



Cambridge University

Botanic Garden

Trees of the Botanic Garden Trail

Our trees provide a framework around which the other elements of the Garden have evolved. The current site was originally acquired to accommodate a wide range of trees, and many of the mature specimens seen along the Main Walk and around the perimeter of the western half of the Garden date back to its establishment in 1846.

All plants in the plant kingdom are grouped into families that share similar characteristics. This is demonstrated in the western half of the Garden, where trees were planted by family as a teaching resource for University students. These family groupings followed the arrangement set out in the early 1800s by Augustin de Candolle, the foremost authority in plant classification at the time.

See an online version of this trail
at www.botanic.cam.ac.uk/trees-trail

Trees of the Botanic Garden

At their most extreme, trees are examples of the plant kingdom at its most impressive. The tallest tree in the world, a coastal redwood (*Sequoia sempervirens*) nicknamed 'Hyperion', reaches 115m; the largest in diameter is a baobab (*Adansonia digitata*) in South Africa, and a Norwegian spruce (*Picea abies*) in Sweden has lived for 9,500 years. Yet trees can also be surprisingly delicate, as seen in the feathered edges of the leaves of Japanese maple (*Acer palmatum*) or the quivering leaves of quaking aspen (*Populus tremula*). Worldwide, estimates suggest that there are around three trillion trees, of which around 15 billion are felled annually, and five billion planted.

Trees are either deciduous, shedding leaves at the end of the growing season, or evergreen, having foliage that persists through the year. The foresight of previous CUBG Directors and Curators means we now have an extensive and mature tree collection here in the Garden. In the 1840s, under the direction of John Stevens Henslow (founder of the Garden on this site), Curator Andrew Murray planted trees in families. This



Two of the black pine trees on the Main Walk. John Stevens Henslow, Professor of Botany, used them to show variation within species.

facilitated botanical education based around similarities and differences between species within those families.

Many of the trees in the Garden have notable histories. Our dawn redwood (*Metasequoia glyptostroboides*) by the Lake is the first example of its species to be grown outside of its native China, and the giant redwood (*Sequoiadendron giganteum*) next to it is from the first batch of seed exported from America.

Like all specimens in the Garden, trees have a finite life. In wildlife reserves and forests, decaying wood provides a valuable habitat for numerous animals, plants and fungi, and so dying or dead trees are frequently left in place. However, a Botanic Garden exists as a resource of living plant material for use by researchers, so we usually remove damaged or dead trees and replace them with new specimens. An example of such replacement can be found on the Main Walk: on the north side of the crossroads stands a magnificent cedar of Lebanon (*Cedrus libani*), which was formerly paired with a fine Atlas cedar (*Cedrus atlantica*) on the south side. In 2018, a long dry summer was followed by a wet autumn, and the crown of the tree split under the weight of the water it had absorbed. After the old tree had been removed, the Botanic Garden's Director Beverley Glover planted an Atlas cedar sapling in its place. While dwarfed by its partner at present, we expect it to match its predecessor in stature in a century or two.



Former Garden Director John Gilmour next to our dawn redwood in 1955.

1 *Pterocarya fraxinifolia*
(Juglandaceae)

The stand of Caucasian wingnut that straddles the stream feeding the Lake is one of the most outstanding features of the Garden. Originally it consisted of two trees, but it is now an immense thicket of suckers. Pendant, plaited green catkins elongate in July before developing into winged fruits. A black walnut (*Juglans nigra*) formerly stood by the magnolia trees on the other side of the path, but it was removed in 2018 after becoming infected by honey fungus.

Recently, our walnut family (Juglandaceae) collection has been sampled by scientists investigating how they make terpenes, essential oils found in their leaves. These chemicals are useful to humans in the perfume industry and for deterring animals which eat plants. Today, species with animal-dispersed fruits such as walnut (*Juglans*) and hickory (*Carya*) are predominant within the family, while wind-dispersed species like the Caucasian wingnut are more unusual.



