

A photograph of a forest of tall, thin trees, possibly pines or cypresses, with a wooden walkway in the foreground. The walkway is made of weathered wood and has a low white railing. The trees are reflected in a body of water in the foreground, creating a symmetrical effect. The sky is overcast and grey.

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Front & back covers: Dawn redwoods (*Metasequoia glyptostroboides*) photographed through an early morning mist by Phyllis Lerman, February 2000. The trees grow on a dike that crosses Donghu (East Lake) in Wuhan, Hubei Province, China.

Inside front cover: A ponderosa pine (*Pinus ponderosa*) growing in Bryce Canyon National Park in Utah. The stunted form and twisted stem clearly indicate a highly stressful existence. Photograph by Peter Del Tredici.

Inside back cover: This espalier of yew (*Taxus cuspidata*) has adorned the Dana Greenhouse complex since 1962. Photograph by Peter Del Tredici.



The Charter Oak

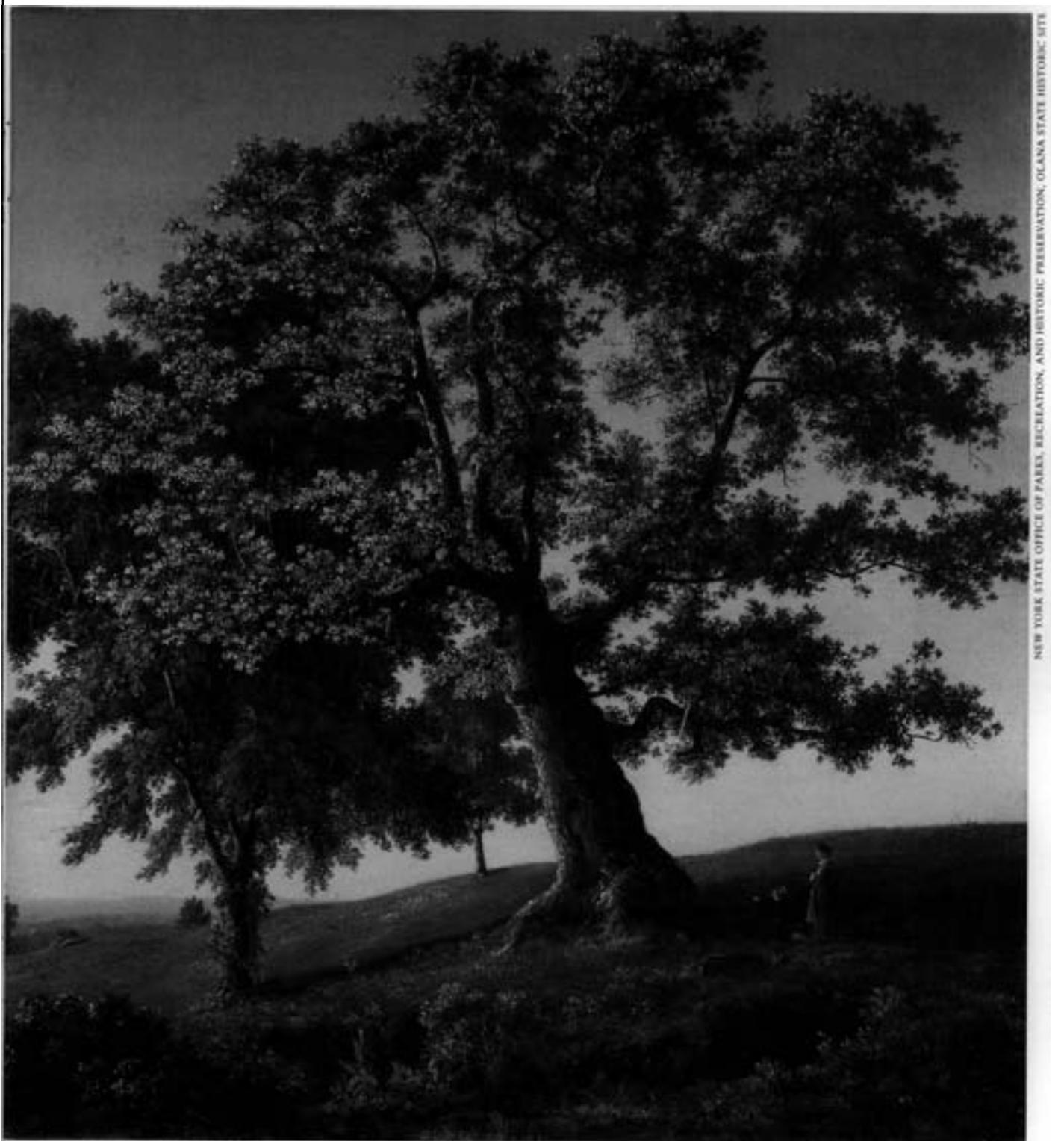
Gayle Barndow Samuels

Hartford is the home of the Connecticut Historical Society. Sitting there in a quiet room at a library table, I am reading about a funeral for a tree. Centered between two items urging support for the newly formed Republican Party's antislavery candidate, the soldier-explorer John C. Frémont, a black-banded front-page obituary in the August 21, 1856, *Hartford Courant* proclaims a tree's death. "The Charter Oak is Prostrate! Our whole community, old and young, rich and poor, were grieved to learn that the famous old CHARTER OAK, in which Wadsworth hid King Charles' Charter of the old colony of Connecticut, in 1687, at the time when James 2nd demanded its return, had been prostrated by the wind." The article goes on to say that "no tree in the country has such legendary associations," and to tell of a dirge being played at noon by Colt's Armory Band and of the bells all over the city tolling at sundown "as a token of universal feeling, that one of the most sacred links that binds these modern days to the irrevocable past, had been suddenly parted."

At the time of its death the Charter Oak had been a Hartford institution for almost two centuries. The tree was fully mature when colonial Hartford was founded. It was then, according to the enduring tale alluded to in the obituary, that the colonists, finding their freedom threatened by their monarch's decision to revoke their liberal charter, had turned to the tree and hidden the cherished document in a cavity within its trunk.

Newspapers across the country and as far away as England sympathetically reported the tree's death—from the *New York Times* to the *Louisville Journal*, *Springfield Daily Republican*, *Washington Daily Union*, and *London Times*. Grief, followed closely by a feeding frenzy among those eager to secure a fragment

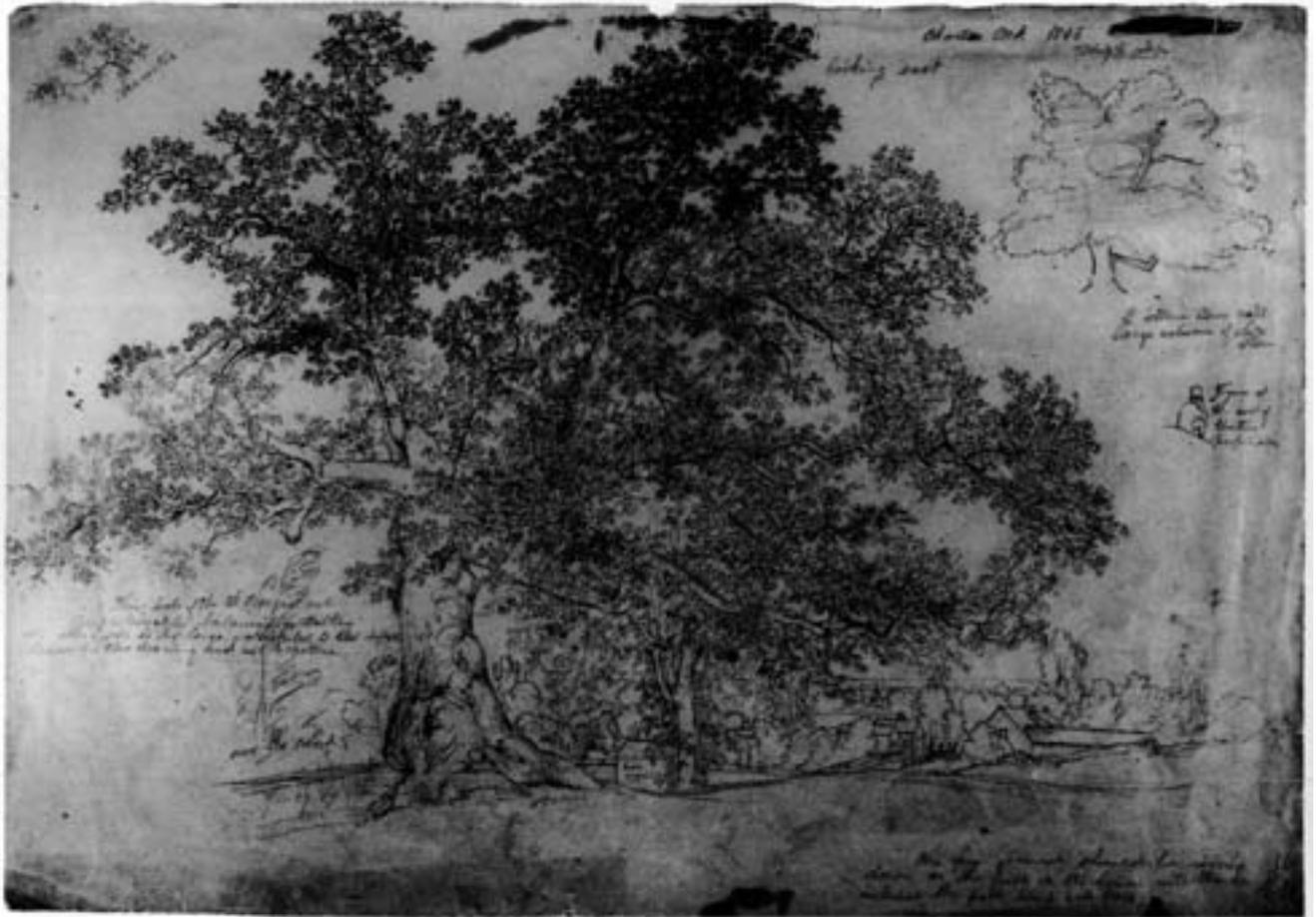




NEW YORK STATE OFFICE OF PARKS, RECREATION, AND HISTORIC PRESERVATION, GLIANA STATE HISTORIC SITE

Frederic Edwin Church, The Charter Oak, looking southwest Oil on canvas, 1846

NEW YORK STATE OFFICE OF PARKS, RECREATION, AND HISTORIC PRESERVATION, OLANA STATE HISTORIC SITE



Frederic Edwin Church, *The Charter Oak, looking east*. Inscribed with notes made by Church, including the word “character” in the upper left. Ink and graphite drawing, August–September 1846.

of the sacred relic, reached into Texas, Alabama, Georgia, the newly admitted state of California, and the Minnesota Territory. The president of Jefferson College in Mississippi requested a piece as did Hartford residents who “bowed with age, and whose eyes were bleared with time begged a sprig in commemoration.”¹ Hartford and Connecticut chairs of state were fashioned from its wood, as were earrings, bracelets, goblets, beads, Bibles, a lamp and screen depicting heroes of the Revolution, and three pianos, which, by using the new technique of veneering, combined a celebration of nineteenth-century technology with commemoration of the ancient oak.²

Hartford resident Mark Twain quipped that he had seen enough pieces of the Charter Oak made into “a walking stick, a dog collar, needle case, three-legged stool . . . toothpick . . . to build a plank road from Hartford to Salt Lake

City.”³ Based on the estimate of one newspaper editor that in 1856 ten thousand pieces of the tree made their way across the country, Twain might have exaggerated only a wee bit. Although it amuses us to learn that some Charter Oak relics were actually made from elm, there was nothing counterfeit in the fervor that swept America in the wake of the tree’s demise. Flag-draped, it had been given a hero’s funeral, and the nation had responded with that mixture of respect and memento-gathering that it would dust off again less than nine years later as solemn onlookers placed pennies on the tracks when the train carrying Abraham Lincoln’s coffin passed by.

Lincoln’s presidency and the Civil War were still several years away when the Charter Oak fell, but the tree’s death was clearly a unifying symbol for the nation during a time of increas-

ing dissension. Portents of the coming conflict had been spewing forth like volcanic ash: the Missouri Compromise excluding slavery from a portion of the Louisiana Purchase; the publication of *Uncle Tom's Cabin*; the battle over Kansas, which had required federal troops to maintain order between pro- and antislavery factions; and the continued drumroll of states declaring their slavery sentiments as they entered the union. Political issues hung heavy in the air, but economic and cultural matters also claimed national attention.

It was a time when the advance of American industrialism, especially the extractive industries that depend on natural resources such as trees, was leaving an ever-greater mark on the common landscape and the collective consciousness. Industrialization created wealth much more rapidly than agriculture ever had, enriched a newly enlarged mercantile class, and populated factories and mills with immigrants, many of whose ethnic roots differed from those of the early colonists. Home-based production was being replaced by newer industrial modes. There was a growing awareness that idealized the past—and glorified its symbols, such as the ancient trees.

