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Page

Front cover: The Beauty of Moscow lilac, *Syringa vulgaris* 'Krasavitska Moskova', in May flower on Bussey Hill Road. Photograph by Peter Del Tredici.

Inside front cover: The flower of the pink lady's slipper orchid, *Cypripedium acaule.* Photograph by Mark Primack.

Inside back cover: The Cottonwood Vista *(Populus monilifera)* in the "wild garden" at Gwinn, on Lake Erie near Cleveland, ca. 1930. Photograph courtesy of Gwinn Archives.

Back cover: Visitors to the lilac display, spring 1908. Photograph by T. E. Marr.

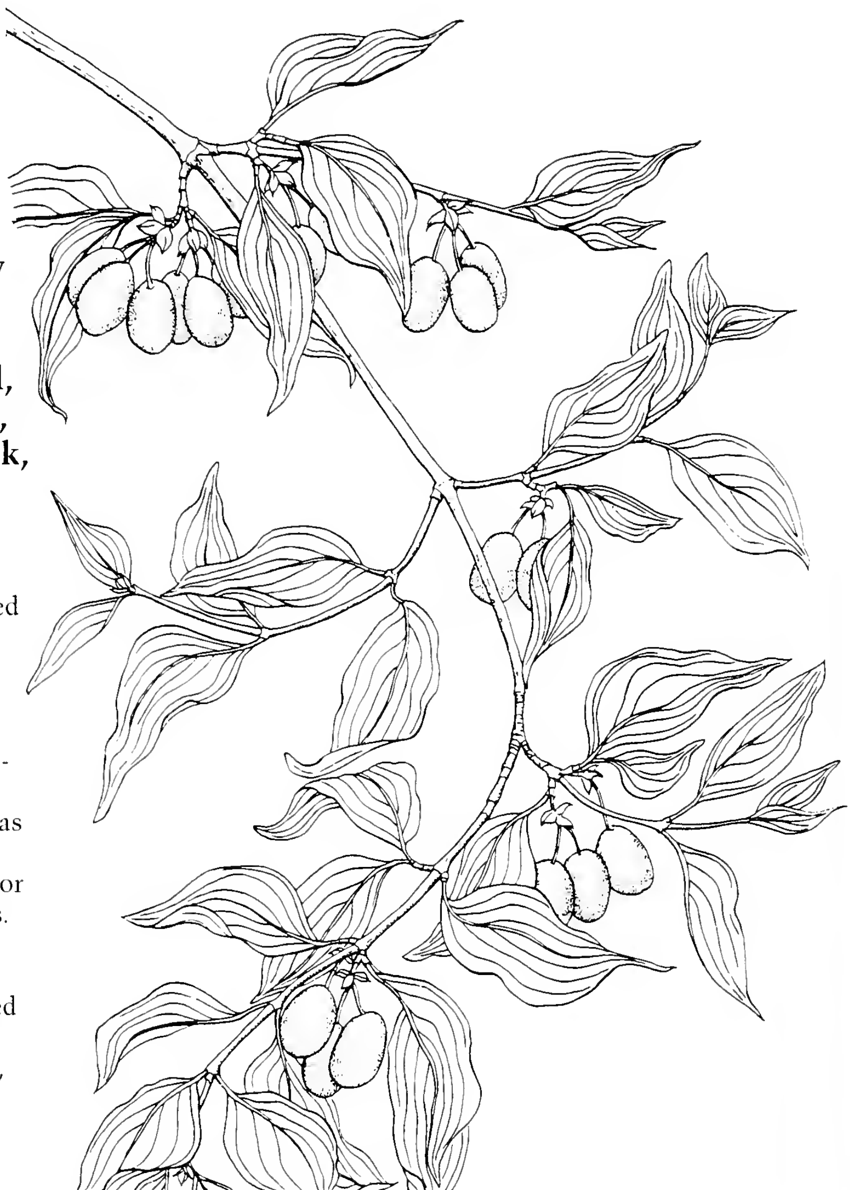
Cornelian Cherry From the Shores of Ancient Greece

Lee Reich

In late March at the Arnold Arboretum the signs of spring are few and subtle. *Cornus mas* is one of the first woody plants to bring color back to the landscape. A first-class ornamental, it offers a graceful habit, attractively mottled bark, soft yellow flowers, and—not least—fruits.

One summer day as I happened upon and ate cornelian cherries from a tree in New York City's Central Park, I had to assure a concerned passerby that I was not experimenting with a possibly poisonous new food. Instead, I was partaking of a fruit that has been enjoyed by humankind for the past seven thousand years. At a site in northern Greece, early Neolithic peoples left remains of meals that included cornelian cherry along with einkorn wheat, barley, lentils, and peas.

Cornelian cherry *(Cornus mas)* was well known to the ancient Greeks and Romans, and references to the plant abound in their literature. Speaking of the Golden Age in



Cornus mas *in fruit, drawn by V. Arlein.*

Metamorphosis, Ovid wrote:

> And Earth, untroubled,
> Unharried by hoe or plowshare, brought forth all
> That men had need for, and those men were happy
> Gathering berries from the mountain sides,
> Cornel cherries, or blackcaps, and edible acorns.

The plant was grown in monastery gardens of continental Europe through the Middle Ages and was introduced to Britain about the sixteenth century. The great herbalist Gerard wrote in 1597 that "there be sundry trees of the cornel in the gardens of such as love rare and dainty plants, whereof I have a tree or two in my garden." By the eighteenth century, the plant was common in English gardens, where it was grown for its fruits, sometimes called cornel plums.

The fruit was familar enough to be found in European markets even up to the end of the nineteenth century. Cornelian cherries were especially popular in France and in Germany, and the fruit was reputedly a favorite with children.

Cornelian cherry is native to regions of eastern Europe and western Asia, and in certain parts of these regions it is appreciated for its fruit even today. Baskets of *kizilcik,* as the Turks call the fruit, are found in markets in Istanbul. Cornelian cherry is a backyard tree in Moldavia, Caucasia, Crimea, and the Ukraine. Although it is not native to the Ukraine, the plant reached that region about nine centuries ago and became established in monastery gardens. A former monastery garden (now a botanical garden) near Kiev has trees 150 to 200 years old that still bear regular crops of fruit. In spite of the long history of use in some regions of the world, and the recognition of superior fruiting types, just about all cornelian cherry plants that are cultivated are from seedlings rather than from more reliable clones.

Over most of Europe and North America today, cornelian cherry is admired solely (for no apparent reason) as an ornamental plant. Even so, the bright fruits do not go unnoticed as they festoon the tree in summer. Fruits generally are cherry-like in size and appearance: oval, fire-engine red, with a single, elongated stone. Even the flavor is akin to that of a cherry, a tart cherry, somewhat austere when the fruit first colors, but developing sweetness and aroma with full ripeness.

Botanically, cornelian cherry is a species of dogwood, unrelated to grocers' cherries. The word "cornelian" refers to the similarity in color of the fruit to cornelian (or carnelian) quartz, which has a waxy lustre and a deep red, reddish-white, or flesh red color. (*Carnis* is Latin for flesh.)

Plant Description

Cornelian cherry grows to a maximum height of about twenty-five feet, becoming a large shrub or an oval-headed tree, usually branching near the ground. In full sun the branches are largely upright, whereas in shade the branches spread wide, as if to embrace the limited light available. Though the cornelian cherry never grows large, it is a long-lived plant that produces bushels of fruit on into old age. In *Arboretum and Fruticetum,* John Claudius Loudon wrote that during travels in Germany in 1828, his party:

> stopped at the gardens of the ancient Chateau of Maskirch; and in a small enclosure close to the chateau, we found a labyrinth, the hedge of which consisted entirely of *Cornus mas,* with standard trees of the same species at regular distances, which were at that time bearing ripe fruit, which we tasted, and found of very good flavour. Later in the same year, we were shown, in the grounds of the Castle of Heidelberg, the famous cornelian cherry trees which were planted there in 1650.

Cornelian cherry has the pattern of leaf attachment and leaf venation characteristic of other members of the dogwood genus. Leaves oppose each other at each node, in contrast to most other trees, on which leaves alternate along the stem. The major veins of a dogwood leaf trace out almost to the leaf margin, then join together and parallel the margin to the leaf's apex. The leaves are satiny green in summer, often turning mahogany red in the fall. (Fall leaf color is not wholly reliable, however, for with

Cornus mas *'Flava' can be seen in its mature form at the Arnold Arboretum near Meadow Road. This multistemmed specimen stands twenty feet high with a spread of equal dimensions.*

some clones and in some climates—probably warmer parts of the plant's range—leaves eventually drop to the ground while still green.)

In winter, the plant is notable from a distance for its rounded form. Step a bit closer to appreciate the bark, flaking off in muted shades of tan and gray. And get right up to the plant to see the distinctive flower buds, perched atop short stalks at the nodes of branches that grew the previous season, and on spurs of older wood.

Flowers appear on leafless branches early in the season, blooming with the "first breath of west wind" (in Italy, at least, according to Pliny, writing in the first century A.D.) or just before forsythia. Individual flowers are tiny, but are born in such profusion that the bare branches appear swathed in a yellow veil. The effect is all the more striking against a backdrop of a dark wall or evergreen plant. Despite the early bloom, fruit production rarely suffers since the blooms have an extended flowering period and an inherent tolerance for some frost. The flowers may not be completely self-fertilizing, because cross-pollination sometimes increases fruit production.

RACZ & DEBRECZY

The developing fruit of Cornus mas *'Flava' ripens and turns yellow at the Arnold Arboretum in fall.*

The names of the few cultivars of cornelian cherry that have been available from nurseries reflect the plant's use as an ornamental rather than as a comestible. 'Golden Glory' is an upright, columnar plant with especially dark green leaves, and 'Nana' is a cultivar diminutive in stature and leaf size. The variegated leaves of 'Elegantissima' and 'Variegata' make for brighter looking plants throughout the summer. Occasional leaves of 'Elegantissima' are completely yellow or tinged with pink. The leaves of 'Variegata' have irregular, creamy white margins.

As mentioned previously, cornelian cherry fruit has always been considered ornamental. 'Macrocarpa' is notable for its large fruit and 'Alba' for its white fruit. The fruit of 'Flava' is large and yellow, and a whit sweeter than those of most other cultivars. Ripening occurs from summer to fall depending on the clone.

If you were to wander into a Macedonian or Bulgarian forest, the wild cornelian cherry trees there would not all be bearing fruits resembling the common cherry. Within the wild population are plants bearing fruits that are barrel-shaped or pear-shaped and some with fruits over an inch long. In fruit color, the spectrum runs from cream to yellow, orange, and fire-engine red to a dark red-violet, and almost black. Were you to taste fruits from a number of trees, you would find similar variations in flavor. The sugar content of fruits ranges from four to twelve percent, and acidity ranges from one to four percent. Vitamin C concentration in cornelian cherries commonly averages twice that of oranges.

If qualities such as large-size fruit and a congenial blend of sweetness and acidity could be bred into a single plant, the result would be a highly ornamental plant bearing especially delectable fruit. The average seedling produces acceptable fruits, and for over two decades Russians have been selecting clones with superior fruits. Since the recent breakup of the Soviet Union, some of the cornelian cherry varieties that were selected there for their fruits have become available here. These include 'Helen', 'Pioneer', 'Red Star', and 'Elegant', all bred by Svetlana Klimenko at the Botanic Garden in Kiev and available in this country through the nursery One Green World (telephone 503/651-3005).

Cultivation

Cornelian cherry transplants easily and once established grows at a moderate rate. Calcereous soils are particularly suitable, though the plant in fact is not choosy about soil, tolerating even those that are somewhat dry. For best fruiting, plants need full sun, or almost so. Cornelian cherry will survive in shade but will not yield well.

Grow cornelian cherry as a specimen tree or shrub, or even as a large, sheared hedge. Space specimen plants twenty to twenty-five feet from other trees or shrubs. Space plants twelve feet apart for a hedge.

Cornelian cherry will grow in USDA hardiness zones 4 through 8, but languishes somewhat in the southern part of this range. At its extreme northern limit, fruiting is uncertain, since the flower buds are hardy only to the colder portions of zone 5.

Cornelian cherry is a plant from which you can expect annual harvests with little or no pruning or spraying. It is rarely subject to insects or disease, but do expect some competition from birds and squirrels for the fruit.

Propagation

Cornelian cherries are usually propagated from seed. This is unfortunate because seedlings produce fruit of variable quality and must be at least a half-dozen years old—sometimes into their teens—before commencing to bear fruit. Seed germination is usually delayed until the second season, though this defect can be overcome by artificially subjecting the seeds to warmth and moisture for four months prior to a one- to four-month period of cool, moist stratification. Nicking the seed coat should suffice in lieu of the four-month, warm, moist treatment.

Do not be disappointed if no fruits set when seedlings finally do begin to flower. Ancient writers referred to the cornelian cherry as the "male cornel" because those first flowers are male. This characteristic is the source of the specific epithet *mas,* meaning male in Latin. (The "female cornel" of the ancients was *C. sanguinea,* a shrubby, precocious species whose fruit is neither prominent nor palatable.) With time, cornelian cherry seedlings will produce perfect flowers.

If only cornelian cherry cuttings rooted as easily in reality as in legend. Plutarch (in *Life of Romulus*) wrote that

> Romulus once to try his strength threw a dart from the Aventine Mount, the staff of which was made of cornel, which struck so deep into the ground, that no one of many that tried could pluck it out, and the soil being fertile, gave nourishment to the wood, which sent forth branches, and produced a cornel stock of considerable bigness.

Ovid's version (in *Metamorphosis*) is even more fantastic: "No less amazed was Romulus when he saw the spear he planted suddenly put forth leaves." With optimum conditions fifty percent of softwood cuttings might take root.

The best time to take softwood cuttings is in late July or early August. Make each cutting about ten inches long with all but the top two leaves removed, and maintain partial shade and high humidity, preferably with mist. Rooting hormones (a modern horticultural aid unavailable to Romulus) greatly facilitate rooting of both hardwood and softwood cornelian cherry cuttings. Use IBA in talc, at concentrations in the range of 0.3 to 0.8 percent. The percentage of cuttings that root varies from clone to clone—softwood cuttings of the cultivar 'Flava' rooted one-hundred percent under ideal conditions.

Opinions differ as to the ease with which cornelian cherry propagates by root cuttings and layering, but no matter, for the easiest method to propagate a superior clone is by any common method of grafting. Use seedlings as rootstocks and graft low. Because cornelian cherry branches low to the ground, take care that all branches on a grafted plant arise from the scion rather than the rootstock.

Harvest and Use

Cornelian cherries ripen from summer through fall, the time varying from clone to clone. Average yield from a single tree typically lies in the range of thirty to seventy pounds of fruit, though there are trees that bear over two hundred pounds of fruit.

Fruits from a single tree ripen over an extended harvest period. The simplest way to harvest in quantity is to periodically give the branches a gentle shake once the fruit has colored, then collect fallen fruit from the ground. Ripe fruits hang well on the tree, becoming with time more concentrated in flavor and sweetness. Some people prefer to allow harvested fruit to sit at room temperature for a day or more, in which case the flavor becomes sweeter, but more sedate.