2 *Aesculus indica* (Sapindaceae)

The Indian horse chestnut is a spectacular sight in early summer as stumpy candles of densely packed white flowers light up the rounded canopy of foliage. Like many of its relatives, its flowers have yellow centres until they have been pollinated, at which point they turn pink. This is a signal to pollinating insects, which avoid the pink flowers. Bees working the flowers can often be seen with baskets of brick-red pollen on their hind legs.

DNA analysis has resulted in the former maple family (Aceraceae) and horse chestnut family (Hippocastanaceae) both being included in the soapberry family (Sapindaceae).



A *Metasequoia glyptostroboides* (Cupressaceae)

Information about the dawn redwood can be found on an interpretation sign next to the tree.

CHAMPION
TREE

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3

***Tilia × europaea* (Malvaceae)**

In full flower, the heady scent of the European lime saturates the summer air. The flowers are rich in nectar, and honeybees working them make a pale-green honey that tastes minty.

The European lime standing to the south of the Main Gate was planted in November 1846 by the Vice-Chancellor of the University of Cambridge to mark the opening of the ‘new’ Botanic Garden. Its leaf has become the Garden’s logo.

Aphids feed on many *Tilia* species and drop sticky honeydew after drinking sap from leaf veins. However, *T. henryana* (planted nearby, with leaves with toothed edges), is resistant to aphids. For this reason, it is planted to give shade to tables outside the Café.

Lime trees were formerly in their own family (Tiliaceae), but DNA evidence shows that they belong to the mallow family (Malvaceae). This family includes many herbs and shrubs, including hibiscus, cotton (*Gossypium*), and trees such as cocoa (*Theobroma cacao*) and kola (*Cola*).

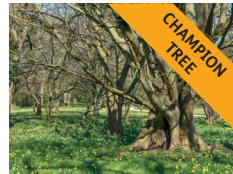


4

***Zelkova carpinifolia* (Ulmaceae)**

The Caucasian elm is an elegant tree valued for its goblet shape and attractive leaves, which are elegantly and regularly toothed. In autumn, the foliage turns a rich copper colour. When mature, the trunk is unusually short and stout. The unusual genus name comes from the Georgian for ‘stone pillar’: the wood is hard and was used for building.

Zelkova trees are more resistant to Dutch elm disease than native elms. This devastating fungus is spread by elm bark beetles, which breed in dead and dying trees, including those killed by the disease. There is no chemical treatment for the fungus and it is impossible to control the beetles. More than 25 million trees have died in the UK alone, and there are very few mature elms left in Britain or much of continental Europe. Notably, Queens’ College has two elms standing 35m tall; these can be seen from Queens’ Green at the end nearest King’s College. These trees are infected with the fungus, but have not been killed by it, and cuttings from them are being propagated.



If you do not wish to keep this booklet, please return it to the ticket office for others to use.

Trees of the Botanic Garden



Numbers indicate the position of selected trees within plant families, which are outlined in white.



5

***Maclura pomifera* (Moraceae)**

The osage orange is one of the most unusual members of the mulberry family (Moraceae). This tree bears orange-sized fruit, a lurid neon green in colour, high up in the tree. In autumn, the ground beneath the tree becomes littered with the fruits, which look like green, deeply wrinkled tennis balls – or, as the horticultural staff call them, “pickled gardeners’ brains”!

Moraceae includes other well-known plants such as fig, breadfruit and jackfruit. Another member of the family, white mulberry (*Morus alba*), is commercially important because it is the preferred foodplant for caterpillars of the silkworm (*Bombyx mori*). Each caterpillar eats around 40g of mulberry leaves as it grows, before spinning silk into a cocoon in which to pupate. Each cocoon yields around 1,000 yards of raw silk filaments, weighing 0.2g. These filaments are combined into thread, which is then twisted together into yarn.



6

***Fraxinus pennsylvanica* (Oleaceae)**

Native to North America, green ash was popular as an urban tree: it grows fast and tolerates pollution and road salt. However, it is susceptible to damage from emerald ash borer beetles, and its planting across the USA assisted the beetle’s spread. The pest has so far not reached the UK. Green ash is also affected by the ash dieback fungus, which is killing many of our native ash trees. Researchers in the Department of Plant Sciences are developing mathematical models to predict the spread of ash dieback and to inform ways of stopping or delaying the spread.

