

Oak

“*Quercus*” redirects here. For other uses, see *Quercus* (disambiguation).

“Oak tree” redirects here. For other uses, see Oak Tree (disambiguation).

This article is about oaks (*Quercus*). For other uses of “Oak”, see Oak (disambiguation).

An **oak** is a tree or shrub in the genus *Quercus* (/ˈkwɜːrkəs/^[1] Latin “oak tree”) of the beech family, Fagaceae, having approximately 600 extant species. The common name “oak” may also appear in the names of species in related genera, notably *Lithocarpus*. The genus is native to the Northern Hemisphere, and includes deciduous and evergreen species extending from cool temperate to tropical latitudes in Asia and the Americas. North America contains the largest number of oak species, with approximately 90 occurring in the United States. Mexico has 160 species, of which 109 are endemic. The second greatest center of oak diversity is China, which contains approximately 100 species.^[2]

Oaks have spirally arranged leaves, with lobate margins in many species; some have serrated leaves or entire leaves with smooth margins. Many deciduous species are marcescent, not dropping dead leaves until spring. In spring, a single oak tree produces both male flowers (in the form of catkins) and small female flowers.^[3] The fruit is a nut called an acorn, borne in a cup-like structure known as a cupule; each acorn contains one seed (rarely two or three) and takes 6–18 months to mature, depending on species. The live oaks are distinguished for being evergreen, but are not actually a distinct group and instead are dispersed across the genus.

1 Classification

Oak trees are a flowering plant. Oaks may be considered divided into two genera (sometimes referred to as subgenera) and a number of sections:

1.1 Genus *Quercus*

See also: List of *Quercus* species

The genus *Quercus* is divided into the following sections:

- Sect. *Quercus* (synonyms *Lepidobalanus* and *Leucobalanus*), the white oaks of Europe, Asia and



Oak at Schönderling

North America. Styles are short; acorns mature in 6 months and taste sweet or slightly bitter; the inside of an acorn shell is hairless. The leaves mostly lack a bristle on their lobe tips, which are usually rounded.

- Sect. *Mesobalanus*, Hungarian oak and its relatives of Europe and Asia. Styles long; acorns mature in about 6 months and taste bitter; the inside of this acorn’s shell is hairless. The section *Mesobalanus* is closely related to section *Quercus* and sometimes included in it.
- Sect. *Cerris*, the Turkey oak and its relatives of Europe and Asia. Styles long; acorn mature in 18 months and taste very bitter. The inside of the acorn’s shell is hairless. Its leaves typically have sharp lobe tips, with bristles at the lobe tip.
- Sect. *Protobalanus*, the canyon live oak and its relatives, in southwest United States and northwest Mexico. Styles short, acorns mature in 18 months and taste very bitter. The inside of the acorn shell appears woolly. Leaves typically have sharp lobe tips, with bristles at the lobe tip.

- Sect. *Lobatae* (synonym *Erythrobalanus*), the red oaks of North America, Central America and northern South America. Styles long; acorns mature in 18 months and taste very bitter. The inside of the acorn shell appears woolly. The actual nut is encased in a thin, clinging, papery skin. Leaves typically have sharp lobe tips, with spiny bristles at the lobe.
- Sect. *Brandonus*, the Japanese Oak of Eastern Asia, and southern Italy. Styles very short; acorns mature in 18 months and taste very sweet. The inside of the acorn shell appears woolly. The nut is encased in a rough, papery shell. Leaves normally have a soft texture. The delicate nature of the leaves often results in their pigments being used in skin products such as face paints and make-ups.

1.2 Genus *Cyclobalanopsis*

- The ring-cupped oaks of eastern and southeastern Asia. Evergreen trees growing 10–40 m (33–131 ft) tall. They are distinct from subgenus *Quercus* in that they have acorns with distinctive cups bearing crescent rings of scales; they commonly also have densely clustered acorns, though this does not apply to all of the species. IUCN, ITIS, Encyclopedia of Life and *Flora of China* treats *Cyclobalanopsis* as a distinct genus, but some taxonomists consider it a subgenus of *Quercus*. It contains about 150 species. Species of *Cyclobalanopsis* are common in the evergreen subtropical laurel forests which extend from southern Japan, southern Korea, and Taiwan across southern China and northern Indochina to the eastern Himalayas, in association with trees of genus *Castanopsis* and the laurel family (Lauraceae).