A century or more ago, when the fruit was popular in Britain, it was rarely eaten out of hand, probably because better-tasting clones were unknown there. The fruits were held in high esteem for the delicious tarts they made, and shops commonly sold *rob de cornis*, a thickened, sweet syrup of cornelian cherry fruits. The juice also added pizzazz to cider and perry.

In other parts of Europe where cornelian cherry is still eaten, the fruit finds a variety of uses. Since ancient times, the unripe fruits have been pickled as olive substitutes.

> Cornel-berries, which we use instead of olives . . . should be picked while they are still hard and not very ripe; they must not, however, be too unripe. They should then be dried for a day in the shade; then vinegar and must boiled down to half or one-third of its original volume should be mixed and poured in, but it will be necessary to add some salt, so that no worms or other form of animal life can be engendered in them, but the better method of preservation is when two parts of must boiled down to half its original volume are mixed with one part of vinegar. (Columella, *On Agriculture*, 1st century A.D.)

Cornelian cherry is a favored ingredient of Turkish *serbert*, a fruit drink sold in stores and from portable containers carried like knapsacks on the backs of street vendors. (Another common English name for cornelian cherry is "sorbet," though it is not the only fruit ever used for the Turkish *serbert*.) In the Ukraine, cornelian cherries are juiced, then bottled commercially as soft drinks. There, the fruits are also made into conserves, fermented into wine, distilled into a liqueur, and dried.

The generic epithet *Cornus* is derived from the Latin word for "horn," alluding to the hardness of the wood. Pliny wrote that cornelian cherry wood was used for making "spokes of wheels, or else for making wedges for splitting wood, and pins or bolts, which have all the hardness of those of iron." The wood's hardness was also put to more menacing use, in spears. From the many gory passages relating this use by ancient writers, the following lines from Virgil's *Aeneid* serve as example:

> Winging through the soft air the Italian
>
> Cornel shaft sank in, deep in the chest
>
> Stuck there, and the black wound's open chasm
>
> Yielded a foaming wave of blood.

Returning to beneficent uses of cornelian cherry, we find many parts of the cornelian cherry plant applied in folk medicine. The fruit allegedly is beneficial in the treatment of gout, anemia, skin diseases, painful joints, and disrupted metabolism. Fruit, leaves, or bark have been employed for gastrointestinal disorders and tuberculosis. Used in a kind of contemporary folk medicine, Russians report that the fruit contains components that leach radioactivity from the body.

But I digress—our primary interest here is with the gustatory pleasure afforded by the fruits, especially fresh fruits of a superior clone carried straight from the tree to the mouth. The fruit is as worth cultivating today as it was three centuries ago when John Parkinson wrote of the cornelian cherry (in *Paradisi in Sole*), that "by reason of the pleasantnesse in them when they are ripe, they are much desired . . . also preferued [sic] and eaten, both for rarity and delight . . . ."

Lee Reich, Ph.D., is a horticultural consultant and writer in New Paltz, New York. While working as a fruit researcher for the USDA, and then Cornell University, he became interested in lesser known fruits, an interest that resulted in his 1991 book, *Uncommon Fruits Worthy of Attention: A Gardener's Guide*, from which this article is drawn.

Science and Serendipity
The Pink Lady's Slipper Project

Richard Primack

What is the cost of reproduction?
An important hypothesis is put to the test.

ARCHIVES OF THE ARNOLD ARBORETUM

The study of plants can sometimes lead to discoveries of an unexpected nature. For over a decade now, I have been investigating the reproductive biology of the pink lady's slipper orchid *(Cypripedium acaule).* When I was growing up in Boston in the 1950s and 1960s, my mother would point out the occasional pink lady's slipper as a special, rare plant to be held in respect, and I remember feeling almost reverential toward the exquisite flowers when I discovered them on hikes as a teenager. Hikers in the eastern United States still react with excitement when they encounter the plant during a late spring excursion, but although the flowers are beautiful and well worth seeking out, certainly they are no longer rare.

The idea that the pink lady's slipper is endangered stems from events earlier in this century when the species was indeed rare. At that time gardeners often dug up wild plants to transplant in their own yards, and this was perceived as a primary threat to the species' survival. Media campaigns to protect wildflowers targeted the pink lady's slipper, and the campaigns appear to have left a lasting impression on the public.

During the last few decades, however, the plant has achieved a tremendous increase in numbers in New England. Woodland areas that once had a few scattered plants now boast dozens, hundreds, or even thousands. In some areas of Boston, pink lady's slippers have become the most common woodland herb, forming dense populations. Although it is tempting to see a simple cause-and-effect relationship between the preservation campaign and the new abundance of the species, the truth is much more complicated. The success of the pink lady's slipper might also be explained by the recovery of its previously disturbed habitat. Much of the eastern United States was cleared for agriculture during the early history of our nation, and the landscape has only gradually returned to forest in the last century. It may be that the specific growing conditions it requires were not present earlier in the young forest.

One of the missing requirements may have been the species of soil fungi with which the orchid has a peculiar obligate relationship. These fungi form extensive networks of filaments in the soil that absorb water and nutrients. When an orchid seed germinates, the seedling is tended by the fungus filaments, which provide all the water, minerals, and carbohydrates the seedling needs to survive. In this early stage, the orchid seedling is just a small blob of white tissue below ground. Only after five years or so does the orchid begin to produce its first green leaves above ground. As the orchid increases in size over subsequent years, it finally becomes photosynthetically self-sufficient. At this point, the orchid begins to supply the fungi with excess carbohydrates in exchange for a continued supply of water and mineral nutrients. If the fungi had been extirpated from the soil after centuries of farming, then the orchid would not be present until the forest—and the fungi—had become firmly reestablished.

Yet another unusual characteristic may have limited the lady's slipper's ability to increase: Its flowers rarely become fruits. The reason for this peculiarity is that the flowers contain no nectar to attract pollinators. In fact, the flowers are mimic flowers that depend on the naiveté of bumblebees and other large insects searching for new nectar sources. If bees visit several flowers in a row in their search for nectar, they may transfer pollen from one plant to the stigma of another plant in the process. Once this happens, the petals droop to prevent further bee visits, the ovary swells, and over the next four months a grape-sized capsule containing tens of thousands of seeds develops. In the fall, the tiny seeds filter out of slits in the capsule and are carried away by the seasonal breezes. Unfortunately for the pink lady's slipper, there are not enough naive bees in the forests of New England. As a result, most orchid flowers remain unvisited, even in large populations. In a typical population, only one or two percent of the flowers develop fruits. Yet because of the large number of seeds per fruit, the populations can increase over time even with low rates of fruiting.

Under different circumstances, however, the orchid has the potential for prolific reproduc-

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Cypripedium acaule *(pink lady's slipper orchid) rendered in pen and ink by Blanche Ames Ames (1878–1969).*

RICHARD PRIMACK

The young orchid fruit expands rapidly following pollination. The grape-sized capsule contains tens of thousands of seeds.

tion. When flowers are artificially pollinated by researchers and volunteers, the rate of fruit set can easily increase to ninety percent. In 1984, I realized that this property made the pink lady's slipper orchid an ideal subject for testing an important but unproven hypothesis: namely, that reproduction exacts a cost from plants and animals. Most biologists accept the idea that each organism has a finite supply of resources available for use in growth, survival, and reproduction. Thus, any individual organism that devotes a large portion of its resources to reproduction will have a slower growth rate and a reduced probability of survival and subsequent reproduction. These reductions are collectively termed the cost of reproduction. The hypothesis is supported by observations that trees grow slowly in years when they fruit heavily, and that pregnant animals lose weight and suffer higher mortality. However, a crucial missing element was experimental evidence: if individuals were manipulated to increase or decrease their levels of reproduction, how would the change affect the rate of growth and survival in a particular species?

Because the orchid readily makes fruits when artificially pollinated, I decided to test the hypothesis using large natural populations in Massachusetts—at the Hammond Woods in Newton and the Case Estates in Weston. With the help of volunteers, experimental plants at these two Boston-area sites were hand pollinated, while other plants in the populations were left untouched as controls. Hand pollination of the pink lady's slipper orchid involves gently spreading open and bending back the petal pouch with one hand, then inserting the index finger of the other hand into the resulting gap between the pouch and stigmatic column until the finger contacts the sticky yellow pollen mass. If one does this just right, the entire pollen mass sticks to the finger in one grainy clump. At the next flower, the process is begun in the same way, but this time one must bend the petal pouch back further to expose the stigma surface. The pollen mass on the index finger can then be rubbed onto the glistening green stigma. If the pollen and the stigma are at the right stage of stickiness, the entire stigma surface will be coated with a covering of pollen.

By the spring of 1985 I was eagerly awaiting the flowering season to see the results of my experiment of the previous year. To my surprise, I found no difference between the control and the experimental plants at the Hammond Woods site, either in the number of plants flowering or in the average size of the plants. At the Case Estates a few more control plants than experimental plants were flowering and the experimental plants seemed smaller, but the difference was not substantial. At this point I had a real dilemma: should I write up the results right away, boldly announcing that there was no cost of reproduction in the pink lady's slipper orchid? Or should I continue the experiment to see if the cost showed up after a second reproductive episode?

Because the two populations seemed to be showing somewhat different patterns, I decided to continue the experiment using a "press"

Hand pollinating required physical contortions of the volunteers, but nonetheless it proved to be one of the most popular aspects of the project.

design. That is, every experimental plant hand-pollinated in 1984 was pollinated for a second time in 1985 and was thus given a chance to make a second fruit. The hand pollinations were successful, with most experimental plants making a second fruit by the fall. As in the previous year, the control plants did not make fruit. By the spring of 1986, the results proved worth the wait. A tremendous difference in plant size appeared between the experimental plants and the control plants, particularly at the Case Estates, where the experimental plants had lost twenty-five percent of their size in comparison with the control plants and far fewer of the experimental plants were in flower.

The results were striking, but I decided to put off writing up the results for publication in favor of conducting the experimental pollinations one more time. By 1987, after the experiment had been repeated three times on individual plants, the cost of reproduction was clearly evident at both sites. The results were slightly different, however, due in part to a contrast in plant health at the two localities. At Hammond Woods, the control plants grew larger over the course of the study, while the experimental plants stayed the same average size. At the Case Estates, however, a disease turned the leaves black every summer and probably killed many plants outright. The average size of control plants at this site declined over the years, but the experimental plants declined in size more precipitously. Clearly, the extra cost of producing fruits added to the stress of disease had major effects on the plants.

The experiment allowed us to test a related hypothesis as well. Scientists have speculated that plants may partially offset the cost of producing fruit by increasing their photosynthetic rate, thereby capturing more light energy. In this scenario, perhaps the chlorophyll might process light energy more rapidly, or the stomates


RICHARD PRIMACK

The pollen mass sticking to the index finger of a young volunteer is about to be rubbed onto the stigma. Hand pollination results in almost every flower becoming a fruit.

chamber and then measuring how rapidly the leaf absorbs carbon dioxide from the enclosed volume of air. The experiments showed, however, that the rate of photosynthesis did not depend on physiological changes to the plant, such as fruiting or removal of one of its two leaves, but did vary according to microenvironmental differences. Plants in full sun, whether control or experimental plants, have higher rates of photosynthesis than plants in shady areas.

Four years into the fieldwork I had a good story to write for publication, so I enlisted another of my graduate students, Pamela Hall, to perform all the elaborate statistical calculations needed to demonstrate the exact cost of reproduction. In the meantime, we continued the experiment, repeating the pollination and adding a third site at Broadmoor Audubon Sanctuary in Natick, which had much larger and apparently older plants than the other sites. Though we published our initial findings in 1990, I decided to continue the study, and by 1994, after further analysis by a third graduate student, Elizabeth Stacy, we had found several intriguing patterns. Of the control plants, which had never been hand pollinated, 73 percent had not produced even a single fruit over the entire duration of the

on the leaf surface might stay open wider or longer to absorb more carbon dioxide. Some limited laboratory evidence supports this idea, but we decided—given our success thus far—to test it in the field. With the aid of an infrared gas analyzer, my former student Miao Shili and I examined the experimental and control plants to discover if the experimental plants were absorbing more carbon dioxide than the control plants—a sure indicator of higher rates of photosynthesis. The analyzer works by enclosing a living leaf inside a transparent


RICHARD PRIMACK

To measure the rate of carbon dioxide absorption, a living leaf is enclosed inside the transparent chamber of an infrared gas analyzer.

The larger plant, on the left, is an experimental plant that never made fruits. The smaller plant is an experimental plant that has made many fruits and has become exhausted.

study, whereas every experimental plant had produced at least one fruit. At the Hammond Woods and Broadmoor, 50 percent of the plants had produced five or more fruits over the years of the study. At the Broadmoor site, three of the largest experimental plants had produced thirteen, fifteen, and seventeen fruits over ten years in contrast to control plants with no fruit at all. At each site, the effects of fruit production were seen in the lower probability of flowering and much smaller leaf area in subsequent years. However, these effects peaked three to seven years after the start of the experiment. After several successive years of fruiting, the experimental plants seemed exhausted to the point where many were very small and unable to flower. The inability to flower, however, gave the plants a rest, which after a few years allowed them to recover and flower again.

By the summer of 1995, I felt it was time to wrap up this project, as we had clearly established the cost of reproduction. Through the years, I had come to know the characteristics of individual plants, almost regarding them as special summer friends. After eleven field seasons, I leave this project with a great sense of satisfaction: my initial love for and curiosity about this beautiful and unique wildflower species had blossomed into a full-scale scientific investigation yielding new insights into the natural history of the species.

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Along the Way

Many unusual incidents occurred over the course of the lady's slipper project, but probably the strangest was the appearance of carefully arranged rock gardens at the Hammond Woods field site beginning in 1987. Groups of ten to twenty stones arranged in concentric circles, often planted with native wildflowers and carefully tended by unknown gardeners, simply appeared from time to time. The gardens varied in size from one only three feet across to a miniature Stonehenge six feet across made of elongated stones set upright in the ground. Curiously enough, none of the gardens interfered with my research plants. Over the years, I occasionally noticed cut flowers, bowls of rice and incense, and red-painted Sanskrit letters on the garden rocks. Though I still didn't know who had made the gardens in the midst of my study population or why they had done so, I began to appreciate them for their beauty and even tended them from time to time, removing dead leaves and fallen branches. Finally, in the spring of 1990 I observed an elderly man standing quietly behind a tree. I introduced myself and asked if he knew anything about the rock gardens. He told me that he had built them with a community of Buddhists and that they often came here to worship. Knowing from my wire tags next to the plants that someone was studying the orchids, he had not disturbed the plants and had even helped to keep them free of fallen branches, just as I had cleared his rock gardens. After that one meeting I never saw him again, and the gardens have gradually fallen into disrepair.

RICHARD PRIMACK

A Buddhist shrine reminiscent of a miniature Stonehenge at the Hammond Woods site.

When the Roots Go Round and Round

Gary W. Watson and Sandra Clark

Investigations of girdling root formation in landscape trees shed light on life in the tree pit.

