A Tour of the Oaks of the Arboretum des Pouyouleix

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Oaks (*Quercus*) occupy every ecological niche in the Northern Hemisphere. The natural distribution of the genus only extends into the Southern Hemisphere in Indonesia where a few species can be found. In Europe there are 38 species, in Asia 156, while North and South America together harbor 236, for a worldwide total of 430. Visitors to the Arboretum des Pouyouleix are always surprised to learn that Mexico, with 150 (90 of which are endemic), is the country with the greatest number of species.

The diversity in number of species is paralleled by the morphological diversity of the

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Oak (*Quercus*) acorns are diverse in size and form. Clockwise from upper left: *Q. insignis* (Mexico); *Q. chrysolepis* (USA); *Q. hypoleucoides* (USA); *Q. dolicholepis* (Asia); *Q. monimotricha* (Asia); *Q. macrolepis* (Europe)

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Leaves of the Mexican oak species *Q. urbanii* are bright crimson when newly emerged.

The handsome form and foliage of loquat oak (*Q. rysophylla*) has made it a favorite of plant connoisseurs.

***Quercus viminea,* native to Mexico, has elegant, glossy foliage.**

***Quercus cornelius-mulleri* is a scrub oak native to California and Baja California. It was named for noted botanist and ecologist Cornelius H. Muller (1909–1997).**

leaves, as reflected by some of their common names: maple-leafed oak, loquat oak, chestnut oak, bamboo oak, holly oak, willow oak, myrtle-leafed oak, laurel oak, and so on. The diversity of acorn morphology is as surprising and wonderful as the diversity of leaf morphology and habit.

Since the oak collection of the Arboretum des Pouyouleix is planted geographically, I'd like to introduce *Arnoldia* readers to some of the most interesting oaks here by taking a tour through the collection and providing some details and personal memories of collecting trips around the world.

MEXICO

Though I find it impossible to decide which is my single favorite oak, without a doubt my favorite oaks come from Mexico. Beyond their extraordinary diversity and beauty, my fondness results from the facts that, one, many of my best oak adventures with both the plants and the people interested in those plants are linked to that country, and two, that all of the Mexican oaks, with a few exceptions, grow so well here at the Arboretum des Pouyouleix. To be sure, there are beautiful and interesting oaks all over the world but for me nothing quite so extraordinary as a young leaf of *Q. urbanii,* as unbelievable as the acorn of *Q. insignis,* as elegant as *Q. viminea,* as majestic as *Q. rysophylla*—the list of superlatives is endless.

Although it might be an exaggeration to say that *Q. rysophylla,* loquat oak, is everybody's favorite tree, it does have an impressive list of admirers. It was selected as "Tree of the Year" in 2015 by the International Dendrology Society (IDS), and botanist Allen Coombes, writing for the IDS Yearbook, described the young coppery leaves as quite unlike anything he had ever seen before when he first saw the tree in 1980 (Coombes 2016). John Grimshaw, in *New Trees: Recent Introductions to Cultivation* (Grimshaw and Bayton 2009), wrote, "Of all the trees in this book, *Quercus rysophylla* is the one that has made the greatest impression on me, wherever it has been seen, and if only one 'new tree' were to be grown, this should perhaps be it." In 1978, Lynn Lowery, horticulturist and plant collector from Texas, regarded this species as a VIP (very important plant) (Creech 2016) and John Fairey, another noted plant collector and nurseryman from Texas, said "If I had to have one oak, it would be *rysophylla.*" (Raver 2012). Our first *Q. rysophylla* was grown from acorns collected in Chipinque Park in Nuevo Léon, Mexico, and planted here in 2004, measuring 23 centimeters (9 inches) tall. Today it measures nearly 9 meters (30 feet). The lovely dark green, thick and shiny, nearly sessile leaves are densely clustered and, when young, vary in color from bronze to red. We have planted six other trees of this species, which have grown even faster.