2 Hybridization



A hybrid white oak, possibly *Quercus stellata* × *Q. muhlenbergii*

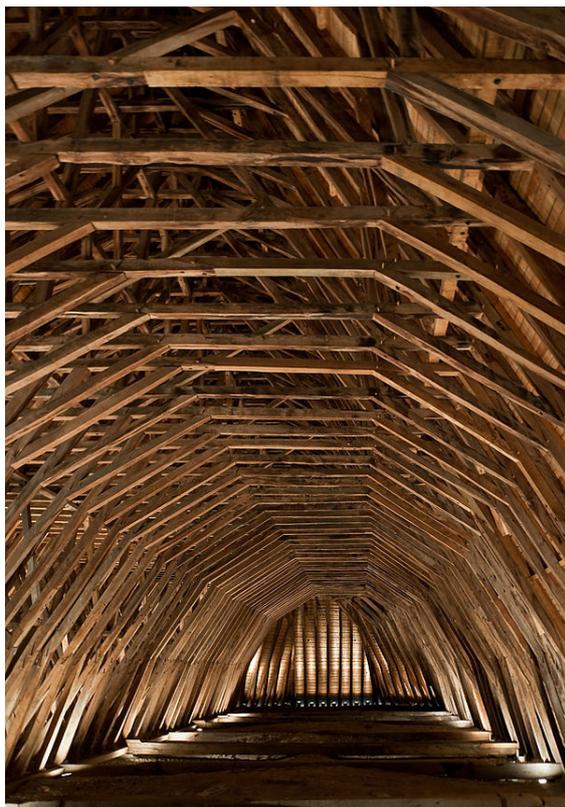
Interspecific hybridization is quite common among oaks but usually between species within the same section only and most common in the white oak group (subgenus *Quercus*, section *Quercus*; see **List of *Quercus* species**). Inter-section hybrids, except between species of sections *Quercus* and *Mesobalanus*, are unknown. Recent systematic studies appear to confirm a high tendency of *Quercus* species to hybridize because of a combination of factors. White oaks are unable to discriminate against pollination by other species in the same section. Because they are wind pollinated and they have weak internal barriers to hybridization, hybridization produces functional seeds and fertile hybrid offspring.^[4] Ecological stresses, especially near habitat margins, can also cause a breakdown of mate recognition as well as a reduction of male function (pollen quantity and quality) in one parent species.^{[4][5]}

Frequent hybridization among oaks has consequences for oak populations around the world; most notably, hybridization has produced large populations of hybrids with copious amounts of introgression, and the evolution of new species.^[6] Frequent hybridization and high levels of introgression have caused different species in the same populations to share up to 50% of their genetic information.^[7] Having high rates of hybridization and introgression produces genetic data that often does not differentiate between two clearly morphologically distinct species, but instead differentiates populations.^[8] Numerous hypotheses have been proposed to explain how oak species are able to remain morphologically and ecologically distinct with such high levels of gene flow, but the phenomenon is still largely a mystery to botanists.

The Fagaceae, or beech family, to which the oaks belong, is a very slow evolving clade compared to other angiosperms,^{[9][10]} and the patterns of hybridization and introgression in *Quercus* pose a great challenge to the concept of a species since a species is often defined as a group of “actually or potentially interbreeding populations which are reproductively isolated from other such groups.”^[11] By this definition, many species of *Quercus* would be lumped together according to their geographic and ecological habitat, despite clear distinctions in morphology and, to a large extent, genetic data.

3 Uses

Oak wood has a density of about 0.75 g/cm³ (0.43 oz/cu in), great strength and hardness, and is very resistant to insect and fungal attack because of its high tannin content. It also has very appealing grain markings, particularly when quartersawn. Oak planking was common on high status Viking longships in the 9th and 10th centuries. The wood was hewn from green logs, by axe and wedge, to produce radial planks, similar to quarter-sawn timber. Wide, quarter-sawn boards of oak have been prized since the Middle Ages for use in interior panelling of prestigious buildings such as the debating chamber of