Several decades ago, American elms dominated our urban landscapes. When large numbers of them succumbed to Dutch elm disease, they were replaced by new plantings that were somewhat less homogenous, but still limited in most cases to a handful of species. Maples, especially Norway maples, were commonly included in these replacement plantings in the Midwest and elsewhere. Norway maples were considered well suited to urban landscapes because of their attractive form and foliage. Moreover, they are easy to propagate and transplant, as well as tolerant of a wide variety of soil conditions.

A few decades later, as some of these Norway maples approached maturity, many started to decline unexplainably, raising new fears of devastating tree losses. Typical canopy symptoms included reduced growth, abnormal color, early fall coloration, and dieback. There was no evidence of diseases, pest infestation, or any other aboveground problem. However, investigations below the ground

GARY W. WATSON

The canopy of a Norway maple in Mt. Pleasant, Illinois, shows symptoms of girdling roots: reduced growth, abnormal color, and dieback.

GARY W. WATSON

Excavation of the root crown reveals a typical girdling root formation in an older Norway maple.

began to reveal that a high percentage of these trees had girdling roots.[1] A girdling root has been defined as "a root that grows around another root or stem, thus tending to strangle the plant."[2] Where the girdling root contacts the trunk, radial growth of both the trunk and root is distorted and reduced. Normal movement of water and nutrients from the roots to the canopy is greatly decreased, leading to stress and then to decline.

How and why these girdling roots form on field-grown trees is unknown. When plants are grown in containers, of course, roots often circle around the interior of the pot. If not cut or removed when the plant is moved into the landscape, these "circling roots" can also strangle the tree as it grows larger. In the case of field-grown stock that has never been in a pot, however, some other mechanism must be involved.

Girdling roots on Norway maples are recognized all over the country as a major problem, and the Chicago area is no exception. As an example, in the suburb of Mt. Prospect, where they represent seventeen percent of all street trees, some of the Norway maples were reaching mature size by 1987, and some were declining because of girdling roots. At that time, we initiated a study to learn what caused girdling roots and how they might be corrected or prevented. Because girdling roots had been reported on sugar maple *(Acer saccharum)* and red maple *(A. rubrum)* as well as Norway maple *(A. platanoides)*, all three of these species were included in the study.[3]

The first phase of the work, involving excavation of the roots of large Norway maples (over twelve inches in diameter), showed that girdling roots can wrap around the entire trunk circumference before crown symptoms develop. In fact, by the time canopy decline becomes evident, the girdling is often at an advanced stage, with the roots so intertwined that little can be done

The Arnold Arboretum

SPRING · NEWS · 1996

A New Board and Council

Robert E. Cook, Director

Karen Madsen

At the April meeting of the Arboretum's Visiting Committee, Putnam Fellow Kim Tripp (right) signed copies of her book, *The Year in Trees*, for Professor Hardy Eshbaugh of Miami University of Ohio (left) and Bob Bartlett of Bartlett Tree Company. Bob Cook stands to Kim's right. Also in the photo, on the library table, is one of the plants of *Heptacodium miconioides* that were given to committee members.

Over the past winter some friends of ours gathered together on several occasions to discuss the creation of a new organization of volunteers to support the work of the institution. These meetings grew out of a recognition that most museums and cultural organizations like the Arboretum enjoy the active involvement of a board of trustees. Such groups have proven immensely helpful in promoting knowledge of the institution's programs and in raising funds for annual operations and capital improvements. No such group exists for the Arboretum.

By tradition, the Director has reported to the Dean of the Faculty of Arts and Science at Harvard. Since 1989 my boss has been Sally Zeckhauser, Vice President for Administration, who in turn reports to the President. Also by tradition, the Arboretum has had a Visiting Committee appointed by Harvard's Board of Overseers to review the programs and progress of the organization and report back findings to the Overseers every three to five years. Basically, the Visiting Committee performs the vital role of communications with the administration of the University.

The new creation will begin regular meetings next fall and will be called the Director's Advisory Board. A group of fifteen to twenty-five individuals will meet through the year to provide counsel to the Director, recruit new volunteers, and develop strategies for raising funds for annual support and future programs. The Advisory Board will have several standing committees (executive, campaign, nominating), as well as commitees focused on specific programs.

Our friends have also recommended the creation of a second, larger body called the Arboretum Council. This group will meet once or twice each year and will consist of three kinds of members: individuals new to the Arboretum who would like to learn more about its programs before volunteering the greater commitment required by the Board; individuals with limited time but great interest in the Arboretum; and former members of the Board and the Visiting Committee.

If you would like to become more involved in supporting the Arboretum and its programs, perhaps as a volunteer for one of these two new groups, drop me a note or an E-mail. I would enjoy talking with you about the possibilities.

"New" Plants From a New Program at the Arnold Arboretum

Kim Tripp, Putnam Fellow, and Peter Del Tredici, Director of Living Collections

The Arnold Arboretum is home to 278 acres of woody plants, many of which have proven to be beautiful, stress tolerant, free of serious pests and diseases, unusual, and yet adaptable to modern nursery production and landscape use. In order to make plants with excellent ornamental potential more widely available to nurseries and, eventually, to the gardening public, we have instituted a new Arnold Arboretum plant introduction, promotion, and distribution program. Our goal is to get exceptional woody plants now in the collections of the Arnold Arboretum into the hands of progressive nurseries and other botanical institutions. To achieve this goal, we will be selecting woody ornamentals with good landscape potential from the collections for increased promotion and direct distribution.

Kim Tripp

Abies borisii-regis, King Boris fir, develops a uniformly dense habit as a young tree and keeps good winter color with no bronzing or dieback.

Each year the Living Collections staff will select plants of particular merit and distribute small quantities of scions and cuttings to professionals who can then propagate plants for trial and eventual sale to the gardening public. The excellent collections records at the Arboretum has enabled the staff to evaluate performance of these plants over a period of decades. Extensive records of propagation trials, in combination with ongoing propagation work at the Dana Greenhouses, also enable us to offer sound propagation recommendations.

Kim Tripp

The very ornamental bark of *Prunus cyclamina*, cyclamen cherry.

Professional horticultural organizations and commercial nurseries are invited to subscribe to the Arnold Arboretum Plant Introduction, Promotion, and Distribution Program on an annual basis. Subscribers will be offered:

- Direct delivery of scions, cuttings, or seed of exceptional plants in the collections
- Written reports and plant profiles including: descriptions, propagation and cultural recommendations, and landscape performance history at the Arnold Arboretum
- An invitation to an annual Subscribers' Propagation Workshop, which will include guided opportunities to collect from much of the Living Collections.

Our 1996 selections are *Abies borisii-regis*, King Boris fir (USDA zone 5), *Magnolia grandiflora* 'Tulsa', a clone of bull bay magnolia selected by Lester Case of Winchester, Massachusetts (USDA zone 6), and *Prunus cyclamina*, cyclamen cherry, a highly ornamental species with unusual reliability (USDA zone 6, possibly 5). Funding generously provided from the Stanley Smith Horticultural Trust and the Willowwood Foundation has made it possible for us to initiate this new program.

If you are a nursery professional or professional horticulturist interested in learning how to participate in the program, please contact Kim Tripp by fax at 617/524-6413.

Spring Planting 1996

Peter Del Tredici, Director of Living Collections

The one thing that can be said for certain about this spring's weather is that it has been good for the plants. Unlike the past few springs with their below-average precipitation, this one provided subtantial moisture at intervals that seemed to occur every other day. In addition, the cool temperatures in May held the plants back enough to allow the entire list of spring plantings to be dug in before leafing out. Were it not for a surprise snowstorm late in April, 1996 might qualify as a perfect spring for transplanting.

Among the highlights of the planting season was the completion of the replanting of the Chinese Path area, where we added more *Corylopsis* species, four specimens of *Lindera obtusiloba*, a young plant of *Chionanthus retusus* (the Chinese fringe tree), and the relocation of a twenty-foot-tall specimen of *Acer triflorum*. The addition of these plants, together with containerized plants to come later this spring, will conclude the renovation of the area, making it not only more beautiful, but also much more accessible to pedestrians.

It was a particular pleasure to see the new plantings on Peters Hill, which featured numerous accessions of cherries, pears, hawthorns, and crabapples, thereby insuring the beauty of that area for future generations of Arboretum visitors. Over the course of the last three years, the Peters Hill area has undergone a nearly complete transformation that will be capped with a redesign of the summit sometime in 1997.

Karen Madsen

Grounds superintendent Patrick Willoughby next to *Magnolia stellata*, in the jaws of a tree spade that has uprooted it for replanting near the Hunnewell Building.

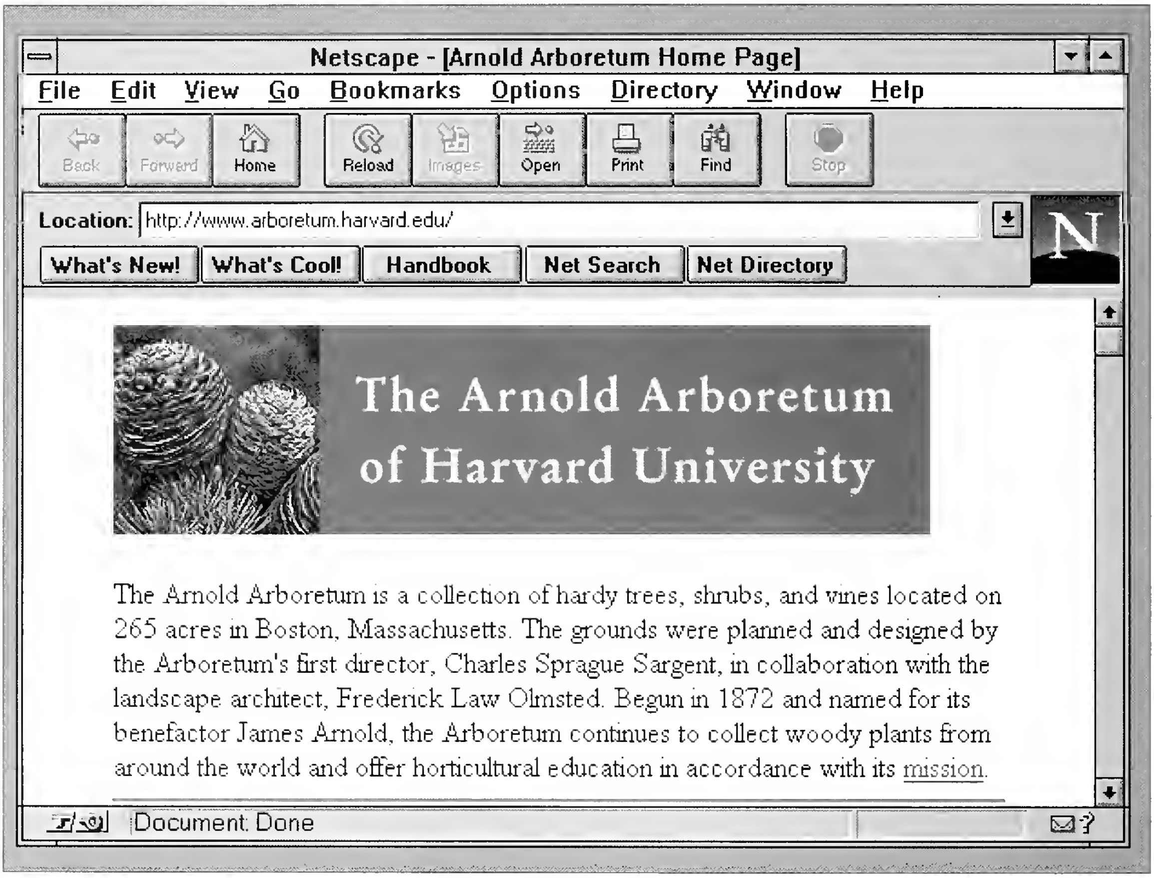
In addition to these two areas, the rest of the Arboretum was liberally sprinkled with a variety of new plants, including maples, alders, birches, the new *Cornus florida* x *kousa* hybrids from Rutgers University, oaks, redbuds, ashes, and the disease-resistant cultivar of the American elm, 'Princeton'. Perhaps the most unusual specimen planted this year was a hackberry from China, *Celtis vandervoetiana*, which is perhaps the only one of its kind in North America. We hope this new generation of trees will in some measure compensate for the weather-related losses of the past two years.

Peter Del Tredici

This specimen of *Ulmus americana* 'Princeton' has been growing on Bussey Hill since 1935. Scions of this disease-resistant cultivar were among the new spring plantings.

The Arboretum Becomes a New Stop on the Information Superhighway

Chris Strand, Outreach Horticulturist



The first page of the Arboretum's World Wide Web site as seen on the computer screen.

On April 1, the Arnold Arboretum became part of the growing community of botanical gardens offering information over the World Wide Web. The web, as it is often abbreviated, is a global computer network that allows users to view images, send electronic mail, read articles, and query databases—all from a personal computer.

The Arboretum's new home page is organized by five basic areas of content: living collections, library and archives, membership, public programs, and visitor information. Some of the page's highlights include a library catalog, a detailed bloom schedule for the Boston area, an inventory of our living collections, course listings for spring and summer educational programs, and articles on woody plants and landscape design.

The World Wide Web is a convenient and potentially powerful way to communicate with new audiences. As of 1995 nearly 10 million users had accessed the web for information, and it is predicted that over 15 million will access the web in 1996. Most classrooms have or are acquiring connections to the World Wide Web, and our own children's education program has begun a project called the Community Science Connection that will link sixteen schools to the Arboretum and one another through the World Wide Web.

To some of our members, this emphasis on technology may seem somewhat uncharacteristic. Although it is true that our web site was unveiled on April Fool's Day, we are serious in our commitment to find new ways to share the Arboretum with the public. After all, we are not proposing to create a virtual Arboretum—there remains no silicon substitute for walking beneath trees.

Annual Fall Plant Sale

Lisa Hastings, Development Officer

Planning is well underway for the Arboretum's Annual Fall Plant Sale, which will take place this year on Sunday, September 15, from 9:00 am–1:00 pm at the Case Estates in Weston. One of the premier horticultural events of the fall season, the plant sale offers distinctive and unusual trees, shrubs, and perennials, many propagated from the Living Collections at the Arboretum. Our largest member event of the year, members receive a free plant dividend, discounts on all purchases, and early entrance to the sale.

A sampling of the plants to be offered this year include: *Cornus florida* 'Xanthocarpa', *Pistacia chinensis*, *Abeliophyllum distichum* 'Roseum', *Euonymus carnosus*, *Hypericum buckleyi*, *Ilex verticillata* 'Winter Gold', *Neillia thibetica*, *Prinsepia sinensis*, *Clematis serratifolia*, *Tsuga diversifolia*, and *Spigelia marilandica*. A complete plant sale catalog, including plants in the Collector's Choice category, will be mailed to all members in early August.

