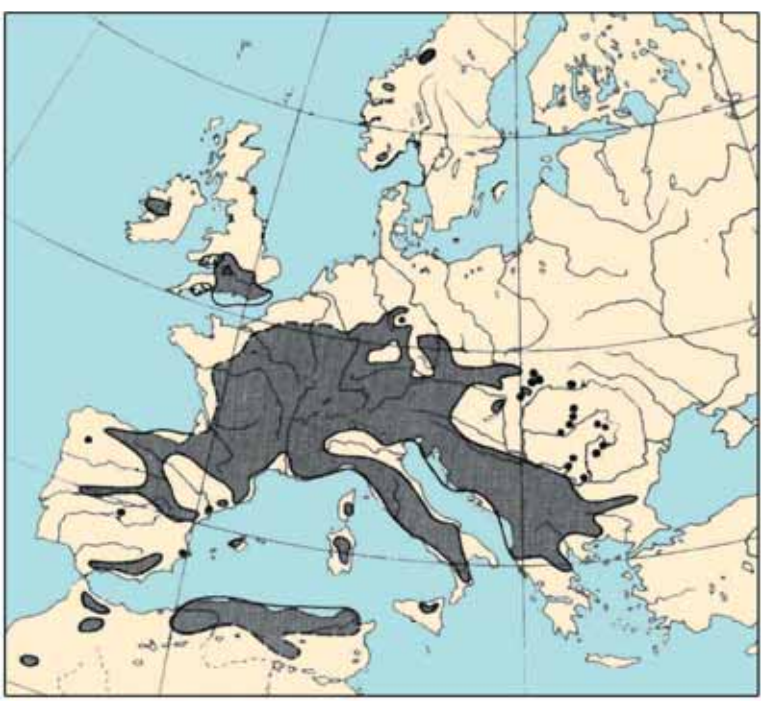
## Habitat

The whitebeam can be found in central and southern Europe up to the Himalayas in thermophilic bushes and mixed forests on limestone. It is typical of warm, dry rocky slopes.

In Thuringia the whitebeam is most often found in thermophilic mixed deciduous forests and forest edges.

## Cultivation

The whitebeam was indirectly supported and propagated by coppice and coppice-with-standards management in private and community forests.



## Use

The whitebeam has a very decorative, fine-grained wood with high density and hardness. The wood has good workability but shrinks significantly.

**Current:** rarely used commercially but still used in handcrafts for veneering and artistic carpentry.

**Historic:** Industry (in mechanical engineering for parts that are heavily exposed to impact and abrasion), handcrafts (carving, turning), raw material (fire wood).

# Wild Cherry (or Bird Cherry)

*Prunus avium* (L.) Moench

About the Specimen on Display

## General characteristics of the wood

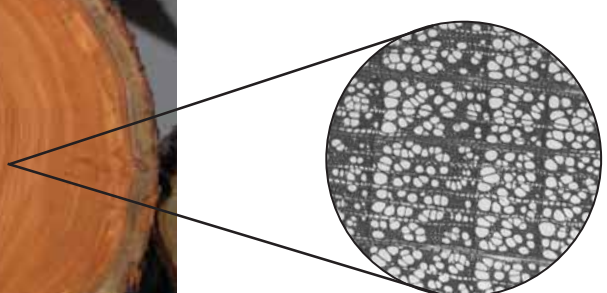
The bird-cherry yields an especially decorative hardwood with reddish to yellow-brown heartwood, clear growth ring boarders, fine semi-ring-porous vessels and defined pith rays.

## The wood on display

**The board** is a tangential cut near the centre of the tree with noticeable grain markings due to the diagonally cut growth rings. The narrow sapwood (2 - 3 cm) is clearly contrasted from the reddish heartwood. The branches have cleanly occluded with little additional heartwood formation, especially visible in the branch that reached to the sapwood. The bird-cherry is a densely coarse-grained wood due to its large vessels. The pith rays can be recognized as light coloured shiny ray flecks, especially in the sapwood. The early wood pores develop fine grains in a tangential cut, and fine stripes in a radial cut (a distinguishing feature).

**The tree slice** (cross section: 42 cm, 60 years: 3.5 mm average growth ring width) has a narrow sapwood with a reddish heartwood. The heart has additional grey discolouration in the centre, induced by the beginning of white rot. The centre was colonized by carpenter ants, whose holes are noticeably visible. The carpenter ants penetrated through a bark injury (lower left) which did not fully heal. The fine pith rays are clearly visible.

**Cherry tree from the Forestry Office Jena, District Heideland, Eisenberg**
**Ø 42 cm, 60 years**



## Botanical characteristics

The bird-cherry is 15 - 20 m (max. 40 m) tall with a branch-free trunk of 40 - 50 cm (max. 80 cm) in diameter. The bark is initially smooth and shiny grey to reddish brown. The lenticel bands arranged crosswise induce the bark to separate from the trunk in horizontal strips. A vertically fissured, blackish grey outer bark forms with age. The leaves are pointed obovate and coarsely serrated with 2 - 4 shiny red glands on the leaf stock. The blossoms are white with long pedicels in tufts of 2 - 4. The stone fruits (cherries) are spherical and shiny black to light red. The fruits of the wild variety are smaller than the cultivars and bitter sweet.

## Habitat

The wild cherry grows in Europe up to 61° N and spreads up to the Caucasus. It is a tree species of diverse deciduous forests, especially in moist, nutrient rich, calcium-carbonate containing loam soils.

In Thuringia they can be found in all deciduous mixed forests, especially on forest edges and in forests formerly managed as coppice-with-standards as well as in hedges.

## Cultivation

The bird-cherry has recently been planted again commercially. It is recommended that the bird-cherry be planted especially during first afforestation because it promises comparably early yields. The tree can be harvested after 70 – 90 years, older trees frequently suffer from rot in the trunk. The cultivated sweet cherries have evolved from cultivation of the bird-cherry.

## Use

The cherry forms a medium heavy, hard wood with good solidity and elasticity; it shrinks somewhat, but nevertheless has good staying power. It is only minimally durable to weathering. It is clean and easy to work, bendable and hard to split.

**Current:** Handcrafts (veneering, furniture (more treasured than nut), custom carpentry, mahogany and nut tree imitation, inlay, sculpting, carving and turning wood, lamps, pipe bowls, musical instruments: pianos, woodwinds), interior construction (walls and ceiling panelling, lasts, frames, stair railings, wood flooring), industry (dashboards in the auto industry, casting models), household (knife handles, crates, brush handles, baking moulds), customs (Cherry branches, if cut on December 4th, the day devoted to the holy Barbara, will blossom at Christmas.).

**Historic:** Handcrafts (turning, furniture, instruments, gum produced from bark injuries was used to stiffen hats), agriculture (leaves as fodder, bee pollen source, hedges), nutrition (fruit), healing (fruits and stems to fight arthritis, obesity, gout, digestive problems).

# Wild Plum

*Prunus domestica* L.

About the Specimen on Display

## General characteristics of the wood

The sapwood is reddish white to brownish; the colouration differences between young and older heartwood is often large (pinkish brown against dark violet brown, freshly cut wood also darkens rapidly). The heartwood obtains dark brown stripes with age. The wild plum has the darkest heartwood of the rose family. The abundant vessels are arranged semi-ring to diffuse-porous. The growth rings are clearly visible because of the lighter early wood. The light coloured pith rays contrast drastically against the dark xylem and form small, faint shiny ray flecks on the radial section.

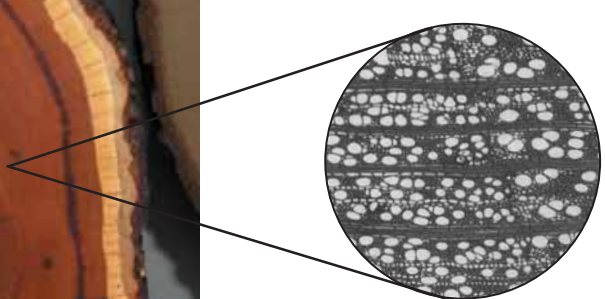
## The wood on display

### The board

The reddish brown heartwood is clearly separated from the yellow sapwood. The hole in the top end of the plank was caused by carpenter ants which penetrated the trunk through a dead branch that is still visible*.

