

# Ginkgo: Eldest Tree Survivor

by Dr. Kim D. Coder, School of Forest Resources University of Georgia

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There is one family of trees which saw the rise and fall of dinosaurs. This same family of trees barely survived the last ice-age. Ginkgo has become a tree without a home -- an exotic wanderer scattered across the globe. Every botanical garden and arboretum worthy of its title has at least one ginkgo tree. Cited as a living fossil, a cultural icon of the orient, and a tree both bizarre and fascinating, ginkgo shares our world today due solely to human cultivation. Its botanical uniqueness, food content, and medicinal values assure people will continue to cultivate this most ancient of trees.

This publication will outline the curiosity surrounding ginkgo from its name to its wood. Appreciating a living ginkgo standing in the sun can be enhanced by understanding its ecological history, biology and structure. Here myths will be discarded and rumors quenched regarding the ginkgo tree, in order for you to grasp the priceless and timeless genetic qualities of *Ginkgo biloba*.

## The Ginkgo Age

The ginkgo family line stretches back beyond 200 million years. The fossil record places one or two species of ginkgo at this beginning. Over time there has been at least 20 species of ginkgo, possibly as many as 50 species, in at least four genera. The ginkgo family reached the height of its ecological success about 150 million years ago when there were approximately five common and widespread species. The ginkgo family covered many parts of what we now call the Northern Hemisphere of Earth. Catastrophe struck 65 million years ago.

The same global changes which initiated the loss of dinosaurs and allowed for the rise of mammals, also decimated the ginkgo forests. Only one ginkgo species survived. Surrounded with more effective competitors and seed predation, ginkgo began a long decline into extinction. Ginkgo disappeared from North America around 7 millions years ago, Europe around 3 million years ago, and its last few refuges in Asia evaporated across the last million years. The successive waves of global cooling snuffed out almost all the scattered remnants of ginkgo. Petrified wood and leaf fossils of ginkgoes were the only remains to be found at sites across the United States.

## Genetic Relationships

*Ginkgo biloba* is unique among trees in occupying its own taxonomic division, class, order, family, and genus. It has outlived its relatives by large genetic distances. Seed plants (Spermatophytes) can be subdivided into two groups, Angiosperms and Gymnosperms. Ginkgo is one of four primary subdivisions of the Gymnosperms which include: cycads (9 genera and ~100 species); conifers (48 genera and ~500 species); Gnetales (3 genera and ~64 species); and, ginkgo (1 genera with 1 species).

In the Gymnosperms, Gnetales are considered developmentally advanced and cycads are considered primitive. Conifers are considered a main-line and dominant group defining Gymnosperms. Ginkgoes share traits intermediate between the cycads (similar reproductive traits) and the conifers (similar growth and structural traits). Ginkgoes are an advanced cycad or a primitive conifer. Ginkgo represents a genetic way-station on the road to modern trees.



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## By Any Other Name?

The given scientific name for this tree is *Ginkgo biloba*. The meaning of the scientific name is a “two-lobed leaved, silver apricot.” The word *ginkgo* is derived from Chinese and Japanese terms *ginkyo* meaning silver apricot. The common name is greatly confused by translation and cultural differences. The most used common name follows the scientific name -- *ginkgo* (*ginkgo* being singular and *ginkgoes* being plural.) Other common names used are: *ginkyo*, *gingkyo*, *ginko*, maidenhair tree, duck-foot leaf tree, duck-foot tree, *icho*, silver apricot, nut apricot, white fruit, white eye, spirited eye, temple tree, grandfather-to-grandson tree, Ginkgobaum, and noyer du Japon.

In the beginning of determining *ginkgo* taxonomy, the common term *ginkyo* was mis-translated / mis-spelled by Latin-based taxonomists as *ginkgo*. *Ginkgo biloba* was the designated name established for the tree in 1771. Renaming and reorganizing the tree’s taxonomic position occurred at least twice with the scientific names *Salisburia adiantifolia* (1797) and *Pterophyllus salisburiensis* (1866) being proposed. The oldest name (*Ginkgo biloba*) remains the proper scientific name.