This year's plant sale will also feature the return of the Silent Auction, to take place from 9:00 to 11:15 am, and the Rare Plant Auction at 11:30 am. The auctions, proceeds of which benefit the curation and maintenance of the Arnold Arboretum's Living Collections, will feature rare and unusual plants donated by nurseries located throughout the United States. Finally, plant societies from around New England will participate in Society Row, located in the field and open from 9:00 am–1:00 pm.

If you have question about the plant sale or are interested in volunteering, please contact Chris Strand, 617/524–1718 x 125, or Kara Stepanian, x 129. *Mark your calendar and plan to join us!*

Amy C. Wilson

In April, a young cork tree (*Phellodendron amurensis*) was planted near Meadow Road in the former shade of the 121-year-old veteran that fell under the weight of twenty-two sixth-graders last fall. The five-year-old was welcomed with great ceremony, and Winsor School students presented Director Bob Cook with a $300 check to help ensure a long and happy life for the newcomer.

Wanted! Needed! Help!

The Arnold Arboretum is currently working on a permanent exhibit for the Hunnewell Building that will be unveiled in October. We are searching for two items that are intrinsic to our "story": a 1950s-era wheelbarrow in relatively good condition and two or three empty burlap bags—preferably with no marks on one side.

If you can donate these items, you will receive a special invitation to the opening along with our heartfelt thanks. Please contact Chris Strand at 617/524-1718 x 125.

Gone West

We regret to announce that after this issue a name will disappear from the roster of our Editorial Committee. Richard Schulhof, Director of Education and Public Programs since 1992, has left the Arboretum to undertake the directorship of Descanso Gardens, La Cañada Flintridge, in his native southern California. Descanso boasts the world's largest collection of camellias as well as an outstanding rose collection, but even more interesting botanically is its native vegetation. This includes an extensive area of chapparal and a pristine woodland of coastal live oak, *Quercus agrifolia*, one of the few that are publicly accessible in southern California. Descanso can be visited via the World Wide Web at http. //www.mobot.org/aabga/member.pages/descanso.html/.

Richard came to the Arboretum in 1989 as a Putnam Fellow and quickly took the role of coordinator of the master planning project. He was instrumental in interpreting both the cultural and scientific missions of the Arboretum, and to him goes credit for the National Endowment for the Humanities grants for the development of a permanent exhibit to be unveiled this autumn. Richard has been a much valued colleague; we wish him all the best.

New Staff

Karen Madsen

Karen Madsen

The Development Department at the Arboretum announces the addition of two new staff members. **Kelly Harvey** replaces David Sieks as the Membership Assistant. In this newly expanded role, Kelly manages all activities related to the Friends of the Arnold Arboretum, including new member acquisition, special membership events, and the membership database. She joins us from the Harvard Graduate School of Design, where as office manager she coordinated the school's computer helpdesk. She also brings prior experience in public relations and fundraising from previous work as circulation assistant of the Harvard University *Gazette* and as membership assistant for Harvard's Sports Alumni Friends groups.

Kara Stepanian joins the Arboretum in the newly created position of Development Assistant. Kara's activities will focus on our fundraising initiatives including the live and silent auctions at the annual fall plant sale, creating and managing a development database, donor research, and special events. Kara comes to us from Harvard's Graduate School of Arts and Sciences Alumni Association where she worked with the alumni advisory council, planned events, and wrote for the alumni publication. Prior to that, she worked in development for the Seattle Symphony in Washington State.

The Arboretum's Education Department offers a wide variety of courses, programs, and lectures in horticulture, botany, and landscape design. A selection of summer courses is shown here. For a complete catalogue of programs and events at the Arboretum, call 617/524–1718 x 162. Please note that fees shown in boldface are for members of the Arboretum. For information about becoming a member, call 617/524–1718 x 165.

HOR 338 Basic Care for Trees and Shrubs

Joseph J. Camilliere III, Consulting Arborist

Trees and shrubs are key structural elements in the landscape. Learn the basic techniques used to care for and enhance woody ornamental trees and shrubs, from identifying stresses to pruning and feeding.

Session 1: Basic Anatomy and Physiology
Understanding tree growth and function

Session 2: Evaluating Trees and Shrubs
Recognizing the signs and symptoms of insects, diseases, and environmental stresses; applying basic treatment tactics

Session 3: Proper Care for Maximum Health
Pruning, maintaining shrubs at desired sizes, fertilizing—what to use and when, mulching and root care, preventing mechanical injury, when to call a professional arborist

Fee: $45, 54

3 Mondays, July 8, 15, 22/ 6:30–8:30 pm (CE)

HOR 393 Planning the Drought-Tolerant Garden

Gary Koller, Senior Horticulturist, Arnold Arboretum

The drought of 1995 took its toll on the gardens of New England and left many gardeners wondering how to proceed. This class will focus on design concepts of xeriscaping, or planning the garden for greater drought tolerance and less dependence on supplemental irrigation. Participants will look at the concepts of water conservation in the garden, designs that group plants based on watering needs, and plant selections that are both drought tolerant and efficient in water usage. Sessions will include discussion, practical planting layouts, and plant lists, as well as a walk to look at drought-tolerant plants growing in the Arnold Arboretum collections.

Fee: $58, $70

3 Wednesdays, July 10, 17, 24/ 4:00–6:00 pm (DG)

BOT 119 The August Landscape: Trees, Shrubs, and Vines

Richard Stomberg, Manager, Harvard University Herbaria Glasshouses

The ornamental potential of plants in August can be overlooked when heat-dazzled Bostonians concentrate their attention on beaches and vacations. *Sophora japonica, Evodia daniellii,* and *Clerodendrum trichotomum* will be among the plants explored on this warm-weather walk through the Arboretum.

Fee: $12, $15

Saturday, August 17/ 10:00–noon (DG)

HOR 136 Ornamental Grasses

Darrell Probst, Horticultural Consultant and Landscape Designer

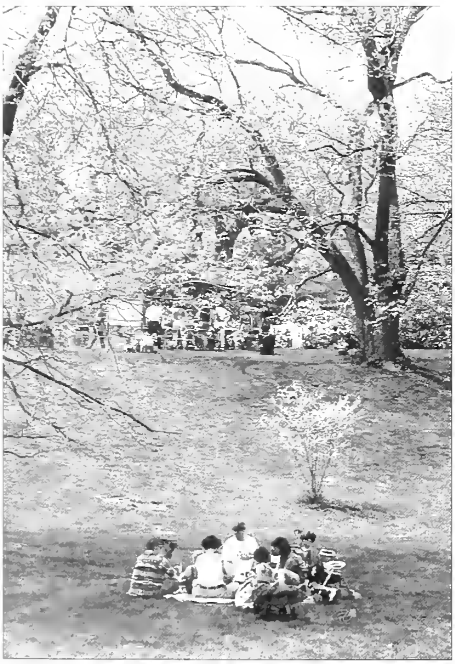
In the diverse world of ornamental grasses exist plants suitable for gardens of every size and for sunny, shady, wet, and dry locations. Some grasses are so large and dramatic that they can be used as shrubs or specimen plantings; others are miniatures, at home in the small-scale landscape. Their colors form a rainbow of greens, pinks, creams, blues, golds, and whites. This introduction to decorative grasses will focus on these versatile perennials.

Fee: $16, $19

Tuesday, August 20/ 6:30–8:30 pm (CE)

Photographs by Karen Madsen

Lilacs 1996
A Cause for Celebration



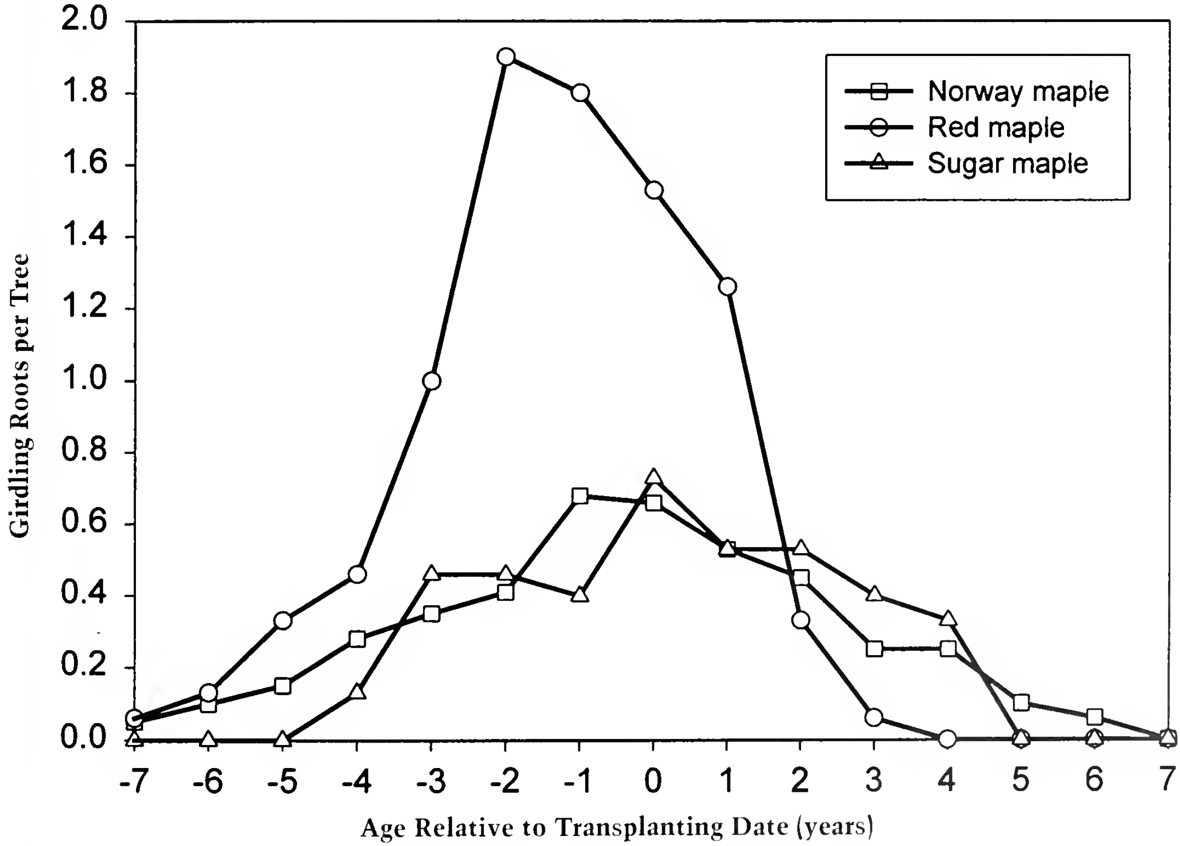
Jack Alexander, Arboretum Plant Propagator and lilac specialist, with Outreach Horticulturist Chris Strand.

to correct the problem. In these cases, the advisability of removing girdling roots is uncertain even where the individual roots are distinct enough to make removal practicable: if a large root constricting the trunk is removed, a substantial portion of the root system may be lost with it. Root loss can also cause stress, decline, and even death of the tree.

After these disappointing initial excavations, the Mt. Prospect study focused on younger parkway trees that had been in place for only three to ten years. Trees of this age are well enough established so that the stress from root crown excavation is minimal, but young enough so that severe girdling has not yet developed. In this second phase of the study, a total of 120 root crowns were excavated over a two-year period. The number of girdling roots was recorded, and these girdling roots were removed when this could be done without substantially reducing the total root system. The approximate age of each root removed was determined by smoothing a cross section and counting the number of annual rings.

Tree roots can be classified as (1) primary roots, which radiate out from the base of the tree-like spokes of a wheel; (2) secondary roots, which are lateral branches of primary roots that grow almost perpendicular to them; and (3) tertiary roots, which are lateral branches of secondary roots. Almost all the girdling roots found were secondary or tertiary roots. This is not surprising since the nearly perpendicular branches of the spoke-like primary roots are more likely to wrap around the base of the trunk or cross other roots.

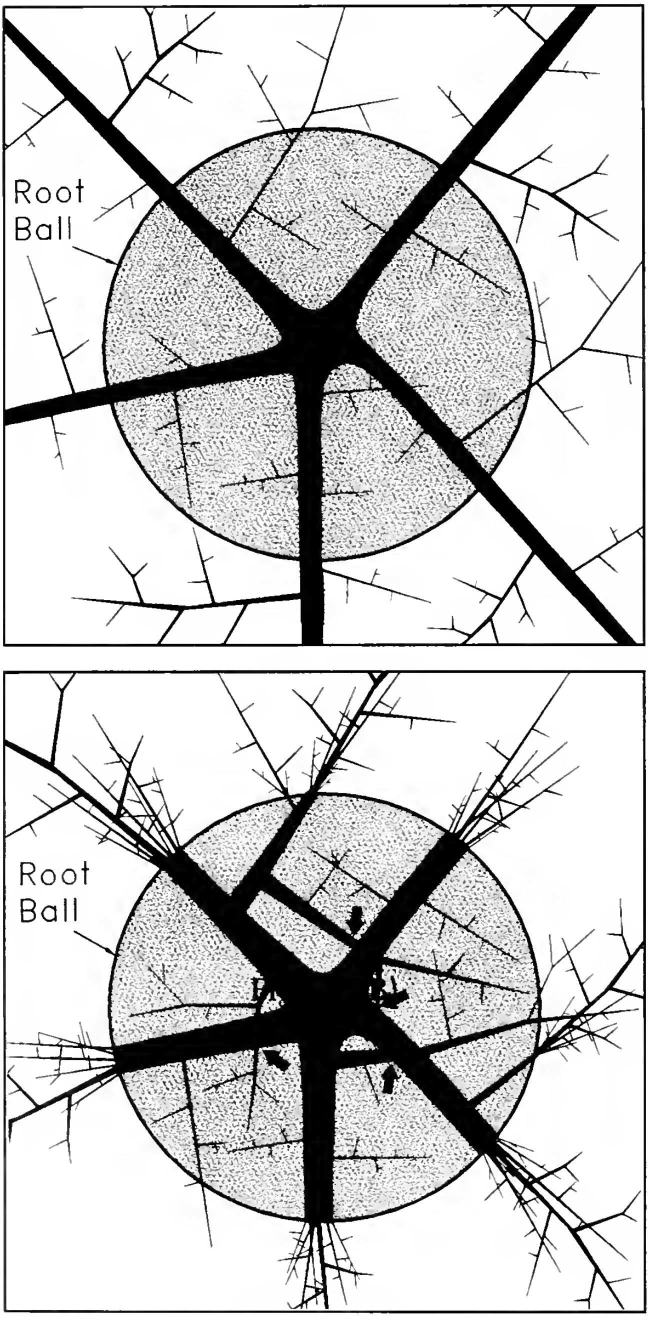
A strong relationship between transplanting and girdling root formation became apparent in



This chart relates the age of the girdling roots of Norway, red, and sugar maples to the number of years since transplantation.

