



# International Oaks

*The Journal of the International Oak Society*

Spring 2006



**Issue No. 17**  
**Spring 2006**



# INTERNATIONAL OAKS

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Inside front: Acorns of *Quercus alba*  
Back: *Q alba*, the Gudge Oak  
Inside back: NADF Survey poster

International Oaks Number 17  
is designed by Clark Communications,  
Asheville, North Carolina, USA  
2006

## Note from the President

Dear Members of the International Oak Society,

In autumn 2005, the Bremen Botanic Garden in Northern Germany, well known for one of the largest *Rhododendron* collections worldwide, celebrated its 100th anniversary. The jubilee meeting had the motto “biodiversity” on its programme, with speakers from all around the world. On behalf of the International Oak Society, I gave a presentation about the biodiversity of oaks, and provided thirty different oaks from all over the world, as a birthday gift. These oaks were raised from acorns that I received directly from members and from the seed exchange of the International Oak Society, and from collecting trips organised by our society. Thanks to your contribution and your help, an oak collection in Northern Germany has been started! Meanwhile, the interest in oaks and all subjects related to our favorite genus grows constantly. In recent years, at least five major oak collections have been founded or are planned in Europe, most of them with the help of the IOS, in form of plants or ideas.

As I wrote last year, our concern must go not only to collections, but also to the natural stands of oaks and oak forests. Whilst the planting of an oak collection is *ex situ* conservation, more important is the *in situ* conservation of oaks in their natural habitat. Only if we can save the ecosystems where oaks are living can we save the tree inventory included in it, for the long term. The newest report on forests in Europe, just released in January 2006, reported that oaks are amongst the most seriously infected trees of central European forests. In Germany, 51 % of all adult oak trees are more or less in decline. Some of our members are involved in saving or replanting oak woods and forests, and many of our members do research with oaks and oak ecosystems. I hope that we, as Oak Society members, can continuously bundle knowledge and enthusiasm on this level, and perhaps increase these efforts in the future.

Another aspect of oaks is their horticultural or ornamental value. It is fascinating to see more and more American oak cultivars, with sometimes outstanding aspects, appearing in the trade in North America and in Europe, and in parts of Asia, as well. We can expect more in the near future. The International Oak Society serves as registrar for oak cultivars, and spreads the word of the new entries via their publications. This is an important task for us.

The upcoming Fifth Triennial International Oak Conference in Texas will summarize much of the activities done by members of the International Oak Society. I hope you all have the chance to attend at this major event in our society’s life, and that you have time to take part, not only at the presentations but also on one or two tours that will be organised in the surroundings of our Conference location. Do not miss the chance, and do try to come. You will find more information on the Conference in our newsletter, and on the website of the International Oak Society; check it frequently for updated news.

At this Conference, there will be also the election of the Board of Directors. The three-year term of current Directors expires with the end of our Triennial meeting. Within the coming weeks you will get information about the ballot, and I hope that you will participate in the election of the new Board of Directors. Your vote is important!

This issue of *International Oaks* contains another compilation of articles dealing with oaks, written by our members. Our journal stays alive only if members continuously contribute articles, making “*International Oaks*” a diverse publication. In this issue, you will read about several oak species, such as *Q. garryana*, *Q. alba*, *Q. xwarburgii*, and *Q. robur*, and the attempts to preserve a single oak tree. You will learn about oaks serving as trail markers in history, about systematic problems in the *Fagaceae* family, and about new oak cultivars. And you will find a portrait of Aimée Camus, a lady who devoted much of her life to the study of oaks. The result is this fine volume, effectively produced with the time-consuming work of Ron Lance and Guy Sternberg. Thanks to all contributors, and to the entire Editorial Committee for this new journal!

See you in Texas,  
and best wishes,

Eike Jablonski  
*President*  
International Oak Society

# Garry Oak (*Quercus garryana*) and its Form in the Environment and Cultural Landscape of Southwestern British Columbia, Canada

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*all photos courtesy of the authors*

**Key words:** Garry oak, *Quercus garryana*, form, aesthetics, historical accounts, landscape preference, British Columbia.

## Abstract

In southwestern British Columbia, Garry oak (*Quercus garryana*) has a varied and interesting form which evokes a strong aesthetic response in many people. Research suggests that Garry oak has been a highly valued aesthetic resource in British Columbia from the early colonial period to the present. The special appeal for the Garry oak environment can be found in the accounts of explorers and early settlers. The imagery employed in these accounts draw parallels with idealized landscapes in the picturesque tradition, or to the parks and pleasure grounds of Europe. The strength of Garry oak's aesthetic appeal is evidenced in the manner it is employed in the cultural landscape of southeastern Vancouver Island where it is used as a landscape feature in more affluent and / or established residential neighbourhoods and as a setting for memorials.

This paper explores the source of this oak's aesthetic appeal as related to forms described in an ecological survey and represented in the Bolsinger hardwood classification system from California. The almost-universal appeal of this tree may be partially explained by landscape preference research. Specifically, the savannah-like setting and ethereal qualities associated with the complex oak form result in a preference for the tree and its landscape. We suggest here that a relationship may exist between the strength of preference for this tree and complexity of form in the classification.

## Introduction

Garry oak (*Quercus garryana* Dougl.) is a Pacific coastal, deciduous white oak (Figure 1), which extends north only to southwestern British Columbia (B.C.) from its southern range in California (Erickson 1993). Therefore, the occurrence of Garry oak on the southern Gulf Islands and adjacent Vancouver Island (Figure 2) is unique within Canada. These oak savannahs and woodlands exhibit a variety of interesting vegetation types, expressed in attractive forms, textures, patterns and shapes, which evoke mystery and complexity.

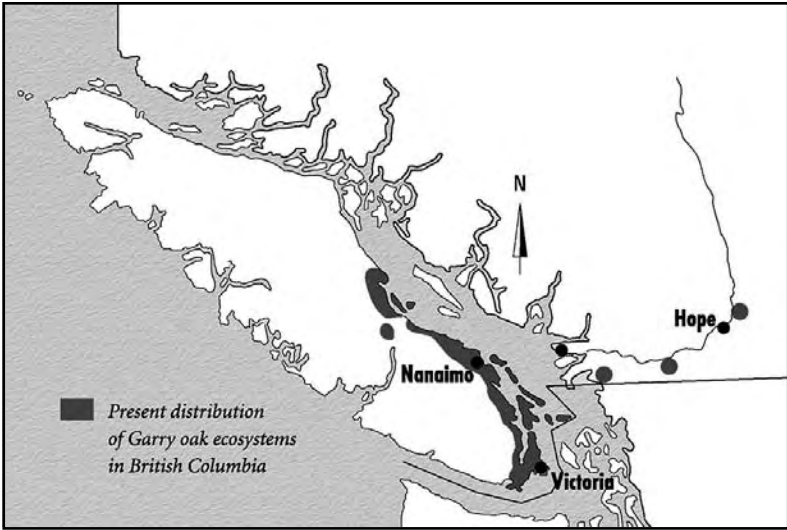


**Figure 1.** The form of Garry oak. ©Briony Penn.

Garry oak ecosystems have been recognized among the rarest and most threatened in Canada (Erickson 2000), there being lost at an alarming rate to continuing urban development (Erickson 1996). Garry oak fascinates many residents, and there is considerable interest in its form (Erickson and Campbell 2001). Research (Lutz 1995, Penn 1992) suggests that Garry oak has been a highly valued aesthetic resource in B.C. from the early colonial period to the present.

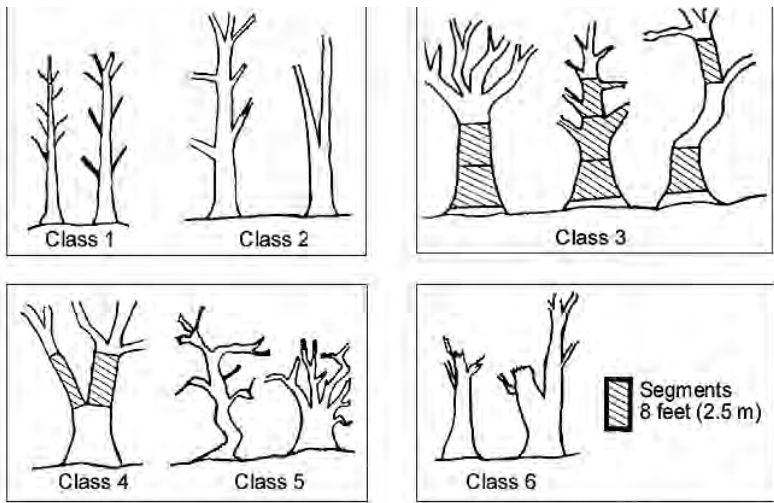
The aesthetic value of Garry oak finds expression in the way it is employed in the cultural landscape of southeastern Vancouver Island. Garry oak was intentionally retained as a landscape feature in projects such as the Uplands Park (designed by the prestigious Olmstead Brothers of New York), the Village of Oak Bay and the neighbourhood of Fairfield. As a result this tree has come to signify affluence and elevated social status on southeastern Vancouver Island. The aesthetic qualities of Garry oak and its environment, and the park-like image they convey, have also been employed as a setting or backdrop for memorial and commemorative features.





**Figure 2.** Range of Garry oak in British Columbia, Canada.

We suggest here that its aesthetic appeal arises from the emotions and feelings evoked by the physical attributes of this tree. Although no research exists that specifically examines preferences for Garry oak over other trees, inferences can be drawn from other, broader scale research (Hamilton 1995, Gobster 1994, Dearden 1984). Additional discussion explores the basis for the aesthetic appeal, of the form and setting of Garry oak, both in the context of contemporary landscape preference research, and as related to the California hardwood form classification (Bolsinger 1988, Erickson and Campbell 2001).



**Figure 3.** Oak form classes, from Bolsinger (1988).

## Approach

The California hardwood classification of Bolsinger (1988) (Figure 3) was applied to tree form descriptions on approximately 250 representative ecological plots across the range of Garry oak in B.C. The current paper follows from this survey and analysis which encompassed biotic and ecological characteristics, management strategies, the applicability of the hardwood classification, wildlife habitat features, classification and their relationships (Erickson 1996, 2000, Erickson and Campbell 2001).

Depictions of Garry oak were explored in the literature from colonial times to the present. The accounts were consulted to determine the extent to which Garry oak environments have been employed as an aesthetic and spiritual resource in B.C. Findings are summarized and illustrated in discussions of landscape preference theory and possible explanations of the appeal of Garry oak. These include innate preferences for savannah-type landscapes, and the factors of visual complexity / diversity, mystery, and familiarity. Aesthetics and landscape preference for Garry oak are discussed relative to the Bolsinger form classification.

## A Historical Overview of Representations of Garry oak in B.C.

Research (Lutz 1995, Penn 1992) suggests that the aesthetic appeal of Garry oak has been highly valued from the early Colonial period to the present in B.C. Observations regarding this landscape made by explorers, settlers, poets and others are many, suggesting a timeless appeal and expressing delight and fascination for this unique landscape.

An example is Captain George Vancouver's poetic description of the Garry oak landscape of southern Vancouver Island in May of 1792: *'almost as enchantingly beautiful as the most elegantly furnished pleasure grounds in Europe. To the northwest was a coppice of shrubs of various sorts that seemed as if it had been planted for the sole purpose of protecting this delightful meadow over which were promiscuously scattered a few clumps of trees that would have puzzled the most ingenious designer of pleasure grounds to have arranged more agreeably. I could not possible believe that any uncultivated country had ever been discovered exhibiting so rich a picture, a picture so pleasing could not fail to call our remembrance to certain delightful and beloved situations in Old England'* (Penn 1992).

In 1843, James Douglas, later to become Governor of the Colony of Vancouver Island, spoke of this landscape in a more restrained tone, as *'the most picturesque and decidedly the most valuable part of the island that we had the good fortune to discover'* (Penn 1992). A similar response was elicited in 1846 from Berthold Seemann, naturalist aboard the HMS Herald, who observed *'we thought we had never seen a more beautiful country; it quite exceeded our expectation; and yet Vancouver's descriptions made us look for something beyond common scenery. It is a natural park; noble oaks and ferns are to be seen in the greatest luxuriance; thickets of the hazel and the willow, shrubberies of the poplar and alder are dotted about. One could hardly believe this was not a work of art'* (Lutz 1995).

Donald Fraser, a London Times correspondent visiting Victoria in 1858, describes the Garry oak landscape encountered as *'clumps, open glades, rows of single trees of umbrageous form, presenting an exact copy of English park scenery'* (Penn 1992).

A final view offered by geographer Charles Forbes, while similar, also employs imagery suggesting a landscape steeped in the mysterious and the sublime: *'The whole district is very beautiful and salubrious...with Druid-like groves of oak and solemn-looking clumps of pine intermingled with the varied foliage of a thick shrubby undergrowth'* (Forward 1976).

### **Garry oak as an Icon in the Cultural Landscape of Vancouver Island**

The preceding passages illustrate the significant historic aesthetic value and general appeal of the Garry oak environment. Further evidence is found in the rich and varied manifestations of this tree and environment in the cultural landscape. Here Garry oak transcends being a mere landscape feature or curiosity and assumes a deeper, symbolic meaning, which becomes more readily apparent when examining its varied roles in Victoria's urban landscape.

### **Garry oak in the Public and Private Realm of the Urban Landscape: The Uplands and Fairfield Neighbourhoods of Victoria**

The symbolic and spiritual value of Garry oak finds expression in the public- and private-realm landscapes of Victoria. The tree and its environment have been incorporated as street trees and/or landscape features in the streetscapes in two notable southern Vancouver Island neighbourhoods: the Uplands and Fairfield (**Figure 4**).

The Uplands subdivision, designed in 1907 by the Olmstead Brothers, landscape architects, makes extensive use of the aesthetic characteristics of Garry oak. From inception, this has been known as an affluent, fashionable neighbourhood (Forward 1973) and envied for its pastoral qualities. The Uplands design was innovative for the time, in that it intentionally planned retention for extensive areas of Garry oak meadow, in order to reinforce the park-like character of the landscape (op.cit.). This design created a pleasing public-realm, with small parks throughout the development which



**Figure 4.** The Garry oak is often a central feature in the residential landscapes of the Uplands.

incorporate Garry oak meadow, individual oaks and rock outcrops as streetscape features. In the private realm, many Uplands homeowners saved large Garry oaks with their meadows and rock-outcrops for landscape amenity. Many homes are situated to avoid removing oaks and to make best use of rock-outcrops in the overall landscape design.

Incorporating these features into the landscapes makes the transition between the public/private-realms ambiguous and reinforces the leafy, park-like image of one of the most desired, and well-known, neighbourhoods in the region. The

extensive remnants of native vegetation found in both realms, combine with the curvilinear streets and irregular lot layouts, to create the pastoral, park-like image characterising this development.

In Fairfield neighbourhood, the presence of Garry oak still significantly influences the landscape character and image of both the public and private realms, but less dramatically so. As in the Uplands, oaks remain scattered along small street-end parks, street boulevards, and the private landscapes of homeowners.

Garry oak is less extensively employed in the landscape in less affluent neighbourhoods. The association of the oak with park-like neighbourhoods, such as the Uplands, has led some to equate park-like neighbourhoods, with the public/private-realms integrated, as symbols of power and affluence. Therefore, Garry oak has come to be associated with social status because of its inclusion in cultural landscapes such as Uplands and Fairfield (**Figure 5**).



**Figure 5.** Garry oak retained as a feature of street-end parks and boulevards in Fairfield.



**Figure 6.** Garry oak as a commemorative feature for Chief Justice Gordon Sloan in Oak Bay.

### **Garry oak as a Feature of Commemoration**

The ethereal, pastoral character of the Garry oak environment is employed in settings for commemoration and memorial. The Uplands Park War Memorial and the Hon. Gordon McGregor Sloan memorial tree in Oak Bay are illustrative of how this environment has been employed to enhance reflective intent (**Figure 6, 7**).

A large, very distinctively shaped Garry oak is used to commemorate the life and works of the eminent Chief Justice Gordon McGregor Sloan, who played a distinguished part in provincial legal, political, and economic life of the early 20<sup>th</sup> century. A



**Figure 7.** The otherworldliness of the Garry oak landscape encourages visitor reflection at the Uplands War Memorial.

simple, unobtrusive plaque identifies the site, while the Garry oak itself, situated in a prominent location in the village of Oak Bay, serves a fitting memorial to one who pioneered the sustained yield concept which so influenced the trees and forests of the Province.

The War Memorial, situated in Uplands park, engages the “other-worldly” qualities of the Garry oak landscape to encourage visitors to pause and reflect on those fallen in the two world wars. Set in the midst of an oak grove, the gnarled forms of the trees provide the backdrop, and the meadows and rock outcrops furnish the base for this memorial to the dead.

### **Preferences for the oak landscape**

Research suggests that the most preferred landscape types include savannah, oak woodlands (Balling and Falk 1982, Appleton 1984), landscapes with mystery and complexity (Kaplan 1984, 1987) and/or a variety of interesting vegetation types expressed in attractive forms, textures, patterns and shapes (Hamilton 1995). The physical characteristics of the Garry oak environment in general, and its form specifically, possess this character, suggesting the source of the almost-universal appeal for this tree. Given this, it may be inferred that individual preferences for oaks will increase where forms are of higher Bolsinger class.

### **Discussion**

The higher Bolsinger classes generally encompass tree forms that are much more diverse in terms of trunk habit, number of stems and branching patterns. Complex forms were prevalent in the survey (Erickson and Campbell 2001). Many of these trees had curvy oak limbs, large-limbed with branches sweeping outward, or leaning with multiple stems. The sculptural, multi-stemmed form of Garry oak and its rich, visually diverse environment are valued not only for wildlife habitat and ecological function, but also for their aesthetic traits. Gnarly and twisted, with an ethereal setting, these combine to create a unique beauty of almost-universal appeal capable of evoking a significant aesthetic response. As a result, the Garry oak environment of southern Vancouver Island is beloved, and has come to be cherished by many.

Depictions of the Garry oak landscape by colonists are remarkably consistent in expressing delight and fascination with these environments and in drawing favourable parallels with oak landscapes of the British Isles. The accounts tend to focus on the spatial organisation and features within these landscapes, the ‘clumps of trees’, the ‘Druid-like groves’, the noble oaks and ferns seen in the greatest luxuriance’ and the ‘delightful meadows’ rather than the form of Garry oak. The few references specific to form tend to be more figurative than literal, depictions including the ‘umbrageous form’ of the tree. Common to these texts are descriptive accounts with strong allusions to the ‘picturesque’.

While enthusiastically portrayed in textual accounts, historical paintings and photographs of the Garry oak are rarely found. Given its widespread appeal, the absence of this tree in the visual arts in the earlier part of the last century is puzzling and may merit further attention as a topic for future research.

## **The Almost-Universal Appeal of Garry Oak and its Environment: A Preliminary Exploration**

From the preceding it may be postulated that, for residents and visitors alike, the form and environment of Garry oak elicit considerable visual appeal and the capacity to evoke a significant aesthetic response. Why does this tree have such strong appeal? What elements in these landscapes evoke such powerful responses? Possible insights into these questions may be gained through reference to the considerable body of landscape preference theory and research available.

### **An Innate Preference for Savannah Landscape Types**

Recent preference research indicates that certain landscape types are consistently preferred over others. Research by Appleton (1996) and Balling and Falk (1982) suggests a preference for landscape types exhibiting the characteristics of savannah habitat (i.e. sparsely-wooded areas of grassland or meadow landscapes), similar to the Garry oak landscape. Such preference may be attributed to the long period of human prehistory, to selection pressures related to the presence of specific structural elements in a landscape that will assist or ensure survival (op.cit).

Appleton's 'prospect – refuge theory' (1996) indicates that people favour landscapes offering unimpeded visual prospect and options for either concealment or a quick withdrawal to a safe refuge. This theory would predict higher levels of preference for landscapes of Garry oak, with alternating meadow and copse, compared with other, more densely forested or open landscapes.