**The tree slice** (cross section: 29 cm, 80 years: 1.8 mm average growth ring width) shows the typical reddish brown heartwood of the wild plum. The penetration of carpenter ants through the trunk is also visible here, which caused darker secondary discolouration.

**Plum tree from Jena,
Garden Peters
Ø 29 cm, 80 years**



*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

The plum (subsp. *domestica*) is a shrub or tree up to 6 m tall. It often has squarrose growth and almost smooth, grey-brown bark. The leaves are wide and elliptical, dark green on the upper side and light green on the lower surface. The blossoms are large and greenish white and grow in umbels of 2 - 3. The blue-black fruits have a solid, medium juicy pulp and the stone is egg to half moon shaped. They ripen in September to October.

## Habitat

The wild plum is cultivated as a fruit tree in western Asia, Europe, North America, northern and southern Africa. It is only known as a cultivated species, or at most as one returned to the wild. The region of origin is only speculatively known. Cultivars are propagated vegetatively through grafting or from root sprouts.
It is generally accepted today that cultivated plum varieties originate from prolonged crossing of the cherry-plum (*P. cerasifera*) with the blackthorn (*P. spinosa*), or directly from polyploid wild forms of *P. cerasifera*. While only primitive varieties that propagated from the fruit stones or root sprouting were cultivated in pre-Roman times, the art of grafting gradually succeeded in Roman times in bringing the cultivated plum to central Europe. Most fruit trees were grown and cared for in monasteries.
Important cultivation areas in Thuringia are on Keuper sandstone and shell limestone. The wild plum can be found in hedges and thickets. The plum is frost-sensitive and thermophilous, but not as much as apricot, peach or almond.

## Cultivation

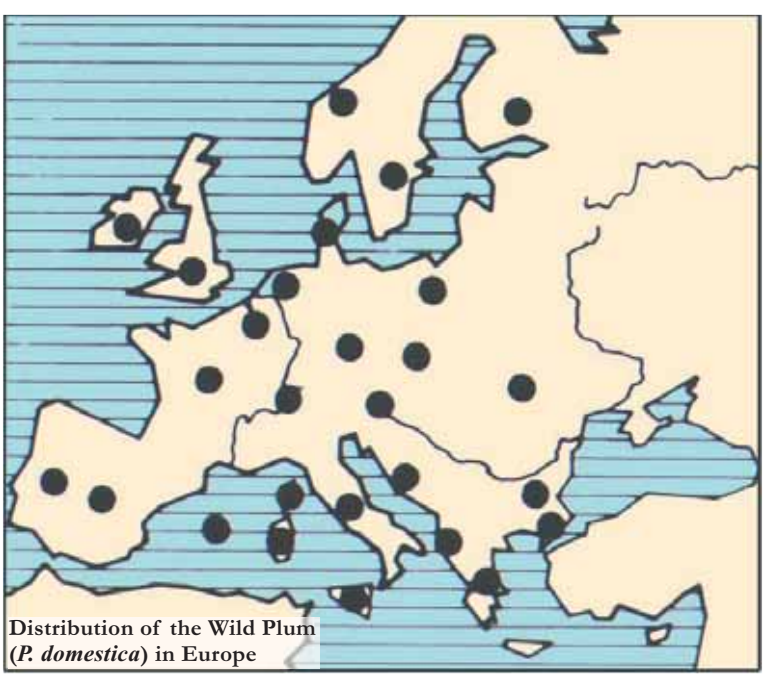
Cultivated as fruit tree in gardens, in orchards and plantations.

## Use

Plum wood is hard, dense and solid. It is difficult to split, but is good for carving and turning because of its interesting colouration. In general, it is good to work with and polishes well.

**Current:** Handcrafts (veneering, furniture, stair railings, grips and handles for knives and tools, turning and carving work like chess pieces, bowls, boxes, inlay, buttons for clothes and furniture, rosary beads, keg taps, fence posts), nutrition (fruits, liquor distilling ("Slibowitz")), medicine (dried fruits have a laxative effect).

**Historic:** Handcrafts, nutrition, healing, customs (fruit and blossoms were once thought of as a love oracle, illnesses were supposedly transferable by "talking" with the tree).



**Distribution of the Wild Plum (*P. domestica*) in Europe**

# Syrian Plum

*Prunus domestica* subsp. *syriaca* (Borkh.) Janchen ex Mansfeld

About the Specimen on Display

## General characteristics of the wood

The wood of the Syrian plum is somewhat lighter than the wild plum, the only major distinguishing difference between the two. This Syrian plum has light, yellowish sapwood, forming a significant contrast to the dark to violet brown heartwood. The wood is red when freshly cut. The clear pith rays make the wood more "precious" than that of the wild plum.

## The wood on display

**The board**
The light coloured sapwood is extremely thin. The bole indicates significant spiral growth and was therefore separated in the middle. White rot is penetrating the heartwood on the lower left side, inducing white stripes and spots*, which are frequently visible on different types of wood (apple, hawthorne).

**The tree slice** (cross section: 20 cm, 64 years: 1.6 mm average growth ring width) shows a red-brown, uniformly coloured heartwood and an irregular and repeatedly injured sapwood (damages occurred approx. 15 years ago).

**Syrian Plum from Bayreuth, Garden v. Hessberg Ø 20 cm, 64 years**

*Visible only at the exhibited board, not in the picture.

### Botanical characteristics

The Syrian plum is a squarrose, thornless tree. It is distinguishable from the wild plum (subsp. *domestica*) because of its spherical fruit, which are deep wax yellow, often with red spots. The pulp is extremely sweet, and separates easily from the stone.

### Habitat

The Syrian plum was presumably brought fairly late from Syria ("*syriaca*" = originating from Syria) or Arabia to Greece, Italy, France and finally to central Europe (cultivated in Germany after 1560). Today it is cultivated in central and southern Europe and northern Africa, though in central Europe mainly in the areas of Elsass, along the central Rhine and the Rhineland and in Main Franconia.

### Cultivation

The Syrian plum is cultivated as a garden fruit tree, in orchards and fruit plantations.

### Use

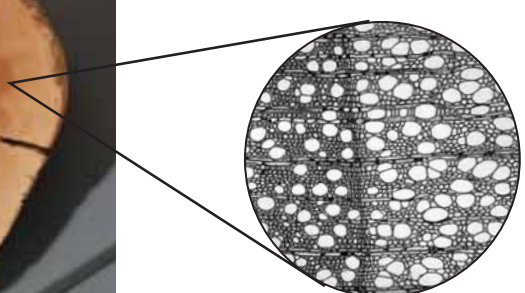
The wood of the Syrian plum is used like the wild plum, mostly for wood turning and carving work (see use of the wild plum, page 79). The fruits are also good for drying.

# Wild Service Tree

*Sorbus torminalis* (L.) Crantz

About the Specimen on Display

Wild Service Tree from the palace grounds Belvedere, Weimar
Ø 28 cm, 149 years



## General characteristics of the wood

The wild service tree is a "mature" species (no stringent formation of coloured heartwood); the wood is a pale, whitish yellow to light red colour, a darker red-yellow in older trees, which then darkens due to light exposure. Red to black-brown facultative coloured heartwood often forms. The abundant, fine vessels are arranged diffuse- to semi-ring-porous. The wood rays are very fine and the growth rings following the darker, last late wood are clearly defined. This causes subtle, fine tangential grain markings appear on tangential surfaces.

## The wood on display

**The board**
The bole is bent at the base, so the bottom* and top ends of the cut almost reach the pith, but in the middle, the tangential grain of the growth rings show that in this case, the cut is farther from the pith. The yellowish sapwood is clearly separated from the darker, reddish brown heartwood, in the middle of which an additional secondary coloured heartwood can be seen*. This dark wood is significantly harder and can be felt as a bulge. The trunk grew relatively rapidly and without branches.

**The tree slice** (cross section: 28 cm, 149 years: 0.9 mm average year ring width) indicates a clearly defined heartwood. There are additional discolourations in the sapwood that possibly occurred during storage after the felling.

*Visible only at the exhibited board, not in the picture.

## Botanical characteristics

The wild service tree is 25 m tall with an egg shaped crown which takes on a flat, curved shape when free-standing. The bole circumference is 50 - 100 cm (max. 135 cm). The bark is smooth and grey at the beginning; with age it forms a dark brown, small-flaked outer bark. The leaves are egg shaped with deeply indented lobes and in autumn a shiny, wine red colour. The white blossoms stand in approximately 30 - 50 upright, loose corymbose cymes. The fruits are spherical or egg shaped pomaceous fruit, yellow-red when unripe, brown when ripe and aspirated by abundant lenticels. The ripened fruit taste starchy and tart. The wild service tree reaches 200 - 300 years of age.