## Native Land?

*Ginkgo* was first known by modern humans in China. Mature *ginkgoes* grow in low density, disturbed, and mixed forests. Ecologically, *ginkgo* is an early successional species which colonizes sunny, open soil areas without much competition. Cut stream banks, soil slide areas, and large forest gaps with little litter are prime seed germination and seedling establishment areas. Mid-slope positions in heavily flooding river valleys, and well-drained, non-saturated mineral soil sites are ideal. *Ginkgo* seed production is a strategy for distribution and new site colonization. *Ginkgo* vegetative reproduction is a strategy for holding onto a site for hundreds of years.

*Ginkgo* can be found in naturalized stands within the mixed species forests concentrated on the lower mountainsides of the Western Tien Mu Shan in Southern Anhui province and in adjacent Western Zhejiang province, West of Shanghai, China. It is unclear if any of the remaining old stands of *ginkgo* in China are true natives to their sites, or were naturalized and cultivated by man over the last two millennia. *Ginkgo* was first recognized as a food and medicine source. *Ginkgo* was conserved for the royal household. Information about the tree slowly escaped the palaces, and *ginkgo* trees were cultivated within protected gardens and monasteries. The reverence and veneration of *ginkgo* occurred not because of religious or spiritual reasons, but because of its uniqueness, food cash value, and perceived medicinal properties.

## World Travels

As more seeds became available, and as more trees were planted to supply the royal court, the more seedlings escaped and were cultivated by merchants. Around 800 years ago *ginkgo* trees were first recorded as part of trade to Japan and Korea. Europeans first saw the tree in Japan in 1691 and noted its unique qualities. Upon further searching through the middle 1700’s, Europeans found *ginkgo* growing in China, Japan, and Korea. *Ginkgo* was first described botanically in continental Europe in 1712. The Dutch introduced the tree to continental Europe in 1727 near Utrecht. Cultivation in England began in 1754.

A botanist and collector named Hamilton planted the first two trees in the United States near Philadelphia in 1784. Both these trees are now gone. The oldest living *ginkgo* tree in the United States was planted in 1785 or shortly thereafter by the Bartram brothers (famous botanical explorers), also near Philadelphia. A planting fad erupted among upper middle class and wealthy households in the northeastern part of the United States in the early 1800’s and again in the 1890’s until the first world war. A curiosity and strangeness factor still propels planting *ginkgoes* around the world – in yards, schools, streets and parks.

## Size, Reach, & Extent

*Ginkgoes* come with many variations in growth. There are *ginkgo* cultivars with many sizes and shapes. Some of these can be accessed by name in the publication by Coder, 2003, *Selected Ginkgo Forms & Culti-*

vars, University of Georgia, School of Forest Resources, Publication FOR03-20, pp.5. The “normal” ginkgo traits will be reviewed here. Ginkgoes are large, tall trees. Many people have mistakenly used ginkgo for street-side plantings and around buildings where there is little below or above ground space for the tree to colonize. Ginkgoes are considered too large for narrow street or tree lawn plantings.

Crown spread is highly variable and has been selected for in various cultivars. Ginkgo trees can reach 50-90 feet in height with a 30 to 60 feet wide crown spread over a trunk 2-3 feet in diameter. The largest ginkgoes occur in China and reach maximum confirmed sizes of approximately 140 feet tall and 16 feet in trunk diameter. Note that true heights and trunk diameters are estimates due to mountainous terrain exposing root collars and root base areas, and to adventitious roots and special aerial root growths clouding where to take measurements.

### Life-form & Life-span

Ginkgoes can reach large sizes on good sites away from site disturbance, tissue injury, and highly competitive plants. Juvenile trees have regularly spaced but sparse branches forming an upright and open crown. As trees mature, crowns become more spreading with branches colonizing more resource space and crowns becoming more dense. With age, branches fill-in the open crown areas of youth. The noticeable, single-leader-dominate young tree crown is overtaken by other branches resulting in a multi-leader tree with age. The final mature form is an elongated wide oval crown shape. There is a trend difference in crown shape between a more upright and narrow crown shape in male trees and a more spreading and shorter female tree. Reliable sources cite maximum existing tree age to be 1,200 years old. Unsubstantiated reports cite 3,000 years of age maximum.