"9,490 Kilometers Across Mexico" (Chassé 2011), an account of my second trip to Mexico, in 2010, could just as well have been titled "In the Footsteps of Cornelius H. Muller." Perhaps *Quercus mulleri* and *Q. cornelius-mulleri* are the most immediately visible traces in the oak world of this incredible botanist who was still actively involved, in his mid-eighties, in preparing the *Quercus* section of the *Flora of North America* with botanist Kevin Nixon. Muller was indefatigable in the field and a large part of my itinerary in 2010 was based on the detailed location descriptions of the oak discoveries he made during his adventures in northern Mexico. These included *Q.* × *basaseachicensis* near the Basaseachic Falls in Chihuahua, *Q. flocculenta* halfway up the Cerro Potosí in Nuevo Léon, *Q. edwardsiae* in Chipinque, Nuevo Léon, but above all, in Chihuahua, *Q. deliquescens,* which provides a story that started in the town of Delicias ("delight" in Spanish) and ended in Milagro ("a miracle").

Muller wrote, "Recent heavy concentration of collecting efforts in the Chihuahuan Desert region of Mexico … have yielded much new information on the flora and its distribution. Among the novelties is a striking species of *Quercus* here described as new" (Muller 1979). The text continues with a precise description of how to approach the location (most useful even when one has GPS coordinates) and so off we went, leaving Delicias for the town of Julimes to get to the Sierra del Roque "… as approached from Minas Las Playas via Rancho El Saucito." After several hours of very difficult and slow driving through the Chihuahuan Desert,

The Arboretum des Pouyouleix, National Oak Collection (France)

How does one become an oak nut? Initially, my motivation was simply to create a botanic garden. But while my companion and I drove around southwestern France in search of suitable land, we kept noticing a majestic tree that dominated the landscape—it was *Quercus robur*. Though perhaps best known as pedunculate or English oak, it is such a common tree in northern Europe that it has dozens of common names in many languages. This inspired us to make oaks the focus of our future garden.

The Arboretum des Pouyouleix is located in the north of the Aquitaine region of France, in the department of the Dordogne, roughly 150 kilometers (93 miles) north of the city of Bordeaux and 200 kilometers (124 miles) from the western coast of France. The topography is quite variable, which provides planting sites with differences in soil composition and structure, drainage, exposure (to both wind and sun), and temperatures. Although we are theoretically in USDA Hardiness Zone 8b (average annual minimum temperature -9.4 to -6.7°C [15 to 20°F]), we rarely experience winter temperatures lower than -4°C (24.8°F), and summer highs are quite often in the mid 20s to 30°C (77 to 86°F). The average annual rainfall (for the past 11 years) is 917 millimeters (36.1 inches).

We decided to create the collection with plants raised from seeds, and preferably from wild-collected seeds in order to reduce (though not entirely eliminate) the possibility of hybridization. A propitious encounter in 2005 with several European oak enthusiasts from the International Oak Society paved the way for a series of collecting trips that have taken me across North America, Mexico, Vietnam, and Taiwan, collecting dozens of species including several new to cultivation in Europe.

The Arboretum des Pouyouleix now holds a little over 300 *Quercus* taxa (including 38 species on the IUCN Red List) and is certified as a National Collection for the genus in France. In addition, the Arboretum has about 600 taxa in a variety of other genera. The table below shows the growth rate of seven *Quercus* species at the Arboretum des Pouyouleix.

NAME	DATE PLANTED AND HEIGHT (m)		HEIGHT (m) 2015	AVERAGE ANNUAL GROWTH
Q. imbricaria[1]	12/2003	2.00	11.00	0.75
Q. saltillensis[2]	11/2011	0.09	3.50	0.90
Q. rysophylla[2]	11/2004	0.23	8.00	0.70
Q. dentata[3]	11/2004	0.87	6.00	0.50
Q. mexicana[2]	06/2012	0.40	5.00	1.50
Q. myrtifolia[1]	03/2008	0.11	3.50	0.50
Q. hintoniorum[2]	03/2007	0.10	4.50	0.60

Native to: [1]North America; [2]Mexico; [3]Asia

The Arboretum des Pouyouleix has varied topography that provides ideal sites for many oak species.

and, according to Mr. Muller's coordinates, just a hop, skip, and a jump from *Q. deliquescens,* we found ourselves confronted with a difficult choice: there before us, for as far as the eye could see in either direction, stretched a very tall barbed-wire fence. To go or not to go over the fence? What would you have done?