### **Other Aspects of Form and Structure Contributing to the Aesthetic Appeal of Garry Oak**

Gobster (1994) proposes that, while the foregoing arguments may explain general preference for savannahs, they do little to explain or describe which specific aspects of the structure of the oak landscape contribute to its powerful aesthetic appeal. Other elements of landscape preference research and theory may provide more specific insight into this question, as follows.

Preference for a landscape is a combination of two broad factors: the physical attributes viewed and the resulting viewing experience of the individual. The patterns of physical elements within a landscape and way they are organised contribute to the emotions, feelings and perceptions evoked (Hamilton 1994). The number, variety and diversity of features in a landscape; the complexity of their organization; the level of meaning; the level of familiarity with the landscape; and the sense of mystery imparted: all contribute to perceptions and the nature of the viewing experience.

### **Visual Complexity and Diversity**

It has been found that the following: a variety of interesting vegetation types, expressed in attractive forms, textures and patterns; vegetation with a high degree of uniqueness; or that is memorable or rare within a region; are several factors among the most preferred elements within a landscape (Hamilton 1994).

Research indicates that complex natural landscapes are generally preferred over less complex ones. Typically, the visual structure of the Garry oak landscape is extraordinarily complex and diverse. This complexity results largely from the combination of its rich form and an equally rich setting. The gnarly, twisted forms of the tree

can assume an endless range of configurations. These forms produce diverse patterns in light and shadow, creating the ethereal ambience for which these landscapes are so well known. This, combined with rich wildflower meadows producing vivid displays of colour, results in a scene that is imbued in mystery; is structurally and visually complex; and is very diverse in terms of colours, lighting effects, textures and forms. These elements of complexity, diversity and mystery may be important contributors to the high level of appeal expressed for the oak environment (Figure 8).



**Figure 8.** The form of Garry oak produces diverse patterns of light and shadow.

### **Mystery**

People prefer landscapes which are unique, that give them a sense of being in a distinct ‘place’ and which provide them with an opportunity to see things they would not see elsewhere (Hamilton 1994). Mystery encourages exploration and invites entry into a landscape, in order to discover and experience more. Mystery in a landscape can be created by unusual forms, special lighting, and the ability to move into and through the landscape. The form of Garry oak; with its twisted multi-stemmed trunks, gnarled branches, patches of shadow and light, and its environment of alternating copses and meadow; by nature invokes a sense of mystery and fantasy that challenges the imagination and invites entry and exploration.

### **Familiarity**

Familiarity is one of the significant factors influencing landscape preference (Dearden 1989, Balling and Falk 1982): ‘*Previous experience of landscape gained through life, travel and work all fostering this sense*’. The previous references to Garry oak, drawn from early colonial times, are rife with fond comparisons between



the oak landscapes of Vancouver Island and the parks and pleasure grounds, or countryside, of the British Isles, homeland for these early settlers. The parallels with the idealized landscapes of England inescapably fostered a sense of familiarity; with the meadow clearings, defined by groves of Garry oak, so reminiscent of those in the well-known, picturesque tradition.

An additional factor is the contrast with the seemingly-endless coniferous forest. This affects familiarity, aesthetic appeal, and even the sense of well-being. Confronted by a wilderness that was dark, foreboding and visually-monotonous; an encounter with a landscape that is light, visually-diverse, and similar to the pastoral landscapes of the British Isles, so beloved and familiar, could only be received with joy.

Just as the high degree of association of Garry oak landscapes with other, similar / familiar settings, such as parks and pleasure grounds, may contribute to the general appeal of the oak; so also the scarcity of these environments in B.C. (and the resulting unfamiliarity for many), may tend to enhance their allure. While familiarity may be a key factor influencing the level of preference for a landscape, as Dearden fittingly suggests (1989): *'the relationship between familiarity and preference is not a simple one'*.

## Summary

Depictions in the historical accounts illustrate that the aesthetic value of Garry oak and its environment hold a special appeal and fascination for many. This appeal finds expression in the cultural landscape of Victoria in myriad patterns, particularly in the public and private realms of the city's streetscapes. The manner in which the tree and its environment are employed in the urban landscape suggests that the tree and its environment have, over time, assumed a deeper, symbolic meaning.

Studies of landscape preference indicate that the almost-universal appeal of this tree could be the result of several factors. The complex and varied form of this oak, combined with a visually diverse environment, present a visual composition of considerable depth. This notion conforms to several key aspects of landscape preference theory; in particular the concept that level of preference increases as landscape scenes become more visually complex, diverse and mysterious.

We suggest here that a relationship may exist between the level of aesthetic appeal of Garry oak and its placement in the Bolsinger classification. Landscape preference may parallel increasing complexity in Garry oak, moving up the class-scale of its form in the Bolsinger hardwood classification system. Therefore, the Bolsinger classification may provide a means for predicting the relative level of preference for a given landscape as it relates to diverse tree forms in terms of trunk habit, number of stems and branching patterns. The higher Bolsinger classes are visually rich and diverse and may, in reflection of the discussion above, result in higher levels of preference or appeal than stems ranked lower on the Bolsinger scale.

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# The Oldest Oaks of Saint-Petersburg, Russia

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Saint-Petersburg is the oldest centre of introduction of arboreal plants in Russia. Planting of trees, both local and exotic, began soon after the foundation of the city (1703). In 1738 at the Karel Isthmus, not far from Saint-Petersburg, the Lindulovskaya larch grove was established, from seeds of *Larix sibirica* of Arkhangelsk origin. Today, 268 years later, these trees have reached the height of 50 m with a trunk diameter of 1 m at breast height. They are among the tallest of all trees, native and introduced, in north-west Russia; but they are not the largest in diameter, nor the oldest ones.

No doubt certain trees of common oak (*Quercus robur* L.) may be considered among the oldest living trees in and around Saint-Petersburg. This species grows wild in this area and is also commonly cultivated. The northern border of its natural distribution lies somewhat north of Saint-Petersburg. Oak has been widely cultivated since the times of Peter the Great, and its natural stands were kept and protected as far as possible.

*Quercus robur* was mentioned by G. Sobolevsky in his "Flora Petropolitana" (1799; 1801-1802) with remarks that it grew wild and was also cultivated at the gardens. A. Inostrantsev (1882) in his book about pre-historic man of the Stone Ages at the coast of Ladoga Lake, reported that on digging the Ladoga Canal, trunks of dead old oaks, up to 250 years old and up to 1.6 m in diameter were often found. They were black, but with well-preserved trunks and root systems. Of course, they were native, not planted, but it was a disputable question, how they happened to appear at this area. All historical data and literature confirm the fact that oaks occurred in this territory long before Saint-Petersburg was established. The original primary woody vegetation was represented by *Betula pubescens*, *Betula pendula*, *Alnus glutinosa*, *Alnus incana*, *Sorbus aucuparia* and *Populus tremula*, with the conifers *Pinus sylvestris* and *Picea abies*, and a mixture of broadleaved species: *Quercus robur*, *Tilia cordata* and *Ulmus laevis*. At this time, broadleaved trees, including oaks, were of rather small significance in forming those pristine woods.

We began to develop our interest in old oak trees more than 10 years ago, when we visited Dubki Park near the town of Sestroretsk (in the northern environs of Saint-Petersburg). The park was established in 1719, and we were much impressed by the massive oaks there (**Figure 1**). We began to analyze historic data, visited several parks and gardens, and measured the oldest and largest trees.

There are two main centers of introduction of arboreal plants in Saint-Petersburg. These are the botanic gardens of the Komarov Botanical Institute of the Russian Academy of Sciences (BIN) and of the Forest-Technical Academy (FTA). Botanic Garden BIN was established in 1714 by the order of Peter the Great as Aptekarsky Ogorod (Pharmaceutical garden) to grow medicinal herbs, but since its early years trees of different kinds were also cultivated there. Near the main building of the Komarov Institute there are two good oaks which may be considered to be the oldest



**Figure 1.** One of the largest *Q. robur* at Dubki Park, Sestroretsk; 36km from Saint-Petersburg, May 1, 2005.

among several thousand trees of Park-Dendrarium BIN. According to some data, they are about 250 years old. Both trees are healthy, they stand in open sunny places, not suppressed by other trees, and have magnificent crowns, as wide as tall. The first tree is 23.0 m tall, 350 cm in circumference at breast height, with the crown 23.8 x 21.6 m. The second tree is 24.0 m tall, 345 cm in circumference with the crown 18.5 x 17.7 m (all measurements made in autumn 2005). These trees grow in the centre of huge industrial city on Aptekarski Island at the mouth of the Neva River, only 3 m above sea level, in an area subject to flooding.

The park FTA was established later, in the 19<sup>th</sup> century. The first plantings of trees here were made in 1827-1828. At that time two oak trees were planted here (not in one year but with an interval of several years). They grow in a beautiful glade, left and right of the entrance to the main building FTA, just behind a flower parterre (**Figure 2**). At present, the right-hand tree (when facing the building) has reached 24.5 m tall, 326 cm in circumference, with the crown 26.4 x 23.5 m. The tree is in a good condition and has a well-developed main trunk with symmetrical branches protruding in different directions. The fully cylindrical trunk forks at 4 m. The left-hand tree is 25.5 m tall, 425 cm in circumference, with the crown 25.0 x 22.2 m. This tree is also with a well-developed crown, without frost damage, and without hollows and signs of dry twigs. At the height of 2.1 m it is divided in two massive trunks. One of them has another division somewhat higher, and in general the crown consists of three main stems, without a leader. These two oak trees grow at the northern area of the city, less subject to environmental pollution, and at a higher elevation compared to the other oaks described here. It is interesting that there are data of Egbert Wolf (1929), who measured these oaks in 1924. He pointed out that



**Figure 2.** The Forest-Technical Academy park, with two *Q. robur* at the entrance.

the right hand oak was 23.5 m tall, and the left one was nearly the same height. The trunk diameter of the right tree was 90 cm, and of the left one 64 cm, measured at 90 cm. The diameter of the crown was 17-18 m. Therefore, in the last 80 years, the height of these trees has remained nearly unchanged while the size of the crown has enlarged by nearly one and half times. Most considerable has been the enlargement of the diameter of the trunk.

There are old oaks in other parks of Saint-Petersburg and its environs as well. Prince A.M. Beloselsky owned Krestovsky Island since 1803. Soon after this, the park was established around his castle (Markov, 1965). Up to the present day, several oaks, larches, limes, silver maples and Siberian pine have survived here. The oldest existing trees here are therefore about 200 years old. As for oaks, one of the largest here is a tree standing on the right bank of the Malaya Nevka River near Petrovsky Bridge, just above the river. It is 19.0 m tall, 374 cm in circumference, with a crown of 18.0 x 16.0 m. The second tree, not far from the first, is smaller, but of the same age: 14.0 m tall, 315 cm in circumference and with the crown 16.5 x 14.0 m.

A special geobotanical and historical research was carried out of Peter the Great's Estate "Blizhnije Dubki" which existed at the northern sea-shore of the Gulf of Finland in 1723-1737. The project was undertaken by a group of experts under the leadership of Dr. Valentina Ukraitseva and Mr. Andrej Reiman (2001). In 1995 they measured the circumference of a dying oak tree as 440 cm. Using the method of radio-carbon analysis, its age was estimated to be 570 years,  $\pm$  54 years. This means that during the first years of Saint-Petersburg's existence, and when the Russian Tsar's estate was being planned, this was already a large and beautiful tree about 300 years old or even older, and was carefully protected.

Ten years later, in summer 2005, we tried to find that very oak. Two of our excursions



**Figure 3.** The author's wife, Barbara, gives scale to the oldest *Q. robur* in the Gulf of Finland, nearly 5m in circumference.



**Figure 4.** The author beneath the ancient *Q. robur*, Gulf of Finland.

were unsuccessful. But finally we were rewarded with the discovery of another oak tree, even larger and apparently older (**Figures 3,4**). This is a wild oak, growing in the forest, not in the park or garden, and not near buildings, but there is a small possibility that it might have been planted by Swedes who were early inhabitants of this area. We express our gratitude to the local amateur oak enthusiast Mrs. Irina Medalinskaya, who helped to find this tree in the wild forest along the Gulf shore on 1 October 2005. This impressive tree is 22.5 m tall and nearly 5 m in circumference (496 cm), with a massive crown of 22 x 25 m. (**Figure 5**). Standing in a

small glade, it looks like a giant among dwarfs, compared with other, smaller trees of the surrounding forest. Apparently, this is the oldest tree, the absolute champion among all trees growing wild or cultivated in the area of Saint-Petersburg and far around. Luckily, this tree is in good condition, and many young seedlings may be found under its canopy. Several of them we took and planted at the nursery of the Komarov Botanical Institute.



**Figure 5.** Measuring the Gulf of Finland *Q. robur*; 496 cm circumference.

But how old might this tree be? The width of its trunk is surpassed by two oaks growing at Elagin Island near the Palace. I.P. Elagin was a courtier of Katherine the Great, and he became the owner of the Island, now named after him, at the end of 1770s. Both oaks grow in an open position near the mouth of the Neva River. One of them has the broadest trunk of all trees in the Saint-Petersburg area. It is 670 cm

in circumference, 26.5 m tall, with compact crown 15.5 x 16.5 m. (**Figure 6**). At 5 m the tree is divided into two massive trunks. The lower part of the tree is partly rotten and destroyed, with a large hollow repaired by iron sheets. On the north side, nearly half the bark is absent up to a height of 6 m. The second tree is of the same height (estimated as 26.5 m tall). Its trunk is less massive – 520 cm in circumference, but surpasses all other trees in Saint-Petersburg, taking the honorable second place after its neighbor. The crown is 25.7 x 19.6 m, with the trunk forked at 3 m. This tree is in better condition. The bark is undamaged, except near soil level where



**Figure 6.** The largest *Q. robur* at Elagin Island, and in Saint-Petersburg, near Elagin Palace.



there are several small fillings protected by cement.

According to some literature (Markov, 1965; Kovjazin et al., 2002) these trees could have been planted in Elagin's time, as, when the park was established, drainage modifications were made and many trees were planted. If this is the case, their age cannot exceed 240-250 years old. In fact, these two oaks are much older. The main expert of Central Park of Culture and Rest (which is now situated now at Elagin Island) Mr. Andrej R. Mets was very kind to report to us that there is an oral legend, that the first and oldest oak was self-sown (an acorn was dropped by a duck) in 1557. According to the legend, the acorn of the second oak was planted by Swedish fishermen A. Petersson, who lived on this island, in autumn 1661, and germinated in spring 1662. This was before Saint-Petersburg was established.

The old oak at Kamenny Island was planted, according to legend, personally by Peter the Great. The tree died in 1988. In 2003 at that very place, a young oak seedling was planted, in memory of the 300<sup>th</sup> anniversary of Saint-Petersburg.

There are other old trees in parks and gardens of Saint-Petersburg, which we were lucky to identify and observe, but this is a subject for other articles. All of them are in need of protection and careful monitoring, in order to prolong their lives as much as possible. We believe that oak trees described in this article will be of interest for The International Oak Society, and that they deserve to be included in a European database of old trees. This is a very important task to estimate the real age of the oldest and largest oaks.

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## **A Botanist and Artist, Aimee Antoinette Camus (1879-1965)**

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**Brigitte Fourier**

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“... We should not forget that ‘amateur’ botanists during the past century rendered distinguished service to science. They were the framework of the Botanical Society of France and several of them were masters.”

This is the way that Jacques Leandri, a student of *Agrostis* and specialist in the flora of Madagascar, begins his article in volume VI of *Adansonia*, the review of the National Museum of Natural History. These pages, written in 1966 to honor the memory of Aimee Camus, who had passed away a year earlier, illuminate her signal role in the most varied areas of botany. Forty years later, it seems that Miss Camus has been all but forgotten except by those who know her as the author of new taxa and who admire her illustrative plates of oaks and chestnuts. In this she proves her worth as a great artist, “and a penetrating observer and possessor of a methodical and precise mind.”

In our day, visitors to the Chinese arboretum of Xishuangbanna, in the far south of Yunnan province, can read her name attached to that of 48 species of Fagaceae (*Castanopsis*, *Cyclobalanopsis*, *Lithocarpus* and *Trigonobalanus*).

It is interesting to recall that Aimee Camus, who was not a professional at first, was a woman who lived in the first half of the twentieth century in a male milieu, among men who were all eminent: museum professors, members of learned societies, botanists whose most recent collections she studied. She earned their confidence, and they urged her to surpass her own achievements.

She wrote hundreds of articles and ten monographs. She was honored several times by the Institute and the Botanic Society of France, and she received the title of Correspondent and then Associate of the Museum, and she was also named a laureate of the Legion d'Honneur.

### **The two daughters of E. G. Camus**

Edmond Gustave Camus (1852-1915), Doctor of Pharmacy, divided his time for thirty years between his Parisian pharmacy and botany. After 1908 he was able to devote himself entirely to the latter. Vice President of the Botanical Society of France, founding member of the Dendrological Society of France, Gustave Camus is remembered for his works on the flora of France, the willows of Europe, the bamboos, and the treatment of the *Cyperaceae* and *Gramineae* in the *General Flora of Indochina*; by studying the herbaria of Father Farges, he described new species of bamboo, including one collected in Thailand by Pierre as well as two *Arundinaria*.

His remarkable illustrations of orchids are eagerly sought by bibliophiles. Concerning the preparation of one of his collections, he explained “I have undertaken the laborious task of preparing twelve copies of the orchid illustrations by sketching and painting the forty plates which compose it twelve different times.”

Each of the copies of *Illustration of the Orchids of the Paris Region* (1885)

bears these carefully traced words from the author: “to my daughter Aimee,” one of his two daughters whom he introduced early to botany. When she was fifteen he took her to botanize in the Jura near Neuchatel, where they put together one of their first herbarium collections.

Blanche is Gustave’s other daughter and the painter of the family to whom we owe an animated portrait of Aimee. The two sisters shared the same feelings of filial piety: when after the death of their father in 1915 they had to prepare the definitive edition of

*Illustration of the Orchids of Europe and the Mediterranean Basin* (whose section on morphology was drawn by Aimee), the two went together to the Pyrenees to search for new hybrids. This expedition required that they visit all of the summits of the Pyrenean chain from the Mediterranean to the Atlantic. Later, in May, 1930, Aimee accompanied Blanche to the Near East so that she could set up her easel and paint pictures in “those luminous places.” Aimee took advantage of this to botanize near Constantinople (Istanbul) and collect orchids.

In 1947, Aimee dedicated her works on oaks to her father and to her sister:

“Blanche Camus, artist and painter, who devoted her talent to completing the numerous plates of these three atlases, not only with art but with the greatest accuracy possible and the greatest care for authenticity, consecrating much precious time to this lengthy undertaking.” One can realize this on contemplating the original drawings of the part which derives from Blanche, thanks to her pencil work which is less assertive than that of her sister and to her miniscule, very refined handwriting.

## The Universe of Miss Aimee Camus

Aimee studied botany with Gaston Bonnier, who occupied the chair of botany at the Faculty of Sciences in Paris and with Philippe Van Tieghen, professor of botany at the Museum. “The latter gave her a taste for systematic morphology, in which she later excelled.”

Little by little, she extended her universe in order to realize her vocation. Professor Lecomte, 33 years her senior, and professor Humbert, younger by eight years, gave her “the greatest support for the completion of her work.” With professor Aubreville, they had her collaborate along with her father on the *General Flora of Indochina*, a work in seven volumes which was written between 1907 and 1951 in the Laboratory of Spermatophytes of the Museum. She kept up with the work of the great collectors of plants in the Indochinese world, men such as Auguste Chevalier



A portrait of Aimee Camus drawn by her sister

and his protégé, Eugene Poilane, “the greatest collector of Indochina.”