The Charter Oak fell during a time when Americans were trying to establish a national culture. Europeans had been busily mining their pasts searching out their “primitive, tribal, barbaric origin[s].” “Americans,” the historian Perry Miller explains, “tried to answer by bragging about the future, but that would not serve . . . [so] many of our best minds went hard to work to prove that we too were a nation in some deeper sense than mere wilfulness.” What emerged was an American culture that was “rooted in the soil.”⁴

Our forebears, then, sought their “identity in their relationship to the land they had settled” and looked to the wonders of the landscape to provide “points of mythic and national unity” not confined to any religion or sect. The genteel tourist pilgrimages of the 1820s and 1830s to places like Niagara Falls, Lake George, or the Catskills reflect that search for a nature-inspired cultural idiom by the part of the population with leisure, money, a broadly defined cultural literacy, and the ability to secure lodging in a network of inns and hotels not open to

everyone. Others saw in the continuing trans-Atlantic trade in new and exotic American plant species an affirmation of the more-than-raw-material value of the American landscape.⁵

And by the 1850s, the entire nation was awed and energized by a specific piece of the American landscape—trees. Reports of Yosemite and the Big Trees (*Sequoia gigantea*) rippled from west to east. The realization that America had living monuments of its own—older by far than Europe’s constructed landscape, reaching back beyond the beginnings of the Christian era—was a matter of national pride.

American scenery was also attracting the attention of serious artists. Influenced by European Romanticism, a school of American artists called the Hudson River School was celebrating the scope and scale of America’s natural riches and, in the process, founding our first truly national school of art. Called “priests of the natural church” by the art historian Barbara Novak, such men as Thomas Cole, Frederic Edwin Church, Asher Brown Durand, Jasper F. Cropsey, and Albert Bierstadt, they converted “the [American] landscape into art” and, in the process, created an “iconography of nationalism.”⁶ They produced a body of work revealing the sweeping grandeur of the American continent in such monumental canvasses as Bierstadt’s *Mount Whitney—Grandeur of the Rockies*, as well as its more intimate treasures, such as Cole’s and Church’s depictions of the Charter Oak.

Cole, who also wrote poetry condemning the widespread destruction of America’s forests (“The Complaint of the Forest” and “The Lament of the Forest” for example), produced a sketch of the oak, and Church did several sketches and two paintings. As Gerald Carr, who has written the catalogue raisonné of Church’s work, explains, “because it was situated only a few blocks from the family residence on Trumbull Street, Church must have passed by the Charter Oak many times during his youth, and doubtless he was nourished visually by images of the tree.” Said to be “one of the first things a stranger visiting Hartford generally wishes to visit,” in 1844 the tree that had preserved democracy was chosen as the backdrop for a Whig convention held “virtually beneath its branches.”

In his 1846 painting of the tree Church included two symbolic figures, presumably a mother and son; the former “passes on her knowledge of the tree to her young son who represents the next generation. The boy already has begun gathering fragments of the sacred tree.” The painting was prescient. Church himself was among the collectors of the tree’s fragments after it fell. The collection at Olana, his home in New York State’s Hudson River Valley, includes “two partial cross sections, one of a branch and the other of a root, and a letter opener with a wooden handle, all inscribed ‘Charter Oak.’”⁷

Church, Cole, and Brownell, however, were hardly the first, or the only, artists to produce renderings of the famous tree. Ralph Earl included the tree in a 1790s portrait of Mary Wylls Pomeroy (the tree stood on the Wylls property), George Francis painted it, and in the 1820s “when it became the custom to decorate earthenware with printed views of historical objects and places, the tree was celebrated on china.” Another “group of images is clustered in the 1830s . . . [and] include[s] schoolgirl watercolors, professional oil paintings, two lithographs, and a skillful pen and ink drawing by a Hartford engraver made on the basis of exact measurements of the tree. The lithographs and the wood engraver’s drawings are extremely important,” decorative arts expert Robert Trent explains, “for they demonstrate that inexpensive prints of the tree were in demand among those who did not have access to a piece of it.”⁸

Pruned of its images and artifacts, however, the Charter Oak emerges even more clearly as a storehouse of national memory. Its role in the 1687 myth of colonial legitimacy and freedom gave it fame and a new name; but this particular white oak had also served Native Americans as a council tree “under which they had met for generations.” As a guide to the time for planting their corn, and as a landmark where “at flood time, they tied their canoes to its branches.” Reaching even farther back, it stood as a primordial visitor, a living reminder of the vast woodlands that had once covered New England.⁹

Trees are the oldest and the largest of all living things. For the centuries before buildings exceeded their height, trees dominated the land-

scape. They still do in many places. Their long life, stature, and seasonal regeneration have made them objects of wonder and worship. Some believe that the tracery of arching branches against the sky inspired the design of Europe’s great Gothic cathedrals and that the quality of filtered light experienced in the forest is what stained glass is meant to duplicate. Why not? What else negotiates the space between heaven and earth as felicitously as a mature tree? Most widely revered among the trees, the oak is called Jupiter’s tree because of its status as king of the forest; it is also, as Michael Pollan points out, “the tree most often struck by lightning, and so may be thought to enjoy a special relationship with the heavens.”¹⁰

The Charter Oak was a white oak (*Quercus alba*), a deciduous tree that can grow to one hundred feet and have a crown spread that exceeds its height. The *cognoscenti* speak of it in superlatives. “I have selected the alba,” Thomas Jefferson wrote to a French gardener to whom he was sending seeds, “because it is the finest of the whole family, it is the only tree with us which disputes for pre-eminence with the Liriodendron [the tulip tree]. It may be called the Jupiter while the latter is the Juno of our groves.”¹¹ And in 1884 when Charles Sprague Sargent, director of the Arnold Arboretum, wrote the first comprehensive catalog of North American trees, his *Silva of North America*, he had this to say about the white oak:

The great size that it attains in good soil, its vigor, longevity, and stately habit, the tender tints of its vernal leaves when the sunlight plays among them, the cheerfulness of its lustrous summer green and the splendor of its autumnal colors, make the White Oak one of the noblest and most beautiful trees of the American forest; and some of the venerable broad-branched individuals growing on the hills of New England and the middle states realize more than any other American tree, the ideal of strength and durability of which the Oak has been the symbol in all ages and all civilized countries.¹²

Natural historian Donald Culross Peattie writes, “if Oak is the king of trees, as tradition has it, then the White Oak, throughout its range, is the king of kings. The Tuliptree can grow taller, and the Sycamore in the days of the



R. U. Piper M.D., *The Charter Oak*, drawing taken from the housefront of the tree's owner. According to Piper, both trunk and canopy measured about seventy feet; the diameter at the ground was sixteen feet. He wrote that "some thirty persons have been at one time within its cavity." Engraving, 1855.

virgin forest had gigantic boles, but no other tree in our sylvia has so great a spread. . . . Indeed, the fortunate possessor of an old White Oak owns a sort of second home, an outdoor mansion of shade and greenery and leafy music."¹³

A slow-growing tree, therefore not likely to reach old age quickly, the oak waits until maturity to really make a statement. White oaks sometimes reach an exceptional size. Wye Oak in Wye Mills, Maryland, for example, has a circumference of 382 inches (at breast height, or

4 1/2 feet above ground level) and measured 96 feet tall with a crown spread of 119 feet in 1996; its estimated age then was over 400 years.¹⁴

But there are older white oaks. At 515 years old, the Columbus Oak in Solebury, Pennsylvania—"so named because it predates Columbus' arrival in the Western Hemisphere"¹⁵—may be one of the oldest white oaks in the eastern United States. There are even older members of the oak genus, *Quercus*, such as the Angel Oak on John's Island, South Carolina. Named after

the nineteenth-century owners of the property on which it stands, the Angel Oak is a live oak (*Quercus virginiana*) believed to be about fourteen hundred years old.¹⁶

On these shores Native Americans were the first to separate the trees from the forest. This was a task of more than philosophical interest to a farmer—creating fields generally means destroying forests—especially a farmer confronted with the once-dense forests of southern New England. Long before the first colonists arrived, as William Cronon points out in *Changes in the Land*, Native American farmers had established fields by repeatedly burning the fallen trees and underbrush. The colonists continued to use some burning to expand their fields, along with girdling and cutting of trees, and they added extensive cutting to support their lumbering. Still, remnants of the forest dotted even the cultivated landscape, and because fire had long been the method of choice for clearing, the more fire-resistant species of hickory, chestnut, and oak achieved a new dominance in the eastern countryside.

The Charter Oak, then, was first of all a survivor of the forest—trees do not stand alone unless they are made to do so—and secondly, a valued part of the Native American landscape. To the agricultural tribes of southern New England, where corn provided about 65 percent of their caloric intake, determining the correct time for planting was crucial to survival. The cultivators were women and, according to the historian of science Carolyn Merchant, they used a variety of ecological indicators as guides: the spring runs of alewives, the position of the stars, and “the spring growth of the leaves of the white oak to the size of a mouse’s ear.”¹⁷ In the 1630s, when the land the tree stood on became the property of George Wyllys, a “deputation of Indians representing the former occupants of the place” came asking that the oak be spared. And it was. The tree, as the librarian of the Connecticut Historical Society, W. I. Fletcher, commented in 1883, thus “became an interesting link between the prehistoric and the modern.”¹⁸

The request would not have seemed strange to the colonists. They, too, were an agricultural people; they understood the importance of determining the correct time to plant crops.

And they were familiar with the oak. It is a tree of both the Old World and the New.

The first Europeans to settle Connecticut were the Dutch. They bought the land for their Hartford settlement from the Pequot and built a trading post there in 1633. That same year English members of the Massachusetts Bay Colony bought land from the Nawaas tribe and established a settlement near Hartford. By 1635, when John Winthrop arrived with the first official claim to the land on the part of the English authorities—a deed from the Earl of Warwick—three English towns surrounded the soon-to-be-abandoned Dutch trading post. Four years later these towns drafted and signed the Fundamental Orders of Connecticut, incorporating provisions for governance that provided for the election of officials, the supremacy of the General Court, and the collection of taxes. The Orders remained in effect until 1662, when Charles II issued the Connecticut Charter, a liberal document that superseded but endorsed the limited self-government the colonists had already set up under their Fundamental Orders.

This arrangement worked as long as Charles II was on the throne, but when James II succeeded his brother, he moved to scrap the Charter and subsume Connecticut, along with all of New England, under the rule of Sir Edward Andros, his appointed governor of New York.

What followed has become the stuff of legend. On October 31, 1687, Andros came seeking the Charter. The colonists understood that its transfer into his hands would mark the end of their limited independence. In a moment that includes the best of theater, magic, and playground strategy, the document mysteriously disappeared at the moment when it was about to be handed over, having been secreted in the oak by Captain Joseph Wadsworth. Although the event itself was magical, without its sequel the colonial action would have been a minor skirmish and not a triumph. Because in 1689, after James II fled England and William and Mary assumed the crown, Andros was displaced and Connecticut’s Charter, never having been officially rescinded, was considered still valid.

Sadly, no contemporary accounts of the event exist. The first recorded mention of the Charter Oak incident came in 1715 when the Connecticut General Assembly voted a stipend to Joseph

Wadsworth for “securing” the charter “in a very troublesome season when our constitution was struck at, and in safely keeping and preserving the same ever since unto this day.” Over the next ninety years the story was embellished by various accounts, most notably one in 1759 by Roger Wolcott, a former governor of Connecticut, which indicates that after the Charter was laid on the table “all the candles were snuffed out at once.” In the time it took to relight the candles, the Charter had vanished. A 1797 account identified the location of the “ancient hollow tree on the property of the Wyllys family in Hartford,” and by 1805 all of the elements of the legend were in place when Abiel Holmes, in *American Annals*, mentioned “the large hollow oak tree, which to this day is regarded with veneration, as the preserver of the constitution of the colony.”¹⁹

Maps began to note the tree’s location in 1846 (during that period of seeking a cultural idiom in the landscape), and soon after it fell the two roads that intersect at the corner where it stood were renamed Charter Oak Avenue and Charter Oak Place. If you visit that eponymous intersection you will find a very small enclosed park planted with a young white oak and featuring a treelike column erected by the Society of Colonial Wars with an inscription praising the former oak for its role “as the hiding place of the Charter.” If you stay long enough you will know you are at a meeting place, a place where people come and go and congregate, next to the monument, in the scant shade of the young white oak planted as a reminder of those earlier deeds.

The Charter Oak, then, has served as the preserver of a limited democracy, as a symbol of national identity deeply rooted in the American soil, and as a place for us to come together, to find that evanescent ideal we call community, or “company,” as the poet said. “To plant trees,” the gardener Russell Page wrote, “is to give body and life to one’s dreams of a better world.”²⁰ Exactly what the Charter Oak is all about.