Heart of oak beams of the frame of Saint-Girons church in Monein, France

the House of Commons in London and in the construction of fine furniture. Oak wood, from *Quercus robur* and *Quercus petraea*, was used in Europe for the construction of ships, especially naval men of war, until the 19th century, and was the principal timber used in the construction of European timber-framed buildings. Today oak wood is still commonly used for furniture making and flooring, timber frame buildings, and for veneer production. Barrels in which wines, sherry, and spirits such as brandy, Irish whiskey, Scotch whisky and Bourbon whiskey are aged are made from European and American oak. The use of oak in wine can add many different dimensions to wine based on the type and style of the oak. Oak barrels, which may be charred before use, contribute to the colour, taste, and aroma of the contents, imparting a desirable oaky vanillin flavour to these drinks. The great dilemma for wine producers is to choose between French and American oakwoods. French oaks (*Quercus robur*, *Q. petraea*) give the wine greater refinement and are chosen for the best wines since they increase the price compared to those aged in American oak wood. American oak contributes greater texture and resistance to ageing, but produces more powerful wine bouquets. Oak wood chips are used for smoking fish, meat, cheeses^[12] and other foods.

Japanese oak is used in the making of professional drums from manufacturer Yamaha Drums. The higher density of oak gives the drum a brighter and louder tone compared to traditional drum materials such as maple and



Sherry maturing in oak barrels

birch. In hill states of India, besides fuelwood and timber, the local people use oak wood for making agricultural implements. The leaves are used as fodder during lean period and bedding for livestock.^{[13][14]}



A cross section of the trunk of a cork oak, *Quercus suber*

The bark of the cork oak is used to produce wine stoppers (corks). This species grows in the Mediterranean Sea region, with Portugal, Spain, Algeria and Morocco producing most of the world's supply.

Of the North American oaks, the northern red oak is the one of most prized of the red oak group for lumber, much of which is marketed as red oak regardless of the species of origin. It is not good for outdoor use due to its open capillaries unless the wood is treated. If the wood is properly treated with preservatives, it will not rot as quickly as cured white oak heartwood. The closed cell structure of white oaks prevent them from absorbing preservatives. With northern red oak, one can blow air through an end grain piece 10 inches long to make bubbles come out in a glass of water. These openings give fungus easy access when the finish deteriorates. Shumard oak, a member of the red oak subgenus, provides timber which is described as "mechanically superior" to Northern Red oak. Cherrybark oak is another type of red oak which provides

excellent timber.

The standard for the lumber of the white oak group – all of which is marketed as white oak – is the white oak. White oak is often used to make wine barrels. The wood of the deciduous pedunculate oak and sessile oak accounts for most of the European oak production, but evergreen species, such as Holm oak and cork oak also produce valuable timber.

The bark of the White Oak is dried and used in medicinal preparations. Oak bark is also rich in tannin, and is used by tanners for tanning leather. Acorns are used for making flour or roasted for acorn coffee.

Oak galls were used for centuries as a main ingredient in iron gall ink, a kind of manuscript ink, harvested at a specific time of year. In Korea, oak bark is used to make shingles for traditional roof construction.

Oak has been listed as one of the 38 substances used to prepare Bach flower remedies,^[15] a kind of alternative medicine promoted for its effect on health. However according to Cancer Research UK, “there is no scientific evidence to prove that flower remedies can control, cure or prevent any type of disease, including cancer”.^[16]

4 Biodiversity and ecology

Oaks are keystone species in a wide range of habitats from Mediterranean semi-desert to subtropical rainforest. For example, oak trees are important components of hardwood forests, and certain species are particularly known to grow in associations with members of the Ericaceae in oak-heath forests.^{[17][18]} A number of kinds of truffles, including the two well known varieties, the black Périgord truffle^[19] and the white Piedmont truffle,^[20] have symbiotic relationships with oak trees. The European pied flycatcher is an example of an animal species that often depends upon oak trees.

Many species of oaks are under threat of extinction in the wild, largely due to land use changes, livestock grazing and unsustainable harvesting. For example, over the past 200 years, large areas of oak forest in the highlands of Mexico, Central America and the northern Andes have been cleared for coffee plantations and cattle ranching. There is a continuing threat to these forests from exploitation for timber, fuelwood and charcoal.^[21] In the USA, entire oak ecosystems have declined due to a combination of factors still imperfectly known, but thought to include fire suppression, increased consumption of acorns by growing mammal populations, herbivory of seedlings, and introduced pests.^[22] In a recent survey, 78 wild oak species have been identified as being in danger of extinction, from a global total of over 500 species.^[23] The proportion under threat may be much higher in reality, as there is insufficient information about over 300 species, making it near impossible to form any judgement of their status.