She was also associated with the uninterrupted discoveries of new plants in Madagascar and she eventually acquired uncontested authority which was not diminished even by advanced age: in 1954 she was asked to make a presentation at the Eighth International Congress of Botany on the grasses of North America, and in 1956, an additional presentation at the International Colloquium of the National Center for Scientific Research (C.N.R.S) on the endemic grasses of Madagascar. In order to complete her revision of the genus *Quercus*, Miss Camus found her study materials mainly in the Museum, but also in the herbaria of the entire world. For that she wove a vast net of correspondents, including the directors of the British Museum the Museum of Kew, the National Herbarium of Washington, the Rijksherbarium of Leyden, and the conservators of the herbaria of Leningrad, Florence, and Jerusalem. She had dealings with professors Gausson of Toulouse and Trelease of Urbana, Dr. Handel-Mazzetti of the Botanical Institute of the University of Vienna, Alfred Rehder, Conservator of the Herbarium of the Arnold Arboretum, etc. She met with “Mr. de Vilmorin, who permitted her to consult his rich library at Verrieres-le-Buisson.” For a dozen years the Director of Forests and Streams, Robert Hickel, collaborated with her, particularly to complete the study of the Fagaceae of Indochina. Although Aimee Camus hardly traveled outside of France, with the exception of her trip to the Middle East and several botanizing trips to Switzerland with her father in 1894 and 1898 and to the Sierra of Guadarrama in Spain in 1932, her sources of interest extended far beyond her apartment in Paris or the Laboratory of Spermatophytes of the Museum.

### The works of a botanist and artist

The books and their illustrative plates and the innumerable notes and articles by Aimee Camus published between 1904 and 1961 witness to the extent of her knowledge, her gift for graphic representation, and her taste for the effort to join the two.

In 1905, Gustave and Aimee Camus published *A Classification of the Willows of Europe*, the *Monograph on the Willows of France*, and, in 1908, with the collaboration of P. Bergon, *Monograph on the Orchids of Europe, North Africa, Asia Minor, and the Russian Transcaspean Provinces*. The *Great Monograph on the Orchids of Europe and the Mediterranean Basin* appeared in 1929, fourteen years after the death of the principal author.

In 1912, Paul Lechevalier edited *Little Flora of Saint-Tropez* by Aimee Camus and, in 1914, her monograph *The Cupressaceae (The Genus Cupressus)*. Hickel published there a new cypress of southwest China, *Cupressus dielouxiana*, “a lovely species which does well in Prafrance (Gard) and should be tried in different regions of the South of France where it could form good windbreaks.”

After World War I, Aimee Camus edited two small books in the pocket-book collection *The Practical Encyclopedia of the Naturalist*, which offered at one and the same time a scientific account and “some picturesque facts.” The books are titled *Flowers of Marsh, Lake, and Pond* and *Ornamental Trees, Bushes, and Shrubs*. In the latter, Aimee complains “about the banality and the extreme monotony which reigned in gardens,” while noting at the same time that “beginning twenty years ago, many trees have been introduced to France whose hardiness has been established beyond doubt, above all thanks to people such as Bois, Dode, Hickel, Lemoine, Vilmorin and Robertson-Proschowsky.” (Footnote: Robertson-Proschowsky has

studied the cold hardness of palms.) Philippe Gerard remembers this little botanical book, the first that his grandfather placed in his hands.

In 1929, Aimee published *The Chestnuts: A Monograph on Castanea and Castanopsis*, a complete monograph with very detailed descriptions and 109 illustrative plates and three volumes of the monograph *The Oaks*, which appeared between 1936 and 1954. This work was honored by the Academy of Sciences and the Academy of Agriculture with the Medaille d'or (gold medal). Fifty years later, Govaerts and Frodin, of the Royal Botanic Gardens at Kew, consider this to be "the most recent global revision of the genus, which remains a basic reference even though handicapped by some gaps..."

These two English botanists also cite in their bibliography Aimee's 1951 study on *The Genus Nothofagus, Beeches of the Southern Hemisphere*. To be found here are a key to the genus (excepting the species of Papua and New Caledonia), several different points of view on the species of South America and Oceania, notes on the genus in cultivation and what differentiates it from the genus *Fagus*.

At times when she was in residence at the paternal properties at Saint-Tropez, Aimee botanized in the Var and the Alpes-Maritimes. There she studied mimosas, cistus, orchids, and hybrid willows on the shores of Lake Thorenc. She sketched the different phases of the germination of a small cork oak between the first of December and the first of March following. Eucalyptus, cypress, bamboos, lemons and even the cultivated mints and basil captured her insatiable curiosity. It was at this time that she assembled herbarium specimens and sketchbooks, and published her observations in *The Scientific Riviera* (a publication of the Association of Naturalists of Nice and the Alpes-Maritimes) and in the *Scientific and Industrial Bulletin of the Roure-Bertrand Company*, the bulletin of the famous perfume house of Grasse.

The majority of her other notes and her publications of new taxa appeared in the *Bulletin of the Museum*, the *Bulletin of the Botanical Society of France*, the *Weekly Reports of the Academy of Sciences*, the *Annals of the Linnean Society of Lyon*, the *Bulletin of the Dendrological Society of France*, *Candollea*, the *Annals of the Natural Sciences (Botany)* of Montpellier, or again in specialized reviews on tropical agriculture, principally those pertaining to Madagascar.

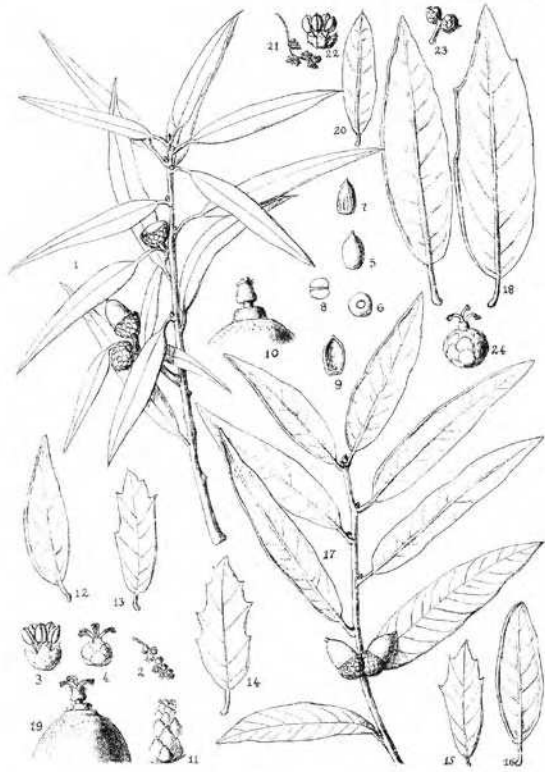
## **Forty years of collaboration with the editor Paul Lechevalier**

Forty years passed between the appearance in 1913 of the monograph *The Bamboos*, by Edmond Gustave Camus and, in 1954, of the last volume of the monumental work of his daughter Aimee, *The Oaks*. These two works, as well as all of those published in between, including the monograph *The Chestnuts*, were edited by "Paul Lechevalier & Son, 12 rue de Tournon, Paris (6<sup>th</sup>)." It was under the auspices of the same editor that there appeared in 1932 the famous work *Travels and scientific discoveries of French missionary naturalists throughout the world (15<sup>th</sup> to 20<sup>th</sup> centuries)* by P. Fournier.

A close and fruitful collaboration had become established between the Camus father and daughter and their editor and it was actually to Paul Lechevalier that we owe the idea of the monograph on oaks. The first of February, 1947, Aimee Camus thanked "the editors Paul and Jacques Lechevalier, who, following the tradition of their publishing house, devoted the utmost care to the presentation of my work," representing a total of 2,824 pages of text and 679 illustrative plates, of which 97 treat morphology.

Paul Lechevalier executed these plates following the drawings of Aimee Camus (and her sister), “realized from type specimens preserved either in the herbarium of the Museum or in other great herbaria, or, when a type specimen is lacking, based on correctly determined plants originating in the same region as the type.” She also sketched *in situ* the cork oaks of her childhood.

The drawings were made in black pencil on sheets of beige paper of different sizes or occasionally in ink on green tracing paper or on the back of a sheet of writing paper from the Museum. The strokes are light, following the curves of an



QUERCUS HYPOLEUGOIDES A. Gamus 1 cm

*Quercus hypoleuroides*, named and drawn by Camus (from les Chênes)

acorn, they linger on the thickness of a petiole, or are repeated in order to juxtapose all of the scales of a cup. Hatching accentuates the volume of a bud or the edge of a folded leaf. The pencil follows the spider web meanderings of the veins, tapers at the end of the sharp tooth of a *Quercus guyavaefolia*, tacks at the top of an acorn to delineate the perianth and the styles.

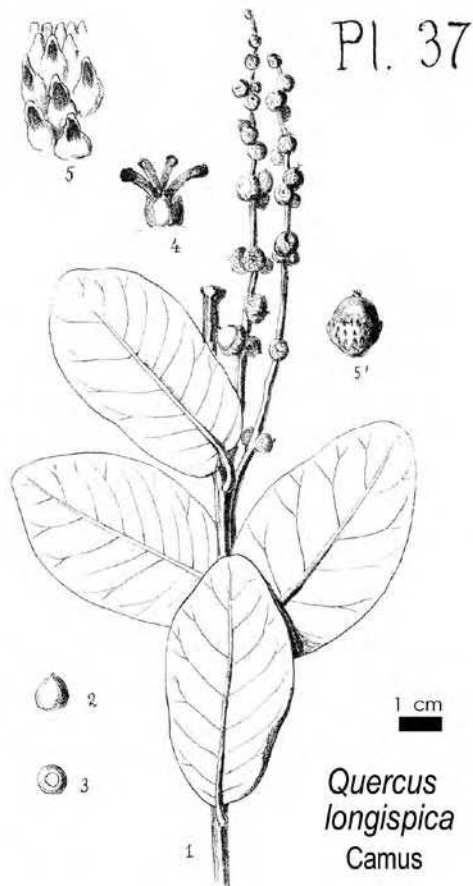
Oak leaves drawn in India ink seem blown off of a “*Quercus armenia, latifolia glande maxima, cupula crinita*” (a specimen of *Quercus cerris* var. *tourneforti* conserved in the herbarium of Tournefort). A thread of ink surrounds an annulate acorn of *Quercus fleuryi* that is beginning to germinate; a clean and precise pencil stroke defines the thick and entire edges of a leaf of *Quercus poilanei*.

On each sheet is indicated in crisp, fine handwriting the name of the taxon with the name of the author, sometimes the origin of the material and the name of the collector, the number of the type specimen, the site of collection and even the altitude. Other specifications are scribbled in: “les Barres, collection by Vilmorin,” “consider making tracing” or “tracing made” or “after the plant at Kew, a very secure sample”

or again “one of the type specimens” etc.

The morphological plates present figures magnified, for the most part, 200 times; to an uninitiated person, they can seem as enigmatic as hieroglyphs. Plate IX of the *Atlas* of volume I, for example, presents 24 anatomical cuts of leaves of *Quercus poilanie*, *Q. gilva*, and *Q. delavayi*: sections of the epidermis of the leaf edge, of the petiole, of the veins, of the teeth. At this scale of magnification, the hairs resemble strange sea anemones.

The two sisters then had to trace their drawings, accentuating here and there with a bit of shadow, light, or contours. The Lechevalier brothers then did the page formatting and the organization of the plates in atlas portfolio. Only the quality of the paper and the binding reflect the economic difficulties of the time.



*Quercus longispica*, named and drawn by Camus  
(from les Chênes)

**Aimee Camus,**  
**describer of new taxa**

Aimee Camus will never be able to equal in their adventures as plant hunters such illustrious contemporary foreigners as Forrest (1873-1932), Wilson (1876-1930) or Handel-Mazzetti (1882-1940). She had to content herself with working with herbarium specimens, leading the kind of life which held no farther attraction for professor Auguste Chevalier, the great specialist in colonial agriculture “Research in the wild became for me irresistibly attractive. A calm life in the confines of a laboratory, bent over a microscope, which I had dreamed of before, weighed heavily on me after that.” (Footnote: *L’Herbier du monde. Cinq siècles d’aventures et de passions botaniques au Muséum national d’histoire naturelle* [The Herbarium of the World. Five centuries of adventures and botanical passions in the National Museum of Natural History] 2004. Under the scientific direction of Philippe Morat, Gerard Aymonin, and Jean-Claude Jolimon. *L’Iconoclaste*, Les Editions du Muséum. p. 170.)

Among the 1,403 new taxa described by Aimee Camus, (sometimes in collaboration with Hickel) are to be found many *Fagaceae*, including some forty *Castanopsis*, around eighty *Lithocarpus*, and some fifty species, subspecies, varieties and hybrids of *Quercus* still considered valid today. Certain of these oaks are poorly known or undergoing reclassification, while others have perhaps disappeared entirely.

Very few have been introduced to Europe, except perhaps for *Quercus hypoleucoides* from New Mexico; still very rare, *Quercus leucotrichophora*, which exists, among others, as a large individual at Serre de la Madrone, or *Quercus* 'Warburgii', which certain of us received from Cambridge more than twenty years ago. Thierry Lamant adds to these, *Q. dentata* subsp. *stewardii*, *Q. dolicholepis*, *Q. longispica*, *Q. rehderiana*, and very probably *Q. stewardiana*. All are hardy in Brittany and in the south of France and some possibly elsewhere in Zone 7. For mild climates with good moisture regimes "Chinese *Cyclobalanopsis*, such as *Q. brevicalyx*, *Q. kouangsiensis*, *Q. arbutifolia*, *Q. macrocalyx* could be attempted, choosing always those of good provenance. As for the *Lithocarpus* described by Aimee Camus, I have no idea which ones might be hardy. It is a genus which could render some pleasant surprises."

We could recall also three other woody species described by Aimee Camus: the prestigious *Cupressus dupreziana* and the less well known *Corylus yunnanensis*, whose type was discovered by Delavay in the Heishanmen mountains at 3,000 meters altitude, and *Carpinus rupestris*, a charming small Chinese shrub from two to four meters high growing in rocky soils between 1,100 and 1,700 meters in altitude.

From his expeditions to Madagascar, professor Humbert (footnote: It is with Henri Humbert that Gilbert Cours Darne, our late lamented friend from the APBF ???, created a map of the vegetation of Madagascar in 1965.) sent specimens for

identification to his Parisian colleague Aimee; the large island is rich: the number of plants which are strictly endemic is above 90%. Thanks to him, Aimee Camus described and named numerous grasses, odoriferous herbs, herbs from prairies, water plants or plants from steppes, and bamboos.

She was interested in grasses her whole life. She described 600 new genera or species of them, whether from Madagascar, from the Congo or Sierra Leone, from New Caledonia or the Solomon Islands, from Asia Minor or East Asia, North America, or France. She educated herself on their role in food production, a high priority at the time, including also the floating rices of the Sudan, the grasses in Indochina used in brewing and the cultivated ferns of India, or again a variety of Japanese millet.

In 1965, after the death of Aimee Camus, Blanche Camus donated to



*Q. dolicholepis* Camus in Southern China  
© Guy Sternberg



the Museum “the E. G. and A. Camus herbarium,” 400 packages and 50,000 specimens. “I remember very well its difficult removal down a narrow stair on the Rue de l’Abbe Groult in Paris,” confides professor Gerard Ayumonin. This collection, Leandri affirmed in 1966, included several single types and some duplicate series from renowned botanists, particularly Leveille. This missionary priest is probably the author of *Quercus guyuavaefolia*, which Aimee drew based on specimen #4,482, collected by Delavay “on the heights of Mo-So-Yn” in Yunnan.

### **Names for the new taxa**

The collectors in Indochina are the first for whom Hickel and Aimee Camus, or Aimee Camus alone, named the *Fagaceae* (*Castanopsis*, *Lithocarpus*, *Quercus*): Thorel, Pierre, the creator of the botanic garden at Saigon, or, among those of her own generation, Bois, Chevalier, Dussaud, Finet, Fleury, Gagnepain, Lecomte, Petelot, Poilane. *Quercus chevalieri* and *Q. fleuryi* bear the names of their discoverers: professor and academician Auguste Chevalier and one of his students, Francois Fleury.

Among the new genera of grasses of Madagascar can be noted those which Aimee Camus named for her colleagues Lecomte, Humbert, Hickel, Perrier de la Bathie, Viguier, Saint-Yves, cf. the genera *Lecomtella*, *Humbertochloa*, *Hickelia*, *Perrierbambus*, *Viguiarella*, *Yvesia*. As for the genus *Hitchcockella*, it honors Albert Spear Hitchcock, the celebrated American agrostologist.

Foreign botanists whom she honored are also for the most part contemporaries of hers, for example, Dr. William Trelease who directed the Missouri Botanical Garden from 1889 to 1912. *Quercus treleaseana* A. Camus is Mexican and considered to be synonymous with *Q. laurina*. This American scholar is the only one who named an oak for her: *Q. camusae* Trel., a *Cyclobalanopsis* from southeast Yunnan and Vietnam. Another American, Dr. Albert Newton Steward, the Austrian Dr. Heinrich Handel-Mazzetti, and the Briton James Sykes Gamble, Conservator of Forests in British India, are among those chosen for naming new *Fagaceae*, determined and named by Miss Camus.

“I am happy,” she wrote “to express my gratitude to the botanists who sent me sample material, their publications, or their photographs.” Many of these pictures were taken by Wilson and sent from the Arnold Arboretum.

### **Ecology and culture of some oaks and chestnuts**

Each oak or chestnut described by Aimee Camus is methodically analysed: after the bibliographic and iconographic references and the morphological and anatomical descriptions, she groups all of the data which she could find on the geographic distribution, habitat, culture and uses of the taxon, sometimes its longevity and other remarkable facts.

With the goal of making known for each species its best chances of acclimatization, she indicates the successful introductions to France, either in particular regions or arboreta such as Les Barres, La Fosse, La Maulevrie, Prafrance, Pezanin, Berrieres-le Buisson or the collections of Lavallee at Segrez or of the Villa Thuret at Antibes.

Here are some examples: *Quercus pontica*, “a very beautiful small oak, with very decorative leaves, deserving of more frequent cultivation. Assumes beautiful color in the fall. Planted at the Domaine de la Fosse (Loir-et-Cher). There is one

at Barres which fruits well and easily hybridizes," *Q. gilva*, "a species with rapid growth which could be cultivated in southern Europe. It is thriving at Prafrance (Gard)." As for *Q. acutissima*, it is surviving well at Verrieres-le-Buisson and in the Bois de Boulogne where it is a shrub. It is doing well at the Maulevrier arboretum, at the Domaine de la Fosse, and at the arboretum of Pezanin.

Cultural requirements occupy only a limited place in the literature of Aimee Camus because they are unknown for a majority of the species. For this reason, we read those which are given with even more interest. Here are some: *Quercus ilicifolia* is very undemanding, "it grows in very mediocre, dry, sandy or rocky soils but it avoids lime. It takes spring frosts and hot sun in stride;" *Q. alnifolia*, which has very beautiful foliage with golden tomentum, is not sensitive to cold; in Cypress, in the mountainous region where it grows, there is frequent snow for a month" or again *Q. dentata*, which can have an asymmetrical and spreading habit, "grows on almost any site, even thin and dry soils and it would be content on sand dunes." Concerning *Q. frainetto*, Aimee repeats the observations of Elwes and Henry: "On the hot and sunny days of summer, in the valley of the Drina (in Yugoslavia), the leaves at the top of the tree exposed to the sun turn their lower surface towards the east in the morning and to the west in the afternoon."

*Quercus pseudosemecarpifolia*, now a synonym of *Q. rehderiana*, lives in limy, sandy or schist-derived soils at 1,800 to 3,500 meters of altitude, in hot temperate regions or regions which are rarely temperate. The type specimen was collected by Delavay above Dapingzi, like the specimens of *Casstanopsis delavayi*, which is one of the most beautiful trees of Yunnan and which yields sweet acorns according to Delavay. "It would do well in France. It has been tried in the United States where it has not been affected by cancre (?)"