## Habitat

It is naturally spread throughout central and southern Europe as far as the Caspian Sea. In Germany the wild service tree is a rare subordinate tree species in oak forests and bushes. It prefers warm climates in dry to moist, base rich soils and grows from the planes to the montane level.
The trees occur in abundance on the shell limestone in and around the Thuringian Basin, especially in the areas around Erfurt, Arnstadt, Jena, Weimar, Naumburg, also in the Upper Permian foothills of the Kyffhäuser and the southern Harz; it does not grow, however, in the Thuringian mountain range (Thüringer Wald).

## Cultivation

The wild service tree, like other wild fruit trees, has been heavily over-harvested since shrub forests began being commercially harvested in the 19th century. For a long time, they had been considered of little value to the forestry industry because of their slow growth but have since increased in economic value to become the most expensive lumber in Germany. In recent years, prices of well over € 5,000 per cubic meter of solid timber of wild service have been paid, a high quality bole earned over € 15,000 per cubic meter in 2001. As a wild fruit tree the wild service tree has been cultivated for ages.

## Use

Wild service tree wood is heavy, tough, medium dense, flexible, very elastic and durable; it tends to shrink and warp. With considerable effort, it works well and produces nice smooth surfaces.

Because they possess similar properties and uses as the pear tree, both the wild service and true service tree are often referred to as the "Swiss pear tree."

**Current:** Handcrafts (veneering, furniture, measuring instruments, rulers, drawing instruments, pencils, musical instruments: harpsichord, bagpipes, flutes, drumsticks, billiard cues), interior construction (wall and ceiling panelling, flooring), industry (dashboard of luxury cars), nutrition (liquor distillery).

**Historic:** Handcrafts (speciality wood for technical uses: parts of grinding equipment, rollers, spinners bobbins, shuttles, presses and spindles for wine presses, ironing rollers, printing letters and typeset, pins and wood screws, carriage building, meat blocks, production of scientific instruments like stethoscopes), healing (tannin content of the fruit fights dysentery, "tormina" = dysentery), raw materials (yellow and reddish brown dies from the branches, charcoal, fire wood), nutrition (fruits eaten raw or cooked, also used as fodder).

# Walnut Tree

*Juglans regia* L.

About the Specimen on Display

## General characteristics of the wood

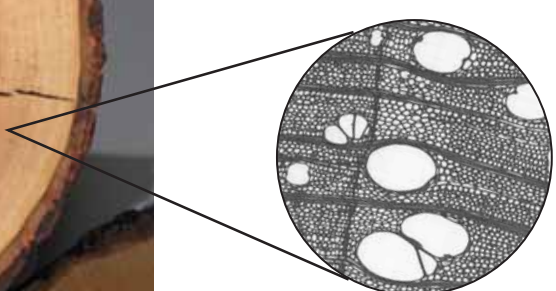
The walnut tree is a heartwood tree with grey to blackish brown coloured heart clearly separated from grey to reddish white coloured sapwood. The heartwood often has a watery cloudiness around the borders of growth rings, inducing a tangential grain or flamy image to appear on a tangential cut. The vessels are arranged semi-ringed-porous and the late wood vessels are significantly smaller than the coarse vessels in the early wood. The vessels fill with secondary plant substances during the heartwood formation and appear pin striped in vertical cuts. The growth rings are clearly marked.

## The wood on display

**The board**
Walnut wood is known for its brown heartwood with short, black vertical stripes, the origins of which can be traced to the black inclusions in the early wood vessels. The border between early and late wood is most often "blurred" in established branches, which means that air and water penetrated these areas, inducing the heartwood formation.

**The tree slice** (cross section: 32 cm, 33 years: 4.8 mm average growth ring width) shows a late heartwood formation. One normally presumes ringed-porous wood to have early heartwood formation.

Walnut tree from the "Garden Peters", Jena
Ø 32 cm, 33 years



# Walnut Family

# Juglandaceae



## Botanical characteristics

Walnut trees usually do not grow over 10 - 12 m tall, but can reach between 15 - 25 m. The trunk diameter is between 60 - 80 cm. When free standing, the crown is especially wide and heavily branched. The bark is smooth and ash grey during the youth of the tree, then forms a blackish brown, deeply fissured outer bark with age. The leaves are alternate in unpaired pinnate, the foliage unfolds only after other trees are already fully foliose. The blossoms are monoecious, the males in abundantly flowered catkins and the females in groups of 1 - 5 in spicate inflorescence. The spherical fruits are botanically considered to be stone fruits, the woody stone contains the edible seed.
Walnut trees grow to be 150 - 160 years old, the most abundant fruit bearing occurs at 40 - 50 years of age.

## Habitat

Originally native to southeastern Europe, southwestern and central Asia (Pamir mountains), walnut was intensively cultivated by the Romans for nuts; from there it spread to the Mediterranean countries until it was introduced to Germany, most likely by Charles the Great. The walnut tree is late-frost sensitive, it therefore prefers areas in Thuringia with milder climates.

## Cultivation

The walnut tree grows mostly as a single tree in gardens, parks, open fields or as a street liner, also wild in some places. Despite the high value of the wood, the walnut found little inclusion in the precious hardwood lumber industry. It is planted for nut harvesting in plantations and orchards, but cultivated to grow only a half size trunk.

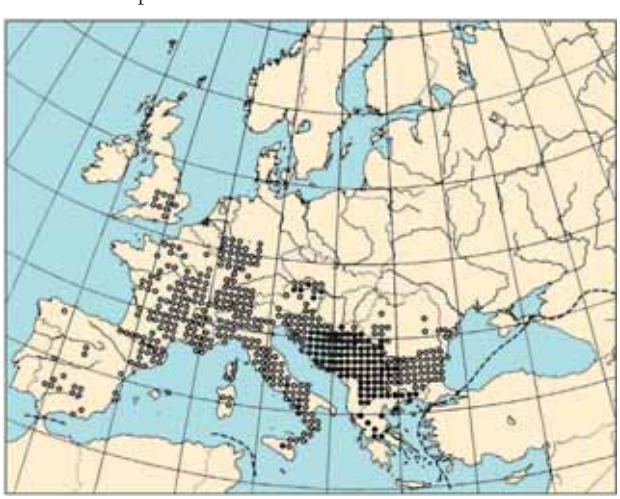
## Use

Walnut wood is fine-grained, hard, has good solidity properties and strong bending capacity. It shrinks minimally and warps only slightly once it is dry. It is not very durable to weathering but durable to water exposure and good and clean to work. Usually the lower, tuberous thickened portions of the trunk ("knobs") are used for special veneers made of nut trees, trunks are therefore dug up with the rootstock.

**Current:** Handcrafts (furniture: chairs, tables, chests, casing for radios and standing clocks, furniture with curves, musical instruments: pianos, buttons, rifle stocks), artistic handcrafts (wood turning and carving work like church interiors, inlay work), interior construction (wall and ceiling covering, parquet flooring).

**Historic:** Handcrafts (furniture, carriages, carving and turning, foundry models, wooden shoes, rifle stocks), interior construction (full wood flooring).

Almost all parts of the tree were previously considered to have medicinal or magical powers, for example the sound of a walnut thrown into the fire was interpreted as a love oracle.



# Hybrid-Poplar

*Populus* x *canadensis* Moench

About the Specimen on Display

## General characteristics of the wood

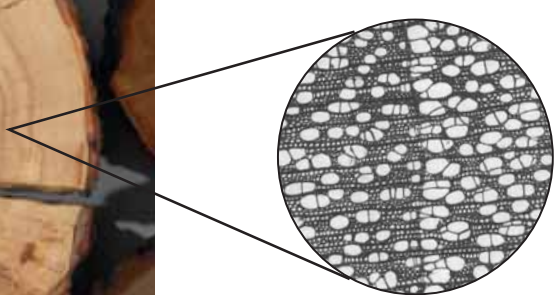
Poplar wood is a faint light coloured, whitish, diffuse-porous hardwood with fine pores and wide, faintly marked growth rings.
The microscopic cross section shows the wood of aspen (*P. tremula*).