In the species *Ginkgo biloba* there are five primary crown or leaf forms (besides “normal” or “typical”) which humans have cultivated: a weeping or pendulous form; a highly upright or fastigate form; a dwarf type; a branch type with aerial root bulges; and, three foliage variations -- rolled tubular leaves, variegated leaves, and leaf and seed-stem fused foliage. Beyond these standard variations, the rest of ginkgo variability is considered “normal.”

### Growth Rate

There are many highly variable citations for growth rate. Many measures are confused by cultivar traits, sex, biological age, and site resources available. Without isolating each factor, a simple growth rate value means little. As a general rule, ginkgo has a moderate growth rate compared with other specimen trees in an established landscape. An establishment period of 2-5 years is usually a time of extremely slow growth. After establishment until approximately 40 years of age, growth rate can be rapid. As active sexual reproduction accelerates, growth rates decline 40-140 years. As female trees reach sexual maturity (20-40 years of age), elongation and crown expansion rates decline as more resources are dedicated to seed production. After 150 years growth rates are usually slow, although ancient ginkgoes on sites with great resources can sustain rapid growth for centuries. The fastest, long-term growth occurs in males on the best resource-available and stress-reduced sites, and where roots are infected with mycorrhizae fungi (endo -- VAM type – *Glomus* spp.).

Figure 1 provides an extremely rough estimate of mortality and normal expected lifespan for ginkgo based only upon information cited in scientific and popular literature. Note established ginkgoes should grow for at least 45 years and should be expected to live to be 110 years of age. Figure 2 provides an extremely rough estimate of ginkgo diameter growth over time. Note that a ginkgo at 110 years of age should have a diameter of 2.1 feet. The height data presented across the literature is confounded much more than diameter and age due to storms and site constraints. In general, a 110 year old ginkgo, 2.1 feet in diameter would be roughly 62 feet tall.

## Tree Health Issues

Ginkgoes are easy to transplant and establish if a large root ball with healthy roots are planted. Because of the mess of seed production, plant only males for shade and street tree uses. Approximately 0.5% of male ginkgoes will generate some isolated female flowers and seeds (monoecious). Females should be planted as specimens away from walking trails and public areas, if at all. Tree health care is minimal except for providing good moisture in a well-aerated, well-drained soil.

Ginkgo has few primary pests and shares key stresses with all other trees – water availability in the growing season. Ginkgo is tolerant of air pollutants at low to moderate levels. Seeds are susceptible to fungal attack. Many different parts of the tree contain a variety of anti-biological compounds targeted primarily at animal systems. One major concern in ginkgo is a failure to effectively deal with wounds. Ginkgo does not react quickly in compartmentalizing injuries. This is especially noticeable in wall four (next year's increment) problems.

Ginkgo should not be green-wood pruned when young. Allow the tree to grow naturally until it is larger, and then do not use crown cleaning or thinning. Use crown raising and terminal subordination to control crown spread. Light nitrogen fertilization, once the tree is established will be essential for good tree performance. Beware of nitrogen fertilizer over-dose, especially when soils are compacted or drainage is poor.

## Site Preference

Ginkgo is an early successional pioneer onto open mineral soils in full sun. They establish and grow on disturbed sites within mixed temperate forests. Ginkgo does well where conditions lean toward warm and moist conditions and perform poorly where sites concentrate low temperatures and wind/ice storms. As with most trees, temperature and water availability regimes override most other site constraints. Ginkgo is considered summer drought tolerant. In general, ginkgo requires 90% to 100% sun, moist but well-drained soils, and neutral to acidic soils. Ginkgo requires North American winter hardiness zones of 4 - 8 and North American heat zones of 4 - 8.5. Altitudinal limits are below 6,000 feet above sea-level. Ginkgo is cited as being urban site and air pollution tolerant, but are salt sensitive. Tolerance is a relative concept and growth rate is significantly sacrificed for any resource poisoning or availability constraints.