*Chrysolepis chrysophylla*: "very decorative, the color of the foliage is beautiful. Rarely cultivated in France, rather hardy, requires a rather mild climate, a healthy, semishaded spot on a heath. It would do well in the South or West. To prosper, it would require a climate more or less identical to that required by camellias.

*Lithocarpus densiflorus* likes rich and moist soils in the vicinity of the coast. "Rarely cultivated in France, it is one of the beautiful species of the genus, with thick foliage of a luxuriant aspect. It is difficult to transplant. It can be sown in a pot but it should be planted out as soon as possible."

In 1961, four years before her death, Aimee Camus was still writing on a malagasy species of bamboo which she named in 1934, together with Stapf, for Professor Humbert: *Humbertochloa*. Today (2004), in *Adansonia* 26(2) are published some new species from Madagascar. The author of a new *Sterculia*, Laurence J. Dorr from the National Museum of Natural History of Washington, writes: "It is believed that there approximately 4,220 species of trees in Madagascar and that 96% of these are endemic. The malagasy flora is very rich, and despite almost four centuries of botanical exploration, collectors continue to find new woody species even in areas which have been relatively well explored."

## Some New and Little-Known Oak Cultivars

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With a recent rapid rise in the number of oak cultivars being selected, as well as a certain amount of confusion over the correct name or identity of existing selections, it seemed to be an opportune time to document some of the new selections and to clarify some of the confusion. With this intention, the authors visited several nurseries and gardens in Belgium, the Netherlands, and Germany. One problem is the use of the same cultivar epithet for different cultivars in the genus. For example ‘Kassel’ has been applied to several selections. Article 27.1 of the International Code of Nomenclature for Cultivated Plants (Brickell et al., 2004) states that “The name of the cultivar or Group must not be re-used within the same denomination class for any other cultivar or Group...”. With this in mind we have encouraged growers to use names that do not duplicate others and in some cases have proposed new names.

The results presented here include descriptions for new cultivars and clarification of the name or identity for others. Herbarium specimens are deposited at the Harold Hillier Herbarium (HILL) at the Sir Harold Hillier Gardens, the official herbarium of the International Oak Society. The holdings of the herbarium, as well as the living collections, can be consulted online using the search facility from the Gardens’ home page at [www.hilliergardens.org.uk](http://www.hilliergardens.org.uk).

*Quercus castaneifolia* C.A. Mey. ‘Zuiderpark’ (van Hoey Smith, 2001) A selection with deeply cut leaves. Leaves to 22 x 8 cm, the teeth to 2 cm long. The splendid specimen at Trompenburg is a spreading tree about 10 x 10 m with glossy dark green leaves grey beneath. It is a graft of the original tree at Zuiderpark. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4863, A.J. Coombes 1022, 21 July 2005. From a propagation of the original, cultivated at Trompenburg Arboretum, Rotterdam (no. BB 60).

*Quercus cerris* L. ‘Afyon Lace’ New cultivar. A form selected for its deeply cut, lace-like, grey-green leaves. Leaves to 9 x 6 cm, dark grey-green above, paler beneath and densely stellate-hairy on both sides. Found near Afyon, central Turkey by Dirk Benoit and Eike Jablonski in 2002 growing with *Q. pubescens* and *Cistus laurifolius*. At this location *Q. cerris* showed great diversity in leaf shape. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 5231, A.J. Coombes 1073, 19 July 2005. From one of the original propagations, cultivated at Pavia Nursery, Belgium.

*Quercus cerris* L. ‘Bolte’s Obelisk’ New cultivar. A form with a narrow upright habit. Leaves mid-green and rough above, pale green to grey-green beneath. Raised by Josef Bolte, Paderborn, Germany from seed collected at Kassel in 1998. The original tree was 5 m tall with a maximum spread of 1 m at the base. Standard

Specimen: Harold Hillier Herbarium (HILL), specimen no. 4874, A.J. Coombes 1035, 22 July 2005. From the original plant, cultivated at Paderborn, Germany.

*Quercus cerris* L. ‘**Marmor Star**’ (van Hoey Smith, 2001) This form, with leaves mottled and flecked with pale green and yellow-green was originally grown as *Q. cerris* ‘Marmorata’ or ‘Aureomarmorata’. The tree at Trompenburg is about 10 m tall and is a graft from the original at Strypemonde, Rockanje, Netherlands. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4862, A.J. Coombes 1021, 21 July 2005. A propagation from the original plant, cultivated at Arboretum Trompenburg, Rotterdam, Netherlands, no. PB 66.

*Quercus cerris* L. ‘**Waasland Compact**’ (*Q. cerris* ‘Waasland Dwarf’) (Jablonski, 2004) A small bushy tree with a compact oval head. Leaves to 12 x 3 cm, oblanceolate in outline with 4-5 forward-pointing, shallow, mucronate lobes on each side reaching  $\frac{1}{4}$  of the way to the midrib or less, cuneate at the base; petiole 1-1.5 cm. Raised and selected at Arboretum Waasland by Michel Decalut. The original tree is about 8 m tall branching at 1.2 m. It has also been distributed as *Q. cerris* ‘Waasland Dwarf’ but the above is the preferred name of the originator. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4829, A.J. Coombes 988, 20 July 2005. From the original plant, cultivated at Arboretum Waasland, Belgium.

*Quercus* ‘**Döring’s Zweizack**’ (Jablonski, 2000) A deciduous tree with obovate leaves to 16 x 9 cm, edged with 7-8, mucronate, slightly undulate lobes on each side, glossy dark green above, grey-green beneath, more or less glabrous on both sides when mature, midrib yellow at base; leaves of second flush with slight bronze tinge; petiole 5-15 mm, yellow; shoots red-purple, glabrous when mature. The original tree, at the Döring nursery, now 3 m tall, was raised from seed of a plant grown as *Q. muehlenbergii* Engelm. at Düsseldorf Botanic Garden, itself probably a hybrid. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4879, A.J. Coombes 1040, 23 July 2005. From the original plant, cultivated at Döring Nursery, Ahnatal, Germany.

*Quercus* x *fernaldii* Trel. (*Q. ilicifolia* Wangenh. x *Q. rubra* L.) The true plant of this name is now in cultivation at Pavia Nursery, Belgium. Most plants previously distributed as this, however, are *Q. rubra* ‘Cyrille’ (Coombes, 2005).

*Quercus* x *haynaldiana* Simonk. ‘**Concris**’ New cultivar. (*Q. frainetto* Ten. x *Q. robur* L. ‘Cristata’). A deciduous tree raised and selected at the Bömer nursery, the seed from *Q. frainetto* at Trompenburg evidently pollinated by *Q. robur* ‘Cristata’. The original was returned to Trompenburg where it now grows. Young shoots slightly hairy; leaves to 8 x 7 cm, somewhat cristate, with 4-5 lobes on each side, each ending in a small mucro and with small, secondary lobes, dark green above, grey-green beneath and hairy, densely so on the veins, base auriculate, petiole very short. The original plant is now about 2 m tall. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4857, A.J. Coombes 1020, 21 July 2005. From the original plant, cultivated at Arboretum Trompenburg, Rotterdam, Netherlands.

*Quercus* x *haynaldiana* Simonk. ‘**Crisnetto**’ New cultivar. (*Q. frainetto* Ten. x *Q. robur* L. ‘Cristata’). Origin as for *Q. x haynaldiana* ‘Concris’. Differs from

'Concris' in the more distinctly cristate leaves, the more pronounced mucros, and lack of secondary lobes. The original, at Trompenburg, is 5 x 1.5 m and is closer to *Q. robur* 'Cristata' than is 'Concris'. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4861, A.J. Coombes 1015, 21 July 2005. From the original plant, cultivated at Arboretum Trompenburg, Rotterdam, no. PP 37.

*Quercus x hispanica* Lam. '**Waasland Select**' (Jablonski, 2004) An evergreen tree; shoots densely grey-hairy; leaves very variable, from linear and barely lobed to ovate with up to 4 pointed, mucronate lobes on each side, to 7 x 2 cm, glabrous above when mature, densely grey-hairy beneath. It seems possible that this cultivar does not belong here. In bark and fruit it is close to *Q. ilex*, while in foliage it most resembles *Q. x hispanica* 'Diversifolia' but differs in the pointed lobes and lacks the corky bark. A tree at Arboretum Waasland, Belgium is 3 x 1.5 m and was grafted from the original at Hof ter Saksen. Specimen: Harold Hillier Herbarium, specimen no. 4832, A.J. Coombes 993, 20 July 2005. From a propagation of the original, cultivated at Arboretum Waasland, Belgium.

*Quercus ilicifolia* Wangenh. '**Tromp Ball**' (van Hoey Smith, 2001) A compact, shrubby form of bushy, spreading habit. Leaves to 12 x 7 cm, shallowly lobed, dull green above, grey-hairy beneath, second flush leaves red when young. The original plant about 40 yrs old, grown from seed from Tervuren is a dense shrub 2 x 5 m; leaves mid-dull green above, greyish beneath, but grafted plants are more vigorous. It was originally distributed as *Q. ilicifolia* 'Nana'. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4858. A.J. Coombes 1016. 21 July 2005. From the original plant, cultivated at Arboretum Trompenburg, Rotterdam (no. VA 1).

*Quercus macranthera* Fischer & C.A. Mey. '**Kasseler Gold**' (Jablonski, 2004) Leaves yellow when young maturing to yellow-green, darker along the midribs and veins. The original plant has made a spreading tree some 20 m tall. It appears that some shoots on this tree have reverted as they (and some plants distributed under this name) have dark green leaves. It has also been distributed as *Q. macranthera* 'Aurea'. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4888. A.J. Coombes 1050, 23 July 2005. From the original plant, cultivated at Kassel Karlsruhe, Germany (no. Z105).

*Quercus nigra* L. '**Beethoven**' (*Q. x ludoviciana* hort. not Sarg.) New cultivar. A deciduous to semi-evergreen tree. It is fast growing when young but does not reach a large size. Young shoots glabrous, red-flushed; leaves leathery and very variable in shape, bronze when young. On young, fast-growing plants they are up to 13 x 5 cm and range from linear-lanceolate and hardly lobed to variously, sometimes deeply cut with up to 4 lobes on each side. Mature plants have obovate leaves to 8 x 5 cm, 3-lobed above the centre, cuneate at the base; petiole 5 mm. The original plant at Trompenburg, some 55 years old is 10 m tall and 12 m across. It has been grown and distributed for many years as *Q. x ludoviciana* (*Q. pagoda* Raf. x *Q. phellos* L.) to which it bears no resemblance. It is not certain how the confusion arose. What appears to be the true *Q. x ludoviciana* was sent by Hillier Nurseries to Eastwoodhill, New Zealand in 1949 (A.J. Coombes 821, HILL), but the plant at Trompenburg was received from the same source in 1951. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4865. A.J. Coombes 1026, 21 July

2005. From the original plant, cultivated at Arboretum Trompenburg, Rotterdam.

*Quercus palustris* Münchh. **‘Döring’s Kompakt’** (Lübbert, 2004, as ‘Kompakt’) A small, shrubby tree; leaves to 11 x 7.5 cm with conspicuous axillary tufts beneath, mid- to dark, glossy green above, slightly glossy below, petiole about 2 cm; autumn colour said to be normal for *Q. palustris*; it appears to be more vigorous than ‘Swamp Pygmy’ and other selections. The plant at the Döring Nursery is a graft 15-18 years old from the original tree at Kassel Wilhelmshöhe, now gone; it was originally grown as *Q. palustris* ‘Kompakt’ but the above is the preferred name of the raiser and avoids confusion with a plant distributed as *Q. palustris* ‘Compacta’. It has reached 8-9 m tall by 5 m with two main trunks both dividing low down, multistemmed above. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4880. A.J. Coombes 1043, 23 July 2005. From the original plant, cultivated at Döring Nursery, Ahnatal, Germany.

*Quercus palustris* Münchh. **‘Isabel’** New cultivar. A shrubby form, leaves to 18 x 14 cm with prominent axillary tufts beneath, dark green and slightly glossy above, paler and glossy beneath, red in autumn; it is faster growing and less compact than ‘Green Dwarf’, and more compact than ‘Swamp Pygmy’. Raised and selected by Maarten and Jo Bömer and named after their granddaughter. The original plant is a compact, domed shrub 4 x 4 m. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4845, A.J. Coombes 1002, 21 July 2005. From the original plant, cultivated at Bömer Nursery, Zundert, Netherlands.

*Quercus palustris* Münchh. **‘Green Dwarf’** (Bärtels, 2001) A slow-growing shrubby form normally top-worked to make a small tree. Young shoots red-flushed, leaves to 13 x 11 cm with prominent axillary tufts beneath, broadly cuneate at the base, petiole red, 1-2 cm. Said to have no autumn colour. The original was found by W. de Vroom at Gemonde, Netherlands. A nursery plant about 10 yrs old and grafted at 2 m, had a head about 1.5 x 1.5 m. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4835, A.J. Coombes 995, 21 July 2005. From a propagation of the original, cultivated at Bömer Nurseries, Zundert, Netherlands.

*Quercus palustris* Münchh. **‘Swamp Pygmy’** (Bärtels, 2001) A small, shrubby tree; leaves to 12 x 11 cm, deeply cut up to  $\frac{3}{4}$  of the way to the midrib, glossy green above, paler and glossy beneath; axillary tufts prominent on young leaves, petiole 1-1.5 cm; shows good red autumn colour. Selected at Bömer Nurseries, a seedling of *Q. palustris* from Meeuwissen Nursery, Zundert where it was found in a swampy area. The original has made a shrubby tree about 5 m tall with 2 main trunks. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4850, A.J. Coombes 1008, 21 July 2005. From the original plant, cultivated at Bömer Nurseries, Zundert, Netherlands.

*Quercus palustris* Münchh. **‘Windischleuba’** (Sekowski, 1984, as *Q. palustris* ‘Picta-Windischleuba’; Jablonski, 2000) Leaves irregularly mottled with creamy white. It was discovered by the Polish dendrologist B. Sekowski in 1983. The original tree grows in the old park of Freiherr von Münchhausen, Windischleuba, Kreis Altenburg, Thuringia, Germany where it is about 25 x 8-12 m. This was the home of Baron von Münchhausen, whose great-uncle, Otto von Münchhausen

(1716-1774) described *Q. palustris* from a plant cultivated in another park. The intensity of variegation varies from shoot to shoot and according to Dieter Döring it is difficult to propagate, with the variegation only appearing 2-3 years after grafting. Standard specimen: Harold Hillier Herbarium (HILL), specimen no. 5333, ex herb. E. Jablonski, no. EJ310, Peter A. Schmidt, 7 June 1998. From the original tree, cultivated at Windischleuba, Germany.

***Quercus pubescens*** Willd. ‘**Aydin**’ New cultivar. A form selected for its grey-blue foliage. Leaves to 6 x 4 cm, deeply cut into pointed lobes, densely grey-hairy on both sides. Cultivated Pavia Nursery, Deerlijk, Belgium. Found near Afyon, central Turkey by Dirk Benoit and Eike Jablonski in 2002 growing with *Q. cerris* and *Cistus laurifolius*. It is named after Aydin Borazan who accompanied the International Oak Society tour to Turkey in 2002 and who tragically died in 2005. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4823, A.J. Coombes 972, 19 July 2005. From a grafted tree 1.5 m tall, the first propagation.

***Quercus* ‘Souvenir de Jacques Lombarts’** New name (*Q. x schochiana* ‘Bömer’ Lübbert, 2004). This small tree has been distributed by nurseries in Continental Europe as *Q. x schochiana*; its origin is unknown but it clearly does not belong to *Q. x schochiana*. Young shoots densely grey-hairy at first becoming glabrous; leaves narrow elliptic, with 6-8 shallow, bristle-tipped teeth on each side, pale glossy green and sparsely stellate hairy above when young becoming glabrous, densely grey-white tomentose beneath at first, later glabrous and pale green; petiole 7-10 mm, grey-hairy at first, later smooth. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 5013, A.J. Coombes 1055, 23 July 2005. From a 2.5 m tall grafted plant, cultivated at Döring Nursery, Ahnatal, Germany.

***Quercus robur*** L. ‘**Antonie Medrzycki**’ New cultivar. A seedling of *Q. robur* found around 1996 in Poland at the nursery of ‘Medrzycki i Syn’ in Gospodarstwo Szkolkarskie, Jasieniec k. Groja near Warsaw, Poland. Leaves oblong-ob lanceolate, to 13 x 5 cm, shallowly lobed to nearly entire, narrowed to an auriculate base or cuneate. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4211, Eike Jablonski s.n., 30 August 2004. From a 5 year old grafted tree, propagated from the original, cultivated at Hoesdorf, Luxembourg.

***Quercus robur*** L. ‘**Blue Gnome**’ New cultivar. A compact bushy shrub; young shoots red-purple; leaves to 8 x 5.5 cm, blue-green above, grey-green beneath; base with small auricles; petiole 5 mm. The original plant, a seedling raised by Bömer about 10 yrs old, and originally called ‘Gnom’ is a dense bush 1.5 x 0.9 m. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4855, A.J. Coombes 1013, 21 July 2005. From the original plant, cultivated at Bömer Nurseries, Zundert, Netherlands.

***Quercus robur*** L. ‘**Irtha**’ (M.M. Bömer catalogue 1997/8) Cultivated Bömer Nurseries, Zundert, Netherlands. A small, slow-growing tree; leaves to 9 x 5 cm, dark green above with irregular pale green markings between the veins, blue-green beneath; lobes slender, rounded at the apex and cut nearly to the midrib, with small, secondary lobes; base auriculate, petiole very short. The original plant, about 15-20 yrs old, is 6 x 5 m. It is a seedling raised by Bömer from ‘Cristata’ or ‘Fennessyi’,

some seedlings from it resemble 'Cristata'. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4851, A.J. Coombes 1009, 21 July 2005. From the original plant, cultivated at Bömer Nurseries, Zundert, Netherlands. The name is from the Nordic Earth Goddess, Irtha.

***Q. robur* L. 'Kasseler Rakete'** New name (*Q. robur* 'Fastigiata Kasseler Rakete', Lübbert, 2005; *Q. robur* 'Kassel', Jablonski, 2004) A narrowly upright tree with strictly upright branches. Shoots red-purple; leaves to 13 x 10 cm; lobes broad, reaching up to ½ way or sometimes slightly more to the midrib; petiole 5 mm, red-purple. By far the narrowest in a group of upright *Q. robur* at Kassel Karlsruhe. The original tree is about 27 x 2 m and about 80 years old. Standard Specimen: Harold Hillier Herbarium (HILL) specimen no. 4884, A.J. Coombes 1046, 23 July 2005. From the original plant, cultivated at Kassel Karlsruhe, Germany, no. T439.

***Quercus robur* L. 'Miki'** (New cultivar) An unusual form selected for its deeply cut foliage. Leaves to 15 x 7 cm, with 5-8 taper-pointed, triangular to linear-lanceolate lobes on each side, ending in thread-like points; lobes cut from ¼ to ½ the way or sometimes completely to the midrib, the larger ones occasionally with small, lateral lobes; base cuneate; petiole to 2 cm long. Standard specimen: Harold Hillier Herbarium, specimen no. 4856, A.J. Coombes 1014, 21 July 2005. From a grafted plant 1.5 m tall propagated from the original tree in Hungary, cultivated at Bömer Nurseries, Zundert, Netherlands. Named after Miklas Barabits and originally thought to be a form of *Q. rubra*.

***Quercus robur* L. 'Timuki'** (Bärtels, 2001) A form with purple leaves found in Latvia by Mr M. Timuks near the arboretum he created next to his country house – Timuki. According to Raimonds Cinovkis, of the National Botanic Garden, Salaspils, Latvia, who distributed material in 1997, it is an improvement on 'Atropurea' because of its greater hardiness in Latvia.