## The wood on display

**The board** is a radial cut through light coloured wood with 5 cm wide sapwood contrasted with grey heartwood. The tree is coarsely branched; wood discolouration beginning on the numerous occluded branches is visible. The burrow of a wood-boring insect (poplar longhorn) is visible in the middle of the left side as well as the beginning passage of the larvae (densely packed wood chips) and an approximately 70 cm long, coloured streak under the first growth ring.

**The tree slice** (cross section: 52 cm, 30 years: 8.7 mm average growth ring width) has a wide, light coloured sapwood and a grey heartwood. The coarse branches are typical of the poplar. Ingrown bark sections occur during rapid growth. In parts of the slice, there are clearly defined "pith flecks" which were most likely induced by insect damage. The growth rings are wavy and irregular. The fine pith rays are not individually distinguishable.

**Poplar from the Forestry Office Rudolstadt, Uhlstädter Heide Ø 52 cm, 30 years**



The microscopic cross section shows the wood of the aspen (*P. tremula*).

## Botanical characteristics

Hybrid-poplars grow to be 30 - 40 m tall and reach up to 150 cm in diameter. The commonly cultivated hybrid-poplars as well as the true black poplar (*P. nigra* - in the picture on the right) are distinguishable by their wide crowns and coarse branches. The outer bark is vertically fissured and black to grey. The large leaves are diamond to roundish-ovate shaped. The blossoms develop catkins and the seeds cannot be mistaken due to their woolly hair-tuft (so-called "cotton wool").
Poplars can grow to be 300 years old, but they are used in the forestry industry after 30 - 40 years and sometimes even earlier.

## Habitat

Poplars are spread throughout Europe, northern Africa and Asia Minor (*P. nigra* in the distribution map in the bottom right corner). The "commercial poplars" predominately found in Germany are not pure species, but new cultivars created by hybridization. There are three native species found Germany. The aspen (*P. tremula*) is typically found in clearings and ruderal areas; however, the black and silver poplars (*P. nigra, P. alba*) are both species found along rivers in lowlands and flood plains.
Poplars also grow in Thuringia, mostly in plantations or in flood plains.

## Cultivation

Poplars are cultivated in plantations; they reach growths of 10 - 20 $m^3$ per hectare a year or more.

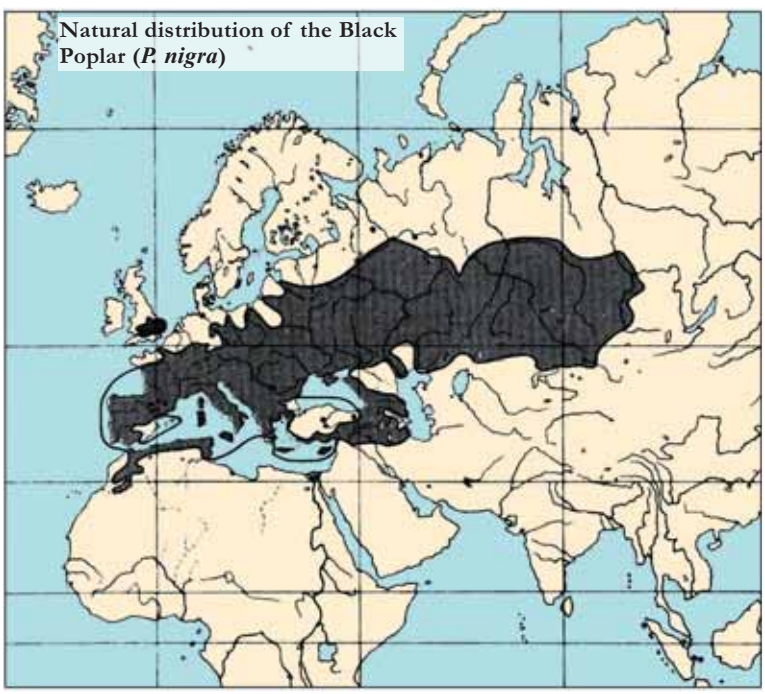
## Use

Poplar wood is a soft wood with little shrinkage, little solidity, but high resistance to wear and tear due to matted fibres on the surface.

**Current:** Handcrafts (sawn-wood for blindwood for furniture, carving, wood peelings for matches, casing, chip baskets, cheese packaging, drawing boards, bakers' boards, butchers' moulds, toothpicks, hat moulds, shoes), hobby (saunas), industry (palettes, crates), raw materials (pulp extraction, plywood, chipboards, wood-wool, wood packaging, speciality charcoal), medicine (wood for prosthetics).

Black Poplar (*P. nigra*)

**Historic:** Handcrafts (turning, shoes, matches, furniture, crates, baskets, carving), industry (interior decoration of railroad cars), healing (hardwood trunk rot (*Phellinus igniarius*), a fungus specific to the poplar, was used as a dye and a medicine), raw materials (paper).



**Natural distribution of the Black Poplar (*P. nigra*)**

# Red Willow (Hybrid)

*Salix* x *rubens* Schrank (*S. fragilis* x *alba*)

About the Specimen on Display

## General characteristics of the wood

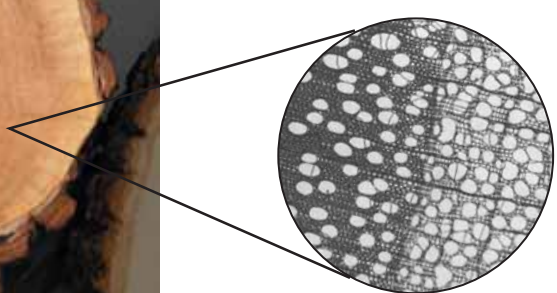
Willow wood is light coloured, most often reddish, diffuse-porous with fine vessels and pith rays. The willow differs from the poplar in its reddish heartwood. The growth rings are wide and the separation between them is often blurred. The microscopic cross section below shows the wood of the white willow (*S. alba*).

## The wood on display

**The board** is a radial cut and has many overgrown alternate branches. There are many wood marks next to the coarse lateral branches in the centre of the board, induced by shorter overgrown lateral branches. The inner heartwood around the branches is more grey and hard. In this place, the wood is raised and can be felt by hand. The growth rings are only visible in the very narrow late wood section. The pith rays form inconspicuous ray flecks.

**The tree slice** (cross section: 35 cm, 70 years: 4.4 mm average growth ring width) is a reddish heartwood with secondary discolouration in the centre. The pith rays are visible as grey bands. The wood is shrinking significantly, but is, in this case, not split open.

**Willow from the Municipal Forest of Großschwabhausen Ø 35 cm, 70 years**



The microscopic cross section shows the wood of the White Willow (*S. alba*).

## Botanical characteristics

Willows can have different growth forms, they can form trees or shrubs. Tree forming willows are the white willow (*S. alba* - in the picture on the right), the crack willow (*S. fragilis*) and the goat willow (*S. caprea*). In tree form, the willow grows to be a magnificent 20 - 30 m tall, with diameters of up to 1 m. The crown is round. The bark is whitish grey, and forms a vertically fissured outer bark with age. The blossoms are dioecious and arranged in catkins. The small seeds with white hair tufts are an effective dispersal agent.
Willows grow to be between 80 - 120 years old.

## Habitat

Willows are rapid growing, light-demanding pioneer trees and many species grow in Germany as shrubs and trees; additionally there are diverse crosses between species and cultivars. The white willow (see distribution map in the bottom right corner) and the crack willow as well as their hybrids are spread throughout Europe and Siberia, especially near rivers. The common osier, or hemp willow, (*S. viminalis*) is heavily planted for extraction of rods and switches and cut as pollarded willows. Willows in general prefer deep, nutrient rich soils with a good water supply, and are therefore mostly found near the water. They are used for river bank trees, the white willow and its ornamental varieties (for example the weeping willow) are especially popular park trees.
Willows are spread in Thuringia along streams and cultivated as pollarded willows in depressions of the Thuringian basin.

## Cultivation

The willow is planted to support river banks. Through pollarding and repeated pruning low on the tree, the pollarded willows (so-called "Kopfweiden") develop rod shaped, long shoots which are extracted for basket weaving material. Willows are rapid growing. The growth increases between 15 - 25 $m^3$ per hectare a year, and it is because of this that they have recently been planted as bioenergy-wood in Scandinavia and also on a trial basis in central Europe.