## Conclusions

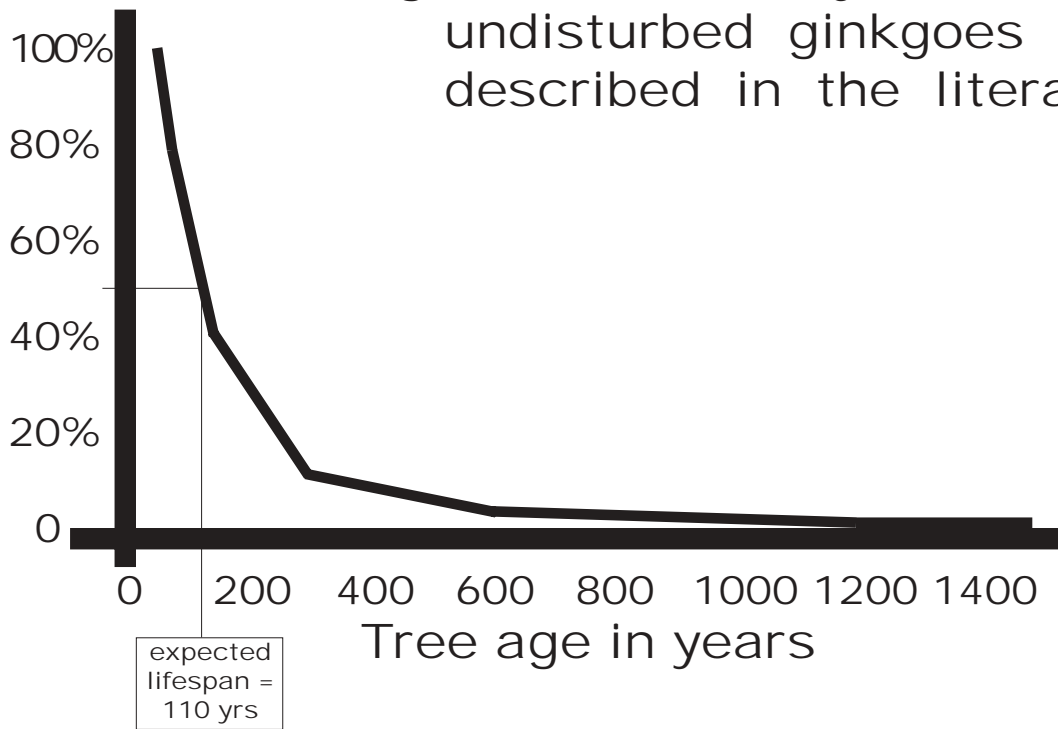
Ginkgo is worth planting and enjoying if only for its rarity of form and ancient lineage. Imagine a tree which was both one of the only living survivors of Hiroshima's atomic blast (from root sprouts), and one of the few trees descended from the age of reptiles virtually unchanged. Plant a piece of ancient history which teetered on the edge of the extinction abyss. Plant a ginkgo.

### Further information:

- Coder, Kim D. 2003. Ginkgo Seed Collection and Preparation. University of Georgia, School of Forest Resources, publication FOR03-21. 7pp.
- Coder, Kim D. 2003. Identification and Silvics of Ginkgo. University of Georgia, School of Forest Resources, publication FOR03-19. 7pp.
- Coder, Kim D. 2003. Selected Ginkgo Forms and Cultivars. University of Georgia, School of Forest Resources, publication FOR03-20. 5pp.

Percent of  
all trees

Figure 1: Mortality curve for  
undisturbed ginkgoes as  
described in the literature.



Diameter  
(DBH)  
in feet

Figure 2: Diameter growth  
over time in undisturbed  
ginkgoes as described  
in the literature.