Driving back to civilization, we realized that we had started off without thinking to bring any food with us, although we did fortunately have enough to drink. So it was a miracle indeed, that the first town we came to, after several more hours of driving, had a small restaurant named … El Milagro! But, truth to tell, the real miracle was that we were luckier than Mr. Muller who ends his description of the species with "… acorns unknown." This species is considered vulnerable by the International Union for Conservation of Nature (IUCN).

The area devoted to Mexico is the largest part of the Arboretum des Pouyouleix and comprises

***Quercus deliquescens* is a rare oak species native to Chihuahua, Mexico.**

Abundant male flowers are seen on the Mexican species *Q. hintoniorum*.

the greatest number of taxa. Many delightful oaks rare in cultivation can be found here: *Q. macvaughii; Q. miquihuanensis,* an endangered species; *Q. hintoniorum,* listed as vulnerable; *Q. crassifolia; Q. furfuraceae,* listed as likely endangered; and *Q. liebmannii,* to name but a few.

ASIA

Current phylogenetic understanding of the genus *Quercus* is that it is composed of eight lineages or groups. The group known as the ring-cupped oaks (section *Cyclobalanopsis*) is only found in Asia. Not all of the oaks that grow in Asia belong to this group—some of them belong to the white oak (section *Quercus*) lineage, which is ubiquitous throughout the natural distribution. Hands down, the ring-cupped oaks would win first prize in a contest for the most un-oak-like plants (at least for Western eyes), just as they would also win the contest for the group whose members are the hardest to distinguish from one another. Come to think of it, the seeds of at least two species, *Q. macrocalyx* (China, Southeast Asia) and *Q. pachyloma* (Southern China, Taiwan), would probably also win first prize in an acorn beauty contest. These two species, collected in Vietnam and Taiwan, respectively, are still in the nursery, perhaps to be planted this year.

Quercus myrsinifolia (China, Japan, Southeast Asia) and *Q. glauca* (China, Japan, Southeast Asia, Afghanistan, Bhutan, Nepal, Sikkim, India) are the two most common oaks from this group found in collections in Europe, the former having been introduced to cultivation in 1854 and the latter in 1804. We have several trees of both of these species that grow well. *Q. myrsinifolia* makes a prettier tree here, whereas *Q. glauca* tends to be bushy. This group of oaks is not very well represented in American arboreta. Of the 20 gardens in the Plant Collections Network (PCN) *Quercus* Multisite Collection, the University of Washington Botanic Garden has four, Bartlett Tree Research Lab (North Carolina) has five, and the Scott Arboretum (Pennsylvania), the University of California–Davis Arboretum, and the Morris Arboretum (Pennsylvania) each has one. Though not part of the Multisite Collection, the Aiken Citywide Arboretum (South Carolina) also has four.

My two favorite ring-cupped oaks growing here are *Q. salicina* (Japan, maybe Taiwan) and *Q. gilva* (Japan, Southern China, Taiwan, Vietnam). *Quercus salicina* is just a perfect, graceful tree. The leaves, evergreen (as with all *Cyclobalanopsis*), are elegantly elongated with a twist at the end. It will produce new leaves at various times from spring until early autumn, coloring the tree to different degrees in a beautiful deep burgundy red that fades to pink and finally to green. Of all our evergreen species it is one of the few that suffered absolutely no damage during a horrific 15-day cold spell in February 2012 with temperatures at night dropping to -18°C (-0.4°F), and daytime temperatures never above -8°C (17.6°F). *Quercus gilva* is one of the more easily recognizable *Cyclobalanopsis* in part because its leaves are characteristically widest in the middle but especially because the new leaves and shoots are distinctly yellow with a soft tomentum, giving it a unique ornamental quality

The Arboretum's Asia section also has many Asian oaks that are in sections other than *Cyclobalanopsis: Q. dentata,* with its huge, leathery leaves and sculptured bark; *Q. spinosa,* a very rare oak in cultivation; and *Q. semecarpifolia,* which holds, along with *Q. guyavifolia* and *Q. monimotricha,* the oak record for high-

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Asian oak species *Q. macrocalyx* (left, photographed in Vietnam) and *Q. pachyloma* (right, photographed in Taiwan) have fabulous acorns.

Asian evergreen oak species *Q. salicina* (left) and *Q. gilva* (right) have handsome foliage.

altitude living (up to 4,000 meters [13,123 feet] for the first two and 4,600 meters [15,092 feet] for the latter).