Plants in the olive family (Oleaceae) often have numerous scented flowers, and trees in Oleaceae are often used to produce ‘hardwood’ timber. Hardwood comes from flowering trees (usually broad-leaved and deciduous), in which multicellular vessels transport water through the wood, giving the tree its strength. Softwood comes from conifers, in which water is conducted through thin, single-celled structures called tracheids. Hardwood is usually hard, and softwood almost always soft, but there are some exceptions: yew is a softwood which is hard, and balsa a hardwood which is soft.



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7

***Parrotia persica* (Hamamelidaceae)**

The Persian ironwood displays ornately tangled branches, some of which have fused together over time to create an intricate lattice. It grows slowly – this specimen was planted in the 1880s – and its wood is so dense that it sinks in water.



Plants in the witch-hazel family (Hamamelidaceae) were widely distributed in the Northern Hemisphere until around 2.5 million years ago, when glaciation restricted them to areas around the equator. The *Liquidambar* next to the Persian ironwood was formerly placed in the witch-hazel family, but early this century was reclassified into a sister family, Altingiaceae, based on DNA evidence. DNA is found in the nucleus of cells, and contains the whole genetic code for how to make the organism. Scientists call this the ‘genetic sequence’. Different species can share lots of the same genetic sequence but there are also many differences. These similarities and differences give information on how species are related.

8

***Cladrastis kentukea* (Fabaceae)**

The Kentucky yellowwood has leaves made up of many leaflets, creating a dense cover against which the long racemes of wisteria-like, fragrant white flowers flutter in the lightest breeze. Flowering is most profuse after hot, dry summers. In the autumn, the foliage turns yellow, gold, and orange.



The pea and bean family (Fabaceae) is large, comprising around 19,000 species (approximately 7% of all flowering plant species). Many of them are agriculturally important, including soybean (*Glycine max*, of which around 350m tonnes is produced every year, 70% of which is used as animal feed), pea (*Pisum sativum*), chickpea (*Cicer arietinum*) and peanut (*Arachis hypogaea*).

Many plants in Fabaceae have specialised structures called ‘root nodules’ that host bacteria called ‘rhizobia’. The bacteria take nitrogen gas and convert (or ‘fix’) it to a form which is usable by the host plant – in effect, providing fertilizer. In return, the plant provides the bacteria with organic acids as a carbon and energy source.

B *Quercus × warburgii* (Fagaceae)

Information about the Cambridge Oak can be found on an interpretation sign next to the fenced tree.

CHAMPION
TREE

9 *Pyrus communis* (Rosaceae)

Legend has it that a gardener was once bricked up inside this wild pear, but the truth is less exciting: a branch split from the trunk in the 1960s and the wound was filled with bricks and covered in tar, following arboricultural practice of the time. The tree is gradually growing around the bricks and encasing them. This treatment for branch loss is no longer recommended.



CHAMPION
TREE

The rose family (Rosaceae) includes many economically important species, such as apples, plums, raspberries, strawberries and almonds. Their flowers are radially symmetrical, often showy, and many of their fruits are edible. However, their seeds often release small quantities of cyanide when crushed, which is a plant defence against herbivory.

10 *Alnus subcordata* (Betulaceae)

The Caucasian alder is native to the Caucasus Mountains, but it clearly enjoys our Cambridge climate. It now towers over the birch collection, measuring a mighty 17.5m, making it one of our Champion Trees. Attractive, crumbly-textured, slender male catkins appear exceptionally early in autumn.



CHAMPION
TREE

The birch family (Betulaceae) comprises around 170 species. All of them bear fruit botanically described as nuts, with the common hazel (*Corylus avellana*) and the filbert (*C. maxima*) being notable orchard plants. Other genera include several ornamental trees, including many with striking bark, such as the paper birch (*Betula papyrifera*).