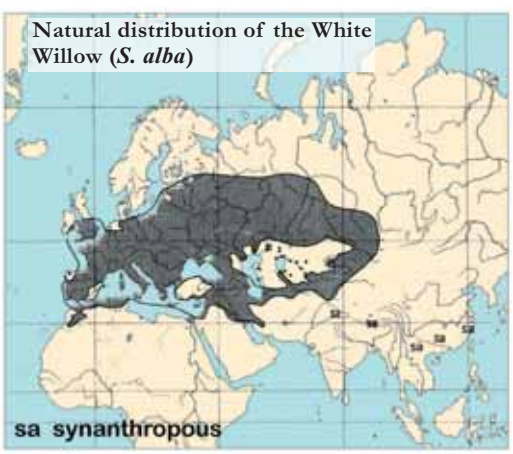
## Use

The willow has a coarse-grained, soft, medium heavy wood that shrinks significantly. It is prone to fungal disease. The workability is poor due to fibrous tissue and fuzzy surfaces. The wood is used similarly to poplar wood.

White Willow (*S. alba*)

**Current:** Handcrafts (blind wood for furniture, wood peelings, matches, baking boards, platters, drawing boards, basket weaving, wooden shoes), exterior building timber (fascine wood in hydraulic engineering construction), medicine (wood for prosthetics), raw material (plywood, fibreboard, pulp), hobby (cricket bats).

**Historic:** Handcrafts (sieve trays, basket moulds, crates, chip baskets, shovel and rake handles, weaving), agriculture (bee pollen and nectar source, vine binding, bird attraction), healing (used for fever illnesses and rheumatism because of its salicylic acid - aspirin is produced today from a synthetic salicylic acid), raw material (charcoal for drawing and gun powder, tanning bark).



# Yew

*Taxus baccata* L.

About the Specimen on Display

Yew from the palace grounds
Belvedere, Weimar

## General characteristics of the wood

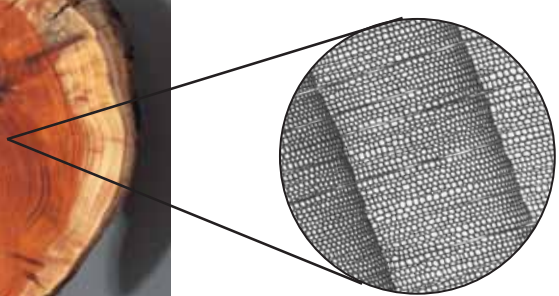
The yew has narrow, yellowish white sapwood and very decorative, colourful heartwood, often with many marks due to ingrown branches and bark occlusions. The growth rings are clearly visible and the pith rays are fine.

## The wood on display

**The board** is made up of three cuts from the same trunk joined together: one radial cut at the bottom and two tangential cuts[1]. The wood is characterised by the striking red, irregularly marked heartwood and narrow sapwood. Sapwood and heartwood are separated by a black line, visible in the uppermost cut. The lower board shows bark damages and ingrown bark sections, which is typical of the yew.

**The tree slice** (cross section: 18 cm, 78 years: 1.1 mm average growth ring width) originates from another trunk than the board. It is from an intergrown double trunk. The multiple trunks (two or more) are typical of the yew and are often referred to as "false trunks". The narrow sapwood is penetrated by the marks of dormant buds. The dormant buds can form new shoots if the yew trunk is exposed to light, even with age (for example after cutting adjacent, overshadowing trees).

Yew from the
Botanical Garden Jena
Ø 18 cm, 78 years



[1] The picture shows the middle part of the composed board, a tangential cut.

# Yew Family

# Taxaceae



## Botanical characteristics

Yews often have multiple trunks, so coalescing, robust, deeply irregular false trunks often form with age. The yew grows to be 15 m tall in central Europe, in the Caucasus it reaches heights of 30 m with 1.3 m diameters. As a tree of the undergrowth, the crown is polymorphic according to light situation. The bark is thin, red or greyish brown and peels off in thin flakes. The shoots have green bark for an extended period of time. The flat needles have a fine prickly point, as opposed to those of the silver fir. The yew is dioecious, i.e. there are male and female yew trees. The cupulate seeds are enclosed until ripe in a bright red, fleshy arillus. Except for the arillus, all parts of the yew tree contain a toxic alkaloid, taxine. Yews can live to be over 1000 years old.

## Habitat

The natural distribution of the yew reaches over Europe and northern Africa to Asia Minor. It is forming stands in the lower areas of the Caucasus. The yew grows from the plains to the medium mountain zones (up to 1400 m in the Alps), especially in areas with mild winters and moist ocean climates; it most often grows individually in inferior positions in deciduous forests. It prefers moist, loose, nutrient- and calcium carbonate rich soils in ravines and steep inclines, it is winter and late-frost sensitive and very shade tolerant.

Yew tree stands have been historically heavily decimated due to over-use (the wood was traded commercially to England for cross bows). It was also wiped out along paths and pastures because of its toxicity, mostly for horses. The few remaining stands are endangered due to forestry measures unfavourable to the yew (clear cutting) as well as game animal damage from red deer. Today the yew is an especially protected species according to German federal laws and is in the Red Data book in Thuringia.

With 30,000 specimens, Thuringia is a comparably yew-abundant German state. It occurs scattered in deciduous forests especially in shell limestone deposits, as well as in parks and cemeteries.

## Cultivation

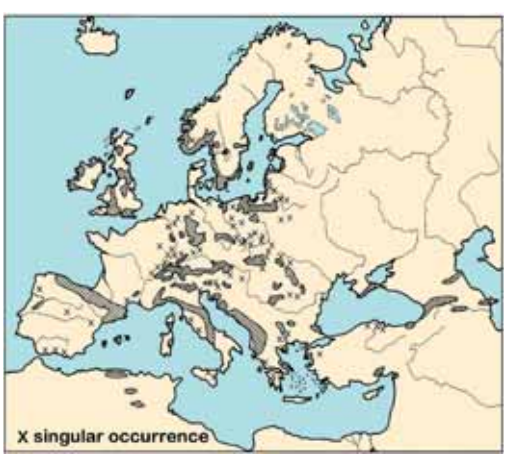
The yew is not cultivated commercially. It is a popular park, garden and cemetery tree.

## Use

Yew wood is extraordinarily heavy, elastic and tough, especially durable, difficult to split but polishable, and shrinks minimally.

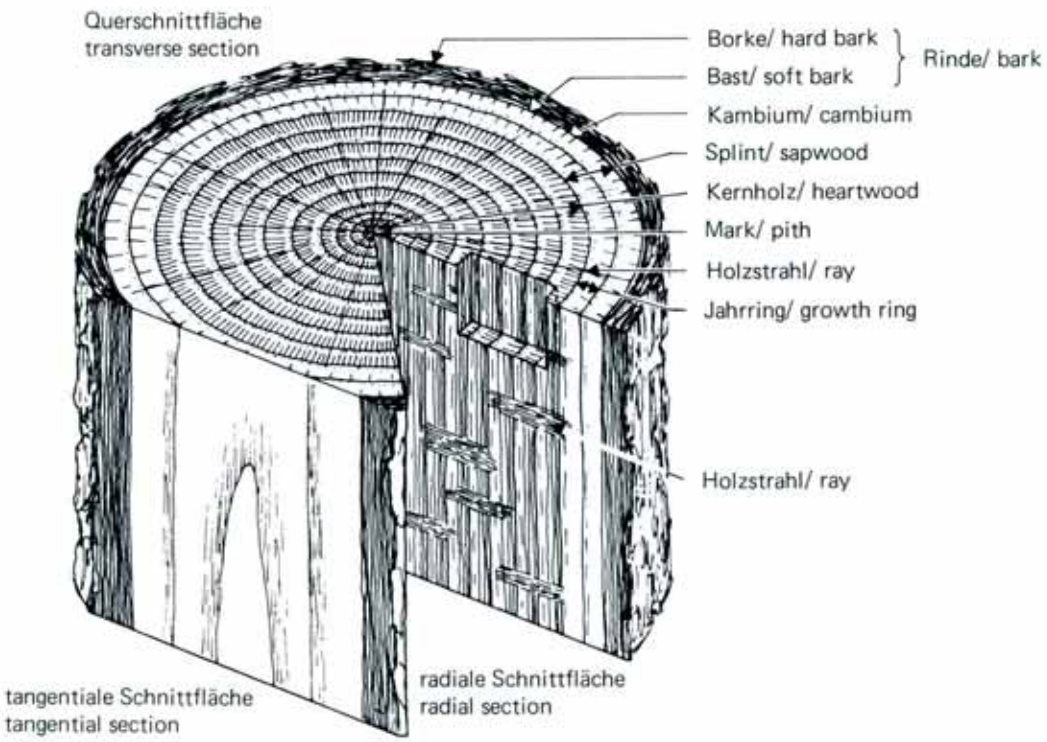
**Current:** Handcrafts (luxury custom carpentry and wood turning objects, luxury furniture, pipe stems, walking sticks, musical instruments: woodwinds), medicine (an effective medicine for cancerous ulcers can be extracted from the bark and needles).