Endnotes

- ¹ *Hartford Courant*, August 24, 1856.
- ² Robert F. Trent, “The Charter Oak Artifacts,” *Connecticut Historical Society Bulletin* (Summer 1984), 133–138.

- ³ Mark Twain, “Charter Oak,” *Alta California*, March 3, 1868
- ⁴ Perry Miller, *Nature’s Nation*, Cambridge Harvard University Press (1967), 11–12.
- ⁵ John F. Sears, *Sacred Places American Tourist Attractions in the Nineteenth Century*, NY: Oxford University Press (1989), 4–5.
- ⁶ Barbara Novak, *Nature and Culture. American Landscape and Painting 1825–1875*, NY: Oxford University Press (1980), xxii, 9. 15.
- ⁷ Gerald L. Carr, *Frederic Edwin Church: Catalogue Raisonné of Works of Art at Olana State Historic Site*, NY: Cambridge University Press (1994), 93, 95, 94.
- ⁸ Trent, “The Charter Oak Artifacts,” 129, 127.
- ⁹ The first quote can be found in Anson T. McCook’s address before the Society of the Founders of Hartford on the 250th Anniversary of the Hiding of the Charter, October 31, 1937, and the second in *The Connecticut Historical Society Bulletin* (July 1956), 67.
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- ¹¹ Jefferson’s letter to Madame Tessé can be found in Allen Lacy’s *The American Gardener. A Sampler*, NY: Farrar, Straus, & Giroux (1988), 169–170.
- ¹² Charles Sprague Sargent, *The Silva of North America*, Boston: Houghton-Mifflin (1890), 8. 19.
- ¹³ Donald Culross Peattie, *A Natural History of Trees of Eastern and Central North America*, Boston: Houghton-Mifflin (1950), 95–196.
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- ¹⁵ Jan Murphy, “512-Year-Old Oak Tree Needs a Helping Hand,” *Bucks County Intelligencer*, August 10, 1995, A1, 8
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- ¹⁷ Carolyn Merchant, *Ecological Revolutions Nature, Gender, and Science in New England*, Chapel Hill: University North Carolina Press (1989), 77.
- ¹⁸ W. L. Fletcher, *The Story of the Charter Oak*, Hartford: Case, Lockwood & Bramard (1883), 34–35.
- ¹⁹ Diana Ross McCain, “The Ol’ Oak Tree,” *Connecticut Magazine*, November 1987, 164–166.
- ²⁰ Russell Page, *The Education of a Gardener*, London: Collins (1962), 173.

Gayle Brandow Samuels is the principal author of *Women in the City of Brotherly Love*. This excerpt is from *Enduring Roots Encounters with Trees, History, and the American Landscape* by Gayle Brandow Samuels, copyright © 1999 by Gayle Brandow Samuels. Reprinted by permission of Rutgers University Press.

Aging and Rejuvenation in Trees

Peter Del Tredici

Trees are absolutely fascinating to study, not least because their entire life histories are recorded in their forms. In a sense, the shape of a tree is analogous to the personality of a human, a unique product of the interaction between genetic endowment and environmental influences, "nature" and "nurture." Trees illustrate an idea first enunciated by the German philosopher and poet Goethe, namely, that the external form of plants is a manifestation of their internal physiological processes (Arber 1950). By carefully studying the shape of a tree, for instance, one can literally recreate everything that has happened to it over the course of its life (Hallé et al. 1978).

Plants develop in ways fundamentally different from those of vertebrate animals. By some point during adolescence, all of an animal's body parts have become fully differentiated, and further growth simply increases size without increasing developmental potential. Plants, on the other hand, show continuous development from a network of meristematic tissue that remains embryonic throughout the entire lifespan of the tree.

In all plants, these meristems produce the differentiated tissue that makes up the plant—roots, stems, leaves, and flowers—but remain undifferentiated themselves. There are thousands of meristems on any given tree. Those located at the heart of every bud are called shoot meristems, just as those at the tip of every root are called root meristems. The third category is the vascular cambium, a cylindrical band of meristematic tissue that sheaths the branches and roots and is responsible for their increase in girth. (Annual growth rings are a visible indicator of the activity of the vascular cambium.) Taken together, the meristematic network forms a thin veneer of embryonic tissue at the periphery of the tree's differentiated woody core. Meristems produce new plant tissue throughout

the life of the tree, always expanding outward and upward; any tree that is not expanding is a tree that is dying.

From a chronological perspective, the cotyledonary node of the seedling, produced at the time of germination, is the oldest part of the tree, but paradoxically, from a developmental point of view it is considered the most juvenile. Conversely, the flowering shoots at the periphery of the tree are the youngest part of the plant chronologically but the most mature developmentally. Researchers have resolved these apparent paradoxes by describing three different types of aging in plants (Fortanier and Jonkers 1976).

Types of Aging in Trees

The first type, *chronological* aging, is simply the time that has elapsed in the course of the lifespan of the entire plant or some part of it. In the case of a giant sequoia, a single stem can be as much as two thousand years old. In the case of root-suckering species, such as quaking aspen, chronological age can refer either to the age of an entire organism measured in thou-



A seedling of eastern arborvitae (Thuja occidentalis) clearly showing the difference between the juvenile, needle-like foliage along the main stem and the mature, scale-like foliage of the branches.



The retention of foliage through the winter is a common manifestation of juvenility among members of *Fagaceae*, in this case, American beech (*Fagus grandifolia*).

sands of years, or the age of a given stem measured in hundreds of years.

The second type, *ontogenetical* aging, refers to the process of a plant passing through different “phases” of development. I distinguish four phases in the life of a tree: the seedling phase extends from the point of seed germination through the end of the tree’s first season of growth, as marked by the onset of a dormant period. The juvenile, or sapling, phase begins in a tree’s second season of vegetative growth and ends with the production of flowers. The

adult, or mature, phase encompasses the major portion of a tree’s lifespan, and the senescent phase begins when the tree starts to deteriorate as a result of damage or disease (Del Tredici 2000). The ontogenetical aging process is controlled by the meristematic tissues of the tree, and it is not uncommon for different parts of a tree to be in different growth phases at any point in time, as when juvenile sucker shoots originate from fully mature trunk tissue.

The third and final type of aging, *physiological*, is related to the general condition of the entire plant body and describes the development as well as the deterioration of the life-support systems of the tree. Specifically, it covers the loss of vigor in the root or shoot system that results from environmental stress or from the damage caused by wind, fire, ice, or snow. In general, the physiological aging process is controlled by the differentiated tissues of the tree (Romberger 1976).

The concept of *rejuvenation* is defined as the opposite of aging. As such, it can be either ontogenetic—a shift of all or part of the tree from an older growth phase to a younger phase—or physiologic—a retardation of the aging process.

Ontogenetic rejuvenation can be thought of as a resetting of the aging clock back to the juvenile stage, whereas physiological rejuvenation involves slowing down the aging clock.

Ontogenetic Rejuvenation

Aging and rejuvenation play important roles in the field of horticulture. Cultivars of various trees have been created by selectively propagating a part of the tree that is locked in a particular ontogenetic phase. The resulting cultivars are not genetic mutants; instead, their distinc-



Thorn production in honey locust (*Gleditsia triacanthos*) raised from seed

tive characteristics stem from variations in gene expression rather than gene composition (Brand and Lineberger 1992; Greenwood 1993).

For plant propagators, it is crucial to choose the right location on the parent tree for the cuttings because this strongly effects the form of the finished product (Hackett 1983). Some well-known examples of nongenetic cultivars maintained by selective propagation include:

- Thornless selections of the honey locust, *Gleditsia triacanthos* 'Inermis', are propagated from sexually mature portions of the tree and do not produce lots of thorns on their trunks. Seed-raised honey locusts, in contrast, always have thorns on their trunks (Warren 1991).
- 'Prostrata'-type cultivars of various dwarf conifers, such as fir, yew, and spruce, are often propagated from lateral branches. These cultivars are locked into the mature, or horizontal, growth phase, and their branches retain a lateral orientation for many years. Unfortunately, many of these low-growing cultivars

are unstable and eventually produce vigorous vertical leaders (Olesen 1978; Del Tredici 1991).

- The vase-shaped, spreading cultivars of various nut-producing species, including ginkgo, pecan, and walnut also represent the mature growth phase of the parent trees. When grown from seed, these same species show the strong, clearly defined central leader and whorled lateral branches that typify the juvenile form (Del Tredici 1991).
- Shrub-form cultivars of English ivy with unlobed leaves and flowers represent the mature, nonrooting phase of growth. In its juvenile state, English ivy has lobed leaves and readily produces adventitious roots. This pattern of development is typical of vines that, in their natural habitats, must cope with the radical difference between the environmental conditions of the shady forest floor, where they first take root, and those of the sunny canopy, which they reach at maturity (Lee and Richards 1991).
- Many dwarf conifers with "immature" foliage and highly congested growth are propagated from parent trees that are "stuck" in the seedling or juvenile growth phases. Examples include the well-known dwarf Alberta spruce (*Picea glauca* 'Conica') and the many "plumose" cultivars within the genus *Chamaecyparis*. Among angiosperms, the florist's *Eucalyptus* is an example of a flowering tree that retains its juvenile foliage for many years (Borchert 1976). Eventually, all of these cultivars show a tendency to "revert" to the mature form, although the process is clearly more of a developmental advancement than a reversion.

Natural Rejuvenation

In nature, one commonly finds ontogenetic rejuvenation in trees that produce sprouts from the base of their trunks or from their roots. This sprouting usually happens in response to some form of periodic disturbance or environmental stress. Four basic types of rejuvenation sprouting are commonly seen in trees.

- Root suckering—the production of new shoots by the root system—occurs in species such as American beech (*Fagus grandifolia*), the tree

of heaven (*Ailanthus*), and various species of poplars (Del Tredici 1995).

- Rhizome sprouting—the production of specialized underground stems, or runners, that send up aerial shoots. These are commonly found among shrubs and trees that are specifically adapted to survive fire.
- Layering—the production of adventitious roots by the trunk or by lateral branches when they come in contact with the soil. Branch or trunk layers are most likely to form on trees growing on exposed mountaintops, where harsh conditions promote the retention of lower branches, or on wet sites, where moist, peaty soil facilitates adventitious rooting (that is, roots formed on branches). Among cultivated trees, layering is commonly seen in open-grown specimens whose lower branches have not been pruned.
- Basal sprouting—the emergence of vigorous shoots and adventitious roots from the collar. This is seen in several species native to eastern North America, including the American linden (*Tilia americana*) and the red and white oaks. In the West, where fires are much more common than in the East, many trees are adapted to sprout back vigorously after being burned; these include the most prolific sprouter of them all, the California redwood, the madrone (*Arbutus menziesii*), the bay laurel (*Umbellularia californica*), and the tan oak (*Lithocarpus densiflorus*). In the case of *Sequoia*, the root collar originates from cotyledonary buds that were produced at the time of germination; nevertheless, when they sprout



Prolific root-suckering in American beech (*Fagus grandifolia*) growing at the Arnold Arboretum.



“Layering” of a low lateral branch of the western arborvitae (*Thuja plicata*) growing at Westonbirt Arboretum in Tetbury, England.

fifty to one hundred years after they were initiated, the shoots they produce are considered fully juvenile (Del Tredici 1999).

Plant propagators learned long ago to mimic trees’ natural methods of rejuvenation for their own commercial purposes. For example, it has long been known that juvenile sprouts from the base of a tree will produce adventitious roots much more readily than mature shoots from the

same tree. Over the years, nurseries have developed a variety of pruning techniques designed to stimulate stock plants to produce such vertically oriented, easy-to-root shoots. These techniques include hedging, the annual shearing of shrubs or trees to create a geometrical shape of fixed size; pollarding, annual pruning of the branches to a fixed point to produce an antler-like crown with prominent swellings at the ends of the branches; and stooling, periodic pruning of a woody plant to ground level, causing it to sprout vigorously from the base (Libby and Hood 1976; Hackett 1988).

Unfortunately, rejuvenation effects achieved through propagation by cuttings is never as complete as those achieved through seed propagation. Using modern tissue culture techniques, researchers have come closer to stimulating full rejuvenation of mature-growth-phase tissue than is possible with cutting propagation, but

even here rejuvenation is never complete (Brand and Lineberger 1992). To put it another way, a tree grown from a seed will always be distinguishable from one grown from a cutting, no matter how much technology is applied to the propagation process (Bon et al. 1994).

Physiological Rejuvenation

Physiological rejuvenation—slowing down rather than resetting the aging clock, as occurs in ontogenetic rejuvenation—is best seen in trees that grow in stressful environments like those at the tops of high mountains. Under these conditions, it is common to find individuals of a given species living much longer than they typically would under more favorable conditions. From the human perspective, this seems paradoxical, but among trees adversity promotes longevity. The best-known example of this phenomenon is the bristle-cone pine (*Pinus*



American linden, *Tilia americana*, sprouting from its basal lignotuber.