(a)

(b)



These drawings describe the probable mechanism involved in girdling root formation: (a) The major roots of a tree normally radiate out from the trunk. These roots and some of their lateral roots are severed during transplanting. (b) After transplanting, new roots that are initiated from the cut ends follow the same direction as the original. Growth in existing and new lateral roots is stimulated and these can become girdling roots, as indicated by the arrows.

all three maple species, with the majority of the girdling roots being initiated within one year of transplanting. This fact, together with the finding that most girdling roots are secondary or tertiary roots, enabled us to construct a hypothesis of the way girdling roots may be formed on field-grown transplanted trees. Normally, secondary roots grow slowly and remain quite small as long as the primary root is intact. When the tree is dug in the nursery and the large radiating primary roots are severed, however, the secondary roots often begin to grow more rapidly. In addition, new secondary roots may form some distance behind the cut end of the primary root. All these vigorously growing secondary roots are located close to the base of the trunk and are well positioned to become girdling roots as both the roots and the trunk grow larger. If severing the primary roots during transplanting is indeed the stimulus for girdling root formation, it is easy to understand why girdling roots do not generally occur in forests.

The Mt. Prospect study found that young Norway maples and sugar maples had an average of four girdling roots per tree. Red maples had even more—nearly twice as many. Why is it, then, that only the Norways show canopy decline when they mature? Excavation of root crowns of sugar and red maples twenty-one to twenty-eight years after transplanting revealed very few girdling roots. Those that were present were relatively small, and all were less than twelve years old. By contrast, girdling roots of Norway maples of similar age were much more numerous and ranged in age up to twenty-four years. For unknown reasons, it seems that the girdling roots that develop on red and sugar maples as a result of transplanting are short-lived, unlike the case of Norway maples.

How can we prevent or correct girdling roots? Numerous girdling roots were removed during the first phase of the Mt. Prospect study in hopes of preventing

PHOTOS BY GARY W WATSON

(a)

(b)

(c)

These photos show the girdling roots of a Norway maple (a) before and (b) after corrective treatment, and then again (c) four years later. The arrows indicate the same location in all photos.

canopy decline in the future; the process of excavation and root removal is time consuming but would be worth the effort if it were effective. To determine whether this was the case, one quarter of the same Norway maple trees were excavated again in 1992 and their roots compared to photos taken at the time of the 1987 excavation. It soon became clear that one or more roots had consistently regenerated from each root removal site. The new roots, just like the old ones, were usually nearly perpendicular to the radially oriented primary roots and well positioned to become girdling roots.

This finding was discouraging, but there may still be hope. It was encouraging to learn that the root systems of Norway maples have diverse growth habits. Those with many large girdling roots at the time of the first excavation showed many large regenerated girdling roots four years later. Likewise, root systems that initially had fewer and smaller girdling roots showed fewer and smaller regenerated roots. And of the sixty older Norway maples examined in the first phase of the study, girdling and potentially girdling roots were completely absent on two trees. Theoretically, this genetic diversity may allow root stock to be selected and propagated so as to reduce or eliminate girdling roots altogether.

Until better root stocks are developed, communities should avoid overplanting Norway maples (or any other single species) and be prepared to accept substantial losses from girdling roots as the trees reach maturity. What these losses may amount to can be estimated only imprecisely at between ten and forty percent.[4] We don't know exactly how long Norway maples would survive if they didn't develop girdling roots. The average life span for all urban trees is only thirty-seven years, however, so it is possible that on average girdling roots shorten the life of Norway maples by only a few years.[5]

It would be easy to say that we shouldn't plant Norway maples because of the girdling root problem, but then we might also

PHOTOS BY GARY W. WATSON

These photos show examples of the diverse character of Norway maple root development. Selection of root stock like that seen on the right in the lower photo may be the best way to eliminate most girdling root problems in the future.

have to stop planting redbuds *(Cercis canadensis)* because they can get verticillium wilt, green ashes *(Fraxinus pennsylvanica)* because they can get borers, and red oaks *(Quercus rubrum)* because they are susceptible to oak wilt. There is an appropriate place for every tree. For reasons of historical significance, American elms are still planted on the National Mall in Washington, DC, even though they may eventually die from Dutch elm disease, and in fact, they may survive the harsh site conditions as well as or better than any other tree. You might not want to plant a Norway maple in a location where survival for many decades is important, but if a life span of thirty years is acceptable, there is no reason not to plant one. The Village of Mt. Prospect continues to plant Norway maples, but tries to use them in mixed species plantings so that no single problem can wipe out all the trees in an area.

Gary Watson is Root System Biologist at The Morton Arboretum in Lisle, Illinois. Sandra Clark is Superintendent of Forestry, Village of Mt. Prospect, Illinois.

Frequency of girdling roots in relation to planting depth for all maple species

It is often contended that trees planted too deeply have more girdling roots, but the matter has never been formally studied. The Mt. Prospect study found no relationship between planting depth and girdling roots. However, the data do show how often trees are planted too deeply in the landscape. Over half the trees studied had been planted two to eight inches too deep, even though all were planted by reputable commercial landscape companies. Planting too deep is one of the major causes of death of trees of all species planted in the landscape. No soil should cover the top of the root ball when the planting job is complete.

*Root flare relative to grade [inches (cm)]**	*Number of trees*	*Average number of girdling roots/tree*
+1 (2.5)	1	4
at grade	21	5
–1 (2.5)	2	3
–2 (5.0)	13	5
–3 (7.5)	2	9
–4 (10.0)	7	5
–5 (12.5)	1	4
–6 (15.0)	4	5
–7 (17.5)	1	1
–8 (20.0)	2	2

* The first root of trees planted 'at grade' was within one inch of the soil surface.

Endnotes

1 Robert L. Tate, Bole characteristics associated with girdled Norway maple trees, *Journal of Arboriculture* (1981) 7(10): 308.

2 *A Technical Glossary of Horticultural and Landscape Terminology.* Washington, DC: Horticultural Research Institute, 1971.

3 Three other species, green ash *(Fraxinus pennsylvanica)*, honeylocust *(Gleditsia triacanthos)*, and littleleaf linden *(Tilia cordata)* were also studied but were found to have less than half as many girdling roots as any of the maples. Girdling roots were especially infrequent in lindens. The authors' documentation of these findings can be found in *Journal of Arboriculture* 16(8): 197–202 and 19(5): 278–280.

4 These percentages are based on R. L. Tate's number of girdling roots and percent of encirclement as well as on data and experience from our own work.

5 This figure for average life span is taken from B. Skiera and G. Moll, Trees in the Red, *Urban Forests* 12(1): 9–11.

Nature's Relentless Onslaught, Redux

Todd Forrest

If watching woody plants endure extreme weather is your interest, then 1996 looks no less promising than 1995.

Ambivalence, not indignation, is the healthier attitude to have towards the weather. It's not that the weather doesn't provide ample cause for complaint—it does—but any protest about the heat, or the rain, or the cold, or the snow is an invitation to compounded frustration. This spring was a case in point. Last year's drought made Arboretum horticulturists anxious for early spring precipitation, and even after the winter's record-breaking snowfall we were still tense when the end of March and first week of April turned out to be abnormally dry. The possibility of another seven-month drought was enough to give us nightmares about our favorite plants withering away on the grounds. Nervously watching long-term forecasts, we consulted our almanacs, looked for solace from meteorologists, and prayed for rain.

Then it snowed. On Monday, April 8, four inches of snow fell, most of which melted by that afternoon. Two days later it snowed for real, dumping eleven-point-five inches of wet and heavy snow across New England, covering cornelian cherries and magnolias and daffodils with nature's version of wet cement. Our much-needed precipitation did even more structural damage to the Arboretum's plants than the ice storm of March 1995.

PETER DEL TREDICI

The weak crotch between the two main leaders of this ninety-year-old red oak couldn't stand the combination of wind and wet, heavy snow brought by the snowstorm on April 10. The tree split in half, crushing a little cherry, mangling an osage orange, and stripping the lower branches from the Metasequoia *in the background.*

All that was left of the red oak after the storm.

About one-hundred plants were recorded by the grounds crew as needing some sort of pruning, and roughly thirty of those had to be removed entirely. Some of the destruction was spectacular, like the ninety-year-old oak growing on the southeast flank of Peters Hill that split in half, crushing a small *Prunus* and peeling all of the lower limbs from a forty-eight-year-old *Metasequoia.* The *Metasequoia* still stands but it looks like a fish skeleton that's been stripped of two-thirds of its ribs. Three mature beeches dropped thousand-pound limbs, and the snow knocked off most of the recently opened *Acer rubrum* and *A. saccharinum* flowers, creating a scarlet carpet at the bases of the larger trees. Our oldest specimen of *Magnolia zenii* (Arnold Arboretum accession 1485-80-B), the Arboretum's official harbinger of spring since it first flowered on 31 March 1988, lost many buds and didn't fully open until 15 April, two weeks later than usual.

But like most things that happen in a garden, the storm also provided us with new information about the collections. After spending more than a week finding and removing seriously injured trees, arborists John Del Rosso and John Olmsted began to see a pattern in the broken and fallen limbs. "Most of the serious damage we found could be traced to a pre-existing condition in the tree," observed Olmsted. "Weak crotches [where two limbs or leaders meet and form a narrow, V-shaped intersection] and old cracks formed by prior storms or badly healed pruning cuts caused most of the big breaks," Del Rosso added. According to Olmsted and Del Rosso, there were a lot of minor cracks and stress damage from last year's ice storm and these grew during the subsequent drought as the wood dried and contracted. Eventually, those cracks got big enough to undermine the tree's ability to endure the combination of wind and snow that came with the spring storm.

A few arborists claim that some species are more prone than others to breaking up in heavy winds, rain, or snow. Olmsted and Del Rosso found little evidence to substantiate this theory: instead, they found that a tree's location is the primary determination of whether it withstands or succumbs to severe weather. Large trees planted along roads or on hillsides exposed to the wind were more likely to lose major limbs while trees protected by buildings or planted amidst other plants tended to fare better. Conifers, shaped by evolution to allow snow to slide off their branches, showed their inbred capacity to weather such an unexpected spring storm: very few of our large pines, firs, or spruces lost limbs and none had to be removed. On the other hand, many of the small ornamental cherries and apples, planted in the open to maximize the effect of their flowers, lost many large branches and about a dozen had to be removed.

This spring snowstorm added to the list of things that need to be done this season to restore and rejuvenate plants in the Arnold Arboretum. Members of the staff are still looking for the inconspicuous cracks and breaks that, if left untended, will cause spectacular damage in the future. Unfortunately, with over twelve thousand accessioned trees and tens of thousands of spontaneous plants growing on the grounds, we will never quite catch up. But even if we don't find all the damage now, we can count on future storms to show us exactly what we missed.

Acknowledgments

Thanks to arborists John Olmsted and John Del Rosso for taking time out of one of their long days of pruning to discuss what they observed on the grounds after the latest snowstorm. This has been a busy spring for John and John—the responsibility for all of the major pruning and removals at the Arboretum falls onto their shoulders, and all of our recent severe weather has left them with a considerably increased workload.

Todd Forrest is the plant recorder at the Arnold Arboretum, at least until August, when he will begin studies at the Yale Graduate School of Forestry.

Corrigendum: In the report of the Arnold Arboretum Weather Station Data—1995, which appeared in Volume 55:4, the length of the growing season was incorrect. It should have read 187 days.

Would a Lilac by Any Other Name Smell So Sweet? A Search for Fragrance

John H. Alexander III

The quest for all-encompassing knowledge of his favorite genus has taken the Arboretum's plant propagator down many byways. This one required a cadre of volunteers and a high-speed computer.

The perfect lilac should have flowers at eye and nose level; the new growth should not obscure the flowers; it should sucker enough to replace old stems; it should not suffer from powdery mildew or leafroll necrosis; it should be available in your favorite color, single- or double-flowered; and it should be fragrant! For years I've sought those perfect lilacs and the prospective parents of new perfect lilacs. I've made many notes on flowers and collected years of data on the susceptibility of different cultivars to foliar diseases, but inevitably the question arises, Is it fragrant?

It's a question I often hear when I'm recommending a lilac. My usual response is, "I'll show you the plant and you can tell me." The problem is that I am not very sensitive to fragrances. I can usually detect them, but it seems that my olfactories are quickly overwhelmed by strong fragrances, and I am then unable to differentiate or even notice them.

Wanting to fill out my knowledge of potential lilac breeding stocks, I enlisted volunteers to sniff in my stead. It would be a simple, informal survey. I would act as clerk; all these self-proclaimed "fragrance-oriented" people need do was to sniff and assign a grade. We undertook this task in 1982 and again in 1983. During peak lilac bloom, two testers and I worked our way through the Arnold Arboretum's collections in Jamaica Plain and, in 1983, at the Case Estates.

We began by sniffing a few lilacs, including *Syringa pubescens,* which is widely considered to be one of the most fragrant, although spicier than the traditional lilac fragrance. We then moved from plant to plant. They sniffed and independently (without discussion) decided on a rating from 0 to 3 with 0 having no fragrance and 3 being the maximum. At first I doubted the ability of the testers and so I tested them, steering them to different plants of the same cultivar and even, once or twice, repeating the very same plant. Their ratings convinced me that they could detect and grade with consistency.

The Results

The mean fragrance level of all 456 samples was 1.08. Of these, 195 plants were sampled in 1982 and 261 in 1983. The overall mean for 1982 was 0.78 whereas it was 1.3 for 1983. Of these, 112 plants were sampled both years; the mean fragrance level for these was 0.84 for 1982 and almost twice as high in 1983 at 1.48. Why the difference? Conjectures are many, but perhaps the most plausible is that like the taste of wines, the fragrance of lilacs is just better some years. Certainly, few samples were taken for most cultivars, and with more years of sampling the results would be more accurate. I am less confident of the negative results than the positive; I am reluctant to say that lilacs sampled once or twice and found not to be fragrant are never fragrant. Therefore, for the following tables I have selected lilac cultivars that either were sampled more than once or received higher fragrance scores. The latter are included on the conviction that a lilac with a grading higher than the overall mean average can confidently be considered fragrant.

When complaints are made that fragrance has been bred out of lilacs, it is generally cultivars of *Syringa vulgaris* that are targeted. In view of that assertion, I included in our 1982 sampling two specimens of *S. vulgaris* that were collected in the wild in the Balkans. The testers gave them grades of 1 and 0.5 (on the scale of 0 to 3), which combines to give a mean of 0.75, a number very close to the overall mean for all plants tested that year (0.84). Certainly it's fair to say that the fragrance of these two specimens was only average. Some of the cultivars sampled possessed more fragrance, just as some had less. Undoubtedly, the same would be true of individual plants in the wild.

The first table below lists selected cultivars of the species *Syringa vulgaris* and *S.* x *hyacinthiflora,* which is a hybrid of *S. vulgaris* and the earlier blooming *S. oblata*. Cultivars of *S. vulgaris* and *S.* x *hyacinthiflora* look and smell much the same, the most obvious difference being that *S.* x *hyacinthiflora* bloom earlier than *S. vulgaris,* as much as ten days earlier.

The fragrances of the species, hybrids, and cultivars listed in the second table, while generally thought pleasant, differ from the hallmark lilac fragrance. Instead, they are often described as spicier and more pungent.