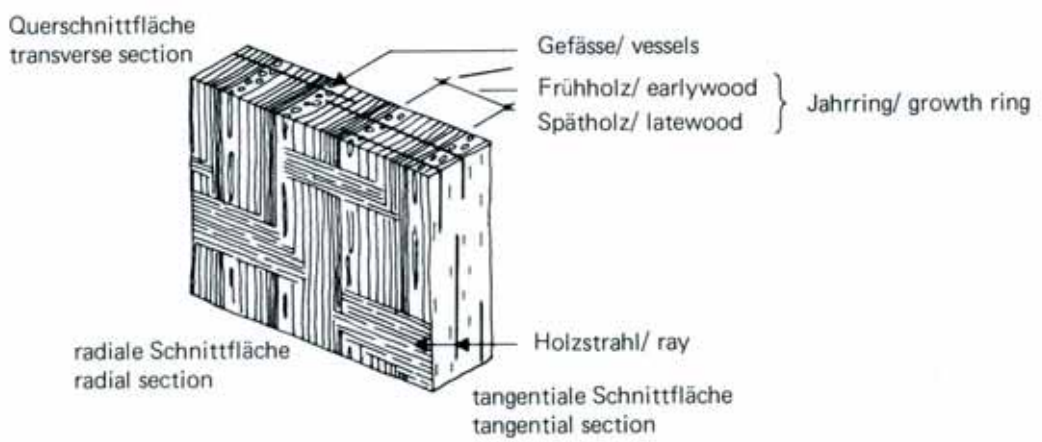
**Historic:** Handcrafts (for spears, bows, tool handles, building timber).



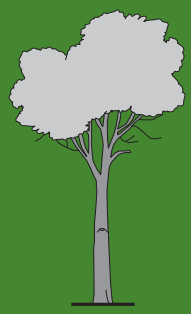
# Glossary

**Makroskopische Merkmale**
**Macroscopic features**



# Glossary





**Annual growth ring:** wood mass produced during one year, that as a rule exist as different zones in the anatomical structure: the softer early wood forms first and the heavier, denser late wood forms second. In a cross section, the increment zone appears as a ring.

**Burl grain:** common in most species (frequently in maple and nut trees). A wavy formation of all cell strands in an axial direction across the fibre direction; the visible result is a play of light that changes with varying incidence of light, appearing as bars of dark and light zones. Causes include knot location, damage to the bark cambium layer, and tree genetics.

**Cambium:** thin level of living, meristimatic (self multiplying) cells between bark (phloem) and wood (xylem), that constantly form new bark cells toward the outside and new wood cells toward the inside, which results in the stem increment of woody plants.

**Colour streaks:** varying colourations in the heartwood, induced by overlapping, most often ring shaped colouration levels on a cross section; just as colour streaks occur on vertical radial cuts, tangential grain discolourations also occur on tangential cuts.

**Coppice:** traditional method of forest management in which multiple stems are allowed to grow up from the base of a felled tree. The stems are then cut every few years mainly for fire wood and baking bread.

**Coppice-with-standards:** coppice system in which scattered trees, typically oak, are allowed to grow to their full height (standards) for use as structural timber, while the understory is coppiced.

**Cross/transverse section:** cut that leads across the bole axis as well as the fibre direction. It is most useful for micro- and macroscopic examination of wood. Annual growth ring development, vertical parenchyma, and wood radials are most clearly defined on the cross section surface.

**Diffuse-porous:** because the pores are regularly separated, there are no clearly recognisable pore zones in a cross section; in a vertical cut there are no pores of a certain structure, like pore-discs or pore-stripes.

**Dormant buds:** even when mature, these buds can be awakened by light exposure to the trunk.

**Early wood:** palest and softest level of wood forms at the beginning of a growth period (spring), it usually forms especially clearly in conifers; frequently distinguished by larger cells and low raw density.

**Flute structured:** bulge like intensifications along the trunk axis; they are often visible on the end of the trunk where the root buttresses form.

**Forked growth:** division of the trunk originates when two or more side buds take over the vertical growth of the tree, for example after the growth drive of the leader dies off.

**Heartwood:** inner part of the bole, often emphasized by a darker colour than the outer ring of sapwood which surrounds it. The heartwood is practically dead and no longer conducts water; it is incrusted with resin, tannin, occasionally even silicic acid. It is always more resistant against fungus infestation than sapwood, has less water content and higher strength, durability and density.

**Late wood:** grows after the early wood, usually less porous in deciduous trees, and in conifers delimited by hard and dark zones; it forms after a growth period ends.

**Lenticel:** cells in the bark which ensure gas exchange and oxygen supply to living cells in the stem, most often lentil-shaped and induced by the activity of a specialized lenticel phellogen.

**Mature trees** ("Reifholzbäume"): old term for trees that do not form a coloured heartwood, even though the inner wood is drier, "more mature" (spruce trees for example); in other words, it describes wood with a pale heartwood, macroscopically indistinguishable from the sapwood.

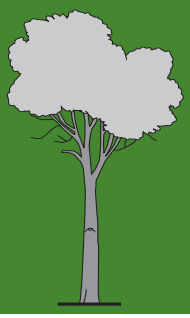
**Pith fleck:** pinkish brown spots of varying sizes, that arise in the growth layer nearest to the bark after a cambium miner infestation; in cross sections they are most often kidney shaped and up to 2 cm wide, in vertical cuts up to 10 cm long.

**Pith lumen:** also known as just the pith. It is the central cavity in the bole inside the first growth ring, different in colour and structure from the surrounding wood.

**Pith rays:** bands of storage cells running in the direction of the pith lumen and in a diagonal direction to the fibres. They emerge in cross sections often as fine lines ("rays"), and often only distinguishable with a magnifying glass. In radial cuts they appear as ray flecks, sometimes so wide that they significantly influence the appearance of the tree, as with the oak.

**Pore valleculae:** visible cut open vessel cells on vertical cuts of deciduous woods; they are more defined the wider the lumen of the vessels (large pored wood species). They are also mistaken for course graining, even though they do not involve rips or tears.

**Pores:** fine tubes that develop in vessel cells that form grooves in vertical cut surfaces, and round or oval openings in transverse sections. In large pored wood the individual pores are visible to the naked eye, and in medium sized pores only the existence of pores is visible, as the individual pores cannot



# Glossary



be differentiated. The pores of fine-porous woods are only visible with a magnifying glass on smooth cross sections. Conifers have no pores, their wood is composed of tracheids.

**Pressure or reaction wood:** abnormal ligneous tissue, which negatively affects the utility of the wood and appears on one side of a cross section in semicircle shaped sections. The tree manifests the reaction on one-sided or unbalanced external effects (e.g., slanting on an incline, wind, snow).

**Radial section:** annual growth rings can be seen running parallel to the bole axis and pith rays can be seen as radial stripes. Vertically cut, tangential rays appear as shiny ray flecks.

**Ray flecks:** bands of storage cells that run across the fibres in the direction of the pith lumen. They appear on cross sections as fine lines ("rays"), often only visible with a magnifying glass, and on radial cuts as a "ray fleck", sometimes so wide that they significantly influence the appearance of the wood, as with the oak.

**Resin canals, resin ducts:** spaces in the wood filled with resin or resin-like substances, running most often with the grain. Because of their smaller diameter they are also recognisable as resin drops, spots or through a difference in the wood colouring. They can occur in coniferous and deciduous trees, in the latter also as ring formations in a cross section.

**Ring-porous:** periodically recurring rings of larger pores in a cross section (early wood). These alternate with small and sparsely scattered pores (late wood). Ring-porous woods produce pore stripes and tangential grain colouration in a radial cut.

