

# OAKS

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The oak group with its many species is the most important aggregation of hardwoods found on the North American continent. The central and southern hardwood forests of the United States may be thought of as oak forests, with the other broad-leaved species playing a secondary role.

## Taxonomy

Kingdom Plantae – Plants Subkingdom

Tracheobionta – Vascular plants

Superdivision Spermatophyta – Seed plants

Division Magnoliophyta – Flowering plants

Class Magnoliopsida – Dicotyledons

Subclass Hamamelididae

Order Fagales

Family Fagaceae – Beech family

Genus *Quercus* L. – oak

**Genus *Quercus*** (Latin "oak tree") consists of trees or shrubs with about 600 existing species. The live oaks, distinguished for being evergreen, are not actually a distinct group but are instead dispersed across the genus. Oaks are deciduous and shed their leaves in one season. The species included in the genus exhibit extreme variability and hybridization is common, creating a grand puzzle for taxonomists.

## Range

The genus is native to the northern hemisphere, and includes deciduous and evergreen species extending from cold latitudes to tropical Asia and the Americas. They are found chiefly in north temperate zones and also in Polynesia. There are possibly 60 to 70 species native to the United States and as many listed hybrids.

## Structures

**Size and Shape:** Oak trees are large, reaching heights of 150 feet. They are pyramidal in youth. Mature trees are massive and spreading with a thick trunk. The stem is erect and branched, the branches ascending or spreading, but never drooping.

**Buds:** The resting buds have numerous pairs of scales or stipules of undeveloped leaves. The lateral buds are in clusters at the tip of the twigs. The lower buds are inactive for long periods, causing the zigzag arrangement of branches.

**Leaves:** The leaves are lobed and spirally arranged. The leaves are short-stalked and have temporary stipules. The leaf blade is hairless and not tapered at the base.

**Flowers:** The flowers are catkins, produced during April and May. The oak is a monoecious plant, and both male and female catkins are borne on the same shoot. The male on the dwarf shoots are pendent, and both male and female occur on terminal parts of the previous year's twigs. The female inflorescence has fewer flowers (1-5), and has a distinct stalk with lateral flowers. Each spike contains one female flower, which forms the acorn cup at the base, or a cluster of flowers. The male

flowers hang in drooping catkins, with 5-7 united sepals and 5-12 stamens. Like other Cupuliferae, the flower is pollinated by the wind.

**Acorns:** 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 acorn develops from a 1-seeded ovary, 5 of the ovules not developing.

**Acorn Production:** The oak trees produce acorns once a year during the fall. Acorn production varies year to year and normally alternates. Not even the healthiest and largest oak can accumulate enough food and energy to produce strong crops two years in succession. Real strong acorn productions might happen every four to ten years. In addition, a late spring frost can blight the flowers and prevent acorn development. Droughts and insect ravages can decimate crops.

Acorn production will increase year after year, following the growth in size of the tree's canopy. Production starts very slowly at around the 25<sup>th</sup> year, the number of acorns produced then accelerates, and when the tree reaches about 100 years of age, it starts slowing down until it reaches a yearly production of about 2,200 acorns per year.

The chances of one acorn making it to become an oak tree are very slim. For every 10,000 acorns, only one will become a tree.

**Hiding Acorns:** Squirrels hide acorns in the ground to last them through the winter when food is scarce. Blue jays and woodpeckers also hide acorns underground. The number of acorns hidden by animals is pretty small as most of the acorns get hidden by the oak trees. When the oak trees shed their leaves during the autumn, they end up covering (and thus hiding) most of the acorns.

### Living Conditions

**Water Needs:** A mature oak tree can draw up to 50 or more gallons of water per day through their root system. Some of the water evaporates from the leaves in a process called transpiration

**Longevity:** Oak trees can live 200 or more years.

**Commensalism:** Various animals may make their home in the oak tree and use the acorns as a winter fodder, among them squirrels, who make nests high in the sheltering branches, usually in a slot where two or three branches meet;

### Stresses of Oak Trees

#### Insects

- **Acorn Destroying Weevils** like to plant their eggs inside acorns before the acorns mature during the late summer months. Up to 90% of the acorns in a region can be destroyed by the larvae of the weevils. On the other hand, if there are not enough acorns, that can impact the weevils' population.
- **Wood-boring beetles** may not be apparent on the outside, often only discovered when the tree come down in a strong gale.
- **Lepidoptera (butterfly and moth) species** such as the Gypsy Moth, *Lymantria dispar*, feed on oaks and can defoliate oak and other broadleaved tree species in North America.

#### Diseases

- **Sudden Oak Death** (*Phytophthora ramorum*) is a water mold 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.

- **Root rot in older trees**
- **Oak galls:** Oak trees are subject to galls and many different species are found on them. Oak galls were used for centuries as the main ingredient in manuscript ink, harvested at a specific time of year.

### Human Uses

**Timbering of the European Oak Forest:** Oak wood, from *Quercus robur* and *Quercus petraea*, was used in Europe for the construction of ships until the 19th century and was the principal timber used in the construction of European timber-framed buildings. Wide, quarter-sawn boards of oak have been prized since the Middle Ages for use in interior paneling of prestigious buildings such as the debating chamber of the British House of Commons in London, England, and in the construction of fine furniture.