Table 1

The asterisks mark cultivars of the hybrid *Syringa* x *hyacinthiflora,* which is a hybrid of *S. vulgaris* and the earlier blooming *S. oblata*. All others are cultivars of *S. vulgaris.*

cultivar	flower type	color	number of samples	fragrance average	cultivar	flower type	color	number of samples	fragrance average
Adelaide Dunbar	D	VII	2	1	Boussingault	D	V	1	2
Alba Grandiflora	S	I	2	0.25	Buffon*	S	V	2	1.75
Alba Virginalis	S	I	3	0.5	C. B. van Nes	S	VII	2	1.25
Aline Mocqueris	S	VII	1	2	Capitaine Baltet	S	VI	3	0.83
Alphonse Lavallee	D	IV	3	1	Carmen	D	V	2	0.5
Assessippi*	S	IV	5	1.6	Carmine	S	VI	2	1.5
Azurea Plena	D	III	2	0.5	Catinat*	S	V	6	1.33
Belle de Nancy	D	V	2	1.25	Charles Joly	D	VII	3	1.67
Beranger	S	VI	1	2	Charlotte Morgan	D	VI	2	1.25
Berryer*	D	V	2	1.75	Christophe Colomb	S	IV	2	0.75
Bleuatre	S	III	2	1.25	City of Longview	D	V	2	0.75
Bountiful	S	V	2	1	Claude de Lorrain	S	V	2	0.75

cultivar	flower type	color	number of samples	fragrance average
Colbert	D	VI	3	0.83
Comte Horace de Choiseul	D	V	2	1
Condorcet	D	VI	2	1
Congo	S	VI	2	1.5
Croix de Brahy	S	V	2	1.75
Dame Blanche	D	I	2	0.5
De Louvain	S	V	2	1
Desfontaines	D	VI	1	2
Deuil d'Emile Galle	D	V	2	1.25
Diderot	S	VII	2	0.5
Diplomate	S	III	4	0.87
Doyen Keteleer	D	IV	3	1
Dr. von Regel	S	V	3	1
Duc de Massa	D	III	2	1
Edouard Andre	D	V	2	1.25
Ekenholm	S	IV	2	0.75
Emil Liebig	D	III	2	1
Emile Gentil	D	III	2	0.5
Emile Lemoine	D	IV	1	2
Esther Staley*	S	VI	2	1.25
Evangeline*	D	VI	5	2.2
Excel*	S	IV	2	2
Galina Ulanova	S	I	1	2
General Sherman	S	V	2	1.25
Gigantea	S	V	3	0.83
Gloire de Moulins	S	V	3	1.33
Grand-Duc Constantin	D	III	2	1
Guizot	D	IV	2	1.25
Henri Martin	D	IV	2	2.25
Herman Eilers	S	V	3	0.83
Hippolyte Maringer	D	IV	2	0.25
Hugo Koster	S	IV	2	0.75
Jean Bart	D	V	2	1.25
Jean Mace	D	V	4	1.25
Jules Simon	D	III	1	2
Justii	S	III	2	1.5
Kapriz	D	IV	1	1.5
Katherine Havemeyer	D	V	4	1.25
Lamartine*	S	V	4	1.87
Laurentian*	S	III	2	1.75
Leon Simon	D	IV	1	2
Linne	D	VI	3	1
Louis Henry	D	VI	2	0.75
Louvois*	S	II	3	0.83
Lucie Baltet	S	V	2	0.25
Macrostachya	S	V	5	1.6
Marechal de Bassompierre	D	VI	3	0.83
Marie Legraye	S	I	3	0.67
Marlyensis	S	IV	4	1.5
Marlyensis Pallida	S	IV	2	1.33
Maud Notcutt	S	I	2	0.75
Maurice de Vilmorin	D	IV	1	2
Mechta	S	VI	1	2
Miss Ellen Willmott	D	I	3	0
Mme. Antoine Buchner	D	V	2	1
Mme. Briot	S	VI	2	0.75
Mme. Casimir Perier	D	I	2	0.75
Mme. Catherine Bruchet	D	I	2	0.75
Mme. F. Morel	S	VI	4	1.25
Mme. Fallieres	S	IV	5	0.8
Mme. Felix	S	I	2	0.5
Mme. Lemoine	D	I	4	0.25
Mme. Leon Simon	D	IV	1	1.5
Monge	S	VII	5	0.4
Mons. Maxime Cornu	D	V	2	1.25
Necker*	S	V	2	1.5
Nokomis*	S	IV	2	1
Pascal	S	IV	2	2.5
Paul Hariot	D	VII	2	0.75
Philemon	S	VII	2	0.75
Pink Cloud*	S	VI	2	1.75
Pink Mist	S	V	2	1
Pocahontas*	S	VII	3	1
President Carnot	D	IV	1	2
President Grevy	D	III	3	1.33

key: flower type—D: double; S: single
color—I: white; II: violet; III: blue; IV: lilac; V: pink; VI: magenta; VII: purple

cultivar	flower type	color	number of samples	fragrance average
President Lambeau	S	V	1	2
President Lincoln	S	III	4	0.87
President Poincare	D	VI	2	1.75
President Roosevelt	S	VII	2	1.75
Prince Imperial	S	VI	2	0.75
Prince Notger	S	III	2	0.5
Princesse Marie	S	V	2	1.25
Prodige	S	VII	2	1
Professor E. H. Wilson	D	I	2	0.5
Pyramidal	D	IV	3	1.67
Pyramidalis Alba	S	I	2	0.5
Reine Elisabeth	S	I	2	0.5
Roi Albert	S	VI	3	1.33
Ronsard	S	III	2	1.25
Rouge de Trianon	S	VI	2	1.25
Rubella Plena	D	VI	2	0.5
Ruhm von Horstenstein	S	VI	3	2
Senateur Volland	D	VI	2	1.5
Serene	S	V	1	3
Souvenir De Simone	D	I	2	0.5
Stadtgartner Rothpletz	D	VII	2	0.75
Stefan Makowiecki	S	VI	3	0.5
Sumierki	S	VII	1	1.5
Summer Skies*	S	VI	1	2
Sunset*	D	VI	2	1
Sweetheart	D	VI	1	1.5
Tankman	D	V	2	0.75
Thunberg	D	IV	2	1.75
Triomphe de Moulins	S	IV	3	1
Turgot*	S	V	3	0.5
Vauban*	D	V	6	2
Vestale	S	I	4	0.75
Viviand-Morel	D	IV	1	2
Waldeck-Rousseau	D	V	4	0.75
William C. Barry	S	IV	2	1
William Robinson	D	IV	2	0.75

Table 2

x *chinensis*	S	IV	1	2
— Bicolor	S	I	1	2
— Metensis	S	I	2	2.25
— President Hayes	S	VI	2	1.5
— Red Rothomagensis	S	VI	2	2
— Saugeana	S	VI	4	2.25
meyeri	S	IV	1	1.5
oblata subsp. *oblata*	S	V	1	3
— subsp. *dilatata*	S	V	3	0.5
pubescens subsp. *pubescens*	S	IV	4	3
— subsp. *julianae*	S	V	1	3
— subsp. *microphylla* Superba	S	V	2	0.5

For Further Information on Lilacs

John H. Alexander, III. 1989. The Quest for the Perfect Lilac. *Arnoldia* 49(2): 2–7. This article includes a list of the fifty best lilacs for the gardens of New England plus an additional ten favorite uncommon lilacs.

———. 1978. The Uncommon Lilacs—Something Old, Something New. *Arnoldia* 38(3): 65–81. This article discusses some of the less common lilacs.

Acknowledgments

Thanks to testers Ellen McFarland, Molly Mason, Michele Krahmer, and Pat Penfield, and to computer aides, the late Leslie Oliver and Richard Dwight.

The fascination that lilacs exert on the Plant Propagator of the Arnold Arboretum appears to have a genetic component. His great-grandfather, The Dahlia King of East Bridgewater, Massachusetts, raised lilacs in his commercial nursery. A generation later, his son, Jack's grandfather, proprietor of Dahliatown in Middleborough, had made lilacs a specialty of *his* nursery. Jack himself has long been active in many capacities in the International Lilac Society, which has in turn bestowed on him their Director's Award and Award of Merit.

Art and Nature in a Garden: Book Review

Phyllis Andersen

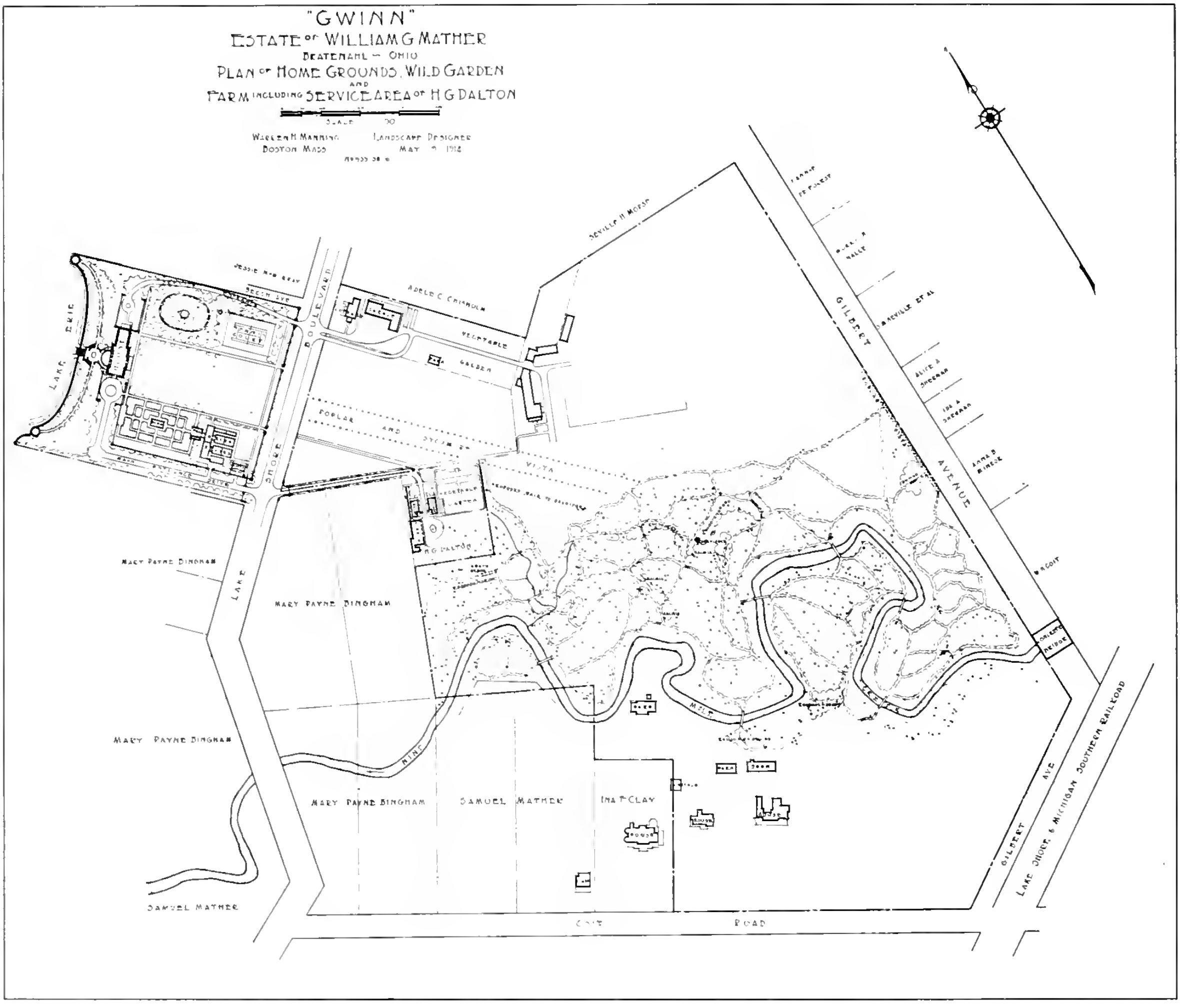
The Muses of Gwinn: Art and Nature in a Garden Designed by Warren H. Manning, Charles A. Platt and Ellen Biddle Shipman. Robin Karson. Sagapress in association with The Library of American Landscape History, 1995. 204 pages. Hardcover. $39.95

Gwinn, five miles east of Cleveland, on a amphitheatre-like bluff overlooking the shores of Lake Erie, is the result of a unique collaboration: a house and garden that involved the design talents of three of the leading lights of the American country place era, the architect Charles Platt (1861–1933) and the landscape architects Warren Manning (1860–1938) and Ellen Shipman (1869–1951). Robin Karson, author of *Fletcher Steele, Landscape Architect,* has structured her book on Gwinn not only to describe the evolution of a beautiful and evocative landscape but to reveal the creative process that wove three very different points of view into a coherent whole.

CAROL BETSCH

A view through the lilac arch. From The Muses of Gwinn.

Manning, Platt, and Shipman —the Muses of Gwinn—would have been a rather unruly lot without the disciplined hand of the client, William Mather (1857–1951). Mather, whose fortune was based on Great Lakes shipping, had a consistent vision of his country place and like a true patron gave his designers the opportunity to work out their ideas within a disciplined framework. Inspired by travel and by his indulgence in the collecting impulse that seems to affect most estate builders, Mather continued to refine his view of Gwinn over forty years and, to his credit, kept his designers personally engaged with the quality of its effect. Like that of many other founding families of Cleveland, the original Mather family home was built on Euclid Avenue. (In 1868 Samuel Clemens called it one of the finest streets in America!) In 1905, at the age of 48, Mather felt the need to leave the city for a



COURTESY OF GWINN ARCHIVES

Estate plan of Gwinn showing home grounds and wild garden, 9 May 1914.

country house and garden suitable for the expansive life and entertainments that a maturing fortune allowed. Role models included John D. Rockefeller and his Cleveland estate, Forest Hill, and the Cyrus McCormicks and their country home, Walden, in Lake Forest, Illinois. Mather, aided by his wife, Elizabeth Ireland, guided the ongoing design and refinement of Gwinn with the firm, gentlemanly deportment that characterized his business dealings and philanthropic endeavors.

Karson relates the story of Gwinn using the extensive correspondence between Mather and the designers (none were based in Cleveland), the many extant historic plant lists and photographs, and the extensive coverage Gwinn received in architectural and garden design publications in the second and third decades of this century. The subtle tensions between the formal and naturalistic elements at Gwinn added greatly to the quality of its design. In her introductory essay, Karson reveals the artificial nature of the intense polemic that pitted formal against informal and permeated the writing about architecture and garden design of that period. Current renderings of garden history can also be faulted for relying too strictly on this dichotomy (a legacy of art historical determinism) to categorize designs. In detailing its historic roots, Karson notes that the argument gained momentum in the late nineteenth century when the work and ideas of Frederick Law Olmsted, who extolled the cultural and environmental superiority of the pastoral landscape, were pitted against the theories of beaux-arts trained designers who were committed to a deliberate symmetry that tightly controlled the house and garden spaces. The Olmsted legacy was championed well into the twentieth century by Manning, Jens Jensen, Wilhelm Miller, and, most visibly, by the writings of Mariana Van Rensselaer and J. Horace McFarland. The formalist camp was filled with architects: McKim, Mead and White, William Welles Bosworth (the architect of the M.I.T campus), Charles Platt. One of the most influential among the latter was Guy Lowell, the architect and son-in-law of Charles Sprague Sargent. Lowell's book, *American Gardens* (1902), traced the history of the formal garden and highlighted such showplaces as the Platt-designed Faulkner Farm in Brookline, Massachusetts. Gwinn was clearly admired for its blend of the two approaches by designers who chose not to take sides.