***Quercus robur* L. 'Tromp Dwarf'** (van Hoey Smith, 2001) Dense slow growing bushy form; leaves to 8 x 6 cm, twisted and congested, dark green above, grey-green beneath; petiole 2 mm. A seedling of *Q. robur* 'Cristata' raised at Trompenburg in 1979. The original plant there is 1.2 x 1 m and multistemmed above 10 cm. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4859, A.J. Coombes 1018, 21 July 2005. From the original plant, cultivated at Arboretum Trompenburg, Rotterdam, no. HK 94.

***Quercus robur* L. 'Totem'** New cultivar. A narrow upright selection raised at the Bömer Nursery in about 1993. The original tree (now dead) reached 7 m tall. A propagation of this was 4 m tall and 45 cm wide in 2005. Cultivated Bömer Nurseries, Zundert, Netherlands. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4854, A.J. Coombes 1012, 21 July 2005. From a propagation of the original, cultivated at Bömer Nurseries, Zundert, Netherlands.

***Q. rubra* L. 'Bolte's Gold'** (Jablonski, 2004) A vigorous tree raised by Josef Bolte from seed from Dortmund Botanic Garden and selected for its yellow foliage that does not burn in full sun. Leaves of the first flush are pale yellow in sun, turning to pale green in shade or on the north side of the tree, while others are mixed



pale yellow and pale green; petiole deep red for its whole length in sun; leaves pale yellow beneath to pale blue-green in shade; second flush leaves bronze-red when young; autumn colour said to be pink to red. The original tree, raised in 1994, is about 8 m tall with a spread of 7 m. It needs to grown in full sun to develop the best colour. Standard Specimen Harold Hillier Herbarium (HILL), specimen no. 4873. A.J. Coombes 1034, 22 July 2005. From the original plant, cultivated by Josef Bolte, Paderborn, Germany.

*Quercus rubra* L. '**Haaren**' (Jablonski, 2004) A compact, shrubby form grown from a witches broom found at 10 m on the trunk of *Q. rubra* in Haaren, Netherlands. Leaves to 18 x 13 cm, dull green above, pale dull blue-green beneath, petiole to 3 cm, red at base. Standard Specimen: Harold Hillier Herbarium (HILL), A.J. Coombes 1005, 21 July 2005. From a propagation of the original, cultivated at Bömer Nurseries, Zundert, Netherlands.

*Quercus x streimii* Heuff. '**Kortrijk**' New cultivar. A deciduous tree; shoots nearly glabrous when mature; leaves to 11 x 6 cm, base slightly auriculate, with 10-11 pointed lobes on each side reaching about ½ way to the midrib, the larger lobes just below the centre often with 1 or 2 lateral lobes; petiole 1-1.2 cm, downy. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4813, A.J. Coombes 956, 19 July 2005. Graft from the original, cultivated at Pavia Nursery, Deerlijk, Belgium.

*Quercus x streimii* Heuff. '**Lanze**' (*Q. petraea* 'Lanze' in Jablonski, 2000) A deciduous tree raised and selected in 1988 by Dieter Döring, a seedling of *Q. x streimii* 'Pungens' growing close to *Q. petraea* 'Mespilifolia'. Young shoots densely grey-hairy; leaves lanceolate, often falcate, undulate, to 11 x 2 cm, glossy dark green and glabrous above paler and thinly hairy beneath when mature; petiole 1.5-2.5 cm. The original is a small tree 5 x 5 m. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4877, A.J. Coombes 1038, 23 July 2005. From the original plant, cultivated at Döring Nursery, Ahnatal, Germany.

*Quercus x turneri* Willd. '**Gnom**' (*Q. x turneri* 'Pseudoturneri Gnom' in Lübbert, 2005) A low growing semi-evergreen shrubby form to 45 x 60 cm, taller when grafted. Shoots glabrous when mature; leaves obovate, to 7 x 4 cm, with 4-5 mucronate lobes on each side reaching about ¼ of the way to the midrib, mid-green and slightly glossy above, paler beneath, glabrous on both sides when mature. Young foliage of the second flush deep bronze-red. Selected by Dieter Döring about 2001 from a batch of seedlings of *Q. x turneri* 'Pseudoturneri', raised by Werner Schulze in Germany from seed collected in 1989 from a park near Potsdam. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 4883, A.J. Coombes 1045, 23 July 2005. From the original plant, cultivated at Döring Nursery, Kassel, Germany.

*Q. x vilmoriniana* A. Camus '**Maurice de Vilmorin**' New cultivar. This name is given here to vegetative propagations from the original tree of this hybrid, which was planted at Arboretum des Barres, France in 1894, but has since died. This distinguishes them from other plants that have been raised from seed and may show the influence of other species such as *Q. robur*. A spreading deciduous tree; shoots stout, stellate-hairy with conspicuous lenticels; leaves obovate, to 20 x 10 cm, with

4-6 shallow, rounded lobes on each side, cuneate to rounded at the base, glossy dark green and smooth above, paler beneath and stellate-hairy; petiole to 2 cm long, densely hairy; fruit clusters short-pedunculate, cups 1.5 cm across, the scales at the rim with short, erect, free tips. Cultivated Arboretum des Barres, original tree, planted 1894. Standard Specimen: Harold Hillier Herbarium (HILL), specimen no. 2560, A.J. Coombes 980708, 30 July 1998. From the original plant, cultivated in Arboretum des Barres, France.

*Quercus vulcanica* Boiss. & Heldr. ex Kotschy '**Kasnak**' (New cultivar) A form selected by Dirk Benoit from the Kasnak Forest, Turkey for its deeply cut leaves. Young shoots red, leaves dark green above. Standard specimen: Harold Hillier Herbarium, specimen no. 4837, A.J. Coombes 983, 19 July 2005. From one of the first propagations, a grafted plant 1.3 m tall, cultivated at Pavia Nursery, Deerlijk, Belgium.

## Acknowledgements

For assisting us with the visits we made, for providing information and for allowing us to collect material we would like to thank Dirk Benoit, Jo and Maarten Bömer, David and Chanta l Bömer, Dick and Riet van Hoey Smith, Michel Decalut, Josef Bolte, Dieter and Frank Döring, and George Moes.

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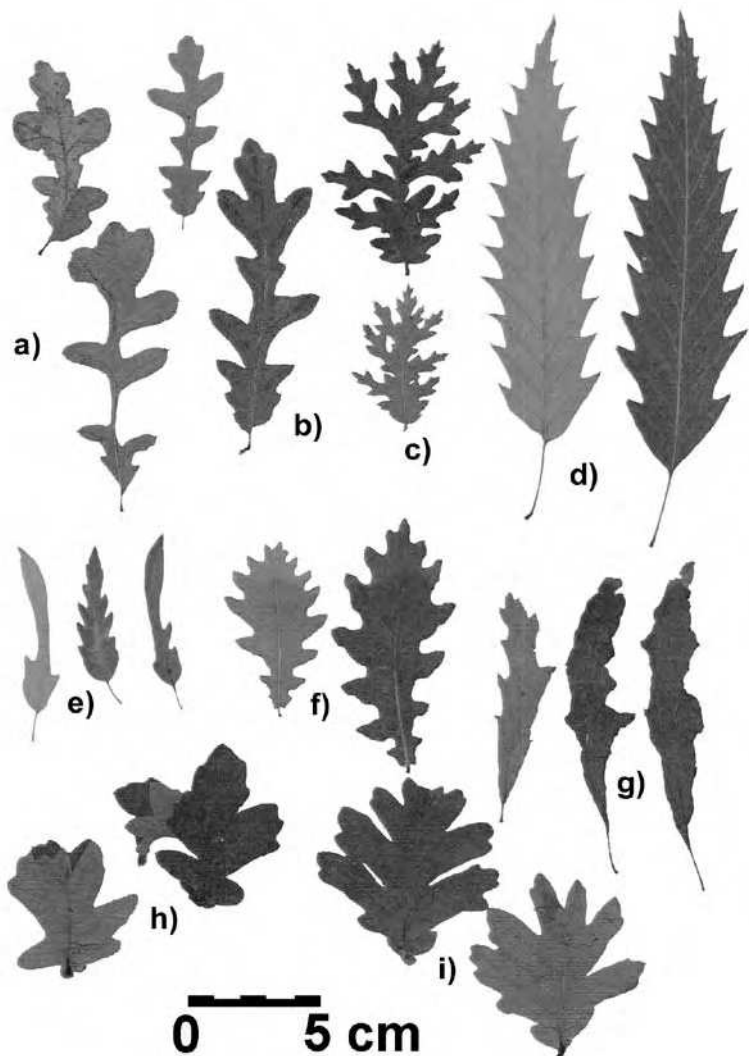


plate 1 : a) *Q. cerris* 'Marmor Star'                      b) *Q. cerris* 'Bolte's Obelisk'  
 c) *Q. cerris* 'Afyon Lace'                                d) *Q. castaneifolia* 'Zuiderpark'  
 e) *Q. x hispanica* 'Waasland select'                f) *Q.* 'Döring's Zweizack'  
 g) *Q. cerris* 'Waasland Compact'                h) *Q. x haynaldiana* 'Crisnetto'  
 i) *Q. x haynaldiana* 'Concris'



# Oaks as Native American Trail Marker Trees

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The eastern half of the United States was once laced with a vast network of trails used by numerous Native American Tribes during their travels. These trails were narrow and travelers moved along them in single file toward their destinations. These trails became difficult to follow in certain terrain, so trail markers were developed to make the routes easier to follow. These trail markers were strategically located trees that were mostly oak species.

There are many reasons why oaks were selected for use as trail markers. They are among the most common trees in the eastern half of the United States. However, abundance alone is not a primary reason for their selection. Most oak species bend easily without breaking when they are saplings. This is a very important trait because any tree being manipulated for use as a trail marker will require a considerable amount of bending.

Oak species, particularly those within the white oak group which includes white, bur, and post oaks, are very resistant to heart rot. Oaks in general also have the capacity to heal readily and compartmentalize wounds. This is another valuable trait because wildland fires were common during occupancy by Native Americans. Their thick bark also makes them highly resistant to wounding due to fires.

White, bur, or post oak trail marker trees can persist for 300 or more years. Live oaks in southern states may live for as much as 800 or more years. Frequent use was made of white and bur oaks in the upper Midwest in states such as Illinois, Michigan, Ohio, and Wisconsin. Post oaks (*Q. stellata*) were used on the dry, rocky ridges in southwestern Missouri and Texas, and live oaks (*Q. virginiana*) and southern red oaks (*Q. falcata*) were the trees of choice in southern states such as Georgia.

Several methods of forming marker trees evolved among Native American tribes with the passage of time. Some tribes also had their own distinct way of making marker trees. In general, oak saplings were bent and tied to stakes using a rope or strings of animal skin or rawhide. The form of the tree would be firmly set by the time the rawhide deteriorated. The direction of the bend indicated the correct course for the traveler. Sometimes rocks were placed on the ground to provide additional emphasis on the right direction to follow.

Cutting the leader or central branch of the tree about three feet above one to three lateral branches altered this general method of form trail marker trees. The sapling was then bent over and tied down. Moss or other material would sometimes be packed around the cut leader, hoping to form a “nose” that would serve as a pointer toward the correct direction. With the passage of time, the lateral branches that were now vertical because of the bend would grow upright, becoming the “secondary trunks of the tree. From certain angles, these types of trees sometimes resemble a letter or number. There was a white oak near Loami in Sangamon County, Illinois in the 1950s known to local inhabitants as the “Old 4 Tree” because of its unusual branching that resembled the number “4”.

In another method of forming trail marker trees, the leader was not cut. The entire sapling was bent to the ground and tied to stakes. With the passage of time, the leader would turn back up toward the sun and continue growing. The bend in these trees tended to be rather dramatic and lengthy, causing these trees to be called “treasure trees.” This term fostered legends of buried treasures at the point where the leader was tied to the ground.

There were also trees shaped by Native Americans that were not trail markers. Instead, these trees marked tribal boundaries. In contrast to trail marker trees, their trunks were upright, not horizontal. These trees were manipulated so two or three main branches developed from the same location on the trunk, much like a candelabra or a football goal post.

Despite their former abundance and widespread use, considerable controversy exists regarding trail marker trees. Some people believe that their forms are due to reasons other than manipulation by Native Americans, such as ice from a winter storm or another tree that pinned them down when they were saplings. There is relatively little information on trail marker trees, and much of this controversy and confusion is likely due to this lack of information and knowledge.

Our forests do contain trees that are growing at odd angles, including some that have been incorrectly labeled as trail marker trees. Fortunately, there are guidelines that individuals can use to determine the authenticity of any trail marker tree. Any trail marker tree in the eastern United States has to be between 200 to 800 years old,



Oak Society member Dirk Benoit of Belgium in the crown of the Trail Marker White Oak (*Quercus alba*) near Athens Illinois. This tree was core dated to 1730 and was bent in a high arch after horses were introduced to the area. Following it from tip to base leads to a natural gravel ford at the confluence of Rock Creek with the Sangamon River. (Photo courtesy of Philippe de Spoelberch)

considering that the practice of shaping these trees was likely discontinued when most Native Americans were forced from the area in the 1830s. Known trail marker tree ages verify this age range. A white oak in central Illinois was determined to be nearly 300 years old, and a live oak in Georgia is known to be 800 years old.

The tree's location can also be helpful in determining authenticity. Trail marker trees were on high ground or in open country where they could be easily seen. Travel was easier here and the vantage points offered by the high ground enabled travelers to see game or enemies at great distances. Strong winds also kept the high grounds free of leaves during autumn and snow during winter.

The location of the bend can also be used to identify trail marker trees. In any authentic marker tree the bend is always in the trunk, not one of the branches. During the early years before horses trees were bent so they were only a few feet from the ground. With the widespread use of horse the trees were bent so the main trunk was eight feet or more above the ground.

Most trail marker trees present today are also likely to be oaks. These were the most common trees in the eastern United States, but their longevity was a primary factor in their selection for use as a trail marker. Most trail marker trees that persist to this day are oaks.

Trail marker trees have been known by a variety of names throughout the years. Some were called "message trees" because their hollow "noses" were used by Creek Indians as places to leave message sticks for travelers. The term "thong trees" has also been used due to the use of a rawhide rope or thong to hold the tree to stakes during the initial years of formation. When horses became widely used in the eastern United States, the term "horse and rider" trees was applied to those formed during this time. The bend in these trees tends to be high, approximately eight feet from the ground, enabling riders to see them from a distance.

Pioneers called them "water trees" because many directed travelers to springs. A white oak trail marker tree still directs visitors to a spring in a Wisconsin state park. Though less commonly used, pioneers also called them "buffalo trees" because Native Americans apparently aired out buffalo robes by hanging them on their low-lying trunks.

Despite their former abundance, few of these trees were ever given names. One exception is a tree that probably was a trail marker was along a Sauk trail in Rock Island County. It became known as the "Lincoln Tree" because Abraham Lincoln passed by it with the militia in 1832 on his way to the Black Hawk War. This tree was located on a point along a bluff and was described as old, ill formed, and scarred by numerous wagons that had passed over it. It remained a few years after the war, but was eventually grubbed out so potatoes could be planted. Its low trunk suggests that this tree was formed prior to the widespread use of horses.

A bur oak marker tree stood along the Ottawa trail in Ford County for many years until it died in the 1950s. Two other bur oak marker trees were present in a pasture along this same trail a few miles to the north, but they were lost one day when the new landowner decided to clear the land. A bur oak marker tree once stood on Elkhart Hill in Logan County near the Edward's Trace. This trail, named after Governor Ninian Edwards, lead from Cahokia to Peoria, the sites of a major Peoria Indian village. Vestiges of this trail remain on Elkhart Hill that was high ground in a region of low, wet prairies and sloughs before the days of drainage ditches and tile lines.

Trail marker trees were once relatively common in Winnetka in Cook County along the “North Shore Trails”. Some even served to guide pioneers for several years following their arrival. As late as 1975, marker trees were still present in Kenilworth in Lake County. Some believe that these trees guided Indians from Lake Michigan to villages and others believe they guided travelers to the portage around the south end of Lake Michigan.

Trail marker trees are now rare. Many have simply grown old and died with the passage of time. Others probably were cut when forests were cleared for agriculture by pioneers. Some were probably regarded as “wolf trees” and removed in timber management practices. However, not all loggers were willing to cut a trail marker tree down. Destroying these trees was thought to arouse the spirits of the ancients, resulting in some very bad luck.

While many have perished, a few living marker trees remain. One still stands on a high bluff in Adams County, Illinois and another stands alone in a Menard County, Illinois pasture. One is present in a Wisconsin state park and others are present in Georgia and Missouri. Consider yourself very fortunate and privileged if you get to see one. They are the last living things touched and formed by Native Americans in some states, making them culturally and historically significant.

These trees will not last forever, not even the live oaks of the south. Despite their historic and cultural significance, little effort has been made to catalog trail marker trees within most states. Some preservation efforts have been by individuals or garden clubs. This lack of interest and information is a tragedy nearing completion as these trees perish.

They were important markers along major travel routes for centuries before fading into the obscurity of the modern world. Besides old age, disease, and storms, the few trees that remain face destruction through development and general habitat destruction. A legacy will be lost when they are gone.



# *Quercus ellipsoidalis* E.J. Hill on Rims of Kettle Bogs in Ontario

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Key Words: Hill's oak, *Quercus ellipsoidalis*, range extension, kettle bog, hybridization, scarlet oak, *Quercus coccinea*, new for Canada, living leaf differences

## Abstract:

Hill's oak, *Quercus ellipsoidalis*, an occupier of a major and extensive disjunction in southwestern Ontario, grows on drier sites of glacial drift. It also grows on kettle bog rims and should be looked for on that very restricted habitat in its U.S.A. range where bogs occur, ie. north of the Wisconsin terminal moraine. Scarlet oak *Q. coccinea*, new for Canada, is mentioned in passing.

Hill's oak is a medium-sized, mid-continent red oak of North America. It occupies the interface between the tall grass prairie and the deciduous forest. It is closely related to its sister clade, the Appalachian scarlet oak *Q. coccinea*. Some say it is the same species, being merely the midwestern expression of its eastern sister. Whatever truth prevails, they are closely allied and have recently evolved from a common ancestor. With experience in the subtle and not so subtle differences they can be distinguished. They both occupy the most xeric habitats in their mostly allopatric ranges. They are both minor species in the great assemblage of American oaks.

To horticulturalists, the pair are a great gift with their small size (for an oak), tight upright-oblong crowns, cold tolerance, ability to withstand heat and drought, but best of all, their superb, consistent autumnal coloration in the red, scarlet, maroon and purple spectrum. Hill's oak is superior to scarlet for horticultural purposes, since the twigs, leaves and buds are smaller and the tree presents a daintier, more delicate aspect. Some individuals are akin to *Q. georgiana* in that respect.

In southern Ontario, Hill's oak currently occupies all or part of ten contiguous counties, cities, or regional municipalities. The range must have been more widespread during the postglacial hypsothermal, otherwise how did this disjunct population get here? The author has been studying this Ontario population for 45 years, and feels that Hill's oak is entitled to a specific name of its own, compared with scarlet oak. It certainly occupies an intermediate position in every respect. However, the author is a lumpner, not a splitter. The main Hill's oak population occurs in Minnesota, Wisconsin, and northern Iowa, with disjunctions in Michigan and in northern Illinois, Indiana, and Ohio. It is definitely a tree of oak savannah and long grass prairie.