In the Himalayan region of India, oak forests are being invaded by pine forests due to the increase in temperature. The associated species of pine forest may cross frontiers and become new elements of the oak forests.^[24]

In eastern North America, rare species of oak trees include scarlet oak (*Quercus coccinea*), chinkapin oak (*Quercus muehlenbergii*), and post oak (*Quercus stellata*).^[25]

5 Diseases and pests

See also: List of Lepidoptera that feed on oaks

Sudden oak death (*Phytophthora ramorum*) is a water



Oak powdery mildew on pedunculate oak

mould that can kill oaks within just a few weeks. Oak wilt, caused by the fungus *Ceratocystis fagacearum* (a fungus closely related to Dutch elm disease), is also a lethal disease of some oaks, particularly the red oaks (the white oaks can be infected but generally live longer). Other dangers include wood-boring beetles, as well as root rot in older trees which may not be apparent on the outside, often being discovered only when the trees come down in a strong gale. Oak apples are galls on oaks made by the gall wasp. The female kermes scale causes galls to grow on kermes oak. Oaks are used as food plants by the larvae of Lepidoptera (butterfly and moth) species such as the gypsy moth, *Lymantria dispar*, which can defoliate oak and other broadleaved tree species in North America.^[26]

A considerable number of galls are found on oak leaves, buds, flowers, roots, etc. Examples are oak artichoke gall, oak marble gall, oak apple gall, knopper gall, and spangle gall.

A number of species of fungus cause powdery mildew on oak species. In Europe the species *Erysiphe alphitoides* is the most common cause.^[27]

A new and as yet little understood disease of mature oaks, acute oak decline, has been reported in parts of the UK since 2009.^[28]

Oak processionary moth (*Thaumetopoea processionea*) has become a serious threat in the UK since 2006. The caterpillars of this species defoliate the trees, and are hazardous to human health; their bodies are covered with poisonous hairs which can cause rashes and respiratory problems.^[29]

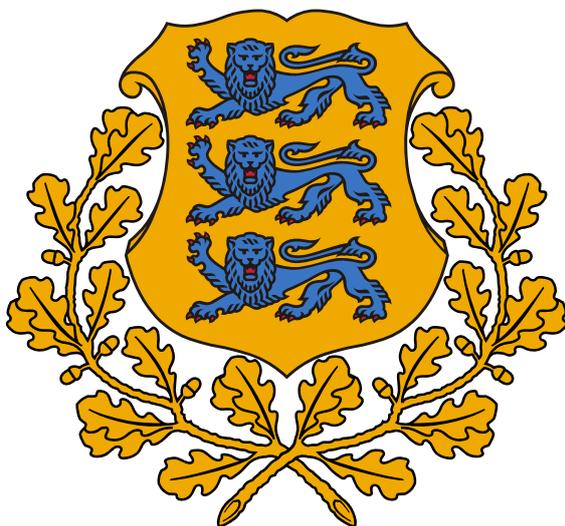
6 Toxicity

The leaves and acorns of the oak tree are poisonous to cattle, horses, sheep, and goats in large amounts due to the toxin tannic acid, and cause kidney damage and gastroenteritis. Additionally, once livestock have a taste for the leaves and acorns, they may seek them out. Symptoms of poisoning include lack of appetite, depression, constipation, diarrhea (which may contain blood), blood in urine, and colic. The exception to livestock and oak toxicity is the domestic pig, which may be fed entirely on acorns in the right conditions, and has traditionally been pastured in oak woodlands (such as the Spanish *dehesa* and the English system of pannage) for hundreds of years.

Acorns are also edible to humans in processed form, after leaching of the tannins.

Acorns are a staple part of the forage consumed by wildlife, including squirrels.