Our expedition to Vietnam in 2013, though not entirely satisfactory in terms of the number of oaks found, was most interesting in what it revealed about the presence of certain oaks hitherto unreported in northern Vietnam (Chassé 2014). Much remains to be learned about the status of the oaks of Vietnam, indeed, about the forest communities in general, since during the second half of the twentieth century war, forest fires, slash and burn agriculture, encroachment for industrial purposes, and other forms of anthropic pressure have reduced forestland in Vietnam from 43% of the country's surface area in 1940 to 17% by the late 1970s (Bien 2001).

Daimyo oak (*Quercus dentata*), native to Japan, Korea, and China, bears enormous leaves.

EUROPE

Oak species diversity in Europe is not very high but there is interesting morphological diversity within the species present, and a few of them can indeed become most spectacular trees with truly impressive lifespans, especially *Q. robur,* pedunculate or English oak. This species also has the honor of being the first oak to have had its genome entirely sequenced (Plomion et al. 2015), a milestone for research into the evolutionary history of the genus. From an aesthetic point of view, the problem with quite a few European oaks is that they are moderately to severely affected by many diseases (powdery mildew, rusts, etc.) that, although not lethal, make the trees rather unattractive fairly quickly after the appearance of new foliage in spring.

Quercus alnifolia, endemic to Cyprus, is one of my favorites with its golden yellow to orange tomentum on the underside of the round and shiny evergreen leaves and its fabulously elegant acorns. It is a large shrub or small tree (6 to 9 meters [20 to 30 feet]) and as such makes a wonderful addition to any small or medium-sized garden. *Q. frainetto* (Balkans, Bulgaria, Greece, Hungary, Italy, Romania, and Turkey) is another very special European oak, the deep sinuses of the leaves giving a delicate lacelike aspect to the silhouette. This species is also less prone to the above-mentioned afflictions.

But my vote for the prettiest of all European oaks would be *Q. macrolepis.* Found across southeastern Europe from the Balkans to the Aegean Sea, Italy, and Turkey, it can be a shrubby tree of 5 meters (16 feet) or attain grand heights of 25 meters (82 feet) or more. The very striking silvery, grayish white color of the new leaves makes it a true eye-catcher on sunny spring days. And then of course, there is the acorn: one of the most fabulous of the genus (see page 29). I think that part of my enchantment with this species comes not only from its beauty but also from the importance of these acorns in human history, both in the leather-tanning industry for more than four hundred years (Mayer Maroulis 2014) and as a food source for probably much longer than that (Chassé 2016).

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Interesting European oak species include (top to bottom) *Q. alnifolia* (photographed in Cyprus), *Q. frainetto* (photographed at Wisley, United Kingdom), and *Q. macrolepis*.

NORTH AMERICA

We move now into the North American section. A dry, rocky, poor-soil area in this part of the Arboretum has proven to be an ideal place to plant many oaks from the southern (both east and west) United States. Generally, these oaks are accustomed to some level of environmental stress such as little rain, few nutrients, or harsh sun exposure. They are healthy plants here in France, many of them fruiting after only a few years, but tend to be slow growers. Four specimens of my favorite one, *Q. palmeri,* raised from seed collected in 2007 in Riverside County, California, were planted here in 2008, each measuring about 8 centimeters tall. Today they are all about 1 meter tall (trees of this shrubby species are generally not more than 3 meters tall at maturity). The emblematic southern live oak (*Q. virginiana*), one of the most magnificent oaks of the southern United States, with its wide-spreading branches that are often dripping with Spanish moss in its natural habitat from Texas to Florida and northward to Virginia, does very well here, as do *Q. chapmanii,* which is also from the southeast, *Q. toumeyi* from Arizona, and *Q. engelmannii* from California (listed as vulnerable on the IUCN Red List).

New foliage and flower buds of *Q. palmeri,* a shrubby oak native to California, Arizona, New Mexico, and Baja California.