Under water it is virtually indestructible, which is why most of Britain's ancient oaks were sacrificed to build its navy fleet that went out to conquer new lands for the Crown. Thus it is on oaks that the British Empire was built. More than 500,000 trees were cut for shipbuilding alone. As a consequence of cutting down the old oak forests, Britain's landscape was denuded. An acute fuel shortage soon followed, which in turn led to the quarrying of coal and to the industrial age of steam engines and factories.

**Lumber:** The oaks furnish more native timber annually than any other related group of broad-leaved trees. The oaks, of which there are in all more than forty varieties, produce woods which are exceedingly variable, but they are usually heavy, hard, tough, porous, very strong, and of coarse texture. The sapwood is whitish, the heartwood ranging in color from a light to a reddish brown. There are three well-marked kinds, - white, red, and live oak. These are kept distinct in the market, the white and the red oak being the most common.

- Oak wood has a density of about 0.75 g/cm<sup>3</sup>. It has great strength and hardness, and is very resistant to insect and fungal attack because of its high tannin content. The standard for the lumber of the white oak group, all of which is marketed as white oak, is the white Oak *Quercus alba*. It has very attractive grain markings, particularly when quarter-sawn. Today oak wood is still commonly used for furniture making and flooring, timber frame buildings, and for veneer production. White oak is often used to make wine barrels.
- Of the North American oaks, the Northern red oak *Quercus rubra* is the most prized of the red oak group for lumber, all of which is marketed as red oak regardless of the species of origin. It is not good for outdoor use due to the open capillaries. 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.

**Wine and Spirit Making:** Whiskey, sherry and wine barrels were traditionally made from oak wood. The tannin renders the wine more durable and imparts a mellowing effect on the spirits.

**Food:** Acorns were formerly dried, roasted, and used for making bread. A nourishing, starchy flour can be obtained by grinding dried acorns. To reduce the bitterness of the nuts, they were washed repeatedly in running water or boiled in several changes of water. American Indian tribes used acorns as a staple dietary item in such foods as bread and pudding soup.

**Smoking Food:** Oakwood is also often used to smoke various foods, such as fish, meat and even cheese, both for the flavor and its preserving qualities.

**Hog feed:** Formerly acorns were in great demand for feeding swine, oak forests being described as of so many hogs.

**Medicine:** The dried inner bark from young branches has been used as an anti-inflammatory and astringent to treat a range of medical conditions, from swollen glands to eczema.

**Tanning and Dyes:** Oak bark is rich in tannin and is used by tanners for tanning leather. Oak sawdust was used to dye fustian and to make colors of drab and brown. The oak galls were used in dyeing and for ink.

**Symbol of Political Strength:** Many nations have adopted the oak tree as their national trees due to its large size and strength, including England, France, Germany, Poland and the United States.

**Boundary Markers:** It was considered unlucky to fell an oak. Hence oaks were used for marking boundaries of property

**Oak as a Sacred Tree:** The sturdy qualities and appearance of many of the oaks, together with their longevity in comparison with other hardwoods, have made them from very ancient times the objects of worship among the early people of the Old World.

- **Celts:** Druids attached much significance to the symbolism of the oak; the tree is grown in sacred groves and burned in ceremonies. In Celtic mythology, it is the tree of doors, believed to be a gateway between worlds, or a place where portals could be erected.
- **Norse:** The oak was sacred to the thunder god, Thor. Some scholars speculate that this is because the oak, as the largest tree in northern Europe, was the one most often struck by lightning. Oaks were used as meeting places for the village elders where they held their moots or tings (meetings) to decide on morals, law and order. Decisions thus made under the watchful eye of Thor himself were meant to endure and stand firm like the oak tree itself. Court was held in their shade, oaths were sworn and no false word was tolerated in its presence. Oaks were held in such high esteem, that anyone who would dare to harm them was sentenced to death.
- **Greek and Roman:** In Classical mythology, the oak was a symbol of Zeus and his sacred tree. The ancient Greeks heard the voice of Zeus speak to them in the rustling of the leaves and branches of the oracular Oak at Dodona. The early Greek and Latin authors believed in the tree descent of man, and the oak and ash were supposed to have given rise to man. Oak leaves formed the civic crown, which was the highest honor, and accorded to Julius Caesar.

**Medieval Folklore:** Folkloristic medicine made widespread use of various trees, not so much as remedies, but for the purpose of transferring the evil spirits of disease from the sufferer to a strong healthy tree which seemed much better equipped to cope with it. The practice is known as 'transfer magic'. A variety of rituals were associated with this custom and all of them involved reciting certain spells, which caused the demon of disease to take leave from the body and take up residence with the tree. Oaks, as the strongest of all the trees, were deemed effective against many different kinds of affliction, among them were gout, fever, toothache, headache and even broken bones.

The Obed Watershed Community Association has as its purpose the protection and enhancement of the natural and cultural heritage of the Obed River watershed within Cumberland County. Louise Gorenflo, OWCA community educator, produced this fact sheet. Those wanting to join this membership organization or more information may contact Dennis Gregg, OWCA Director at 484-9033 or at 185 Hood Drive, Crossville, TN 38555.