7 Cultural significance



Oak branches on the coat of arms of Estonia

7.1 National symbol

The oak is a common symbol of strength and endurance and has been chosen as the national tree of many countries. Already an ancient Germanic symbol (in the form

of the Donar Oak, for instance), certainly since the early nineteenth century, it stands for the nation of Germany and oak branches are thus displayed on some German coins, both of the former *Deutsche Mark* and the current Euro currency.^[30] In 2004 the Arbor Day Foundation^[31] held a vote for the official National Tree of the United States of America. In November 2004, the United States Congress passed legislation designating the oak as America's National Tree.^[32]

Other countries have also designated the oak as their national tree including Serbia, Cyprus (Golden Oak), England, Estonia, France, Germany, Moldova, Romania, Latvia, Lithuania, Poland, the United States, Wales, Galicia and Bulgaria.^[33]

7.1.1 Oaks as regional and state symbols

The oak is the emblem of County Londonderry in Northern Ireland, as a vast amount of the county was covered in forests of the tree until relatively recently. The name of the county comes from the city of Derry, which originally in Irish was known as *Doire* meaning *oak*.

The Irish County Kildare derives its name from the town of Kildare which originally in Irish was *Cill Dara* meaning the Church of the Oak or Oak Church.

Iowa designated the oak as its official state tree in 1961; and the White Oak is the state tree of Connecticut, Illinois and Maryland. The Northern Red Oak is the provincial tree of Prince Edward Island, as well as the state tree of New Jersey. The Live Oak is the state tree of Georgia, USA.

The oak is a national symbol from the Basque Country, specially in the province of Biscay.

The coat-of-arms of Vest-Agder, Norway, features an oak tree.

Oak leaves are traditionally an important part of German Army regalia. They also symbolize rank in the United States Armed Forces. A gold oak leaf indicates an O-4 (Major or Lt. Commander), whereas a silver oak leaf indicates an O-5 (Lt. Colonel or Commander).^[34] Arrangements of oak leaves, acorns and sprigs indicate different branches of the United States Navy Staff corps officers.^[34] Oak leaves are embroidered onto the covers (hats) worn by field grade officers and flag officers in the United States armed services.

If a member of the United States Army or Air Force earns multiple awards of the same medal, then instead of wearing a ribbon or medal for each award, he or she wears one metal representation of an "oak leaf cluster" attached to the appropriate ribbon for each subsequent award.

7.1.2 Political use

The oak tree is used as a symbol by a number of political parties. It is the symbol of Toryism (on account of the Royal Oak) and the Conservative Party in the United Kingdom,^[35] and formerly of the Progressive Democrats in Ireland^[36] and the Democrats of the Left in Italy. In the cultural arena, the oakleaf is the symbol of the National Trust (UK), The Woodland Trust, and The Royal Oak Foundation.^[34]

7.2 Religious

In Greek mythology, the oak is the tree sacred to Zeus, king of the gods. In Zeus's oracle in Dodona, Epirus, the sacred oak was the centerpiece of the precinct, and the priests would divine the pronouncements of the god by interpreting the rustling of the oak's leaves.^[37]

In Baltic mythology, the oak is the sacred tree of Latvian Pērkons, Lithuanian Perkūnas and Prussian Perkūns. Pērkons is the god of thunder and one of the most important deities in the Baltic pantheon.

In Celtic polytheism, the name of the oak tree was part of the Proto-Celtic word for 'druid': **derwo-weyd-* > **druwid-*; however, Proto-Celtic **derwo-* (and **dru-*) can also be adjectives for 'strong' and 'firm', so Ranko Matasovic interprets that **druwid-* may mean 'strong knowledge'. As in other Indo-European faiths, Taranus, being a Thunder God, was associated with the oak tree.^[38] The Indo-Europeans worshiped the oak and connected it with a thunder or lightning god; "tree" and *drus* may also be cognate with "Druid," the Celtic priest to whom the oak was sacred. There has even been a study that shows that oaks are more likely to be struck by lightning than any other tree of the same height.^[39]

In Norse mythology, the oak was sacred to the thunder god, Thor. Thor's Oak was a sacred tree of the Germanic Chatti tribe. According to legend, the Christianisation of the heathen tribes by Saint Boniface was marked by the oak's being replaced by the fir (whose triangular shape symbolizes the Trinity) as a "sacred" tree.^[40]

Thrice on my bossy shield I struck my spear;
And thrice a ghost's shrill voice was heard in air;
The sacred oaks that skirt this sloping wood
Are dead--revive their withered roots with blood;
The blood of foes shall fertilize the plain,
and Odin's spirt feast on heaps of slain.
Hark! now I hear his mighty voice from far--
Rise, sons of Odin, and prepare for war!^[41]

In the Bible, the oak tree at Shechem is the site where Jacob buries the foreign gods of his people (Gen. 35:4). In addition, Joshua erects a stone under an oak tree as the first covenant of the Lord (Josh. 24.25–7). In Isaiah 61, the prophet refers to the Israelites as "Oaks of Righteousness".