In Ontario's Brant County, it is arguably the most common of the three native red oaks in that jurisdiction; this could be considered the centre of its Ontario, and therefore Canadian, distribution (the author has not mentioned a second population along the Minnesota border - far from the one under discussion). In Brant County, it is currently genetically swamping its congeners red oak, *Q. rubra*, and black oak, *Q. velutina*, producing some interesting, but confusing to the neophyte, hybrids. These

hybrids, or their progeny, should be able to occupy progressively less xeric habitats than the dominant parent, therefore eventually producing a new entity capable of occupying more mesic habitats than Hill's oak presently does. Near Dunnville, in Haldimand County, in the Niagara peninsula between lakes Erie and Ontario, Hill's oak grows within one km. of the native Pin oak, *Q. palustris*. There is no hybridization occurring between these two, allopatric by virtue of being occupiers of the driest and wettest habitats for their genus, in Canada. Another wetland species, Shumard oak, *Q. shumardii*, does not hybridize with Hill's oak at a location slightly north, in the town of Grimsby, Region of Niagara.

Ontario is blessed with a nearly full complement of the pin/Shumard complex, lacking only the gulf coastal plain *Q. nuttallii*. Until recently, few realized that Hill's and Shumard's oaks were even in this province, and fewer still realized that these oaks would turn out to be more widespread than pin oak, long known to occur here.

Recently, the author discovered a few individuals of scarlet oak, *Q. coccinea*, near the Niagara River. He has studied this species throughout its North American range for forty-seven years, and feels confident in stating its presence in Ontario; however, this is not the forum or the time for this discussion. To put an old plagiarized myth to rest, in all those years, the author has only seen one individual with apical acorn rings! Most, however, have longitudinal striping, as do many species.

Many dimensional parameters and fruit, bud, crown, and bark characteristics for the five species in the Shumard complex have been published elsewhere. The author has never seen a comparison of living leaves, useful for field work, in contrast to using dried specimens, where many features are lost. We repeat the axiom of oak study: use sun leaves from fruiting twigs. For a comparison of the four native Ontario oaks in this complex, see Table 1

Table 1: Shumard oak complex; living leaf rankings and habitat requirements:

Species	Habitat	Ventral Gloss	Ventral Abaxial Tufts	Dorsal Gloss	Leaf Size
scarlet oak <i>Q. coccinea</i>	xeric – all ages, shade intolerant (2)	1 shinier than dorsum	NIL	1 bright emerald Green	1(2)
Hill's oak <i>Q. ellipsoidalis</i>	xeric – all ages, shade intolerant (1)	2 shinier than dorsum	2	2 very dark green	3(4)
pin oak <i>Q. palustris</i>	wet feet shade tolerant (as a seedling)	4	3 minor (if at all)	3 yellow/green	4(3)
Shumard oak <i>Q. shumardii</i>	wet feet Shade tolerant (as a seedling)	3	1 major (rusty)	4 often opaque	2(1)

Southern Ontario contains three distinct substrate types, widely separated by time and erosion episodes. Lowest is the igneous and metamorphic basement, which also forms the basement of two thirds of North America. It is commonly known, where it is exposed across much of boreal and arctic Canada as the Canadian shield. It spans the inconceivable time span from three billion to one billion years ago. Lest a textbook purist-geologist attack this paper, the Grenville province portion of the shield, lying under that portion of southern Ontario concerning this article, is only

1.3 ~ 1.1 billion years old.

From one billion to 570 million years ago, there is a large gap in deposits known as the great unconformity. Much of the bedrock of southern Ontario has above it Paleozoic sedimentaries such as shales, siltstones, sandstones, limestones, and dolostones, ranging in age, from the bottom up, from 570 million to 350 million years old, or ordovician to devonian, inclusive.

The water of four of the five Great Lakes, flowing over a Sirlurian dolostone capstone, unto an Ordovician redstone shale (Queenston), softer, and therefore undermined, forms the world famous Niagara Falls. The feature over which it plunges,



Fig 1. Hill's oak on bank.



Fig.2 Long view of a bog; oaks on far bank, spruce on the bog in middle ground, mixed ericads and miscellaneous species in front, with glimpse of *Thuja* in immediate foreground.



Fig 3. Hill's oak and bog; on right showing mostly *Larix*

a United Nations-designated World Heritage Site, known as the Niagara escarpment, is an 800 km long feature of southern Ontario, and can be seen from space. This escarpment can actually be traced from Iowa to New York in a great northward curving arc. It forms, to name a few, the Door peninsula of Wisconsin, Manitoulin Island, Ontario (the world's largest freshwater island, famed for its alvars), and the Bruce peninsula of Ontario, famous for the large diversity of temperate-latitude ferns, orchids, and endemic dicots. Do not forget Niagara Falls, over which flowed, before human intervention,  $6,000\text{m}^3/\text{sec.}$  of water.

After another lengthy time period dubbed the "Big Gap" from 350 million years ago to 135,000 years ago, when there was only uplift and erosion in Ontario, glacial deposits began to be laid down and alternately scraped away. The most recent glaciation, known as the Wisconsin, began retreating (melting back) about 20,000 years ago. The resulting deposits form the third and uppermost layer of Ontario bedrock. It is composed of some stratified but mostly unconsolidated tills of sand, silt, clay, conglomerates, and erratic boulders. These often form recognizable structures such as drumlins, kames, eskers, and moraines. There are also many fluvial and lacustrine deposits including abandoned beaches, bars, outwash plains, and deltas. These may be variously sand, silt, clay, or cobbles.

Features that are common indicators of retreating continental glaciers are kettle bogs. These are formed when blocks of ice sever from the decaying ice. Subsequently they become buried by till, usually sand or gravel in an outwash plain. Insulated by their cover, they take longer to decay than exposed ice. When eventually they do melt, they result in a dimple in the landscape, usually pot- or kettle-shaped, hence the name. If they fill with ground water, and eventually vegetation, it is usually ericaceous and sphagnum, cooler and more acid than the surroundings. In southern Ontario, which at the time of European settlement in 1780-1820, the cover was 90% deciduous forest and 10% long grass prairie/oak savannahs, the bogs contained boreal relict species, mostly ericads, *Larix* and some *Picea*. The ericads included such genera as *Andromeda*, *Chamaedaphne*, *Gaultheria* (2 sp.), *Gaylussacia*, *Kalmia*, *Ledum*, and *Vaccinium* (5 sp.). Other shrubs present might include *Cephalanthus*, *Cornus* (3 sp.), *Ilex*, *Nemopanthus*, *Pinus*, *Rosa*, *Rubus* (2 sp.), *Salix* (numerous sp.), *Spiraea*, and *Thuja*. These bogs today often have Hill's oak growing on their banks. **Figures 1, 2 and 3** show such a bog in late winter.

There are several possibilities for the explanation of oaks near these bogs:

- 1) If a mature closed canopy forest had developed over centuries in the surrounding vicinity, the only place with full or at least half-sunlight for a medium-sized tree would be the bog bank. Individual crowns could reach over the open bog.
- 2) As senescent leaning trees toppled into the bog, they would create large sunny beds for seedling recruitment.
- 3) When the aboriginal people had used fire to clear the surrounding level area for agriculture, the bog bank might serve as a refuge.
- 4) Similarly, after European settlement, soil tillage would destroy seedling recruitment on the level grounds, but the bog bank would function as fence lines do today.
- 5) In a natural fire, prior to human interference, there would be enough moisture in the lower bog bank to allow more roots to survive and sucker than at the higher elevations.
- 6) With a greater accumulation of organic debris at the bottom of the bank and

in the presence of the peat and/or sphagnum itself, the pH would be lower there, than at the higher elevations, creating a more agreeable seedbed for an oak.

7) In a fairly level area, the top of the bank would represent the best drainage site for an obligate xeric species.

In Ontario today, urban expansion and suburban sprawl coupled with farm industrialization are threatening the rural landscape. Kettle bogs and their banks, themselves always rare and now endangered, may represent the last refuge of Hill's oak in Ontario.

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*Special thanks to Robert Walling for photography and formatting of this paper.*

# Some Thoughts on Evolutionary and Phylogenetic Perspectives in the Oaks - *Quercus* and *Lithocarpus*

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## Introduction - the family *Fagaceae*

An important justification for carrying out experimental taxonomic studies on a large group such as the oaks is the belief that these can help to resolve difficulties and ambiguities which the classical taxonomic approaches cannot. The oaks are a widely distributed and species-rich group with a complex evolutionary history, and it is therefore helpful to view our present perceptions of the oaks particularly in the broader context of the family to which they belong.

The *Fagaceae* is not a large family; there are ten recognised genera (Nixon, 1989). *Fagus* - the beeches, *Nothofagus* - the southern beeches, *Castanea* - the chestnuts, *Castanopsis* and *Chrysolepis* - the chinkapins and two genera of oaks, *Lithocarpus* and *Quercus*. In terms of species richness, the oak genera are by far the largest. Camus (1936-1954), in her monumental work *Les Chenes*, recognises 279 species of *Lithocarpus* and 430 of *Quercus*. In addition, there are 3 very small genera containing rare and possibly relict species, namely *Trigonobalanus*, *Colombobalanus* and *Formanodendron*. The number of species she recognised in the other genera is 8 in *Fagus*, 12 in *Nothofagus*, 7 in *Castanea* and 27 in *Castanopsis*. Although the actual number of species recognised by different authorities varies, these figures indicate relative species richness. On this basis, oaks constitute the bulk of the family, the majority of which belong to the genus *Quercus*.

The characteristic feature of the family is that seed (or seeds) are borne in a cupule; in some genera (*Castanea*, *Fagus* and *Nothofagus*), seeds are enclosed; in *Castanopsis*, *Chrysolepis*, *Lithocarpus*, and *Quercus*, they are not. The form of the cupule in the latter two genera is a well-marked feature of the oaks, as a whole, and can be considered to be the most important single diagnostic feature of the group. A very basic definition of an oak might well be a tree or shrub which produces acorns. Other variable characters within the family have been used as diagnostics, not always with entirely satisfactory results. This can be illustrated by reference to a simple phylogenetic tree of the family.

The basic and most primitive form is best represented by the genera *Castanopsis* and *Chrysolepis*. The salient features are:

1. They include both evergreen trees and shrubs
2. The fruit is a burr which is open at the apex; 1-3 seeds per fruit may be produced
3. The fruit mature in their second season
4. Distribution is tropical Asia and California (*Chrysolepis*)
5. Rigid male inflorescence occur.

The chestnuts, *Castanea*:

1. Deciduous trees and shrubs
2. The fruit is a burr which may contain up to 3 seeds and which are fully enclosed
3. The fruit mature in a single season
4. Distribution is north-temperate
5. Rigid male inflorescence

The southern beeches, *Nothofagus*:

1. Evergreen or deciduous shrubs and trees
2. The fruit is a burr enclosing up to 3 seeds, commonly 2, which are fully enclosed and relatively small in size
3. Fruit may mature in one or two seasons
4. Distribution is in the southern hemisphere

The beeches, *Fagus*:

1. Deciduous trees
2. The fruit is a burr enclosing up to 3 seeds, commonly 2 which are fully enclosed and relatively small in size (cf *Nothofagus*)
3. Fruit mature in a single season
4. Distribution is in the northern hemisphere.

The oaks, *Lithocarpus*:

1. Evergreen trees
2. Fruit an acorn, single seeds are borne in an open cupule
3. Fruits mature in second season
4. Male inflorescence is rigid as in *Castanopsis*
5. Distribution more or less subtropical-tropical, Asia and California

The oaks, *Quercus*:

1. Evergreen or deciduous trees and shrubs (some scrubby)
2. Fruit an acorn
3. Fruits may mature in first or second season
4. Male inflorescence lax
5. Distribution, northern hemisphere (Old and New Worlds)

From the salient points listed it is possible to identify the evolutionary lineages from the basic *Castanopsis* type, which might be called oak, chestnut and beech lines. The major evolutionary imperative seems to have been the expansion of range from the tropical Asian centre of the family. Ancestral forms appear to have been components of rainforest at middle elevations. For such taxa, one means of increasing geographic range is to colonise lower elevations at higher latitudes. This has been a very successful strategy in all three evolutionary lineages, certainly as far as temperate latitudes are concerned. Oak, beech, and chestnut are all to be found as significant and even dominant elements of temperate woodland climax vegetation in the northern hemisphere, and in the case of the beech line, in parts of the southern hemisphere, also. This migration has been accompanied by a number of common evolutionary tendencies, most notably the adoption of the deciduous



habit and the shortening of the period taken by fruits to mature from two seasons to a single season.

Some characteristics of the rainforest ancestry are still retained. The relatively large seed size is still to be found in the oaks and chestnuts, although significant reduction has occurred in beeches. Seed dormancy is a common feature of temperate plants, coupled with some measure of seed longevity. These features are conspicuously lacking in most groups in the family. An interesting divergence is to be found in the oaks, in North American and European species; the white oaks have no seed dormancy and can germinate soon after being shed. This exposes the seedlings to winter conditions which they may be able to survive when and if they are protected by fallen leaves from the canopy. The black oaks have a short-term dormancy which ensures that seed germinates in the spring, thus avoiding adverse winter conditions. This probably increases seed longevity to a small degree and has probable survival value.

The evergreen habit, characteristic of tropical rainforest, has been retained within both the oaks and southern beeches. Evergreen oaks and southern beeches survive well in the northern latitudes of the British Isles; they are adversely affected in very severe winters in less oceanic climates, however.

The distribution of groups within the family is both interesting and intriguing. Relatively few arborescent families are as strongly represented in both hemispheres as the Fagaceae, and the presence in the southern hemisphere of *Nothofagus* and that of *Fagus* in the northern hemisphere suggests that the family is very ancient and occurred in Pangaea before this land mass broke up. While all three lineages within the family were represented in Laurasia, which gave rise to North America and Eurasia, the progenitors of *Nothofagus* beeches were present in Gondwanaland, which gave rise to South America and Australasia where it is well represented. No ancient lineages of the Fagaceae persisted in the proto-African land mass, it seems; modern Fagaceae in Africa bordering the Mediterranean are obviously recent immigrants.

The evolutionary strategies successfully followed in the chestnut, beech and oak lines are closely similar and merit further consideration because the differences generated are often used diagnostically in the generation of systems of classification. Their actual diagnostic value may well be more limited than generally appreciated. What may appear to be a clear cut distinction may, on examination, appear to be much less so. Discussion can most usefully be based on the situation in the oaks generally and more particularly on those included in *Quercus*. The broad position in the family at large can most conveniently be summarised in diagrammatic form in the scheme presented in Figure 1.

## **Biosystematics and Taxonomy of the Oaks**

In the Fagaceae as a whole, there is a repetitive pattern of change from evergreen to the deciduous habit, and a reduction of time of fruit maturation from two to a single season. The feature which distinguishes the oak lineage from the other two is the production of the very distinctive acorn fruit. In this, a single seed is borne in a cupule in which no evidence of the basic primitive valved structure is apparent. This circumstance justifies the concept that any tree, shrub, or scrubby plant which produces an acorn is an oak.

If we review the perception of the oaks held by botanists over the past three

centuries, Linnaeus had no difficulty in recognising the genus *Quercus* as embracing the oak species known to him. Bentham and Hooker (1880) followed Linnaeus. Engler and Prantl (1894) however divided the oaks into two genera, *Quercus* and *Pasania*, which included the more highly evolved and more primitive forms respectively. Further collections and the study of these resulted in recognition of two oak genera, *Quercus* and *Lithocarpus* (of which *Pasania* became a synonym). It was considered that the more primitive genus had features shared with the chestnut lineage. However, in subsequent taxonomic revisions the section *Chlamydoalanus*, as defined by Engler and Prantl, has been transferred to *Castanopsis*. This section is truly intermediate between the chinkapins and the oaks; it has consistent reduction of the number of seeds to one per cupule, and the morphology of the latter strongly tends to an acorn-like form.

Both genera are large, and this has generally militated against production of monographs, however, Camus (1936-1958) did produce her monograph *Les Chenes*, the most comprehensive treatment available. This was produced without the benefit of the modern aids to taxonomy such as population genetics, cytogenetics, serological and chemical approaches, and the more recently developed statistical techniques of multivariate analysis, to name only a sample of those available. Camus recognises 279 species of *Lithocarpus* and 430 of *Quercus*. A curious feature of her system is that she recognizes only two subgenera in the more species rich *Quercus*, but 14 in *Lithocarpus*, one of which is the chinkapin-like *Pseudocastanopsis*. It is possible that the problems of classifying oaks have been exacerbated by the decision to erect two genera in the first place; perhaps Bentham and Hooker's view was the soundest. An alternative, and possibly a more productive approach, might be a cladistic one. Bentham and Hooker recognized *Cyclobalanus* as a section of *Quercus*. This is characterized by the presence of annular, concentric scales on the cupule and appears to be well defined on this character. Engler and Prantl divide this section into two; *Cyclobalanopsis* in *Quercus*, and *Cyclobalanus* in *Pasania* (*Lithocarpus*). Camus' approach is similar, but the sections are raised to sub-generic rank. Recognition at this level implies a high degree of distinctness from other members of the two genera. (Figure 2)

Perhaps the most sensible solution to this problem is to reunite these sections/subgenera in the taxon *Cyclobalanus*, recognising that the characters used in generic diagnosis are perhaps relatively trivial. Further study of the two genera as defined at the present time might well reveal further clades which could be studied profitably. The value of some of the features used diagnostically, such as the nature of the male inflorescence whether rigid or lax, could have quite a simple genetic basis.

### **Informal classification approaches**

The difficulty over the past half century of producing a revised and up-dated monograph of the oaks has led to the development of informal schemes of classification which are both interesting and useful. This development has taken place in North America, which has a richer and more diverse oak flora than Europe. It is unfortunate that while highly significant studies have been carried out, these are all too frequently somewhat parochial in nature, delimited by political rather than sensible geographical boundaries. Fortunately, in the case of American studies the species covered include all those native to the United States and Canada, as well as those whose range extends into Mexico. Excluded commonly are Mexican endemics.

In Asia, a similar situation exists where oak species are treated in national floras rather than on a sensible geographical or biosystematic basis.

For the North American oaks, Sargent (1949) presents a very simple scheme based on two sub-genera; Erythrobalanus and Lepidobalanus. Within each group he recognises two sub-groups. His scheme can be summarised as follows:

1. Erythrobalanus- characterized by the dark color of the bark and the maturation of acorns in their second season
  - a) Black oaks - leaves lobed, with bristle tips on lobes; examples *Quercus rubra*, *Q. palustris*, *Q. nigra*
  - b) Willow oaks - leaf margins entire; examples *Q. phellos*, *Q. laurifolia*, *Q. agrifolia*
2. Lepidobalanus- characterised by the light grey bark color, with acorns maturing in a single season
  - a) White oaks- margins deeply sinuate, leaves lobed, e.g. *Q. alba*, *Q. stellata*
  - b) Chestnut oaks- margins shallowly sinuate, leaves lobed or toothed, e.g. *Q. montana*, *Q. bicolor*, *Q. muehlenbergii*

Sargent includes the live oak, *Q. virginiana*, in this group because its acorns mature in a single season; live oaks such as *Q. agrifolia*, with 2-season acorns, he includes under the willow oaks. Preston (1961) recognizes three sub-genera, with sub-divisions:

1. Erythrobalanus - Red oaks; a name based on autumn leaf colour
  - a) True red oaks (=Sargent's black oaks, except for *Q. nigra*)
  - b) Willow oaks (= Sargent's willow oaks with *Q. nigra*, but excluding *Q. agrifolia*)
2. Lepidobalanus - White oaks (bark colour)
  - a) True white oaks (= Sargent's white oaks, except *Q. virginiana*)
  - b) Chestnut oaks (= Sargent's chestnut oaks)
3. Sclerophyllodrys - Live Oaks (evergreen); includes forms maturing acorns in both first and second seasons; e.g. *Q. virginiana*, *Q. agrifolia*, *Q. wizlizenii*

The Flora Europaea recognizes four sub-genera:

1. Erythrobalanus (introduced Black oaks) -e.g. *Q. rubra*, *Q. palustris* (commonly planted)
2. Sclerophyllodrys - e.g. *Q. ilex*
3. Cerris - e.g. *Q. suber*, *Q. cerris*
4. Quercus - e.g. *Q. robur*, *Q. petraea*

Rehder (1954), reviewing cultivated trees and shrubs, considers oak species in three sub-genera:

1. Cyclobalanopsis - e.g. *Q. myrsinaefolia*
2. Erythrobalanus - e.g. *Q. phellos*, *Q. nigra*, *Q. laurifolia*, *Q. marilandica*, *Q. rubra*
3. Lepidobalanus - e.g. *Q. cerris*, *Q. suber*, *Q. ilex*, *Q. virginiana*, *Q. robur*, *Q. petraea*, *Q. alba*, *Q. stellata*, *Q. lyrata*, *Q. montana*

This brief and by no means comprehensive summary of perceptions of the structure of the genus shows that there is no overall consensus on what species should be included in the various sub-generic taxa. The species groups which are most useful practically are the informal classes developed and used by North American botanists and dendrologists. These work very well on the whole for the deciduous species, but the evergreen live oaks do create some difficulties. Problems also are likely to arise if this informal system is extended to include the Eurasian species.

