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Resurrecting Ancient Forests

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Sempervirens = ever living, ever green.
The tallest trees on earth, *Sequoia sempervirens* , the coast redwoods, date back to the Jurassic Period, 200 – 145 million years ago. Fossils show their prehistoric range included Europe and Asia as well as North America.

Today, coast redwoods grow along the fog belt of the North American Pacific Coast and in isolated groves on the western slopes of the Sierra Nevada mountains. Reaching nearly 400 feet high, *Sequoia sempervirens* relies on fog for 30% of its water needs. Working against gravity to pull water up hundreds of feet through xylem tubes would limit the trees' height were it not for unique adaptations allowing them to access the water they need.

Fog water can be taken in through the epidermal tissue of the sequoia's flat needles, as well as being absorbed directly through bark. Heavy fog collecting on redwood foliage drips to the forest floor, soaking into the ground to be taken up by roots.

The oldest known coast redwood is 2,200 years old.

Once covering over 2 million acres along the coast, redwoods were heavily logged in the 1800's and many of the grandest were sent to the sawmill.

A project is underway to bring back the strongest, mightiest trees of *Sequoia sempervirens* through genetic cloning of basal trunk sprouts from long-felled giant trees. The hope is that the genetic make-up of these sprouts will produce the tallest, strongest, most resilient examples of the species.

Groves of these young clones of the mightiest of the ancients have been planted in San Francisco, New Zealand, Great Britain, and other locations with suitable climate. Perhaps, once again, great *Sequoia sempervirens* forests will spread across the globe.

Tree #751, sec. D on map available at the front desk.

Sciadopitys verticillata

Sciadopitys verticillata , the Japanese Umbrella Pine, has spread its umbrella-spoke whorls since the time of dinosaurs. Fossil records date this tree back to the Upper Triassic, 230 million years ago. One of the oldest of all existing conifers, its prehistoric range spread across North America, Europe and Asia.

Waxy, evergreen 'leaves' radiate in whorls of 10 – 30. The photosynthesizing 3-5" strap-like leaves are actually *cladodes* , modified stem tissue. The true leaves appear as tiny brown bracts hugging the stem. Trunk bark is thin, orangish to reddish-brown, exfoliating in long strips.

Upward-facing cones form in the terminal branch whorls. 4"cones are barrel-shaped, greenish with tan edging, becoming woody brown with chunky scales.

Now growing wild only in Japan, *Sciadopitys* thrives in mid-altitude cloud forests with high rainfall and humidity where it can grow to 100' or more.

In our midsouth region, *Sciadopitys* prefers moist, slightly acidic soil with good drainage, sun with afternoon shade, growing slowly to 30 or 40'.

Tree #118, sec. L on map available at front desk.

Ginkgo biloba – ' *the 2-lobed silver apricot'*

Ginkgo biloba is a curiously unique tree. With delicate, fan-shaped leaves and a flexible reproductive strategy, ginkgo has survived environmental upheavals of crashing continents, ice ages and floods, dinosaurs and meteorites, to grow and reproduce for 270 million years.

The ginkgo tree has intrigued and puzzled scientists for centuries:

A seed encased in a fleshy plum-like pulp that is not a fruit because the tree has no flower, and therefore, no carpel (ovary) to hold the ovule (egg).

This means the ginkgo is not an angiosperm (vessel seed / flowering plant), but a gymnosperm (naked seed). Most gymnosperm plants we know are conifers, but not the ginkgo…

Ginkgo trees are dioecious, with male and female reproductive parts on separate plants. Female ginkgo trees develop paired ovules on slender stalks in the axils of leaves growing from spur shoots. (Conifer seeds grow on cone scales.) Ginkgo ovules have both fleshy and hard outer seed layers (*integument*), are round and green, ripening to yellow.

Male trees have catkin-like pollen strobili, clustered in the axils of leaves on spur shoots. Pollination is by wind in springtime, the catkins falling immediately after. Fertilization (by flagellated sperm) begins in springtime and continues for 4-5 months into autumn when the seed falls. Squirrels and other animals aid in seed dispersal.

After several days on the ground, the ripened fleshy integument turns purplish-green, giving off a rotten odor of butyric acid. Internal embryo development continues for seven months with seed germination in the coming spring.

Ginkgo is a gap-opportunist in forests, biding its time in the shade until an opening appears in the canopy, then bolting upward to fill the space. In cases of soil disturbance or erosion, Ginkgo biloba can reproduce clonally from embedded buds, *lignotubers* , near the trunk base. In older trees with crown damage, latent spur buds create burls on large branches from which aerial roots can grow down, rooting when they touch the earth and then producing leafy growth. The upper side of burls can generate green shoots leading to expanded tree tops.

Ginkgo biloba is native to China, can grow 100’ tall and live over 1,000 years (3,500 the current oldest). Ginkgo enjoys full sun, medium water, good drainage, and is pH adaptable.

Tree #109, sec. K on map available at front desk.

Sources : www.mortonarb.org ; www.science.sciencemag.org ; www.landscapeplants.oregonstate.edu ; www.conifers.org/the gymnosperm database 2019 ; www.missouribotanicalgarden.org ; C.N.Page in Kubitzky 1990; ‘Ecological Conservatism in the Living Fossil Ginkgo’ Royer, Hickey, Wing 2003, Paleobiology 29(1); Zhang, Jian-Wei, Ashalata D’Rozario, Jonathan M. Adams, Ya Li, Xiao-Qing Liang, Frédéric M. Jacques, Tao Su, and Zhe-Kun Zhou. 2015. *Sequoia maguanensis* , a new Miocene relative of the coast redwood, *Sequoia sempervirens* , from China: implications for paleogeography and paleoclimate. *American Journal of Botany* , Del Tredici, Peter. 1999. Redwood burls: immortality underground. *Arnoldia* 59(3):14-22; https://www.conifers.org/refs/ farjon05 ; http://www.forestry.gov.uk/pdf/eng-bedgebury-tree-info-japanese umbrella pine; "More on Morphology of the Ginkgoales" ; *www.ucmp.berkeley.edu;* . http://www.biologydiscussion.com/essay/gymnosperms/essay-on-the-life-cycle-of-ginkgo-biloba gymnosperms-botany/77616 **;** https://www.hindawi.com/journals/ism/2012/230685/; http://bioweb.uwlax.edu/bio203/2011/lehrer_brit/reproduction.htm; The swimming of the Ginkgo sperm **by William (Ned) Friedman, Director of the Arnold Arboretum, 2015**

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