Nearby is an area with deep, rich soil that we call "la Grande Prairie." It was the first part of the Arboretum to be planted, on December 7, 2003, with the help of many neighbors and friends. We planted nearly 300 trees, most of them here. Under a bright blue sunny sky we toiled away and, when we were finished, it began to rain. Though I am not at all a superstitious person, one has to admit that this was a good omen! In this part of the Arboretum can be found most of the common North American oaks. I use the word "common" in the sense that they have been in cultivation for a long time—some for more than two centuries—and can be easily obtained through the nursery trade, but they are nonetheless extraordinary trees. Northern pin oak (*Q. ellipsoidalis*), scarlet oak (*Q. coccinea*), Shumard oak (*Q. shumardii*), willow oak (*Q. phellos*), shingle oak (*Q. imbricaria*), northern red oak *(Q. rubra*), water oak (*Q. nigra*), swamp white oak (*Q. bicolor*), white oak (*Q. alba*), black oak (*Q. velutina*), bur oak (*Q. macrocarpa*), pin oak (*Q. palustris*), and many, many others are thriving here, reaching heights (for the fastest growers) of more than 15 meters (49 feet) since 2003. This area of the Arboretum is the best seat in the house come autumn as this mix of trees produces a vertiginous scale of color from yellow to orange to pink to red, set off by the surrounding chestnut-oak woodland that gives a magnificent backdrop of yellow and orangish brown.

It is in this part of the Arboretum that I am occasionally struck by the awesome temporal dimension of what it means to plant trees. In just thirteen years, these trees, destined to live several hundred years, have created a world of their own but of which I am a part. And though, regrettably, I will not live for several hundred years, it is as though my trees have created a bridge through time for me. This exceptional experience was magnified a hundred-fold when I visited the Arnold Arboretum in October 2015 because, of course, many of the trees there (oaks and other) have been planted for decades, some for more than a century. They are thus at once a bridge through time past and time future. For those of us who plant trees, the Arnold is truly a unique voyage, and without a doubt the most magnificent arboretum I have ever visited.

Many of the North American oaks display bright autumn leaf color. From right to left, going down the hill, *Q. palustris, Q. coccinea,* and *Q. muehlenbergii.*

On either side of "la Grande Prairie," moderately steep slopes with rather poor soil have provided well-drained, sheltered areas for the planting of more fragile species from North America. I have come to the conclusion that, although cold is obviously a limiting factor to plant survival, heavy, rich soil and too much water in the fall and winter are equally serious handicaps for a great many oaks. On these slopes, many oaks that probably shouldn't enjoy being here because of the cold are very happy indeed: *Q. myrtifolia* (fruiting this year) and *Q. inopina* from Florida, and *Q. invaginata* and *Q. insignis* from Mexico, to name but a few.

CONCLUSION

As we turn to walk back up "la Grande Prairie" I should just point out a fine specimen of *Q. tomentella,* an oak endemic to the Channel Islands (off the coast of southern California), considered to be vulnerable by the IUCN. Near the house and other buildings, at the top of "la Grande Prairie," many oaks, irrespective of geographic origin but that share the characteristic of being rather short and liking fairly poor soil, have been planted, including *Q. vacciniifolia* from California, *Q. pumila* from Georgia, *Q. minima* from South Carolina, and *Q. guyavifolia* and *Q. monimotricha* from China.

Many, many seeds have been—and are being—sown here at the Arboretum des Pouyouleix. The seeds collected during the trips I've mentioned in this article, and plants raised from them, have been shared with different gardens and arboreta in France and around the world (Argentina, Belgium, China, the Czech Republic, Germany, the Netherlands, Spain, Taiwan, the United Kingdom, the United

States of America, and Uruguay). A few years ago, there were almost exclusively Mexican and North American species in our nursery: these days, almost only Asian species, with many wonderfully exciting plants from Vietnam, China, and Taiwan, including some that have yet to be identified.

In these times of ecological crisis, I should like to end this little journey with a sincere homage to plant collectors and plant propagators past and present. Identifying fragile zones and endangered species is surely a useful exercise, but is it not necessary, if we want to save those species, to have knowledge about their cultivation? In Europe, very nearly the only arboreta that are growing many endangered oak taxa, or, less dramatically, the more recent introductions, are the private ones. These collections are a valuable resource for conservation efforts and for building awareness about the beauty and the diversity of our planet.

Runner oak (*Q. pumila*) is a shrubby, spreading oak native to the Coastal Plain of the southeastern United States.

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