Pollarded lindens, *Tilia vulgaris*, growing in Selborne, England. The trees were planted by the naturalist Gilbert White (1720–1793).

longaeva), which reaches its maximum age of more than 4,000 years at high elevations in the White Mountains of southern California.

A less well-known, but equally remarkable example has been documented in the eastern arborvitae (*Thuja occidentalis*), which grows on the steep limestone cliffs of the Niagara Escarpment in Ontario, Canada, as well as on flooded bottomlands. On exposed cliffs, the trees are extremely stunted—reaching only five to fifteen feet in height—and attain ages of over 1,200 years. In moister, more protected sites, the trees are much larger—forty to fifty feet tall—but live only 200 to 300 years (Larson et al. 2000).

These examples follow a general rule: within any given species, the slowest growing individuals are the longest-lived; or conversely, the biggest trees in a forest are never the oldest. A survey by Loehle (1988) of the longevity of North American trees found that the longest-lived species among both conifers and angiosperms were those that invested the greatest proportion of their carbohydrate reserves in chemical and structural defenses against environmental stress. Put another way, the more energy a plant invests in defense mechanisms as opposed to vegetative growth, the longer it will live.

Horticulturists have also exploited the natural capacity of trees to rejuvenate themselves physiologically. In cultivated trees, the environmental stress that slows physiological aging—analogueous to the stress that trees in nature encounter at high altitudes—is intensive pruning. The Asian art of bonsai is a well-known example of rejuvenation induced by pruning. The techniques used in bonsai, especially periodic root pruning, seem to suspend physiological aging indefinitely (Del Tredici 1989). When applied to appropriate species—hazelnuts, plane trees, lindens, and elms, among others—pruning techniques such as pollarding and coppicing



A ginkgo raised from seed on the left and a grafted ginkgo on the right, both planted at the same time. The differences in form are a manifestation of different growth phases.

also promote greater longevity than one sees in unpruned trees, a clear indicator of physiological rejuvenation (Rackham, 1986).

In general, pruning brings about a measure of physiological rejuvenation by (1) inducing the growth of ontogenetically younger meristems; (2) shortening the internal transport path of water and nutrients; or (3) reestablishing the balance between shoot and root activity when the latter is in some way limited (Borchert 1976; Fortanier and Jonkers 1976).

One final question remains: Can the root systems of old trees undergo rejuvenation in the way that shoot systems can? The practical experience of bonsai masters who recognize the necessity of periodic repotting, as well as arborists who specialize in transplanting large trees, certainly suggests that root systems can be rejuvenated, but given that root systems are underground, morphological evidence for this idea is lacking.

I began by saying that the development pattern of trees differs strikingly from that of animals; in trees, the ontogenetical and physiological aging processes operate independently of each other. This means that trees, unlike people and other animals, can be simultaneously embryonic and senile. When carried to the extreme, this would effectively result in a form of ecological immortality. It is this poten-



A beautiful juniper bonsai (*Juniperus californica*) in the collection of the National Arboretum in Washington DC. The plant was collected from the wild.

tial for immortality that makes trees so fascinating to study and cultivate.

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Fruiting Espaliers: A Fusion of Art and Science

Lee Reich

An espalier is a plant, usually a fruit plant, trained to an orderly two-dimensional form. The word may derive from the Old French *aspau*, meaning a prop, and in fact, most espaliers must be propped up with stakes or wires. (Another possible origin of the word is the Italian *spalliera*, referring to a support for a shoulder or back.) Espalier had its formal beginnings in Europe in the sixteenth century, when fruit trees were trained on walls to take advantage of their extra warmth. Strictly speaking, an espalier grown on a trellis in open ground—that is, away from any wall—is termed a *contre-espalier* or an *espalier-aere*. But no need to be a stickler for words, the definition of espalier is as lax as the plant is formal. The British reserve the term for a specific two-dimensional form; and some fanciful, yet well-ordered shapes that are called “espalier” by some gardeners are, in fact, three-dimensional.

Why go to all the trouble of erecting a trellis and then frequently having to pinch and snip a plant to keep it in shape? Because a well-grown espalier represents a happy commingling of art and science, resulting in a plant that pleases not only the eye, but also the palate. This science is applied artfully (or the art scientifically) by pulling exuberant stems downward to slow their growth and increase their fruitfulness; by cutting notches just above buds to awaken them where a stem threatens to remain bare, and by pruning back stems in summer to keep growth neat and fruitful. Every stem on a well-grown espalier is furnished throughout its length with fruits, and

these fruits, bathed in abundant sunlight and air, are luscious, large, and fully colored.

The physiological bases of plant responses to the branch bending and pruning needed to maintain an espalier are known to some extent. Pruning response depends on time of year, growth



One structure (a *contre-espalier*) serves to support two apple trees in horizontal palmette form growing back to back at Colonial Williamsburg, Virginia.

stage of stem, degree of cutting, species, and, in some cases, even cultivar. Perhaps the most significant (or best understood) responses involve the hormones auxin and ethylene. Auxin is produced at the tips and most elevated portions of stems; among the effects of this hormone is that of suppressing bud growth farther down a stem so that growth of the apical bud or buds dominates. Ethylene is a hormone produced in response to wounding or branch bending, and one of its effects is fruit bud formation, which helps explain how branch bending promotes fruiting. Other hormones are also involved



As pear spurs age, they must be thinned to stimulate and make room for younger spurs. The spurs on this branch are well spaced and still vigorous. They will not need thinning for a few years.

in shoot growth and fruit bud formation; the effects of all of them vary with concentrations and ratios.

Despite the constant attention espaliers demand, caring for them is not burdensome. Repeated pruning keeps trees small enough to be conveniently clipped, thinned, and harvested from the ground. And while pruning must be frequent, the cuts are small and quickly executed, in many cases requiring nothing more than a thumbnail.

Note that espalier is not restricted to plants bearing edible fruits. A strictly ornamental espalier is in keeping with a formal setting. (But so is an edible-fruited espalier.) Maintenance of a purely ornamental espalier, especially when the plant does not bear even ornamental fruit, entails nothing more than repeated clipping of wayward stems.

When fruit, especially edible fruit, is a goal, however, you must carefully consider the response of the plant before you cut back shoots. Are there enough leaves to adequately nourish each fruit? (Each apple fruit, for example, needs about 40 leaves for best quality.) Will a new shoot grow to defiantly replace the one you just cut off? Will your pruning restrict growth and keep stems furnished with fruit buds along their entire length?

Forms for an Espalier

An espalier consists of main stems, called leaders, from which grow branches which, in some cases, become arms or ribs. Arms and ribs are

permanent; all other branches are temporary and the trick is to minimize branch growth while maximizing fruiting.

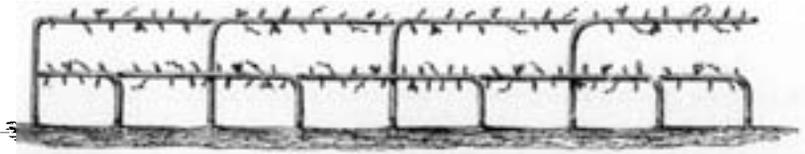
The simplest form for an espalier is a single stem, a cordon (which some people choose to call an “espalier”). Vertical cordons can be set a mere eighteen inches apart in a row, so are useful, for example, for growing many varieties of apple in a small space. Or, a cordon can be trained horizontally to border a path or create a living edge to a garden.

The cordon is best suited to plants that bear fruit on spurs—stubby, long-lived stems that elongate only a fraction of an inch per year—thus avoiding a cordon that looks more like a porcupine than a cordon. Among common fruits, apples and pears and, to a lesser extent, plums make good cordons. To counteract the tendency towards topheavy growth (due to apical dominance of a vertical stem), single cordons are commonly planted and grown at an angle. This practice encourages uniform budbreak and growth up and down the length of the cordon.

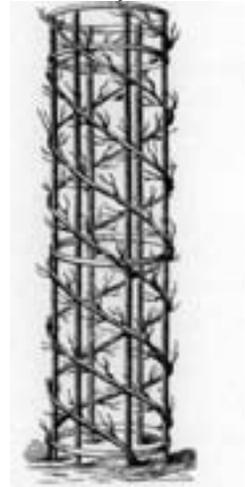
Now suppose you were to terminate that single stem of a vertical cordon near ground level and split it into two leaders that turn away from each other before growing vertically again. You now have a “U palmette.” Split those two vertical leaders again and you have a “double-U palmette,” increasing the spread and yield from a single plant—and also changing the design, of course.

There exist many variations on this theme. The central stem could have two side branches grow into a wide U, then continue upwards with another two side branches growing into a less wide U, and so on with increasing height. Or, the central stem could grow to the full height, along the way sending out tiers of horizontal leaders growing off to left and right. (This latter form is what the British choose to call an “espalier”; others call it a “horizontal palmette” or, if the side arms angle upwards, an “oblique

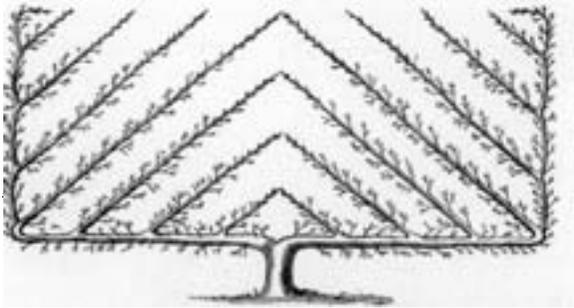
*The horizontal palmette, opposite, is from J & A Hardy, *Traité de la taille des arbres fruitiers* (Treatise on Pruning Fruit Trees), 1900. All other drawings on pages 19 and 20 are from Dr. Ed Lucas, *Die Lehre vom Baumschnitt für die deutschen Gartenbearbeiter* (Dwarf Fruit Trees), 1899. *Library of the Arnold Arboretum.**



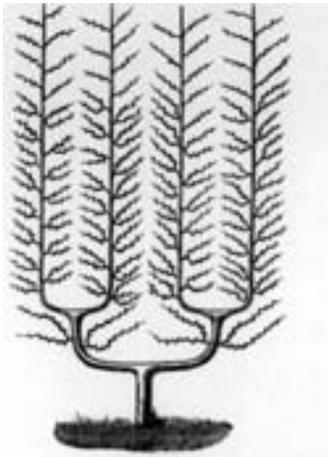
Horizontal cordons



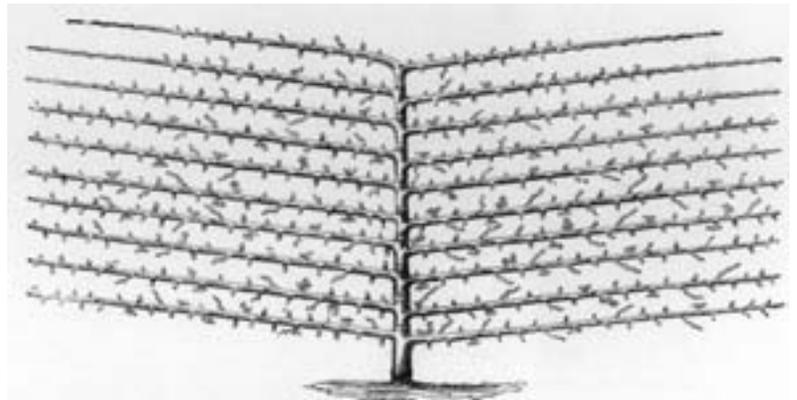
Three spiraling cordons



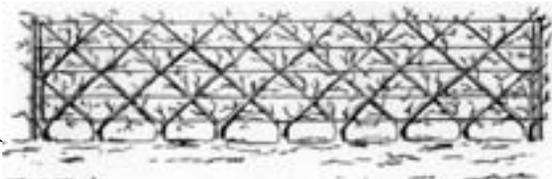
Candelabra palmette with oblique arms.



Double U palmette, a form of candelabra palmette



Horizontal palmette



Belgian fence



Fan palmette

palmette.”) In yet another variation, the central stem could split into a broad U with horizontal tiers of leaders growing outwardly from each upright of the U.