The section/sub-genus *Erythrobalanus* includes forms variously called Black oaks, Red oaks, and Willow oaks. It is somewhat unfortunate that the name *Erythrobalanus* literally means red oaks since the name "Black Oaks" applies equally well to Red Oaks and Willow Oaks which both have dark coloured or "black" bark. A useful informal hierarchy would be to apply the term "Black Oak" to all the deciduous members of the section, the term "Red Oak" to those with strongly lobed leaves and "Willow Oak" to those with entire leaves e.g. (*Q.phellos*, *Q.laurifolia*) or only slightly lobed leaves (*Q.nigra*). Some species such as *Q.marilandica* might be problematic in their assignment but on the basis of leaf size would probably be best assigned to the Red Oaks.

A parallel breakdown can be applied to American species of *Lepidobalanus*. The whole group share one feature in common - they all have relatively light-coloured bark, hence the term "White Oak". A distinction is made between constituent groups on leaf shape, those with a sinuous margin with shallow indentations, or toothed, are called "Chestnut Oaks", while those with more deeply cut leaves are called "True White Oaks" by Preston (1961). There are, however, some species with only slight or irregular lobing, and these are somewhat arbitrarily assigned to the "True White Oaks"; the blue oak *Q. douglasii*, for example.

In addition to the bark character difference, Red Oaks can be distinguished from the White Oaks (*sens.lat.*) in that the lobes have angular extremities which have bristle-like tips. In species such as *Q. nigra*, only leaves with the most developed lobing actually develop bristle tips. Such bristle tips are absent from the white oaks. A second difference is in the time taken by fruits to mature. In most Black Oaks, this takes two seasons; the White Oak acorns mature in the first.

The live oaks are, as mentioned, evergreens and have been grouped together by Preston on this basis. Sargent, however, separates them into those with single-season acorns and those which require two seasons for fruit maturation. The first group are assigned to the White Oaks, the latter to the Black Oaks. Leaf size is relatively small, and no obvious patterns of leaf shape have evolved; all are relatively simple and some may be toothed. Clarification of the true relationships between live oak species and the white and black oaks has come from the study of wood anatomy in these groups. This has shown that the relatively primitive type found in the black oaks (with respect to the white oaks) is also found in the live oaks, regardless of the differences in maturation period of their acorns. This raises the possibility of assigning all live oaks to *Erythrobalanus*, and suggests that the significance of difference in the acorn maturation period be re-evaluated, as well as the true nature of the difference between the evergreen and deciduous habits. In *Lepidobalanus*, wood anatomy is the more advanced type.

## Evaluation of diagnostic features

Taking the question of maturation period first, a study of the interspecific hybrids

noted by Sargent (1949) shows that all are within Erythrobalanus or Lepidobalanus. This has led to the conclusion being drawn that a formidable isolating mechanism exists between the two groups.

The difference between the evergreen and deciduous habits is frequently regarded as a discontinuity. However, if one considers this in terms of leaf longevity it actually becomes a continuum. The life span of individual oak leaves ranges from six months (or less) to upwards of four years. In mild environments, leaf longevity in deciduous species may be such that young leaves have emerged before the old leaves have fully senesced and been shed; *Q. canariensis* shows this trait in southern England.

It is a moot point whether this could be considered an evergreen, as most would recognize that the persistent leaves are obviously senescent. A similar situation occurs in American live oaks such as *Q. virginiana*, where leaves persist until the new ones appear but are less obviously senescent at the time they fall, and it is considered to be evergreen.

Variation in leaf morphology also has implications in the oaks. If we take the leaf form of the tanbark oak, *Lithocarpus densiflorus*, as representing primitive leaf morphology, we can consider the changes which have come about in the course of oak dispersion in the Northern Hemisphere. Relative reduction of leaf size is more apparent in the advanced evergreen species, however with development of the deciduous habit, there has been a reversal of this trend. Leaves of *Lithocarpus densiflorus* are characteristically robust with a very firm texture, midrib and lateral leaf veins robust and prominent. The margin is very slightly toothed. Leaf size is relatively large for a simple-leaved form. Leaf texture is generally softer in *Quercus* than in *Lithocarpus*.

## Ecological diversification

As has already been noted, extension of the distribution range of oaks has occurred through an ecological adaptive radiation process. From an original tropical sub-montane rainforest, centre migration to higher latitudes has necessitated adaptation to more variable environments with greater ranges of both temperature and relative humidity. Initially, to marked wet and dry seasons, subsequently to summer and winter temperature regimes. Much can be done to accommodate such changes by migration to lower elevations. The American live oak, *Q. virginiana*, provides a good illustration of this strategy. In Mexico, it occurs in the mountains, while in the northern part of its range it is found on the coastal plain of the Atlantic seaboard, as far north as Virginia. This distribution suggests it is not tolerant of continental temperature extremes. In size, the leaves are slightly smaller than those of *Lithocarpus* (3-13 cm in length, as against 8-13).

The live oaks of western North America tend to have smaller leaves, in the range of 2-5cm. They are often to be found in dry conditions, and presumably the reduced leaf size is adaptive. A common feature of many western oaks such as the scrub oak is for leaf fall to occur at or about the time of the emergence of new leaves. Some of these oaks are known as "live" oaks, even though the life span of the individual leaves is rarely over twelve months. This is probably due to the leaf texture; coriaceous leaves do not show their age as obviously as those of a softer texture. For this reason, *Q. canariensis* might lack credibility as an evergreen while a western live oak such as *Q. agrifolia* is acceptable as such.

It is interesting to note that retention of the primitive coriaceous leaf texture

coupled with reduction in leaf size is adaptive to the harsher ecology of desert fringe and seasonally arid areas. The next major expansion of range into temperature regions depended on a further reduction of leaf longevity and the generation of the deciduous habit. In the case of the oaks this enabled the colonization of temperate continental areas to occur, where loss of leaves in autumn proved an effective strategy to avoid the stress of extremely low temperatures. Coupled with the often very short days and low light intensities at high latitudes the deciduous habit reduced the drain of resources entailed by periods when respiration outstripped photosynthesis in the energy balance.

Migration to northern temperate latitudes also brought about a reversal in the evolutionary strategy of leaf size reduction and change in leaf shape. However, increased leaf size brings about enhanced interception of both light and heat energy. The resulting increase in temperature could be deleterious in both its direct effect on living tissues, producing death, and also in wastefully increasing rates of respiration and transpiration. Development of lobing increases the rate at which the leaves can radiate excessive heat energy. Temperate species with the largest leaves tend to be the more strongly lobed; *Q. rubra* and *Q. frainetto* are good examples.

Leaf shape evolution is well illustrated in the American black oaks, the deciduous members of which fall into two reasonably well-defined groups; the willow oaks and the red oaks. The former, typified by *Q. phellos* and *Q. laurifolia*, have elongated but relatively narrow leaves with a length/breadth ratio in excess of 2.5; this shape provides reasonably effective radiation capacity, provided that length is not excessive. The red oaks with the largest leaves such as *Q. rubra* and *Q. velutina* have deeply incised leaves and the lobes so produced are markedly toothed. In species such as *Q. georgiana*, the degree of lobing is much less while leaf size is appreciably smaller. The situation in the white oaks follows a similar trend with much less contrast in the range of leaf shape. It is interesting to note that the most widely distributed oaks in North America, the red oak *Q. velutina* and the white oak *Q. alba* both have strongly lobed leaves. Among white oaks, the chestnut oaks tend to have more restricted distributions.

A characteristic difference between white oaks and black oaks is in the palatability of the kernels; those of white oaks (sens.lat.) are sweet while in the black oaks they are bitter. This may be correlated with the tannin content of the bark, which is less in the white oaks. The North American species within *Lepidobalanus* differ from those in Europe, regarding the darker bark colour of the latter, and in their low acorn palatability. The acorns of the native British oaks are eaten avidly by swine but are toxic to cattle and horses, hence the practice of herding pigs in woodland of the New Forest in England (pannage) to reduce the hazard to cattle and ponies. In the live oak group, there are some species with palatable kernels and some in which they are bitter. It may be that this divergence predates the divergence of the deciduous black and white oak lineages.

### **Possible approaches to taxonomic revision**

Broad studies of the oaks indicate that a more serviceable system of taxonomy could be developed by judicious use of a range of approaches. The morphological approach is not only the classical method but the easiest to use, and the most cost effective. A problem does arise when diagnostic characters used are ambivalent, if not ambiguous. Difficulties arise most often when these are used at an inappropriate level or when the probable phylogeny is not appreciated and the extent of parallel

evolution is not realised. Homologous mutants can arise independently in different evolutionary lineages. There are several examples; lax inflorescences have arisen in both the beech and oak lineages, and the deciduous habit has evolved in all lineages as has the development of fruit which mature in a single season. The extent of the adaptive radiation, which has occurred in the oak lineage, greatly exceeds that of the other two. While all three groups have evolved deciduous forms which flourish in mesic environments, only the live oak line has colonised additionally arid and semi desert habitats. Even in mesic environments, where all three lines are sympatric, the oaks exceed the number of species which have evolved in the other two lines.

Because they are less numerous in terms of species number, the taxonomy of beeches, chestnuts, and chinkapins presents no very great difficulty. The phenomenal biodiversity within the oak lineage does create difficulties and problems. Some clarification might be achieved by seeking diagnostic characters which identify clades. A number of these have been suggested; the cyclobalanoids form just such a group. Anatomical differences in wood structure appears to have identified clades, already. The situation in the live oaks is particularly interesting, when considered in conjunction with the chemical differences in the bark and the acorns, observable in the white and black oak groups. It may be possible to identify a point in evolution where the two groups diverged.

The diagnostic value of the difference between species maturing fruit in a single season and those in which it takes two would certainly repay exploration. Since this difference is also to be found in species-poor lineages, it is perfectly feasible that it has arisen more than once and possibly several times independently, in the very numerous oak species. Ostensibly this difference could have considerable physiological implications in reproduction, with disruption of fertilization processes. This difference has been considered important as an isolating mechanism between groups of North American oaks.

Isolation between black and white oaks may be determined by a great deal more than what could possibly be a relatively simple genetic difference affecting success of pollination.

Exploration of the genera for additional diagnostic characters could be valuable. The morphology of the cupule itself could be helpful in the indication of clades. The majority of oaks produce cupules with imbricate scales, apart from the Cyclobalanoids already noted. In *Q. ithaburensis* subsp. *macrolepis* (syn. *Q. vallonina*), the scales are elongated and extend at right angles to the cupule surface.

Arguably the most remarkable feature of the oaks among the members of the Fagaceae is that in the course of their evolution they have colonized a much wider range of habitats. The western North American and Mexican oaks include species which are to be found in semi-arid environments on the fringes of deserts. They have adapted to this morphologically by the adoption of a scrubby growth habit and production of small coriaceous leaves, a xeromorphic feature. Leaf longevity is often reduced to little more than twelve months, but a continuous leaf canopy is effectively maintained. It is difficult to easily assess the considerable adaptive changes which must also have occurred and probably been extensive.

### **The use of chemical and other data (Manos et al, 2001)**

It is very salutary to review progress in developing understanding of the phylogeny and evolution of the oaks in the past century. From the recent studies on Systematics of the Fagaceae (Manos et al, 2001), the only conclusion that can be

drawn is that these are inconclusive. Manos et al categorize taxonomic approaches as traditional, and what might loosely be called modern. Traditional approaches based on very detailed morphological studies of *all* material classified in bio-systematic schemes or taxonomies depend on what might well be considered judgements, which though possibly largely intuitive, are actually founded on a very sophisticated and highly educated intuition. Modern taxonomic approaches can be regarded as broadly numerical and experimental. These approaches have been considered to be more objective than the traditional intuitive approaches which have been regarded as, if not dismissed as, overly subjective. It has been asserted by those who developed numerical approaches (principally Sokal and Sneath in the sixties) that use of unselected characters in large numbers would produce more objective schemes of classification. Experience has tended to show that many, if not most, of these characters generate noise. The argument was also put forward that classification schemes could be produced by operatives with little experience.

The alternative experimental approaches had much to commend them. "Experimental taxonomy" based on hybridization studies as well as cyto- and sero-taxonomy yielded very interesting information. The value of this frequently was in the resolution of particular problems where morphological studies gave equivocal results. These two approaches were particularly useful in resolving difficulties in distinguishing and characterising close relatives. Cyto-taxonomy was useful in some instances in resolving problems up to the family level. Sero-taxonomy was limited by the extent to which antigen-antibody reactions could be detected.

A much broader field was opened when differences in proteins and secondary metabolites were studied in a taxonomic context. The ultimate chemo-taxonomic approach involves the comparative study of the DNA in defined taxa. This is an enormously complicated and complex field, but useful taxonomic information can be generated. The studies of Manos et al (2001) have generated significant and important data on the relationships within the Fagaceae. The most interesting feature of this work is that it supports the conclusions of traditional taxonomists, rather than those of investigators using more arcane and esoteric characters (Nixon, 1989), who reach strongly anti-intuitive conclusions that do not produce a credible phylogeny.

In species-rich genera such as *Quercus* ( $\pm 450$  species) and *Lithocarpus* ( $\pm 300$  species), both the numerical-multivariate analytical approach and the experimental taxonomic approach pose enormous logistical problems in the generation of databases that truly represent the variability within genera such as these. In the work of Nixon and collaborators, questions can be raised as to how representative the sampling of species actually is, and what is the discriminative power of the character differences explored. The genetic basis of such discriminants is not considered, for example, a great deal is made of the difference between epigeal and hypogeal germination; this could be due to a simple allelic difference.

Perhaps the most telling criticism of much modern chemical information is that when used taxonomically, inconsistent results are produced (when, for example, different secondary metabolites are used). Such incongruences lead to the conclusion that the data is just taxonomic noise. They may be virtually plucked out of the air with little or nothing in the way of justification for their taxonomic use.

It is to be hoped that in the foreseeable future that an improved taxonomic conspectus of the oaks can be produced. The accumulation of knowledge of oaks in the field and their geographic range, and the range of experimental studies coupled



with the sophistication of numerical taxonomic and statistical procedures which have been developed in recent times, should make this feasible. The wealth of information collected by Camus and the application of new procedures to it, such as cladistics, could well serve to reduce the present state of uncertainty.

The authors wish to acknowledge the review and helpful suggestions of Allen Coombes of the Sir Harold Hillier Arboretum, Romsey, Hampshire, United Kingdom in the preparation of this paper.

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**Figure 1** Generic inter-relationships in the Fagaceae:

Castanopsis and Chrysolepis:

1. Distribution- Northern Hemisphere, Tropical and sub-tropical Asia and California (Chrysolepis)
2. Evergreen
3. Fruit an incompletely sealed burr, dehiscent, 1-3 seeded, maturing in second season
4. Male inflorescence rigid



Oak Lineages

Beech and Chestnut Lineages

1. Distribution- Northern Hemisphere, Tropical and sub-tropical Asia, Europe, North and Central America
2. Evergreen and deciduous
3. Fruit an open cupule, valvate structure lost; typical acorn single-seeded, maturing in 1 or 2 seasons
4. Rigid or lax inflorescences

Lithocarpus (Pasania):

1. Distribution- Northern Hemisphere, Tropical and sub-tropical Asia and California
2. Evergreen
3. Fruit maturing in second season
4. Rigid male inflorescence

Quercus:

1. Distribution- Northern Hemisphere, Eurasia, North and Central America
2. Evergreen and deciduous
3. Fruit maturing in first or second season
4. Lax male inflorescence

Castanea:

1. Distribution- Temperate Northern Hemisphere, Eurasia, North America
2. Deciduous- leaves relatively large
3. Fruit a sealed burr, relatively large, maturing in a single season
4. Rigid male inflorescence



Chestnut Lineage

1. Deciduous and evergreen
2. Enclosure of burr valved, dehiscent, with 1-3 seeds maturing in 1-2 seasons
3. Male inflorescence rigid or lax



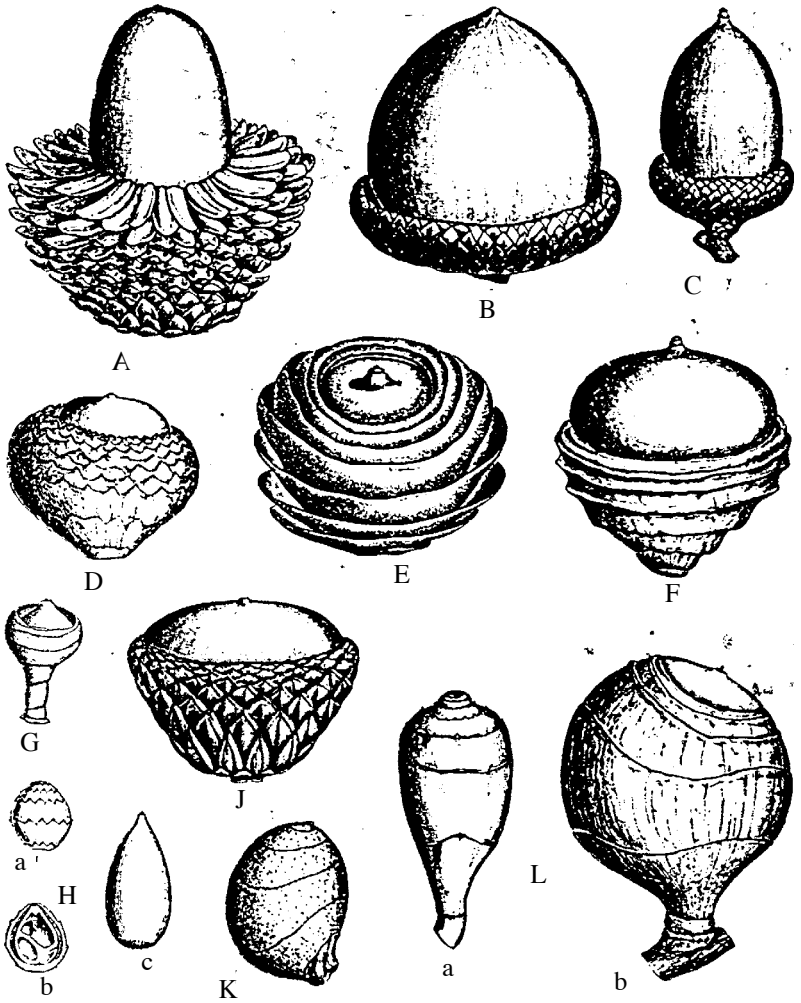
Beech Lineage

Southern beeches (Nothofagus):

1. Distribution- Southern Hemisphere, S. America, Australasia
2. Deciduous and evergreen, leaf size small
3. Fruit size relatively small, maturing in 1 or 2 seasons
4. Lax male inflorescence

Northern beeches (Fagus):

1. Distribution - Northern Hemisphere, Eurasia, N. America
2. Deciduous leaf, size relatively small
3. Fruit maturing in a single season
4. Lax male inflorescence



Cupule scale types

1. Elongate (A)
2. Imbricate (B,C,D, and J)
3. Concentric (E,F,G,H,K and L)



Flowers of *Castanea mollissima* (© Guy Sternberg)



Flowers of *Lithocarpus henryi* (© Guy Sternberg)



Fruit of *Castanopsis orthacantha* (© Guy Sternberg)



Fruit of *Fagus sylvatica* (© Guy Sternberg)



Flowers of a white oak, *Quercus prinoides* (© Guy Sternberg)



Flowers of a red oak, *Quercus ilicifolia* (© Guy Sternberg)

## Cambridge Oak (*Quercus* × *warburgii*), An Intriguing Hybrid

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In the Arboretum Trompenburg of Rotterdam we find two specimens of *Quercus* × *warburgii* obtained from Hilliers Nursery, Winchester, UK in 1974. Since then, this oak has become more and more of a mystery for me. I wanted to know its origin, but in the literature available to me I could find some information only in Bean III, page 520 where a good description and also a history can be found. Below please find the text of W. J. Bean (*Trees and Shrubs hardy in the British Isles*):

*Q.* × *warburgii* Camus CAMBRIDGE OAK

*Q. obtusata* sens. Henry, not Humb. & Bonpl.; *Q. genuensis* Hort.;

*Q. rugosa genuensis* Hort.; *Q. hartwegii* var. *glabrata* Trclease

A semi-evergreen tree so far only known in cultivation, where it has attained a height of almost 60 ft (see below); young stems glabrous, greenish brown in late summer, ageing to greyish brown. Leaves persisting on the tree until spring, rather leathery, obovate to oblanceolate, mostly rounded at the apex, tapering from about the middle to a narrow truncate, sometimes slightly auricled base, 2 1/2 to 5 in. long, 1 1/2 to 3 in. wide, dull green and slightly rugose above, palish grey-green and rather veiny beneath, glabrous on both sides, margins shallowly and irregularly lobulate, the main lateral veins ending in short mucros; petiole glabrous, 1/4 to 1/2 in. long. Fruits borne singly or in pairs on fairly slender peduncles about 1 1/2 in. long; acorns glabrous, ovoid, about 1 in. long; cup hemispherical, enclosing about one-third of the acorn, with numerous appressed scales which are grey-hairy at the base, glabrous and brown at the tips, and decrease in size from the base of the cup upwards.