The hop-hornbeam (*Ostrya carpinifolia*) is a 'Tertiary' tree: native to Britain before the last ice age but which, unlike Beech and Oak, was not able to recolonise the country before it was cut off from mainland Europe when sea levels rose. There is a fine hop-hornbeam at the junction of Middle Walk and Bateson Walk.

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at www.botanic.cam.ac.uk/trees-trail

11 *Pinus nigra* (Pinaceae)

John Stevens Henslow, the founder of the Garden, designed plantings to demonstrate variation within species, including the black pines in this grove and along the Main Walk.

Despite being the same species, the black pines that come from warm climates hold their branches erect, while those from cold areas have sloping branches to allow snow to slide off. This limits the load on their branches and ensures the leaves are free to photosynthesize. The wood of the black pine is relatively hard and straight-grained, and is used for building, fuel and papermaking.

The pine family (Pinaceae) includes cedars, firs, larches, pines and spruces. Female trees produce cones which bear two seeds on each 'scale' of the cone. The cones of the Coulter pine (*Pinus coulteri*) can be up to half a metre long and can produce up to 200 seeds per cone. Pine seeds sometimes have wings to aid dispersal by wind, or can be spread by animals such as squirrels and jays.



12 *Quercus suber* (Fagaceae)

Located at the eastern end of the Glasshouse Range is a spectacular cork oak. Its remarkable and characteristic bark is slow to burn, making it a natural barrier against fires. Cork bark also has the unusual property of not expanding sideways when squashed, which means it is easy to push a wine cork into a bottle. Despite its reputation for poor growth in England, this tree is a fine specimen, remaining evergreen throughout all but the very coldest Cambridge winters.

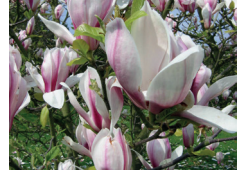
The beech family (Fagaceae) includes beeches, oaks and chestnuts (which are not closely related to horse chestnuts (Sapindaceae)). Many species provide commercially useful timber, and several are planted as ornamental trees. Beeches and oaks are 'native' trees: species which colonised the UK after the last ice age but before it was cut off from mainland Europe by the North Sea and English Channel. It has long been thought that the Romans brought chestnut trees to Britain, but archaeobotanical samples have not definitively confirmed this.



13

Magnolia × soulangeana (Magnoliaceae)

Flowering in spring, the saucer magnolia (a hybrid between *M. denudata* and *M. liliiflora*) produces a succession of large flowers that open before the leaves. Named after the Professor of Botany at Montpellier, Pierre Magnol (1638–1715), the genus *Magnolia* includes around 125 species from Asia and America.



Plants belonging to the magnolia family (Magnoliaceae) appear in fossils dating back around 95 million years, which predates the evolution of bees. The flowers are thought to have evolved to encourage pollination by beetles, while the seeds of nearly all species within the family are fleshy, brightly coloured, and distributed by birds. The exceptions are the two species within the genus *Liriodendron* (tulip tree), whose flowers form ‘samaras’, structures where the seed is attached to a flattened wing of tissue. Examples of samaras in other tree families include ash (Oleaceae) and sycamore (Sapindaceae).

What is a Champion Tree?

Champion Trees are individual trees that are exceptional examples of their species because of their enormous size, great age, rarity or historical significance. We have a number of UK Champion Trees in the Garden, as well as several Champion Trees of England and of Cambridgeshire. For more information, see www.treeregister.org.

Three of our Champion Trees are native to the UK: English whitebeam (*Sorbus anglica*), round-leaved whitebeam (*S. eminens*) and Ley’s whitebeam (*S. leyana*). All of them can be found in the rose family (Rosaceae), near the wild pear (*Pyrus communis*).

Ley’s whitebeam is native to Wales, and is one of the country’s rarest tree species. Since its discovery and naming in the 19th century by Reverend Augustin Ley, quarrying has destroyed much of its natural habitat. It is now critically endangered: the total wild population is around 20 trees. In 2002, a *S. leyana* growing in Wales was one of 50 trees selected to commemorate the Queen’s Golden Jubilee; another was our dawn redwood, found near the Lake.

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