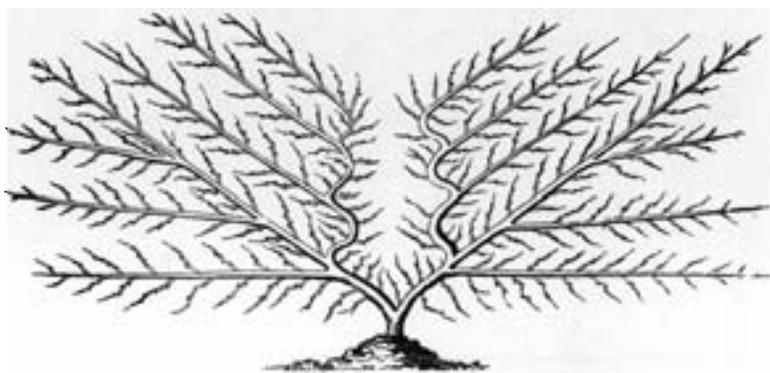
All these forms are prey to the problem of excess growth near the tops of the plant. Auxin produced at the tips of those upright leaders inclines them to grow vigorously, mostly from their tips, and prevents fruit buds from forming farther down. Although the hormone auxin was not isolated until the twentieth century, its effects had long been observed. To quote M. Gressent (*Arboriculture Fruitière*, 1869), a vertical growth “throws trouble into the whole economy of the tree and paralyzes its production and compromises the very existence of the horizontal branches.”

To counteract the hazards of apical dominance, other shapes have been devised. One popular form is the “fan,” in which the central stem terminates low in the plant, dividing into two leaders that angle upwards and outwards. Off each of these leaders, above and below, grow permanent ribs, with fruiting spurs or temporary fruiting branches growing from them. The number of ribs, and just how vertically they are allowed to grow, depends on the inherent vigor of the plant. Building up the lower and outside parts of the fan first keeps the potentially most vigorous part—the highest and most central—from overtaking the rest. In other designs, the central leader is purposely weakened by being bent around in a decorative curve, rather than allowed to grow straight upward.

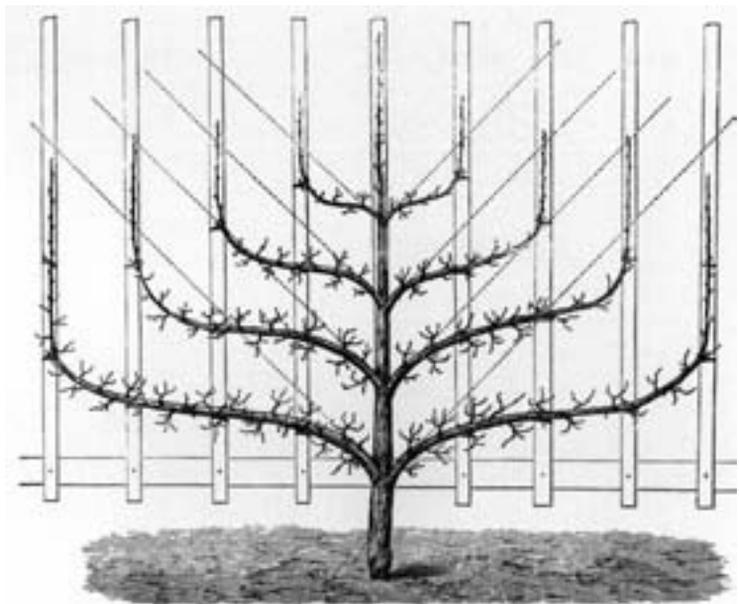
Mention should also be made of espaliers that create an effect *en masse* from plants lined up and overlapping in a row. Among the most popular of such designs is the Belgian fence, a living latticework of branches. In some designs, adjacent branches actually graft together so that the espalier eventually becomes self-supporting.

Training

Training an espalier is just like training any other plant. “Heading” cuts—that is, shortening of stems—release buds lower down the stem from the inhibiting effects of auxins produced at the stem tips, thus causing growth from the lower buds. “Thinning” cuts—totally removing stems at their origins—get rid of unwanted growths (which include stems growing perpendicular to the plane of the espalier) without inducing new growth at that point.



The two central leaders of this double palmette have been trained to curve, an effective method of thwarting apical dominance.



A candelabra palmette in training.

Differences between training a conventional fruit plant and an espalier lie in the goals: With an espalier, the ideal is to develop branches with near perfect symmetry and active, fruitful buds throughout their length. No matter what the design, sufficient space (about twelve inches) must be allowed between leaders. Wherever one leader is to divide into a Y or a U, the ideal is to have the resulting two leaders growing as nearly as possible directly opposite each other. Suitably positioned shoots might already exist; if not, they can be induced with heading cuts just above the desired point of bifurcation. Of course, in plants with alternate leaves (which originate some distance apart along the stem), heading back a dormant shoot never results in leaders exactly opposite each other.

For the connoisseur who demands nearly perfect symmetry even in alternate-leaved plants, there are ways to position those leaders more directly across from each other. One way is to graft a shoot opposite an existing shoot, or a bud opposite an existing bud, where arms are wanted. Another way is to cut the stem back to desired points while the plant is dormant. Typically, a vigorous, vertical shoot grows from the top of that cut stem out of a whorl of tightly packed buds. If, when that vertical shoot is about a foot long, it is cut back to the whorl (leaving about a quarter of an inch of new growth), two new shoots should originate from buds within that whorl—at almost exactly the same level. Aesthetics aside, leaders that originate at the same level are more likely to keep in step as they grow.

As a young espalier develops, its leader or leaders are shortened each year, typically while the plant is dormant. Reducing a leader's length by about a quarter of the previous year's growth—even more on weak shoots, to channel energy into fewer buds—keeps buds along the stem active. Upon reaching full length, the leaders are annually cut back to within an inch or so of the previous season's growth.

The thumbnail is a useful tool for pinching tips of growing shoots during training; it can hold back a shoot trying to outgrow others. Pinching back the tips of developing leaders every foot or so also keeps buds lower on the shoot active, avoiding "blind" wood and reducing or even eliminating the need for dormant heading of the leader(s).

Typically, leading shoots are tied to bamboo canes that, in turn, are tied to the wooden or wire framework that supports the plant. By tying a leader to the cane rather than directly to the framework, the shoot can be kept ramrod straight even as the angle of the supporting cane is adjusted to make best use of that old bugbear, apical dominance. For example, if an espalier is to have two horizontal arms, these arms could initially be held at an upward angle to keep growth moving along—the more upward pointing, the faster the growth. As the arms approach full length, they could gradually be lowered to slow growth and increase the development of side branches and fruit buds. All that needs to be done is to untie the cane from the framework and, with the branch still firmly lashed to it, retie it at the desired angle.

Another way is to simply lash all but the ends of the developing shoots to horizontal supports. The free ends of the shoots then do what they are naturally inclined to do, turn upwards, and



Oblique cordons slow growth and promote fruiting.

that upward orientation keeps the growing tips vigorous. As the shoot elongates, older portions are tied to the horizontal support.

Maintaining an Espalier

Even before an espalier is fully trained, the older parts of the plant require strict pruning to control branch growth in order to maintain a neat shape—all the while avoiding sacrifice of fruit yield or quality. How pruning can help depends on the plant's fruiting habit. For example, peach and Oriental plum fruit freely on one-year-old wood. Apple and pear, on the other hand, generally fruit on spurs. (A popular misconception is that shortening any apple or pear stem to spur length converts it to a fruiting spur. Not so. A spur is a physiologically unique entity.) No matter what the plant, any shoots growing perpendicular to the plane of an espalier are kept in check by thinning or pinching. Overcrowded branches also must be thinned. Stems of the perfect espalier are solidly clothed with fruit, and if this goal is realized, developing fruits will need to be thinned. And with plants that fruit on long-lived spurs, old or overcrowded spurs eventually need pruning.

The specifics of maintaining an espalier vary with kind of fruit plant, the cultivar, possibly even geographical region. Success might also depend on the predictability of the climate and its vagaries; in my opinion it is those vagaries that are responsible for espaliers that become nothing more than fruitless and flowerless stems bent in fanciful shapes. Consistent

response with apple and pear, for example, demands more consistent weather patterns than is experienced over much of the United States.

The Apple Espalier

Variable response to espalier pruning is well illustrated by the apple, a tree extensively espaliered in Europe. Spur fruiting enables apple trees to assume many different shapes. No doubt that accounts for the many different systems devised for apple espaliers.

One of the most elegant of them was devised at the end of the nineteenth century by Louis Lorette, curator and professor of the Practical School of Agriculture at Wagonville, France, north of Paris, near the Belgian border. In the Lorette system, which can produce spectacularly beautiful and fecund results, trees are pruned only during the growing season. When branches are about two inches long (late April in Wagonville), the extension growth of leaders is shortened according to their vigor—the less vigorous are shortened more to strengthen growth in the bud just behind the cut—and according to whether further extension is desired.

Pruning of branches themselves begins as soon as any are pencil-thick, about a foot long, and becoming woody at their bases (in Wagonville, the middle of June). Such branches are cut back to the whorl of leaves at their bases, leaving stubs about a quarter of an inch long. Branches that have not yet reached the proper growth maturity are left untouched.

Properly mature branches are cut back at monthly intervals throughout the summer. Regrowth that follows pruning is also cut back, but only if it is at the stage of maturity described for the first cut. At the last pruning, in late summer, any immature branches are cut back to three buds. This description covers no more than the bare bones of Lorette pruning; for more detail, see *The Lorette System of Pruning*, 1946.

Research has shown that Lorette pruning does, in fact, increase ethylene production in stubs that remain and that could lead to flower bud formation. It has also been suggested that repeated cutting removes young leaves and so decreases formation of another hormone, gibberellic acid, which can inhibit flower bud formation. Where the Lorette system works, buds



Pruning the Lorette way: a half-woody shoot is cut back to the whorl of leaves at its base.

at the bases of pruned side shoots eventually become fruit buds hugging the leaders. But here's the rub: Lorette pruning is not effective everywhere. It seems to work where the climate is equable year-round with a long period of warmish weather in autumn. This describes the maritime climate of northern France, but not very much of North America. My experiences with Lorette pruning in the continental climate of the northern United States concur with those of many others who have tried it. Variable summer rainfall, hot summers, and cold winters result too often either in rampant regrowth that is susceptible to winter injury—or in nothing more than dead stubs.

Across the English Channel, the British devised their own system of pruning apple espaliers: the "three-bud" system. The essence of this system is the cutting back of young branches, in winter, to three buds. Older branches are trimmed to a single stem and/or shortened to three buds beyond any fruit buds. Pruning continues throughout the growing season: tips of side shoots are pinched when they have grown three leaves beyond the whorl of leaves at the base of the shoot. Shoots may also develop from older, fruiting branches and the time to pinch these depends on the vigor and activity of the lower buds. Pinched too early, the lower buds are jarred awake and grow out into shoots. But pinched at just the right time, they plump up into fat fruit buds. Close observation and the ability to predict the weather improve results.

Soon after becoming familiar with the elegance of the Lorette system, the British modified it to their conditions and inclinations. "Modified Lorette" pruning requires that trees be pruned only twice a year. The timing of the first branch cut corresponds with M. Lorette's, except that half-woody shoots are shortened to the second leaf (not counting the basal cluster of leaves), perhaps to the third leaf if growth is very strong.

In winter, regrowth from summer cuts is shortened. If one stem grew from a two-bud stub, it is shortened to two buds. If new stems grew from both those buds, the farthest one is shortened to one bud, and the lower one to two buds. Notice, either way, that the branch



This pear tree pruned according to the Lorette system approaches perfection: it is spectacularly beautiful and fully clothed with fruit.



A full-grown, vase-trained "Lorette" apple tree.

FROM THE LORETTE SYSTEM OF PRUNING, 1946. LIBRARY OF THE ARNOLD ARBORETUM



Redcurrant espaliers require only twice yearly maintenance.

is left with a total of the signature three buds. The following summer, half-woody shoots are pruned to leave a total of three buds on any of these branches.

Other pruning methods also have been devised for the apple. Pinching the tips of branches when they are half woody and about a foot long, then shortening them to an inch two weeks later, has quelled growth and set up fruit buds in New Zealand. In northeastern United States, a similar result has been achieved by shortening any branches longer than a foot back to a quarter of an inch in the middle of August. This latter pruning is supplemented by winter pruning that cuts back regrowth and all vertical sprouts. Of course, an espalier that spends the bulk of the summer spiked with relatively long branches growing from the leaders is not particularly neat.

In Australia, a technique called “twice-heading” is used to make fruiting spurs from vigorous branches. A branch is shortened early in the season and then, when the resulting regrowth of two or three shoots is three or four inches long, a second cut is made just below this regrowth.

The Redcurrant Espalier

Redcurrant represents the other extreme in espalier. It is very easy and responds predictably and well over a wide range of locations and climates. A redcurrant can be trained as a fan, cordon, or U-palmette.*

It requires twice yearly maintenance pruning. For the mature plant, summer pruning entails nothing more than cutting back all shoots growing off leaders to five inches in early July, when the fruits are beginning to color. Each winter, those branches are again shortened, this time to an inch or two in length. This program works as well on this side of the Atlantic as on the other side.

Redcurrant bears fruit laterally on one-year-old stems and on spurs on older wood, so it is easy to see why this program can

keep a redcurrant espalier neat and fruitful at the same time. On the other hand, why don't the shortened shoots resprout after summer pruning? What would be the effect of earlier pruning, which would keep the plant even neater between spring and early summer? Those are the questions are that make experimenting with any espalier interesting, even as the plant provides gustatory and aesthetic pleasure.