**Sapwood:** mantle of light coloured wood that encircles the heart wood; it serves as support and for water and nutrient transport; pith rays run throughout. The size of this portion is dependent on species, age and growth conditions. It is most sensitive to fungus and insect infestation when moist.

**Semi-ring-porous:** category in between ringed and scattered porous; the vessels in early wood are only a little larger than in late wood. The ring formation is not present in the young wood vessels like in typical ring-porous species.

**Shrinkage:** shrinking of the dimensions and volume of wood after a reduction of moisture. Shrinking, like swelling, is only possible below the fibre saturation point. In this case the change in dimensions are in the direction of the growth zones (tangential) and always larger than in the direction of the wood rays (radial).

**Sliced veneer:** veneer sliced in sheets from the log. Blades operate parallel or vertical to the supporting surface (contrary to peeled veneer, where the bole is being turned against a fixed blade).

**Spiral grain:** the fibres run in a screw formation against the bole axis, instead of running with the bole axis, which impairs the staying power of the wood (e.g. the pear tree).

**Staying power:** The condition of the wood with respect to changes in form and dimension due to the relative air moisture of the environment. Favourable conditions for the staying power of the wood include: minimal swelling or shrinkage, minimal difference between radial and tangential degrees of swelling, even graining, inert moisture exchange between wood and environment.

**Sympodial growth:** side axes near the leader (top of crown) assume terminal growth, whereas the main axes do not develop further or begin budding.

**Synanthropous:** a species dispersed together with man.

**Tangential cut:** growth rings appear as arch and wave-shaped lines. Larger pith rays cut through at right angles appear as spindle-shaped dark stripes (mainly oak and beech).

**Tangential grain colouration:** usually a cone shaped or oval image, induced by colour or structure differences which can be seen in a flat tangential cut. Tangential grain colouration is also visible in most conifers and in all ring-porous woods due to the difference between early and late wood, in deciduous trees through the exchange between fibre cells and storage cells.

**Tracheids:** occurring in conifers, these are elongated, fibre-shaped cells with reinforced cell walls. They run parallel to the trunk axis, have a relatively large lumen, and serve mostly as water transport and reinforcement. They have openings in the walls (bordered pit) to allow water to flow from cell to cell.

**Vessels:** called pores in cross sections, and also known as wood vessels; they are a characteristic type of cell in deciduous trees. Vessels are made up of individual tubular segments arranged on top of each other. Immediately after the cell forms the walls between the segments dissolve, so that their length can often reach several meters. They provide a water conduct for the sapwood.

**Warping:** "wind slanted" warping of the wood in the form of vertical spiral shaped distortions; the four corners of a surface are no longer situated at the same level.

# Notes

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**Digital photographs of the exhibited wood:**

ART-KON-TOR Film und Fotodesign GbR Jena

**Other photos:**

p. 3 top: Sebastian Weist
p. 3 bottom: BMBW Architekten BDA – Partner München
pp. 39 and 81: Leo Michels, http://www.plantimag.de/

**Microscopic cross sections were taken from:**

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(magnification factor of all sections approx. 40x)

**apart cross section on p. 82 from:**

Grosser, D.: Einheimische Nutzhölzer – Loseblattsammlung: Vorkommen, Baum- und Stammform, Holzbeschreibung, Eigenschaften, Verwendung. - Holzabsatzfonds, Bonn, CMA Centrale Marketinggesellschaft der Deutschen Agrarwirtschaft mbH (Eds.), 1999

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pp. 43, 53, 57, 7



**Printing and processing:**
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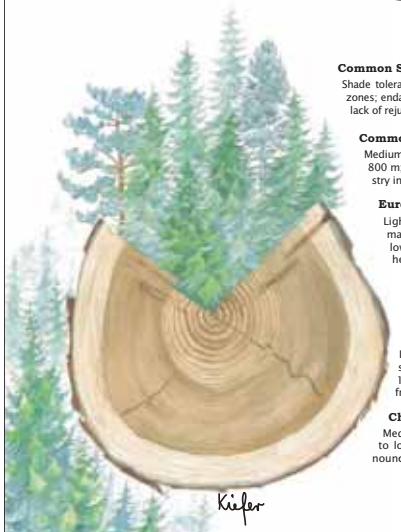
# Thuringian Wood Species

## Coniferous Trees




**Common Silver Fir (*Abies alba*), Pine Family**
Shade tolerant tree growing in the middle and upper montane forest zones; endangered in Germany due to heavy game animal damage and lack of rejuvenation. Wood: whitish with no heartwood colouration; soft.

**Common Spruce (*Picea abies*), Pine Family**
Medium shade tolerant, prefers cool, moist mountainous areas over 800 m; planted also in the lowlands; most important species for forestry in Germany. Wood: light coloured, no heartwood formation; soft.

**European Larch (*Larix decidua*), Pine Family**
Light-demanding species, main occurrence in the continental climate of the central Alps near the timber line; planted also in the lowlands. Wood: narrow, yellowish sapwood and reddish brown heartwood colouration; hard and medium heavy.

**Douglas Fir (*Pseudotsuga menziesii*), Pine Family**
Medium shade tolerant, native distribution along the North American Pacific Coast; most important non-native tree species in forestry industry. Wood: wide, yellow sapwood, dark red heartwood; hard and medium heavy.

**Common Pine (*Pinus sylvestris*), Pine Family**
Resilient, light demanding species, mainly in the lowlands, but can grow up to 2100 m; extensively planted. Wood: light coloured with reddish brown heartwood formation; moderately hard.

**Yew (*Taxus baccata*), Yew Family**
Shade tolerant tree, from the plains to medium montane zones, mainly in areas with mild winters; historically heavily decimated due to over-use. Wood: narrow, yellowish sapwood, decorative, colourful heartwood; extraordinarily tough, dense, heavy and elastic.

## Deciduous Forests on Acidic Soils

**European Beech (*Fagus sylvatica*), Beech Family**
In central Europe, naturally the most competitive forest tree species, shade tolerant; from the lowlands to middle mountain ranges (up to 1400 m in the Alps). Wood: yellowish to reddish brown; with age, frequently with red heartwood; very homogeneous, heavy and tough.

**Chestnut Oak (*Quercus petraea*), Beech Family**
Medium shade tolerant tree in deciduous forests from the plains to lower mountain ranges. Wood: light to dark brown with pronounced tangential grain markings; hard and heavy.

**Weeping or Common Birch (*Betula pendula*), Birch Family**
Rapid growing, light-demanding pioneer tree of the lowlands, less often in the mountains (in the Alps up to 1800 m). Wood: Light coloured, silky shine, with age, reddish to brown heartwood formation possible; medium heavy, not very hard.

**Mountain Ash, Rowan (*Sorbus aucuparia*), Rose Family**
Undemanding pioneer tree, wide-spread at all elevations, up to 2400 m in the Alps. Wood: wide, light coloured sapwood, light to reddish brown heartwood; dense, finely structured with good elasticity and solidity properties.

## Forests at Moist and Wet Sites

**Poplar (*Populus* spec.), Willow Family**
Rapid growing pioneer tree; the aspen (*P. tremula*) is found in clearings and ruderal areas, black and silver poplars (*P. nigra, P. alba*) are found along rivers in lowlands and flood plains; "commercial poplars" in Germany are not pure species, but new cultivars created by hybridization. Wood: faint light coloured; soft, light and with little solidity, but high resistance to wear and tear.

**Common Alder (*Alnus glutinosa*), Birch Family**
Light-demanding species of the lowlands, rarely in the mountains, characteristic of moist locations, stream banks and alder swamp forests with stagnant water; nitrogen-fixing. Wood: light to reddish; soft, little weight-bearing capacity and elasticity.

**Common Ash (*Fraxinus excelsior*), Olive Tree Family**
Medium shade tolerant tree in mixed deciduous forests from the lowlands up to medium mountain ranges (up to 1300 m in the Alps). Wood: light coloured, with age, brown secondary heartwood might form; heavy, hard, very tough and resistant.

**Willow (*Salix* spec.), Willow Family**
Rapid growing pioneer species, from the lowlands up to high mountain ranges in the Alps; tree forming are the white (*S. alba*), the crack (*S. fragilis*) and the goat willow (*S. caprea*); distribution: silver and crack willow grow in floodplains, goat willow is a pioneer on clearings and forest edges. Wood: light coloured with reddish heartwood, wide growth rings; coarse-grained, soft, medium heavy, prone to fungal disease.