Most and probably all the trees of *Q. warburgii* in this country were distributed by the nurseryman Smith of Worcester in the 1870s, or derive from these. He had received the seeds from the Genoa Botanic Garden in 1869 under the name *Q. rugosa*, and sent out grafted plants under the name *Q. rugosa genuensis* (i.e., 'of Genoa'). In 'Elwes and Henry' (Vol. 5, p. 1312), this oak was referred to *Q. obtusata*, which, like the true *Q. rugosa*, is a Mexican species. In 1933, E. F. Warburg pointed out that this identification was incorrect and proposed for it the provisional name *Q. genuensis* Hort. (*Journ. R.H.S.*, Vol. 58, pp. 186-7). Finally, it was given botanical status by Mmc Camus in 1939 as *Q. warburgii* (*Les Chenes*, Vol. 2, pp. 621-3 and 793). She groups it with *Q. obtusata* but remarks that it differs in its smaller, more glabrous leaves, longer female catkins, and in the thinner, more appressed scales of the cups.

The status of *Q. warburgii* is uncertain. Warburg and Camus both suggested that it might be a hybrid, though neither mentioned the possibility that it might have *Q. robur* as one parent. In fact, its resemblance to the common oak is slight and anyway superficial.

The planting date and origin of the famous tree in the University Botanic Garden, Cambridge, is not certain, but, like the Kew tree, it is grafted on common oak and could be one of the set sent out by Smith of Worcester. It measures 58 × 7 1/2 ft (1969); in 1910 it was 39 ft. high (*Journ. R.H.S.*, Vol. 41, p. 8 and fig. 5). The tree at Kew, which came from Smith in 1875, measures 39 × 4 ft. (1967). Both trees bear fertile acorns quite frequently.

Owing to my curiosity, I wrote to the Botanic Garden of Cambridge for acorns. After several reminders they wrote to me that before being ripe, all acorns are eaten every year by gray squirrels and for that reason they could not comply with my requests.

In the meantime, I observed that my two specimens flowered and made acorns, notwithstanding the fact that they were only 20 years old. The reason for this early maturation in my opinion is that the grafts were not knitted very well; the trees "felt" that they would not live long and had to make sure that offspring were produced. This may be due also to the typically early maturity of one of the putative parent species, *Quercus rugosa*. Anyhow, I got my acorns!

Collecting them, I found the peduncles of the fruits to be very long – between 10 and 20 cm! I also found that the acorns were only half size of normal. Both facts Bean does not mention. Bean, however, states that it bears fertile acorns quite frequently. Apparently they did not sow them. Why?

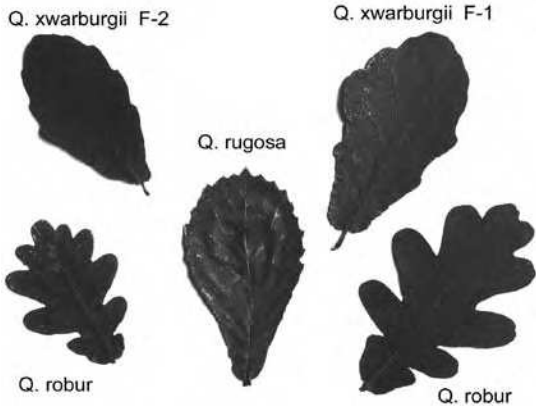
I did sow them, and from the offspring some 30 resembled pure *Quercus robur* and only two were like the mother. However, these two seedlings are fully deciduous and somewhat less leathery. It is possible that at maturity they may become half evergreen like the mother. *Q. rugosa* has leaves with a gray back, not pubescent; the F<sub>1</sub> & F<sub>2</sub> have that same gray back.

From my investigation it seems clear that the pollen of the F<sub>1</sub> came from *Quercus robur*. Further evidence can be found in the fact that the F<sub>1</sub> peduncles of the fruits are very long. In this case properties of both parents may have caused an increase of the peduncle length via heterosis.

It is a pity that the laws of Mendel and the proofs did not show the full origin, as his proofs with peas. I would like to have found also some offspring resembling pure *Quercus rugosa*.

However, further proofs with F<sub>2</sub> acorns someday may show that as well. We keep sowing, and may find in this way the final proof of the origin of the other parent.

The description in Bean, coupled with my observations, leads me to suppose that *Quercus rugosa* was the F<sub>1</sub> mother and *Q. robur* the father. Although I am 84 now, I hope to report again when having definite proof!





## A Gallery of White Oaks

A Photographic Presentation of the Eastern North American  
White Oak, *Quercus alba*

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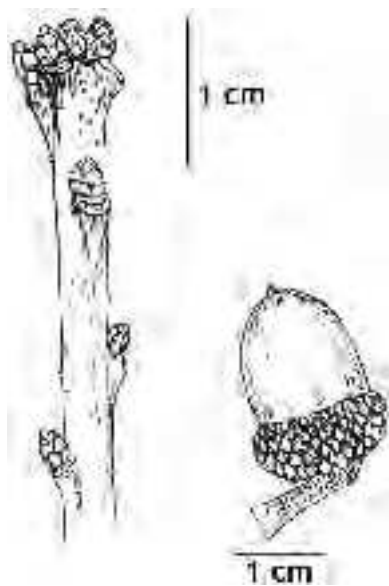
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These *Quercus alba* trees at Starhill Forest Arboretum have been core-dated to 120 years of age.



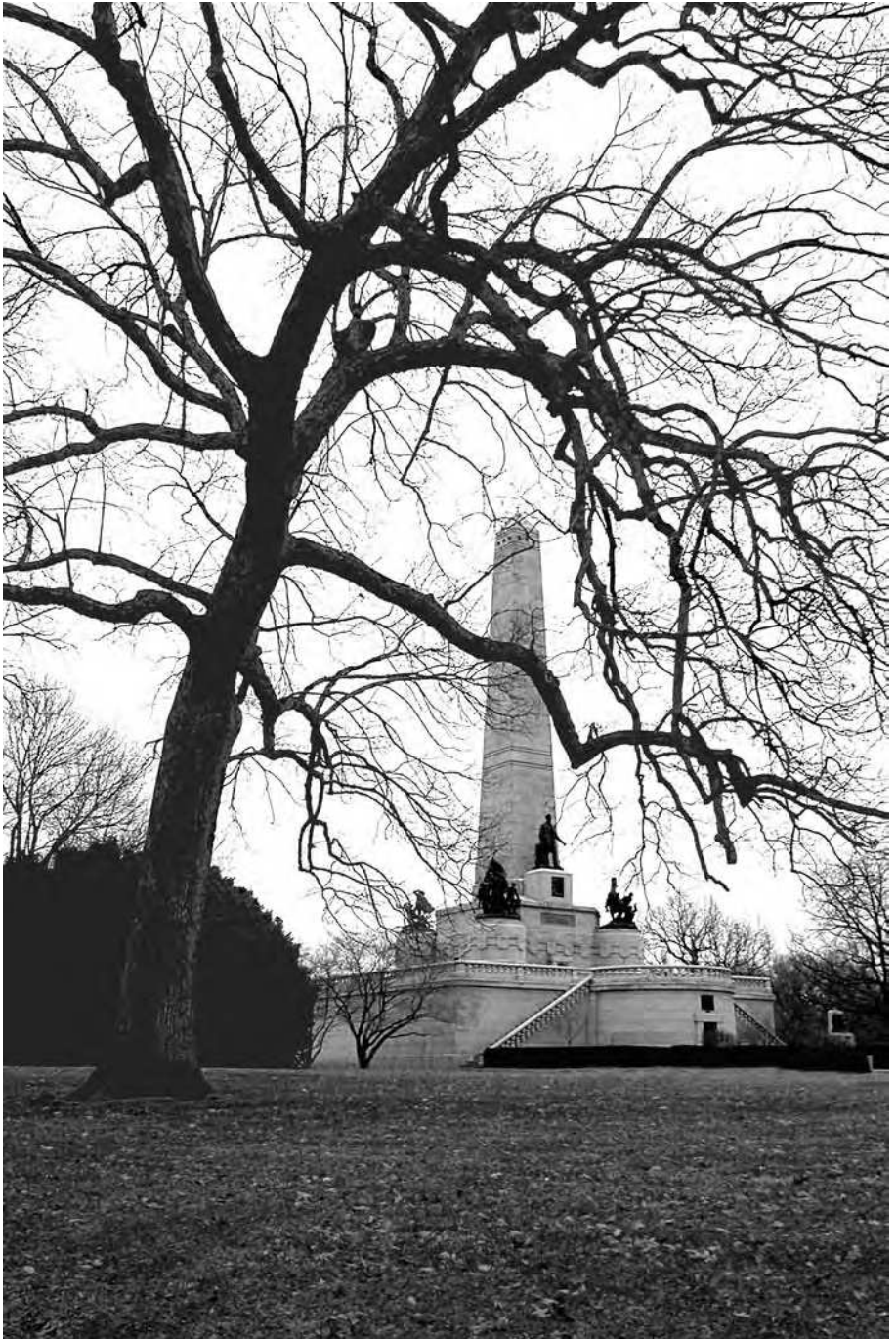
Guy Sternberg with an old *Quercus alba* at Buffalo Rock, Illinois



Buds and acorn of *Quercus alba*,  
from *Woody Plants of the Southeast;*  
*a Winter Guide* by Ron Lance.



A huge burl formation in a *Quercus alba* tree in central Illinois.



*Quercus alba* trees surround the tomb of Abraham Lincoln.



A broad-crowned savanna-origin *Quercus alba* around 200 years of age.



An ancient, sprawling *Quercus alba* in West Tisbury, Massachusetts.



Oak Society member Tim Boland with the typical stunted form of *Quercus alba* found in coastal areas, at Sepiessa Point Reservation in Massachusetts.



Magnificent presettlement *Quercus alba* trees are found frequently in old cemeteries in the Midwest (here with Guy Sternberg in Petersburg, Illinois), where the loggers were not permitted access to the sacred ground.



Male flowers of *Quercus alba*.



Snow highlights the structure of a 300-year-old *Quercus alba* in Sangamon County, Illinois (photo courtesy of Chris Young, the Illinois State Journal-Register).



*Quercus alba* 'Lincoln', a cutleaved cultivar named by Dick van Hoey Smith due to its location at Lincoln's Tomb.



*Quercus alba* (identifiable here by the tuft of foliage) was the subject of beautiful tree-form grave monuments in many cemeteries in the late 1800s-early 1900s. Sculptural details such as broken limbs, peeled bark, climbing vines, and squirrels all have symbolic significance. This monument is located in the cemetery of Palmyra, Illinois.



The picturesque, plagiotropic limb structure of an ancient *Quercus alba* in West Tidbury, Massachusetts.



A five-meter *Quercus alba* shades the location of General Washington's famous crossing of the Delaware River, the turning point in the American War for Independence. The tree has not been dated but may have been a sapling during this period.



Young *Quercus alba* often are marcescent and can be bowed by heavy accumulation of snow and ice, usually recovering their form with the next thaw.



Deeply incised foliage of *Quercus alba* forma *pinnatifida* in eastern Missouri (the cultivar 'Brush Creek')

## The Gudgel Oak – Working with a Historic Tree

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**Guy Sternberg**

Starhill Forest Arboretum, Petersburg, Illinois

all photos © Guy Sternberg

The story began long ago. I had admired for decades an old white oak (*Quercus alba* L.) growing along a rural road near our home. I have taken many Oak Society members from around the world to see the tree during local oak tours. A few friends and I decided to begin measuring and core-dating some of the most impressive trees in our county, so I suggested that we include this tree due to its size and to its prominent location along the road right of way.

When we examined the tree closely, we noticed a serious split in the main fork. The split probably had occurred long ago, but was placing the tree (and the traffic below) in jeopardy during wind and ice-loading events. We proceeded to core the oak and it was shown to date to 1759, making it one of the oldest trees in the area. This age was derived via extrapolation (a common practice in coring large trees) because the core was incomplete due to a large hollow in the center of the trunk.

We could have made a few notes and moved on. But I could not let this old veteran continue to try to stand on its own, with no help during future storms. We all know that, sooner or later, such trees come tumbling down, and I now was culpable – I had seen the split and I had become aware of the hollow trunk! I set out to raise funds to have the tree cabled and pruned. Things rapidly fell into place.

The first order of business was to give the tree a personality – *i.e.*, a name. It grew along Gudgel Road adjacent to land originally homesteaded by the Gudgel family. “Gudgel” is unique enough that people tend to remember the name when they hear it, so I named it the Gudgel Oak. This gave us a selling point: “Help save the Gudgel Oak!”

The State Journal-Register newspaper outdoor editor (a friend and outstanding naturalist) ran an article about the tree and the proposal to work on it. A local non-profit organization agreed to accept the contributions, granting donors the benefit of its tax-deductible status. A certified arborist stepped forward and agreed to do the work for the cost of paying his crew – his own time and equipment would be furnished at no charge. Donations began pouring in from the local community as well as from other cities and other states, due to the news spreading on the Internet. Many people contributed a few dollars, and a few gave hundreds. Some of them told me that they never had an opportunity before to help save an old tree, and they felt a sense of satisfaction in participating in our project.

As the work was being planned, an artist (and Oak Society member) from Chicago offered to create a plaque for the tree. Then a local stone mason volunteered to donate a large (1700-pound / 750-kilo) boulder and mount the plaque on it. A concrete contractor donated concrete for the base for the rock, and another contractor dug the footing for the base and placed the rock with his excavator. The local road supervisor gave permission for the work to be done on the road right of way, handled traffic control for us, and even built a small parking lot for viewing the tree.

Tree work included pruning (removing all major dead wood and reducing the weight on the limbs supported by the splitting stem), installing reinforcing cables high in the crown, cleaning out surrounding brush to remove competition and in-





Looking up into the crown of the Gudgel Oak, a *Quercus alba* about 250 years of age. The branch stubs visible on the lower trunk remain from a broad crown confirming the savanna origin of this tree in central Illinois.

On Saturday, 7 May 2005, a dedication ceremony was held. Many of the donors participated, coming from as far away as Kansas City, and a follow-up article was published in several local newspapers. The community can take pride in their special oak tree, and know that every reasonable effort has been made to extend its life for future generations to appreciate.

This tree was worth saving, as a source of community pride and awareness and a living link to the pre-settlement history of the region. But more importantly, I hope others will see such opportunities in their own communities, and believe that they also can help save other historic or special trees and landscapes. Once gone, old and rare trees cannot be restored.



Arborists entering the tree crown to prune and cable



Installing reinforcing cables on one of the major side limbs, high in the crown.





The main fork of the trunk, showing the split that caused the project to be undertaken.



The Gudgel Oak (*Quercus alba*), core-dated to 1759, is one of several historic trees inventoried in Menard County, Illinois –it was a seedling during the French and Indian War of the 1750s.

# Authors' Guidelines

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Contributions will be accepted in legible format in English only. Text should be restricted to a single, standard font, preferably Times or Times New Roman. No more than two levels of subheadings should be included. Electronic files written in WordPerfect or Microsoft Word are preferred and must be accompanied by a paper copy. Text may be submitted via e-mail or on floppy disks or CDs. Do not add page numbers, borders, headers, or footers. Double space all text, including citations, use no indents, and avoid bold type, custom margins, and other optional format codes. Authors submitting papers in other formats must pay \$10 US per manuscript page, in advance, to help defray the additional costs of reformatting for publication. Illustrations and photographs may be submitted via postal mail on CDs (no DVD or zip disks accepted) in IBM-compatible TIFF or high-resolution JPEG format. The minimum size is 5 inches (13 cm) at no less than 300 DPI resolution for digital art. All artwork should be submitted separately, not as part of the body of the work. Please include full but concise captions and credit lines, exactly as they are intended to appear in publication. Drawings, slides, or photos may be mailed to be scanned, and these will be returned upon request. Illustrations and photos should be sharp and compatible with monochromatic reproduction. Style, citation methods, and abstracts are left to the reasonable discretion of the author. Refer to the current Council of Biological Editors (CBE) Style Manual for Biological Journals for general guidelines.

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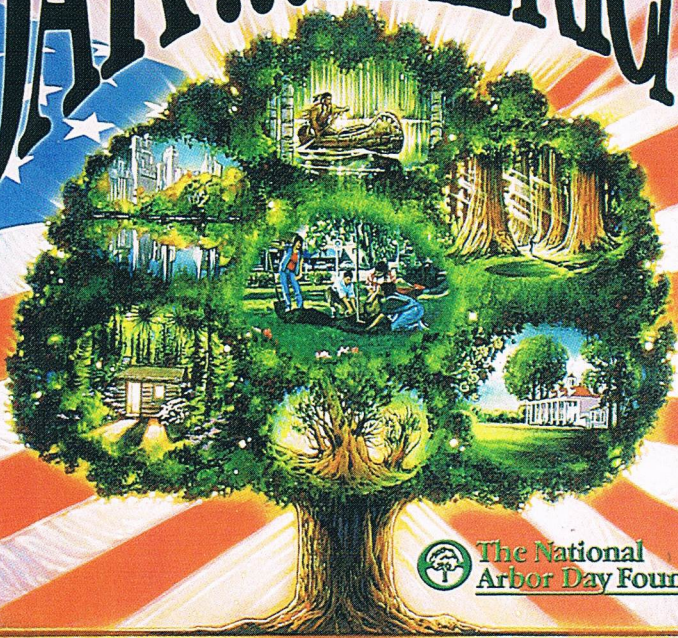
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