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Lee Reich, PhD, is the author of *Uncommon Fruits Worthy of Attention* (Addison-Wesley, 1991), *A Northeast Gardener's Year* (Addison-Wesley, 1992), and *Growing Fruit in Your Backyard* (MacMillan, 1996) Much of the information in this article was derived from his latest book, *The Pruning Book* (Taunton Press, 1997).

* But bear in mind that because the black currant is an alternate host to white pine blister, all currants are prohibited in many towns and counties in the Northeast.

Rose Standish Nichols, A Proper Bostonian

Judith B. Tankard

Outspoken advocate of social reform, tireless promoter of international peace, intrepid traveler, connoisseur of antiques, and all-round enthusiast of the arts, Rose Standish Nichols (1872–1960) was for many decades a familiar institution to the denizens of Boston’s Beacon Hill. But she was also one of the country’s earliest professional garden designers and an accomplished writer of garden history and criticism. Her three books on historical gardens in England, Italy, and Spain, together with dozens of articles about gardens around the world, earned her a considerable reputation in her own lifetime.

However, unlike the names of her well-known contemporaries—Marian Coffin, Beatrix Farrand, Ellen Shipman—Nichols’ name long ago fell into obscurity, largely because so few of her gardens survive. Even for those few, there remain none of the plans, drawings, or client correspondence that might enable restorers to bring them back to life. The papers of Coffin, Farrand, and Shipman have been preserved in libraries or other institutions.¹ But Nichols seems not to have hired assistants; she had few professional affiliations; she may not even have had an office; and she herself made no provisions for establishing an archive. That may partly explain why, sometime after her death, documents related to her work disappeared.

Unlike her colleagues whose lives were devoted almost exclusively to professional design, Nichols spent a great deal of time on her many other interests, and even in her professional life she may have regarded herself primarily as a writer and connoisseur rather than a designer. The pursuit of a financially viable career—the primary goal of Coffin, Farrand, and Shipman—seems to have been of little importance to her: the number of commissions she undertook was small, and most of them can be traced to her renown as an author or to family connections.



Watercolor portrait of Rose Standish Nichols by Taylor Greer, 1912

Nichols was well informed in all the many fields that piqued her curiosity. To this day she is remembered by longtime Bostonians for her Sunday afternoon teas, which brought together people of diverse professions for “a friendly exchange of ideas in order to create a better understanding among people.” In 1896, “to create a feeling of neighborliness on the Hill,” she established the Beacon Hill Reading Club, and under its aegis she invited women to her elegant Beacon Hill home to discuss important books of the day and even to read drafts of their own works.² She wrote many magazine articles on the subject of antiques and prepared a book (unpublished) on American decorative arts.³ Her home, located at 55 Mt. Vernon Street, is now the Nichols House Museum, established in 1961 by a legacy in her will. Furnished with ancestral portraits and antiques collected on her many trips abroad, the house museum offers

a glimpse of early twentieth-century life on Boston's Beacon Hill.

Nichols was a forthright woman who rarely stood on ceremony when she had a bone to pick. In his book *The Proper Bostonians*, Cleveland Amory described Nichols as a noted Beacon Hill spinster who did not hesitate to write directly to Washington during World War II to complain that Admiral Halsey was "a disgrace to the Navy," and—worse—"not a gentleman."⁴ Much earlier, in 1908, Nichols and Boston poet Amy Lowell successfully opposed a controversial proposal to move the Boston Athenaeum from Beacon Hill to Back Bay. After the First World War, she enlisted the first lady, Edith Galt Wilson, to urge her husband to include a woman among the American delegates to the 1919 Paris Peace Conference. President Wilson refused, but Nichols checked into a nearby hotel and sat in on all the meetings anyway.⁵

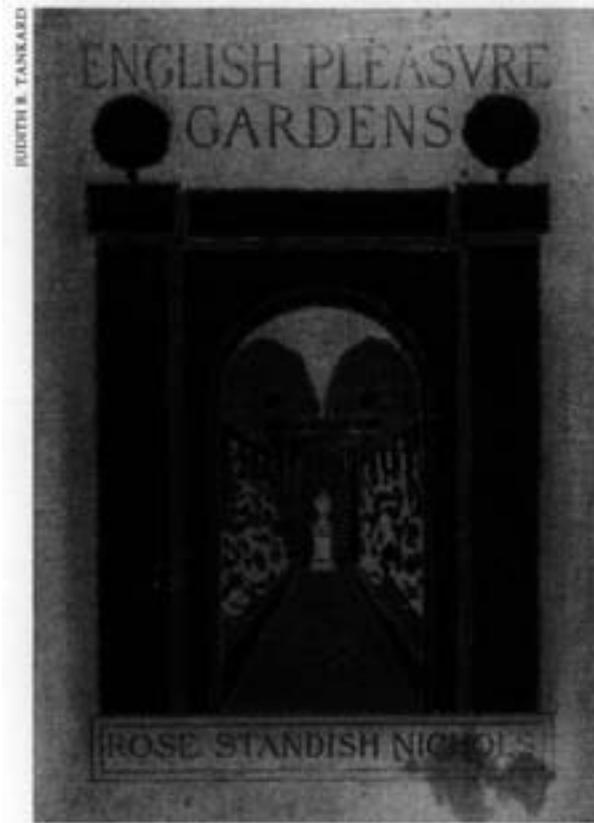
Nichols believed that the love of gardens is universal and that this shared passion could be a tool for improving international relations. For that reason she fostered friendships with influential women around the world, including Queen Sophie of Greece. In one of her articles Nichols described the queen's deep love of gardening and her remarkable garden, designed by the English landscape architect Thomas Mawson. She had been introduced to the royal family through a Beacon Hill neighbor, Gordon Allen; by her own account, her afternoon at the royal palace included "a discussion with the King about international politics."⁶ This was typical Rose Nichols.

Nichols first became enamored of gardening as a child, when her grandfather Thomas Johnston Homer allowed her to cultivate a small corner of his garden in Roxbury. Rose and her two younger sisters Marian and Margaret grew up in Boston at 130 Warren Street, where their father, Arthur Howard Nichols, practiced homeopathic medicine. In 1885, when Rose was thirteen, the Nichols family moved to the house on Mt. Vernon Street, where she would live for the remainder of her life. Rose's mother, Elizabeth Fisher Homer, was the sister-in-law of Augustus Saint-Gaudens. In 1889, when the Nichols family spent the summer at Saint-Gaudens' home in the Cornish Colony of rural

New Hampshire, Rose immediately fell in love with the mountains. The following winter she persuaded her father to buy an old farmhouse in Cornish, where she spent many happy summers enjoying the area's renowned natural beauty and learning about gardens. It was her uncle Augustus who, because of his admiration for her garden there, encouraged her to take up garden design.

Like many garden designers, Nichols devised her own training program; the profession was still in its formative stage and few educational options were open to women. Our knowledge of her studies is sketchy. She was tutored privately by Charles A. Platt, an artist-turned-architect whom she had first met in Cornish.⁷ One winter, while living in New York City with the Saint-Gaudens family, she studied drafting with Thomas Hastings of the architectural firm Carrère and Hastings. In January of 1899 she was admitted as a special student at the Massachusetts Institute of Technology. Records show that she took only one course, an upper-level design studio, suggesting that she already possessed some advanced skills. The course was taught by Désiré Despradelle, a charismatic professor of architecture whose teaching methods were based on Beaux Arts principles.⁸ It was here, she later said, that she "learned to apply architectural principles to the plans of gardens."⁹

Nichols also enrolled at the École des Beaux Arts in Paris where she took at least one course. Later she studied in England with "the author of *The English Formal Garden*," as she put it. It is unclear whether she meant H. Inigo Triggs, author of a sumptuous folio entitled *The Formal Garden in England and Scotland*, or F. Inigo Thomas, co-author with Reginald Blomfield of *The Formal Garden in England*. Whichever it was, Nichols' approach to design became firmly entrenched in formalism rather than in the naturalism whose best-known advocate was William Robinson, author of *The Wild Garden* (1870) and *The English Flower Garden* (1883). Nichols rarely alluded to Robinson or to naturalism in either her writings or her design work. Her allegiance to the formal garden was shared with the artists of the Cornish Colony. Years later she wrote, "All the artists in Cornish . . .



Nichols' English Pleasure Gardens was published in 1902.

became champions and exponents of the so-called 'formal' school. We eagerly read John Sedding's *Garden Craft Old and New* and got ideas from [Blomfield's] *The Formal Garden in England*.¹⁰

Nichols' first book, *English Pleasure Gardens*, appeared in 1902. It championed the formal garden and carefully traced the origins and history of English gardens, with emphasis on Elizabethan and Tudor walled gardens. Part of the book's charm lies in its visual materials, which include her own photographs and drawings as well as illustrations from medieval manuscripts that Nichols had ferreted out in libraries and museums. *English Pleasure Gardens* remains a useful reference for garden history even today.

An energetic traveler, Nichols made thirty trips abroad in search of gardens to write about. After World War I, she published two more books in the same format as the first, *Spanish and Portuguese Gardens* (1924) and *Italian Pleasure Gardens* (1928). For both of these

books, Nichols chose gardens that were not well known to American and English travelers. Her extensive knowledge of each country's history, decorative arts, and architectural styles enriched her books with a cultural flavor lacking in other garden books of the period. Over the course of her life she also published about fifty magazine articles on gardens in France, Germany, Ireland, Greece, Spain, Portugal, India, and China, but most of her writings were devoted to her first loves, the gardens of England and Italy.

Around 1896, while she was still pursuing her studies, Nichols designed her first garden, at Mastlands, the family's summer home in the Cornish Colony. She laid out a sunken walled garden in a clearing among the old farmyard enclosures, using the abundant stone of the area.¹¹ The garden so transformed the undistinguished farmhouse that the family abandoned their plans to build a new house.¹² Set in a grove of the tall pine trees that had given the property its name, it was hailed by noted garden writer Frances Duncan as "one of the most delightful gardens in all artist-inhabited and garden-loving Cornish. . . . Miss Nichols has shown herself wise beyond her years."¹³

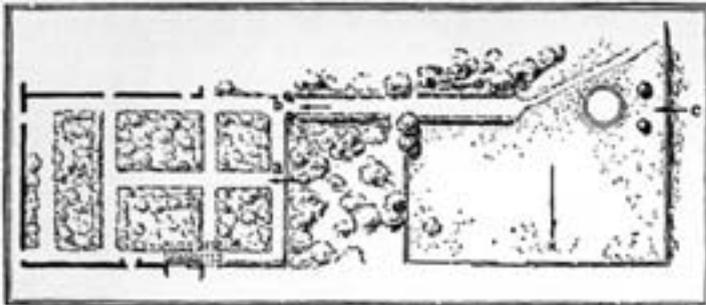
The garden, separated from the house by a sloping grass terrace and a low retaining wall, was reached by descending a few steps leading down from the terrace. The large rectangular space was divided into sixteen beds with a network of linear paths, the main one on axis with the porch—a design derived from the English walled gardens that inspired Nichols throughout her career. With its hardy New England plants, the Mastlands garden—still intact—has a personal nature that was lacking in her work for clients.

Despite the lack of archival material, some information about Nichols' professional career has recently come to light, mostly from research in periodicals. About thirty commissions have been identified, ranging geographically from California and Arizona to Illinois, Wisconsin, Georgia, and, of course, New England. The list of clients is heavily sprinkled with prominent Boston society names, such as Mrs. Gardiner Green Hammond, Mrs. Francis Peabody, and Mrs. Philip Sears.

FROM AMERICAN GARDENS, EDITED BY GUY LOWELL, 1955. LIBRARY OF THE ANGLED ARBORETUM



A Garden at Cornish, N. H.



- In the Flower Garden *a*
 1 The South Path *b*
 2 Looking from the Terrace *c*

Two views of the garden at "Mastlands," Cornish, New Hampshire, and its plan.

Nichols landed her first professional commission in 1904 when a Beacon Hill neighbor, Ellen Mason, asked for advice about her Newport, Rhode Island, garden. Since Miss Mason, an heiress from a prominent Boston family, embraced many causes such as Indian rights, tenement improvement, and family welfare, designer and client had much in common. In a magazine article about the Mason house and garden, Nichols claimed to have laid out the garden as a series of enclosures, including a cold-frame area, a cutting garden, fountain garden, and—near the house—an ornamental garden in a style “reminiscent of Spain.”¹⁴ Curiously, she neglected to mention that the entire estate, including the garden plots, had been laid out by the Olmsted firm in 1882. Nichols’ role in 1904 seems to have been limited to planting design.