## Thermophilic Mixed Deciduous Forests


**Robinia (*Robinia pseudoacacia*), Pea Family**
Light-demanding pioneer species that prefers loose, moist, warm soils, frost-sensitive, nitrogen-fixing; natural habitat is in North America, common in central Europe. Wood: narrow, light coloured sapwood, greenish brown to dark brown heartwood, darkens to golden dark brown; very hard, heavy and tough.

**Wild Cherry (*Prunus avium*), Rose Family**
Tree species of diverse deciduous forests, on forest edges and in hedges, from the lowlands to the mountains (up to 1700 m in the Alps). Wood: very decorative hardwood with yellowish sapwood and slightly darker, reddish heartwood, darkens to light golden brown; hard and heavy, with good solidity and elasticity.

**Wych Elm (*Ulmus glabra*), Elm Family**
Medium shade tolerant tree from the lowlands up to medium mountain ranges; popular park and street tree. Heavily threatened by Dutch elm disease, a fungal infection. Wood: whitish-gray sapwood, light to chocolate brown heartwood; very elastic, hard and heavy, valuable.

**Horse Chestnut (*Aesculus hippocastanum*), Horse Chestnut Family**
Medium shade tolerant tree in moist mountain forests; native to the Balkan mountains, introduced to central Europe in the Middle Ages. Frequent spiral growth in stems. Wood: lightly coloured, dark secondary heartwood; soft, fine-grained, not very elastic.

**Hornbeam (*Carpinus betulus*), Hazel Family**
Medium shade tolerant tree in lowlands, in mountains up to 800 m; in central Europe indirectly supported by coppice systems. Wood: simple, lightly coloured wood,

**Large-leaved Linden (*Tilia platyphyllos*), Lime Family**
Shade tolerant tree species in deciduous mixed forests at low to medium elevations; found frequently along streets or in village centres. Wood: lightly coloured, faintly red or brown; homogenously structured, soft and medium heavy.

**Whitebeam (*Sorbus aria*), Rose Family**
Light-demanding species on limestone, from the lowlands to the subalpine level (up to 1600 m in the Alps); Wood: light coloured sapwood, brown heartwood; very decorative.

**Trueservice Tree (*Sorbus domestica*), Rose Family**
Rare tree species, mainly spread throughout the submediterranean climate areas; 60-100 specimens in Thuringia. Wood: reddish white to brown sapwood, darker heartwood in older stems; fine-fibrous, hard and sturdy.

**Wild Service Tree (*Sorbus torminalis*), Rose Family**
Rare species of the lowlands to the montane level (up to 750 m); in abundance on the shell limestone in and around the Thuringian basin. Wood: light coloured in young trees, later darker; dark brown facultative heartwood often in older trees; heavy, dense, tough and elastic. Most valuable lumber in Germany.

**Sycamore (*Acer pseudoplatanus*), Maple Family**
Grows in cool, moist climates; found in montane beech abundant mixed forests and shady ravine forests. Wood: lightly coloured, with age, greyish brown heartwood; fine-fibrous, very hard and heavy.

**Common Maple (*Acer campestre*), Maple Family**
Found in mixed deciduous forests in the planes and hills, on forest edges, in hedges and bush land, largest range of all maple species. Wood: reddish brown, darkest of the maple species; heartwood formation possible with age; similar to sycamore.

**Norway Maple (*Acer platanoides*), Maple Family**
Grows in the lowlands and lower mountains. Wood: slightly darker than sycamore wood, reddish yellow; heartwood formation possible; like sycamore, fine-fibrous, very hard and heavy.

## Fruit Trees

**Apple (*Malus domestica*), Rose Family**
Cultivated varieties originate predominantly from different wild apple species from Asia, whereas the native European wild apple (*M. sylvestris*) is often used as a grafting stock. Wood: wide, light coloured sapwood, darker, reddish brown heartwood; dense, hard and heavy.

**Syrian Plum (*Prunus domestica ssp. syriaca*), Rose Family**
Subspecies of the wild plum, cultivated in central Europe. Wood: light coloured sapwood, violet brown heartwood, similar to the wood of the wild plum, just somewhat lighter.

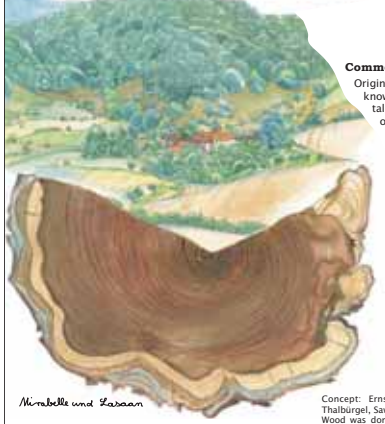
**Medlar (*Mespilus germanica*), Rose Family**
Originates, despite its name, from Near Asia, cultivated in central Europe during the Middle Ages, now growing wild at warm and sunny sites. Wood: reddish white, brown heartwood; very hard and sturdy.

**Pear (*Pyrus communis*), Rose Family**
Wide range of varieties cultivated through selection and cross breeding of the wild pear (*P. pyraster*) and Asian pear species. Wood: significantly variable colouration, from uniformly reddish to wood with yellow sapwood and irregular, brown-violet facultative heartwood; homogeneous, high capacity to keep its shape.

**Wild Plum (*Prunus domestica*), Rose Family**
Known in central Europe only as cultivated species. Wood: heartwood pinkish brown when young, later dark violet brown.

**Walnut (*Juglans regia*), Walnut Family**
Light-demanding and frost-sensitive species, originally native to southeastern Europe, southwestern and central Asia, cultivated in central Europe, growing wild now in some places. Wood: blackish brown heartwood clearly separated from light coloured sapwood; very decorative, hard, heavy and sturdy.

## Hedges and Bushes




**Common Lilac (*Syringa vulgaris*), Olive Tree Family**
Original habitat is southern Europe and the Balkans, has been known in Germany since the 16th century, now popular ornamental plant. Wood: yellowish sapwood, brown heartwood with stripes of violet deposits; very hard, dense, heavy and solid.

**Common Hazel (*Corylus avellana*), Hazel Family**
Spread throughout Europe from the lowlands up to the subalpine level; widely cultivated in central Europe, though the Asian variety *C. maxima* is used more than the native *C. avellana*. Wood: reddish white; soft.

**Blackthorn (*Prunus spinosa*), Rose Family**
Typical pioneer species of hedges, open forests and ruderal areas (in the Alps up to 1000 m). Wood: reddish sapwood and brown-red heartwood; somewhat shiny, fine grained, tough and hard.

**Hawthorn (*Crateagus* spec.), Rose Family**
Spread throughout Europe from the lowlands to medium altitudes. Wood: delicate flesh-red colour; homogeneous, dense and sturdy.

**Dog Rose (*Rosa canina*), Rose Family**
Abundant pioneer species, spread throughout Europe, North Africa and western Asia; from the plains up to 1500 m in the Alps. Wood: light yellow; very dense, sturdy and smooth.

**Bird Cherry (*Prunus padus*), Rose Family**
Spread throughout Europe, thrives in moist, riverine deciduous forests, in mountain valleys up to 2000 m. Wood: wide, yellow sapwood, brownish heartwood; fine grained, soft, medium heavy; unpleasant smell.

**Cornelian Cherry (*Cornus mas*), Dogwood Family**
Light-demanding to semi-shade tolerant species, prefers warm, dry sites, frequently cultivated. Wood: reddish white sapwood, dark red-brown heartwood; extraordinarily hard, heavy and tough.

**Purgatory Buckthorn (*Rhamnus catharticus*), Buckthorn Family**
Spread across Europe in sunny locations from the plains to medium mountain ranges. Wood: narrow, yellow-white sapwood, shiny brownish red heartwood; hard and heavy.

**Black Elder (*Sambucus nigra*), Elder Family**
Spread throughout Europe, from the plains up to 1200 m in the Alps; frequent in forest clearings and road edges; cultivated since ancient times for its blossoms and fruits. Wood: yellowish white, the pith lumen remains contained in the wood; dense, hard, not very durable.

**Golden Rain Tree (*Laburnum anagyroides*), Pea Family**
Native to southern Europe, in central Europe planted as an ornamental shrub; toxic. Wood: narrow, light yellow sapwood, contrasted by a greenish black heartwood; hard and heavy, not very durable.

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