Karson then gives brief biographical studies of the three designers. Here she draws on a recent confluence of biographical work already completed by other scholars, confining her descriptions to facts relevant to their work at Gwinn. Charles Platt, whose career has been documented by Keith Morgan in Charles A. *Platt: the Artist as Architect,* 1985, is described through his country house work. Ellen Shipman, whose work is soon to be available in a forthcoming book by Judith Tankard *(The Gardens of Ellen Biddle Shipman),* is given credit for her extensive residential work both in concert with architects and as an independent designer. Warren Manning produced a significant body of work that spanned two generations of landscape architectural practice. He is the the only figure in this group still lacking a full biographical treatment.*

From his early association with the office of Frederick Law Olmsted to his estate design work in New England and the Midwest and on to his innovative work in environmental planning, which predated Ian McHarg's design-with-nature methodology by some sixty years, Manning was a important figure who connected the worlds of ornamental horticulture, planting design, and town planning. Like Olmsted's, the Manning office operated an apprentice program that nurtured the careers of many young landscape architects. Some, like Fletcher Steele and Dan Kiley, would go on to form the core of a modernist approach to landscape design.

The Gwinn complex centered on the house designed by Charles Platt in the Italian villa format he adapted so well for American clients. He tied the house to the dramatic site by a series of terraces and stairs and by a long curving seawall. Platt was also responsible for the structure of the formal garden, for its geometric relationships, its ornaments, and its controlled views. Manning, who was brought into the process early to consult on site selection and later returned to consult on planting design, became, in fact, a full partner. He and Platt agreed on the selection of the site, a sheltered cove with a spectacular view of Lake Erie. Manning evaluated the existing vegetation, a not very promising community of elm, beech, and maples on poor clay soil. He worked with Platt on the planting of the formal garden. Through what Karson calls "dialogues," Manning and Platt proved that planting design is not incidental to architecture but integral to forming the character of a garden. The correspondence to the client from Platt, the refined New York-based architect with European training ("Platt is all taste"), and from Manning, the nurseryman's son from Reading, Massachusetts, who trained through apprenticeship, is very revealing of their backgrounds and training. Mather's responses in mediating a solution between two slightly diverging views is a lesson for all clients of large projects. Karson suggests that the creative tension between the two designers resulted in some of the most refined parts of the landscape, especially in the transition zones between formal and natural—in the main drive with its double row of American elms underplanted with a

* For the best treatment of Manning's life and work, see Lance Neckar, "Developing Landscape Architecture for the Twentieth Century: The Career of Warren Manning," *Landscape Journal* 8 (Fall 1989): 78–91.

continuous mass of *Viburnum dentatum* and in the lilac arch that created a boundary between the formal garden and the lawn.

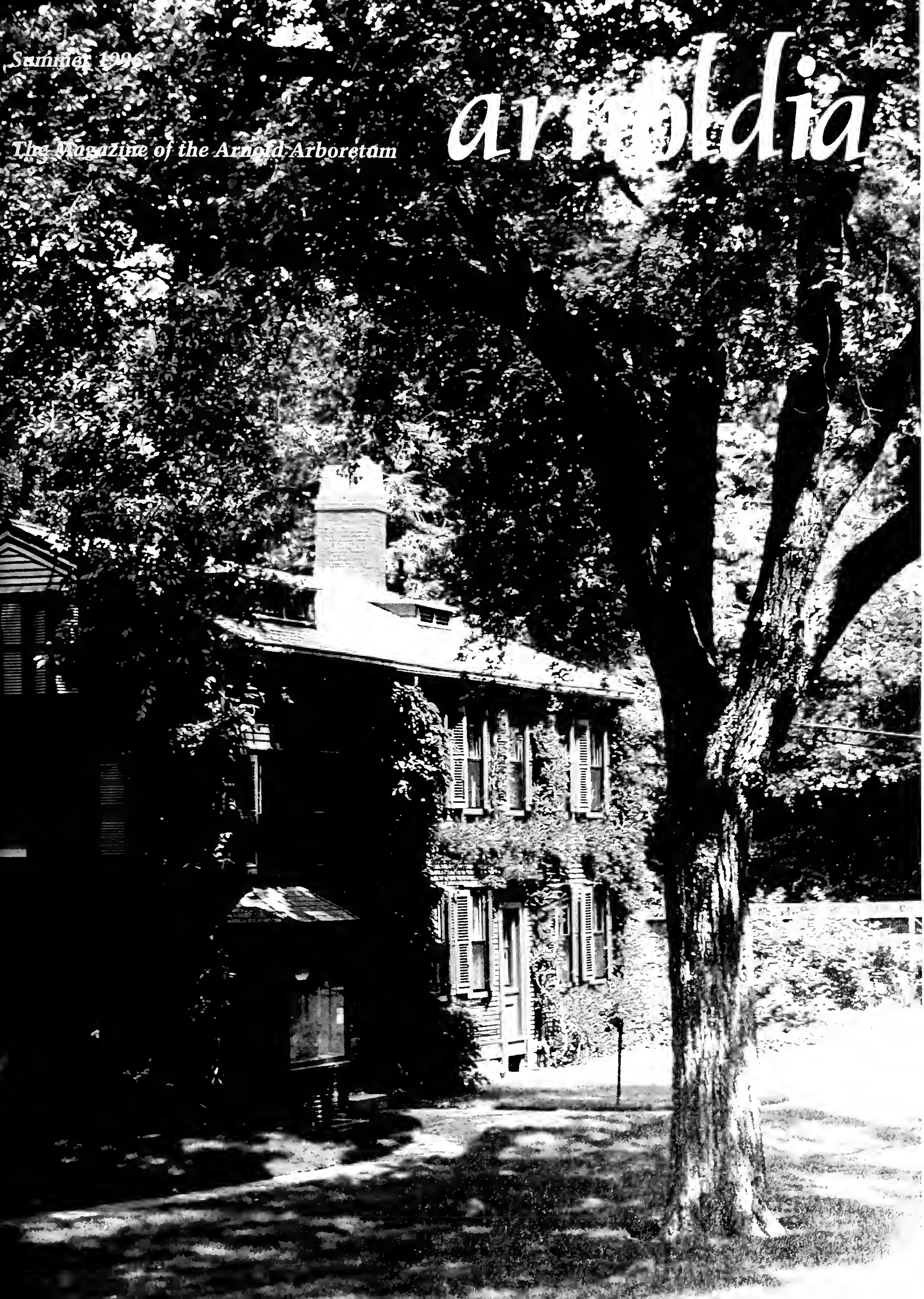
Manning's great contribution to Gwinn were the wild gardens, the first a small bosque adjacent to the formal garden and the second created out of twenty-one additional acres across Lake Shore Boulevard purchased by Mather in 1912 with a view to developing it as "a species of wild garden." The irony, of course, is that the wild gardens were not wild at all, but plantings carefully manipulated by Manning, whose knowledge of plant communities can be dated to his youthful botanizing and to his work on the *Flora of Middlesex County* (1888). The dense plantings, replaced and realigned over the years, featured masses of rhododendrons, wildflowers, and ferns. Mather used his Great Lakes steamers to transport crates and crates of wildflowers from the upper peninsula of Michigan to Cleveland (iron ore and violets as Karson puts it).

Ellen Shipman was brought in as a planting consultant for the formal garden in 1914 and again in the 1930s and 1940s. She produced her characteristic lush and dramatic planting plans, captured here in period photographs. Like much of Shipman's work with herbaceous plants (which are so vulnerable to change), her plantings at Gwinn are no longer extant. However, her extensive plant lists and nursery orders are in the Gwinn archive, making restoration possible. To Karson's great credit she not only documents the work of the designers but that of the gardeners as well. Gwinn's first superintendent, George Jacques, born and trained in England, played an important part in the gardenmaking process. When Jacques died in 1923, Lillie Jacques, George's daughter, was hired on Mannings' recommendation and became the only woman garden superintendent in the world and the only female member of the American Gardeners' Association. She continued her work on the estate until the mid-1930s.

As someone who grew up in Cleveland (albeit on the banks of the Cuyahoga River rather than the shores of Lake Erie), I have a distinct picture of Gwinn in my mind's eye despite never having been there. The famous fountain terrace was photographed so often by the local press as the site of social and cultural events that Clevelanders came to identify the term "garden party" with Gwinn. Mather died at Gwinn in 1951 at the age of ninety-three. His widow, Elizabeth, died in 1957. Before her death she made arrangements for Gwinn to become a small conference center for nonprofit activities. Hence Gwinn made the transition from private to semipublic use almost forty years ago. The integrity of the garden has been preserved although some of the more labor intensive parts are no longer in their original form. Karson began this work as a case study to guide the present staff through their preservation activities. As a case study the book is a great success, but it is more than this: because of the vividness with which the story is told, Karson renders Gwinn as a living entity—not just another icon in the history of American gardenmaking.

Phyllis Andersen is Landscape Historian at the Arnold Arboretum.

The Cottonwood Vista (Populus monilifera) *in the "wild garden" at Gwinn, on Lake Erie near Cleveland, ca. 1930. Photograph courtesy of Gwinn Archives.*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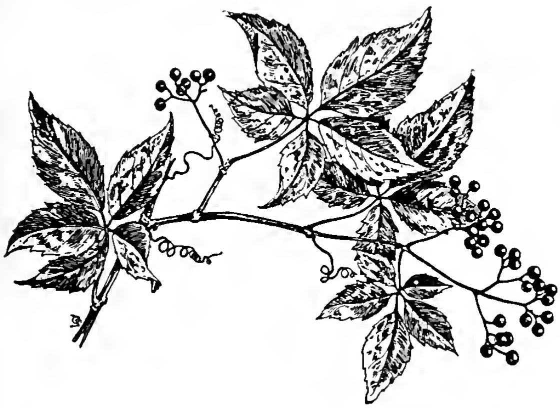

Page

Front cover: The tranquil, vine-covered face of Fairsted, Frederick Law Olmsted's Brookline home and office from 1883 to his retirement in 1895, is shaded today by the same American elm as when he purchased the property. Photograph by John Furlong.

Inside front cover: The papery, rosy-red seed capsules of *Koelreuteria paniculata* 'Rose Lantern' are produced in great numbers in the tree's large infructescences. These three-parted capsules develop quickly once flowering has come to an end toward the middle of September. Photograph by Peter Del Tredici.

Inside back cover: This recent photograph looking out the circular drive to Fairsted's entry arch captures some of the diversity, lushness, even mystery of plants as Olmsted used them. Photograph by John Furlong.

Back cover: The mixture of vines—*Wisteria*, *Parthenocissus*, and, possibly, *Hedera helix*, have completely enveloped the southeastern side of Fairsted, with only the shutters avoiding obliteration. Photograph by Theodora Kimball, c. 1904. Courtesy of the National Park Service, Frederick Law Olmsted National Historic Site.

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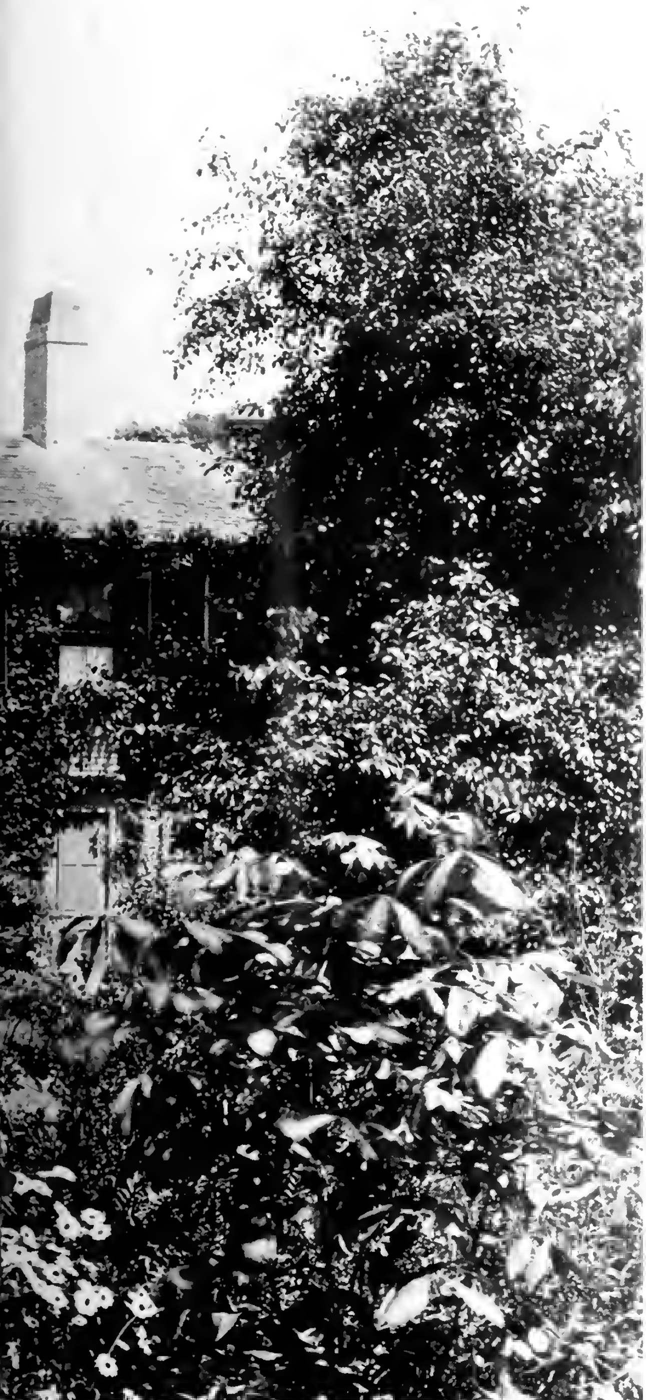
Fairsted
A Landscape as Olmsted's Looking Glass

Mac Griswold



Fairsted, in Brookline, Massachusetts, was Frederick Law Olmsted's home and office from the peak of his career in 1883 to his retirement in 1895. Olmsted is often called "the father of American landscape architecture," and Fairsted is the place where, for the first time, he was able to create a permanent family residence and office for himself in surroundings he found ideal: an old farmhouse in a small rural (or rural-seeming) community. The grounds he laid out were divided between office and home use, with business on the north and east, and residential to the south and west.

As an example of a residential office in the profession of landscape architecture, Fairsted stands alone, a unique survivor. Olmsted Brothers, the successor firm, headed by Olmsted's two sons, was the largest and most important one in the nation for the first half of the twentieth century. Consequently, even the minor changes that were made in the office side of the landscape shed light on stylistic changes within the firm throughout its most important years (1900–1939), as well as changes in the status of the profession.