In fact, it was rare that Nichols had full responsibility for the layout of a garden; more typically her role was confined to designing planting schemes for gardens previously laid out by the architect of the house or by landscape architects such as Jens Jensen or the Olmsted firm. In Lake Forest, Illinois, an area where she completed a dozen commissions, she frequently worked with architects Howard Van Doren Shaw and David Adler. The connection to Lake Forest may have come about through her brother-in-law, Arthur Shurcliff, whose professional path crossed that of Adler.

One of Nichols’ most spectacular Lake Forest commissions was the water court at the House of the Four Winds, designed by Shaw for Hugh McBirney. Inspired by the Generalife gardens in Granada (which were illustrated in her book *Spanish and Portuguese Gardens*), Nichols’ striking but understated plantings accentuated the geometry of Shaw’s garden layout. At Haven Wood, a Renaissance-style villa designed by Shaw for steel magnate Edward

Ryerson, Nichols shared the limelight with Jens Jensen, who laid out the grounds, and Shaw, who designed the principal garden features.

A project that Nichols worked on with David Adler—a large lakeside garden in Milwaukee for Lloyd R. Smith, an executive of the A. C. Smith Corporation—illustrates Nichols' use of her extensive knowledge of historic gardens. Here, as for another commission in Augusta, Georgia, she adapted a water feature from the Villa Cicogna in the Italian Lakes, laying out a terrace garden and a long water cascade to accompany Adler's Italian Renaissance-style house. No drawings or photographs of the garden remain, but it is currently being restored based in part on the architect's records.

Through her Lake Forest connections, Nichols received a commission in 1913 from Chicago businessman Charles Blair Macdonald for his new home, Ballyshear, in Southampton, Long Island. One of the leaders in bringing golf to the United States, Macdonald had developed the National Golf Course on Long Island and built for himself a house overlooking the links, on a 72-acre property. Here, in contrast to most of her commissions, Nichols had major design responsibility. She laid out two walled gardens to the east of the house, the upper one planted with evergreens and perennial borders and the lower one surrounded by an arbor covered with grapevines. Sadly, these lavishly planted gardens were short-lived, being replaced in the 1920s for the second owner of the house, Charles Van Vleck, by an Annette Hoyt Flanders design.

The circumstances surrounding the gardens of Mrs. Gifford Pinchot at Grey Towers, in Milford, Pennsylvania, are more typical of the commissions that Nichols received. When she was approached in 1937, quite late in her career, the gardens at Grey Towers were already well developed. Gifford Pinchot, a two-term governor of Pennsylvania who is best remembered for having elevated the practice of forestry to a science, made his home at Grey Towers after 1910. His wife, Long Island heiress Cornelia Bryce Pinchot, set out to make her mark on the gardens, leaving her husband to improve the grounds. In 1918 she asked Ellen Shipman to advise her on the plantings for a one-and-one-half-acre walled garden that had been built in



Water court with replica of Giambologna's Mercury (1564) at "House of the Four Winds," Lake Forest, Illinois, designed by Howard Van Doren Shaw and Rose Standish Nichols



"Haven Wood," Lake Forest, Illinois Nichols used eastern red cedar (*Juniperus virginiana*) in place of the too tender Italian cypresses (*Cupressus sempervirens*).



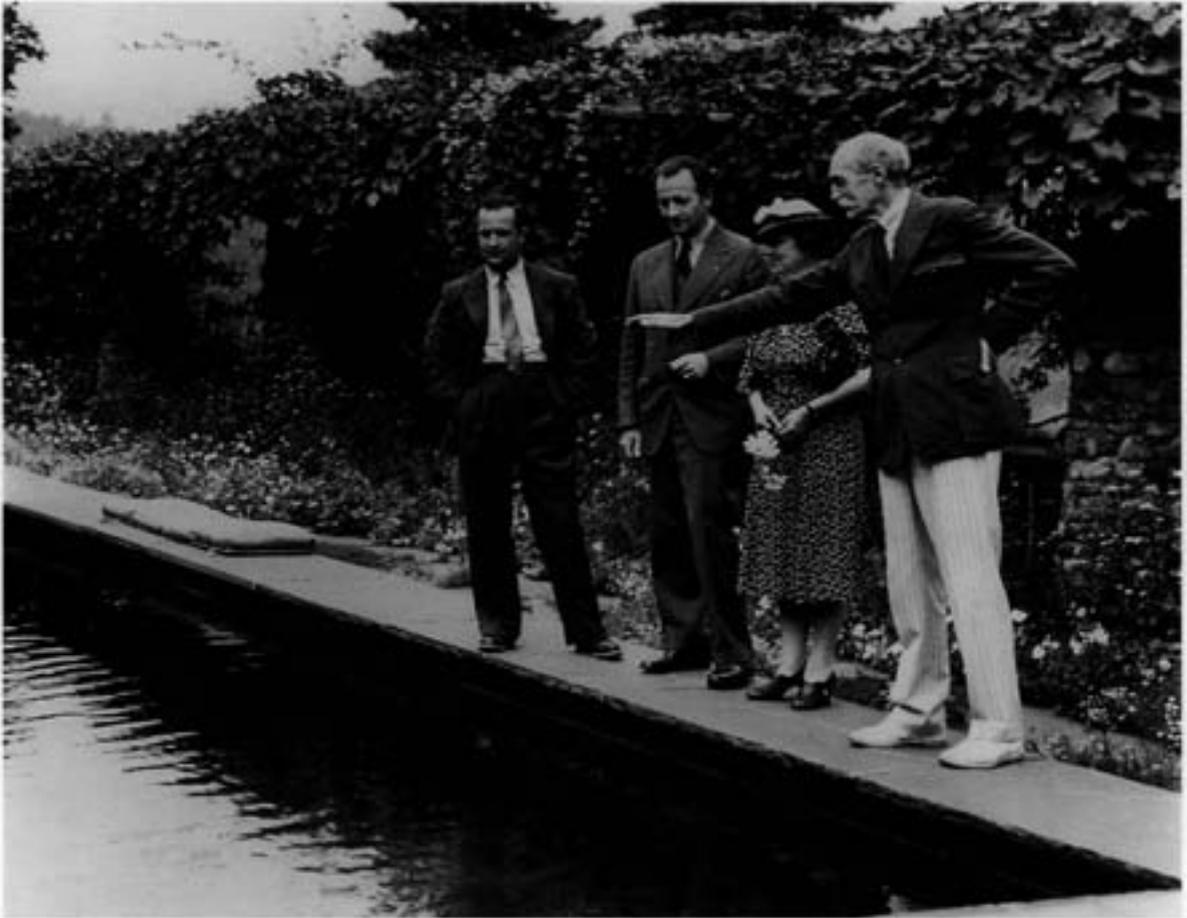
The great water-staircase at the Villa Cicogna, Bisuschio.



Water-staircase at the Villa Terrace Museum of Decorative Arts, Milwaukee, Wisconsin.



The walled garden of perennials and evergreens at "Ballyshear," Southampton, New York.



UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE

Gifford Pinchot (right) and guests at Grey Tower's swimming pool. Nichols planted the walls and borders

1889, the same year as the looming gray stone house designed by Richard Morris Hunt. Like Nichols, Mrs. Pinchot loved the traditional English walled gardens she had visited on trips abroad, and over the years she embellished the lushly planted walled garden with classical columns and terracotta vases.

By the 1930s, Mrs. Pinchot's attention had turned to borders for a new swimming pool. She first hired Harriet Kaupp to draw up a planting plan that included delphinium, lilies, canterbury bells, and iris edged with sweet william and coral bells. In 1937, when Mrs. Pinchot was introduced to Rose Nichols, she asked her to prepare another planting plan for the pool border. Nichols agreed to come to Milford: "I shan't charge anything for time spent in traveling. The cost of the plan will be reduced to the minimum because I think it would be fun to work with you in such a lovely spot."

Mrs. Pinchot replied, "What I want from you is first, a new point of view, and second and most important, the benefit of your expert knowledge and wide experience."¹⁵

Nichols' plan, which like other documents related to the property survived in the Grey Towers archives, was dated November 7, 1937. It was quickly approved. "Anything you say is one hundred per cent right," Mrs. Pinchot wrote. The plan called for five-foot-wide flower borders encircling the pool, edged by dwarf French marigolds and ageratum. Nichols proposed a succession of bloom from June through September in a palette of orange, yellow, buff, copper, salmon, and white, using lilies, gladioli, salvia, hollyhocks, and various annuals. Unfortunately, Mrs. Pinchot's dreams for the pool garden were never realized. When she sent Nichols a check the following July, she enclosed a note saying that she'd had to cut back drastically on

the upkeep of Grey Towers, even letting the longtime gardener go. "Things went rather higgledy-piggledy. . . . I'm afraid the planting plan was not adhered to."¹⁶

Although little survives of Rose Nichols' gardens, her legacy should not be underestimated. In addition to her important books and articles, it includes the gardens, which deserve—and are now getting—further study. The resurgence of interest in the golden age of American garden design has led to the rediscovery and preservation of the work by early practitioners. Mastlands, Rose Nichols' summer home in Cornish, New Hampshire, has recently become the Cornish Colony Museum and its slumbering walled garden has been replanted. The Lloyd Smith estate in Milwaukee has become the Villa Terrace Decorative Arts Museum and the water cascade is undergoing restoration. Restoration is being considered for Grey Towers (now a National Historic Landmark) along with some of its gardens. Several private gardens in Lake Forest still exist in fragmentary form or have taken on a new life under sympathetic owners who share Nichols' passion for gardening.¹⁷

Endnotes

- ¹ Coffin's archives are held at the Winterthur Museum and Library, Delaware; Farrand's are located at The College of Environmental Design Documents Collection, University of California at Berkeley; and Shipman's papers are in the Rare and Manuscripts Collection, Cornell University Library, Ithaca, New York.
- ² Both quotations are from George Taloumis, "Rose Standish Nichols: Sixty Years Ago She Organized the Beacon Hill Reading Club (1896)," *Boston Sunday Globe*, 16 September 1956.
- ³ Entitled "New England Baroque," circa 1933, the working typescript and illustrations are held in the archives of the Society for the Preservation of New England Antiquities in Boston.
- ⁴ Cleveland Amory, *The Proper Bostonians* (1950), 109–110.
- ⁵ Southard Menzel, "Sketches of the Life and Character of Rose Nichols, Artist, Collector, Social Reformer, Museum Founder," in *Rose Standish Nichols as We Knew Her: A Tribute to a Friend* (privately printed in Boston, 1986), 11–13.
- ⁶ Rose Standish Nichols, "A Glimpse of a Pro-American Queen and Her Gardens," *House Beautiful* (August 1922), 110–111.

⁷ Taloumis, "Rose Standish Nichols."

⁸ Kimberly A. Shilland, Curator, Architectural Collections, provided insight into Nichols' course of study at MIT.

MIT's short-lived landscape design program (1900–1910) was directed by Guy Lowell, who advised women not to go into landscape gardening "unless you simply can't keep out." Marian Coffin and Martha Brookes Hutcheson were among his students (From Mary Bronson Hartt, "Women and the Art of Landscape Gardening," *The Outlook*, 24 March 1908, 704).

⁹ Taloumis, "Rose Standish Nichols."

¹⁰ Rose Standish Nichols, "A Little Garden Hunt in England," *House Beautiful* (July 1923), 29. Nichols acknowledged having met Thomas "a few years later."

¹¹ Menzel, "Sketches," 10–11.

¹² Margaret Homer Shurcliff, *Lively Days: Some Memoirs of Margaret Homer Shurcliff* (Taipei: Literature House, 1965), 34.

¹³ Frances Duncan, "A Cornish Garden," *Country Life in America* (March 1908), 507.

¹⁴ Rose Standish Nichols, "A Newport House and Garden," *House and Garden* (April 1905), 189–194.

¹⁵ Cornelia Bryce Pinchot, letter to Rose Standish Nichols, 6 October 1937, Pinchot Papers, Library of Congress, courtesy of Grey Towers.

¹⁶ Correspondence between Cornelia Bryce Pinchot and Rose Nichols, 1937–1938, Pinchot Papers, Library of Congress, courtesy of Grey Towers.

¹⁷ See Deborah A. Starr, "Inspirations Past and Present," *Horticulture*, February 1996, 42–47.

Acknowledgments

I would like to thank Flavia Cigliano, Executive Director, and William H. Pear II, Nichols House Museum, Boston; Susan Modder, Executive Director, Villa Terrace Decorative Arts Museum, Milwaukee, Wisconsin; Alma Gilbert-Smith, Director, Cornish Colony Museum, Cornish, New Hampshire, Art Miller, Archivist, Lake Forest College; Jennifer Wellington, Landscape Curator, Grey Towers, Milford, Pennsylvania; and Lesley Bryne for help in preparing this article.

Judith B. Tankard is co-author with Alma Gilbert of *A Place of Beauty: Artists and Gardens of the Cornish Colony*, which will be published this spring by Ten Speed Press.