The badnjak is central tradition in Serbian Orthodox Church Christmas celebration where young and straight oak, is ceremonially felled early on the morning of Christmas Eve.

In Slavic mythology, the oak was the most important tree of the god Perun.

7.3 Historical

Several singular oak trees, such as the Royal Oak in Britain and the Charter Oak in the United States, are of great historical or cultural importance; for a list of important oaks, see Individual oak trees.

"The Proscribed Royalist, 1651", a famous painting by John Everett Millais, depicted a Royalist fleeing from Cromwell's forces and hidden in an oak. Millais painted the picture in Hayes, Kent, from a local oak tree that became known as the Millais Oak.^{[42][43]}

Approximately 50 km west of Toronto, Canada is the town of Oakville, ON, famous for its history as a ship-building port on Lake Ontario.

The city of Raleigh, N.C., is known as "The City of Oaks."

The Jurupa Oak tree – a clonal colony of *Quercus palmeria* or Palmer's oak found in Riverside County, California – is believed to be the world's oldest organism at 13,000 years.^[44]

Large groups of very old oak trees are rare. One of the oldest groups of oak trees, found in Poland, is about 480 years old, which was assessed by dendrochronological methods.^[45]

In Republican Rome a crown of oak leaves was given to those who had saved a life of a citizen in battle; it was called the "civic oak".^[39]

7.4 Famous oak trees

Main article: List of notable trees

- The Emancipation Oak is designated one of the 10 Great Trees of the World by the National Geographic Society and is part of the National Historic Landmark district of Hampton University.
- The Ivenack Oak which is one of the largest trees in Europe is located in Mecklenburg-Vorpommern, Germany, and is approximately 800 years old.^[46]

- The Bowthorpe Oak, located in Bourne, Lincolnshire, is thought to be 1,000 years old. It was featured in the Guinness Book of World Records and was filmed for a TV documentary for its astonishing longevity.^[46]
- The Minchenden (or Chandos) Oak, in Southgate, London, is said to be the largest oak tree in England (already 27 feet or 8.2 meters in girth in the nineteenth century), and is perhaps 800 years old.^[47]
- The Seven Sisters Oak is the largest certified southern live oak tree. Located in Mandeville, Louisiana, it is estimated to be up to 1,500 years old with a trunk that measures 38 ft (11.6 meters).^{[48][49]}
- The Major Oak is an 800–1000 year old tree located in Sherwood Forest, Nottinghamshire. According to folklore, it was used by Robin Hood for shelter.
- Friendship Oak is a 500-year-old southern live oak located in Long Beach, Mississippi.
- The Crouch Oak is believed to have originated in the 11th Century and is located in Addlestone, Surrey. It is an important symbol of the town with many local businesses adopting its name. It used to mark the boundary of Windsor Great Park. Legend says that Queen Elizabeth I stopped by it and had a picnic.
- The Angel Oak is a southern live oak located in Angel Oak Park on John's Island near Charleston, South Carolina. The Angel Oak is estimated to be in excess of 1400 years old, stands 66.5 ft (20.3 m) tall, and measures 28 ft (8.5 m) in circumference.

8 Historical note on Linnaean species

Linnaeus described only five species of oak from eastern North America, based on general leaf form. These were white oak, *Quercus alba*; chestnut oak, *Q. montana*; red oak, *Q. rubra*; willow oak *Q. phellos*; and water oak, *Q. nigra*. Because he was dealing with confusing leaf forms, the *Q. montana* and *Q. rubra* specimens actually included mixed foliage of more than one species.

9 See also

- Donar's Oak
- Fab Tree Hab
- Foloi oak forest
- Goethe Oak
- List of plants poisonous to equines

- List of *Quercus* species
- Oak Apple Day
- Thousand Oaks, California

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12 External links

- *Flora of China – Cyclobalanopsis*
- Flora Europaea: *Quercus*
- Oaks from Bialowieza Forest
- Common Oaks of Florida
- Oaks of the world
- The Global Trees Campaign The Red List of Oaks and Global Survey of Threatened Quercus
- Latvia - the land of oaks
- Janka Hardness Scale – The Janka Hardness Scale for many Exotic and Domestic species
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