Arnold Arboretum Weather Station Data — 1999

	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Max. Temp. (°F)	Min. Temp. (°F)	Precipi- tation (in.)	Snow- fall (in.)
JAN	40	19	30	61	-1	7.69	16.9
FEB	42	23	33	60	7	3.97	7.85
MAR	49	30	40	71	1	5.58	7.5
APRIL	63	39	51	80	28	.93	0
MAY	75	48	62	92	33	3.53	0
JUNE	86	61	74	98	43	T	0
JULY	91	65	78	100	51	4.84	0
AUG	87	62	75	97	51	1.81	0
SEPT	81	55	68	99	44	10.39	0
OCT	64	39	52	77	30	4.63	0
NOV	59	37	48	75	22	2.91	0
DEC	45	27	36	63	10	2.11	0

Average Maximum Temperature	65°
Average Minimum Temperature	42°
Average Temperature	54°
Total Precipitation	48.39 inches
Total Snowfall	32.25 inches
Warmest Temperature	100° on July 6
Coldest Temperature	-1° on January 2
Date of Last Spring Frost	28° on April 19
Date of First Fall Frost	30° on October 8
Growing Season	170 days

Note: According to state climatologist R. Lautzenheiser, for warmth 1999 ranks tenth in Massachusetts' 129 years of weather-keeping. It was a mere 0.2° cooler than 1998. Seven months were drier than normal; the wettest month was September with 10.39 inches of precipitation. The year's total of 48.39 inches is 8 inches above normal, although not all of it was to the good. The rains of July and September came as downpours and often ran off before the moisture soaked in and replenished the soil.

Snowfall totaled only 32.25 inches, 10.05 inches below normal. Nearly half fell in January (16.9 inches). No snow at all fell in the latter part of the year, setting a new record for latest initial snowfall of a new season, which was previously held by December 22, 1998.

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The Arnold Arboretum

W I N T E R • N E W S • 1 9 9 9 - 2 0 0 0

Digital Projects in the Library

Bess Wellborn, Archival Fellow

The Arnold Arboretum library staff is in the midst of two very interesting digital projects. We are collaborating with the preservation reformatting division of the Library of Congress to provide value-added enhancements to the digitization of *Garden and Forest: A Journal of Horticulture, Landscape Art and Forestry*, conducted by the Arboretum's founding director, Charles S. Sargent, and published from 1892 through 1902. This undertaking is the Library of Congress' first web-based historic journal project. All ten volumes have been scanned, including advertisements, drawings, and text and can be accessed at <http://lcweb.loc.gov/preserv/prdl/gardfor/gfhome.html>. To date horticultural research archivist Sheila Connor has contributed an essay that illuminates the historical background of the journal. Ongoing collaborations will include Arboretum-sponsored essays from scholars in the four major fields that *Garden and Forest* addresses: botany, horticulture, landscape design and preservation, and forestry. In addition, archival fellow Bess Wellborn is developing an electronic finding aid based on the volume-level indices in each original print volume that will enable users to search and browse subject terms, as well as author, title, and illustration caption information.

Another digital project, comparable to Boston's "Big Dig," has just begun. The library received a grant in October 1999 from Harvard's Library Digital Initiative (LDI) Program to take part in establishing on-line access to a selection of Harvard's historical and contemporary ethnographic and natural history collections of southwestern China. Although many of these complementary collections, which are held at several of Harvard's museums, libraries, and archives, date from the first quarter of the 20th century, ongoing exploration and research ensures the addition of current material well into the new millennium. The Arboretum's historical collections begin in 1924 with our expedition to northwestern China and northeastern Tibet led by Joseph



A photograph from the Arboretum's archival collections that will be included in the effort to digitize Joseph Rock's photos. The photo depicts a monk on the banks of the upper Yellow River. He repeatedly raises and lowers the prayer board on the surface of the water, "printing" the river with images of Buddhist deities, which are carried downstream.

C. Rock. Rock, in his quarter-century association with Harvard, began as a plant and bird collector for the Arnold Arboretum and the Museum of Comparative Zoology and ended at the Harvard-Yenching Institute, where he pursued linguistic studies as a research fellow from 1945-50. In 1997, the National Science Foundation awarded a grant to the Harvard University Herbaria to fund biological collections from the same floristic regions explored by Rock.

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• from page 1

This project, entitled "Plant and fungal diversity of western Sichuan and eastern Xizang, China," not only complements the historic collections through the addition of contemporary images, but also furthers our understanding of an area of high floristic diversity and endemism.

The digital format, constructed by the LDI group, will link the various repositories and facilitate study by allowing students and scholars to move through time and several collections. Material in the collections not only depicts the area's natural and ecological resources, but also documents the social and cultural history of China and Tibet. Sheila Connor, assisted by library assistant Carol David, network systems manager Andrew Hubble, and David Boufford, assistant director for collections and research taxonomist at the Harvard University Herbaria, as well as Bess Wellborn, have been working together to prepare the various collections. Ultimately, they will be accessible via the worldwide web.

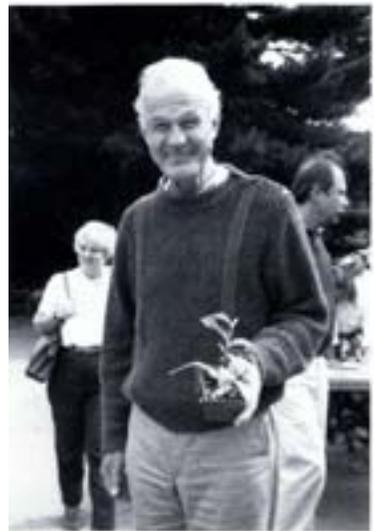
MEMBERSHIP SURVEY

We want YOU . . . to tell us how we are doing. You can expect to receive our membership survey through the mail in May. Please take the time to let us know what your needs and interests are and whether we are fulfilling your expectations. We aim to please, and your feedback will help us do just that.

Farewell to Walter Hunnewell

Robert E. Cook, Director

On December 30, 1999, the Arnold Arboretum lost a loyal and generous friend in Walter Hunnewell. A former member of the Arboretum Visiting Committee and member of the Arboretum Council, Walter's deep interest in horticulture continued a historic relationship between this institution and the Hunnewell family. We particularly remember the annual visits by our summer interns to the pinetum at his Wellesley home, where he would graciously guide these young students through his special collections. He was instrumental in helping the Hunnewell family



raise \$1,000,000 for our recent, successful campaign for endowment, and he brought his generous and kind spirit to many other botanical institutions in Boston. We shall all miss him very much.

New Research Facility Opens at Dana Greenhouses

Jianhua Li, Horticultural Taxonomist

In support of its mission to perform research in botany and horticulture, the Arboretum has established the new Laboratory of Plant Anatomy and Morphology, located in the basement of the Dana Greenhouses. The lab will be used to observe and record plant traits at both the internal and external levels. The facility has been furnished with state-of-the-art equipment, including a multi-magnification dissecting microscope with a camera and a drawing tube, a programmable automated tissue processor, a programmable automated tissue stainer, and a compound microscope with a camera and a drawing tube. Processes that, in the past, have required hours of close oversight now can be accomplished with minimal supervision using this current technology.

A research project presently underway in the lab compares internal structures of the leaves of yew (*Taxus*)-related genera, including *Torreya*, *Amentotaxus*, *Pseudotaxus*, *Austrotaxus*, and *Cephalotaxus*. Other projects slated for the future include a study of the embryological development in sweetgum (*Liquidambar styraciflua*), alder hazel (*Fothergilla major*), and seven-son flower (*Heptacodium miconioides*), as well as an investigation of leaf structure differences between mildew-resistant and mildew-susceptible lilacs (*Syringa*).

The Laboratory of Plant Anatomy and Morphology is available for use by outside researchers; contact Jianhua Li at 617/524-1718 x150 for further information in this regard.

An Update on the Plant Introduction, Promotion, and Distribution Program (PIPD)

Jack Alexander, Plant Propagator

Initiated in 1995, the Arboretum's Plant Introduction, Promotion, and Distribution Program (PIPD) strives to share exceptional woody plants from the living collections with progressive nursery professionals. Each year staff members select woody ornamentals with good landscape potential from the collections for promotion and distribution to hundreds of nurseries. Descriptions of the chosen plants are published annually in *American Nurseryman*.

The program is designed exclusively for the nursery industry. Plants that are selected may or may not be "new" cultivars, but all are chosen primarily for their promise as landscape plants, for horticultural characteristics that appeal to a larger market, and for their general unavailability in the trade. Before choosing a plant for the program, it is evaluated on the grounds and in the greenhouse/nursery. Propagation experiments performed in advance of selection often yield plants that are distributed first at the Annual Fall Plant Sale. Nurserymen interested in participating in the program should contact Tom Ward by fax at 617/524-6413.

Following are descriptions of the plants chosen for the 2000 PIPD program:

Cephalotaxus harringtonia var. *koreana* (syn. *C. koreana*), the Korean plum yew, is a densely branched evergreen shrub with dark green, needle-like foliage and reddish-brown fruits (produced only by the female plants). Native to Korea, Japan, and China, this slow-growing plant reaches about six to eight feet in height. In addition to its handsome appearance, the plant is not attractive to deer.

Euonymus carnosus features glossy, rich green leaves that turn mahogany red in autumn. The pink fruit capsule surrounded by an orange seed coat is stunning. An upright growing small tree, the plant will reach 20 feet in height in almost as many years. Unlike its relatives within the genus, *E. carnosus* does not appear to attract euonymus scale.

Syringa x chinensis 'Lilac Sunday,' the 'Lilac Sunday' lilac, was introduced by the Arnold Arboretum in 1997. The fragrant, light purple flower panicles are produced not only at the branch tips, like the common lilac, but also from the lateral buds along the stems. This unusual arrangement results in magnificent inflorescences that appear to be two feet long. Reaching 12 feet in height, the plant has a graceful, arching habit. Though the plant is resistant to powdery mildew and leaf-roll necrosis, it is not immune.





New Staff

In January Chris Santos joined the Arboretum as director of development, succeeding Lisa Hastings, who left last year to join the leadership gifts staff at her alma mater, Boston College. A native Bostonian, Chris worked for the past five years at Simmons College, first as director of annual giving and then as director of advancement services and campaign operations. Prior to that, she was on the annual giving staff at Wellesley College, where she earned her bachelor's degree in music and English. Chris also holds a master's degree in music education with a major in music therapy from the University of Kansas and a graduate certificate in management from the Radcliffe Seminars. She volunteers for Wellesley College, raises funds for the Brookline public schools that her two children attend, and looks forward to making the acquaintance of Arboretum aficionados.

The Arnold Arboretum of Harvard University

INSTITUTE for CULTURAL LANDSCAPE STUDIES



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7–9 pm, 4 May 2000

in the Lecture Hall, Hunnewell Building, the Arnold Arboretum
125 Arborway, Jamaica Plain, Massachusetts

Connecting Landscapes to Communities

Applying the Lessons of Vermont's Experience in
Conservation, Preservation, and Affordable Housing

James M. Libby, Jr.

*General Counsel, Vermont Housing and Conservation Board & Founding
Member, Vermont Housing and Conservation Coalition*

with a response by

Betsy Shure Gross

*Special Assistant for Community Preservation, Massachusetts
Executive Office of Environmental Affairs & Former Chair of the Board,
Historic Massachusetts*

This event is free, but advance registration is required. Reserve by
telephone: 617/524-1718 x162, email: icls@arnarb.harvard.edu

Since it was established in 1987, the Vermont Housing and Conservation Board (VHCB) has supported 745 projects in 205 towns, linking affordable housing and community development with land conservation and historic preservation. Jim Libby will discuss what others can learn from the Green Mountain State's unique community-based approach to strengthening the connections between land and people. Betsy Shure Gross will comment on the prospects for sustained collaboration among a similar coalition of preservation, conservation, and affordable housing interests that has been supporting the proposed Community Preservation Act in Massachusetts.

MARK YOUR CALENDAR

Lilac Sunday, May 14, 2000

Join us for our traditional celebration of lilacs and spring. The sights and scents of our lilacs – over 500 plants of more than 200 kinds – have delighted visitors since the turn of the century. Enjoy picnicking (allowed only on this special day), entertainment, refreshments, and, of course, the lilacs.

Annual Fall Plant Sale, September 17, 2000

The 20th Annual Fall Plant Sale is scheduled for Sunday, September 17, 2000, at the Case Estates of the Arnold Arboretum, 135 Wellesley Street, Weston, Massachusetts. More than 200 special and rare varieties of trees, shrubs, vines, and herbaceous perennials will be available for purchase. See you there!

Additional details are posted on our website, www.arboretum.harvard.edu. Those interested in volunteering at either of these events should contact Ellen Bennett at 617/524-1718 x125.