On the other hand, because much of the residential landscape has been altered only by growth and neglect, Fairsted still reveals much of Olmsted's character and lyrical talent in its design and plantings. Fairsted is also deeply

Light and air—among Olmsted's chief requirements for healthy, happy homes—were abundant at Fairsted. Shutters and vines insulate effectively against summer heat while awnings protect the conservatory and side door. To the left is the domestic end of the house, with a laundry yard screened by shrubs. The 1904 photograph's lush but low foreground plantings actually screen a stone wall that separates the Olmsted lawn from the neighbor's bucolic pasture.

interesting because it embodies many of his most cherished residential landscape ideas.

Olmsted always held that the contemplation of quiet pastoral scenery—a passive, non-authoritarian, and beautiful presence—was therapeutic. It encouraged people to become civilized, to develop that "combination of qualities which fit [a man] to serve others and to be served by others in the most intimate, complete and extend[ed] degree imaginable."[1] Even the most modest home landscape could induce "a quiescent and cheerfully musing state of mind" where "the eye is not drawn to dwell upon, nor the mind to be occupied with, details."[2] Fairsted's modest but considered "rurality" (Olmsted's word for abundant nature held serenely and productively in check by man) conveys this mid-nineteenth-century suburban ideal.

By the time Olmsted moved permanently to Brookline in 1881 (where at first the family rented a house), he was both a wide-ranging intellectual and a truly effective activist. His urban parks, the works for which he is best known, gave reality to what has been called a utilitarian transcendentalism. They were to be restorative, both for the individual and the crowd, especially through the power of "unconscious recreation."[3] He also intended them to be democratic, bringing different classes together harmoniously. This concept, which resonates with Emersonian thought, was set apart by Olmsted as the highest value scenery could afford. His suburban planning, though intended only for an upper middle-class elite, was also intended to offer restorative powers but in a residential setting.

Finding Brookline

Olmsted had moved to Brookline because he found work in the Boston area which interested him, and he had a wide circle of congenial friends and colleagues there. Chief among them was the architect Henry Hobson Richardson. Richardson, who lived in Brookline himself, urged Olmsted to settle there when he began his large-scale work on the Arnold Arboretum, the first portion of Boston's park system, which he designed in the late 1870s. The deciding factor for Olmsted was the rural yet progressive atmosphere that he found so civilized, an atmosphere fostered by the same intellectual ideas he had found compelling as a young man. It seemed very different from the corrupt and money-grubbing New York City Olmsted was leaving with relief; a city which, as he saw it, was incapable of wholehearted civic effort.

The Brookline that Olmsted observed was a template for the suburbs he wished to create. The town had transformed itself from conservative agricultural village to liberal suburb without losing its character or intimacy.[4] For him, it stood as proof positive that well-planned suburban communities *could* accommodate change and stress, *could* benefit the cities of which they were a vital part. If the great nineteenth-century moral and social question of how to reconcile idealism and materialism, family and community, rural and urban values, could thus be answered in Brookline, why could it not be answered in every planned community in America?

Brookline's transformation had been speeded by the mass arrival of Boston's rich merchants as summer residents beginning in the 1820s—an odd variation on Brookline's settlement history as a summer pasture for livestock! Over the next fifty years, many of these summer residences became elaborate gentlemen's farms, supported by their owners' large city incomes. By comparison, life at Fairsted was modest and some of its immediate surroundings were redolent of an older, simpler order. At the nearby corner of Walnut and Warren Streets, a triangular green marked the earliest center of the town, which once held a schoolhouse (1713), Congregational meetinghouse (1715), and cemetery (1717). But the population center shifted when Brookline Avenue opened in 1821, and by the 1880s the Walnut and Warren neighborhood was largely residential—only the green, and a new, fashionable Unitarian church on the site, remained to mark the spot's older civic history.

Olmsted bought a "farmstead" of two acres: like many Brookline "farms," it produced only orchard fruit, firewood, and a little summer grass for cattle. Nineteenth-century atlases show the hundred-and-more acre properties of Boston Brahmin families cheek by jowl with residences the size of Fairsted or smaller.[5]

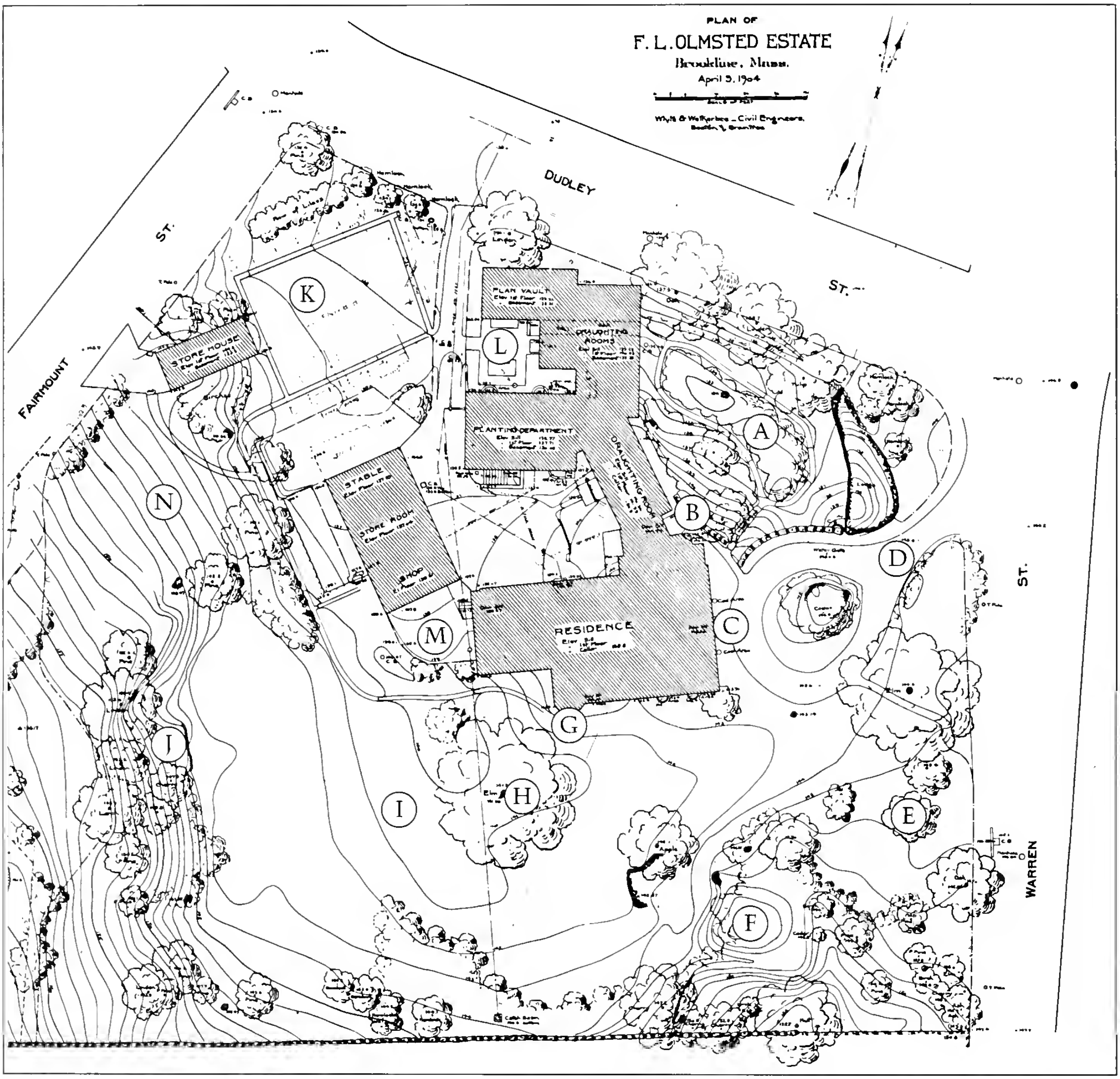
Unflattering family pictures can shed light on family dynamics. Here, Mary Perkins Olmsted, in checks, dominates a July 1885 gathering at Fairsted. Frederick Law Olmsted, Sr., looks attentively out from behind her. At left stands John Charles, Mary's oldest child and Olmsted's partner and righthand man, caught in a blink that unwittingly illustrates his retiring character. Marion, the spinster daughter who never left home, is at far right, while two unidentified women complete the group. Missing is Frederick Law Olmsted, Jr., then fifteen years old and known as "Rick."

Though many were tenant houses belonging to the larger neighbors, such a wide range of adjoining property sizes also reflected a hierarchy of income that must have seemed attractively democratic to Olmsted.

The Olmsted Family

Olmsted arrived with his wife of twenty-four years, the tiny, doughty, acid-tongued, competent Mary, who would live to be ninety-one, and with three of their seven children. John Charles, aged thirty-one, and Marion, aged twenty-two, were both Olmsted's stepchildren; Frederick, thirteen years old, was Olmsted's only biological son and the apple of his father's eye. Marion would live at home all her life, a victim of Victorian spinsterhood and her own nervous temperament.[6] Frederick would become his father's most trusted colleague and confidant in the years just before Olmsted's retirement in 1895, when failing mental abilities hastened Olmsted's retirement. Frederick would inherit Fairsted on his mother's death in 1921.

John Charles was already the firm's office manager and a partner (1884) in the earliest Fairsted years. In photographs he is short, delicate-featured, bespectacled, serious, and reticent-seeming to the point of remoteness. Because Olmsted Sr. traveled on business so extensively during the 1880s, it is John Charles who is credited with actually transforming the threadbare sketch of a farm into a place that looked like an illustration from the most influential treatise on picturesque home landscape in the nineteenth century, A. J. Downing's *Theory and Practice of Landscape Gardening.*[7] How-



The 1904 survey by White & Wetherbee, Civil Engineers, accurately indicates the final footprint of both home and office, as well as the location of the different landscape features.

A. Hollow
B. East office entrance
C. Front door
D. Entrance arch & circular drive
E. Cucumber magnolia
F. Rock garden
G. Conservatory
H. American elm
I. South lawn
J. West slope
K. Garden; after 1926, parking lot
L. Office courtyard
M. Laundry yard
N. 1880s cutting garden & coldframes

ever, because John Charles lived at home there are few written records about the making of Fairsted's landscape, as he and his stepfather quite naturally talked it over instead.

From what Olmsted wrote about the physical and emotional benefits of well-designed landscapes, both public and private, and from the lists of outdoor practices that nineteenth-century women's household management and gardening books prescribe, one can begin to reconstruct how this family and their servants used their tiny green haven. We can assume that residential Fairsted was intended for quiet pastimes, not sports, and for the kinds of outdoor household work and garden production common at the time.

We can also assume that the south and west, or residential, sides were used mostly by the women of the family, since their lives were so much more homebound than those of Olmsted or his sons and employees. Sitting for contemplation or for reading aloud to children, walking for health, light gardening, with a male gardener to help with the heavy tasks, painting to elevate the mind, all were some of the outdoor activities recommended for women by educator Catherine Beecher and garden writer Jane Loudon. (The works of both women were widely circulated, both in serial and in book form.)[8]

Where would such activities have taken place? Although no actual description exists, there are some clues in planting as well as design. A friendly, flow-

By 1885, when the sixty-year-old Olmsted stood in the wintery landscape of Fairsted, he had completed projects such as Central Park and Riverside in Chicago that became national models. In his remaining years in Brookline his office would carry out hundreds of projects, among which the most influential were the Boston park system (begun 1878), Stanford University campus (1886–1891), and the World's Columbian Exhibition (1888–1893).

His nephew, stepson, and partner, John Charles Olmsted, photographed him in the Hollow, Fairsted's sunken garden, against a rugged outcrop of Brookline's characteristic sedimentary rock, Roxbury puddingstone. The ledge defines the shape of the little garden as well as the local context.

John Charles' 1900 winter view from the second story of the house surveys Fairsted's entrance gate and drive turnaround. Wild-looking plantings, which screen out Warren Street and yet harmonize with the natural growth on the rocky ridge beyond, carry out Olmsted's residential ideal: to offer both domestic privacy and unity with the larger landscape and the community.

ery little area lay just around the corner to the west of the conservatory on the south front. It was tucked into the sunny angle between the laundry yard lattice fence and the path that led to the production area of Fairsted: the original flower garden and cold frames (west of the barn and parallel to it), and the vegetable garden. (The locations of both the flower garden and the vegetable garden were changed at least once; they eventually were merged together in the enclosure which in 1926 became the firm's parking lot.) This little area, close to but not part of the service end of the house, was planted with shrubs such as deutzia, weigela, rose of sharon, lilac—all familiar creatures of the New England dooryard garden, the traditional domain of women. These plants, with the exception of lilac, are not seen elsewhere at Fairsted in the early years.

This end of the lawn, bright, protected from the wind by the bulk of the house and from intrusion by its distance from the street, would have had a particularly domestic and private atmosphere. It combined the old-fashioned floweriness so often associated with women with proximity to the household end of the building. The conservatory, which is located towards the west end of the house and whose large glass panes command a view of almost the entire south landscape, would have been the closest position for overseeing the kitchen areas and the working gardens to the west—the household "engine," and traditionally the "business side" of the house for women. Similarly, the presence of a door to the drafting rooms and the use of the house front door to enter the partners' office might be said to mark the east entrance front as the "men's side."

Together with the continuous stretch of lawn which curled around the south front and gave onto the entrance drive circle, the rock garden was the landscape attraction that linked the south and east exposures. Where the lawn is expansive, a place to walk companionably or to pull out chairs to sit in the fresh air, the rock garden seems intended for more solitary purposes. Its paths are narrow for two abreast and were originally screened from the lawn by plantings, many of them evergreen. One can imagine this was a place for private, contemplative strolls, both for the family and members of the office staff. Here the eye could rest absentmindedly on an embroidery of groundcovers, and on the details of lichen- and moss-covered rock, patterns as abstract as thought itself.

The Office

Olmsted's first office improvement to the existing structures was very simple: in 1884, at the same time that other changes were made to his new dwelling, he added about ten feet to the north parlor of the farmhouse to accommodate a long drafting table. Later office enlargements slowly extended the north end of the house even farther toward Dudley Street, in workmanlike angular increments that fit in nicely with an old barn that had been joined to the rear of the house sometime in the eighties. By 1904 the final footprint was complete.

For more than fifteen years (until Harvard founded the first formal training program in 1900), the home office at Fairsted was effectively the only school of landscape design in America, providing practical experience in design and execution, urban planning, and horticulture. Every landscape vignette at Fairsted can be seen as a miniature version of some larger idea of Olmsted's: for instance, the rock garden is reminiscent of Central Park's Ramble. It would be difficult to trace exactly how these surroundings influenced the work of firm members, but all of them doubtless absorbed something of Fairsted's essence, whether they stayed with the firm or set up independent practice. Echoes of Fairsted's quiet, shaggy, green imagery resonate in many of their works. Warren Manning's quarry garden at Stan Hywet, in Akron, Ohio, and Percival Gallagher's ravine garden at what is now the Indianapolis Museum of Fine Art both seem like variations on the Hollow, the signature sunken wild garden at the Fairsted front entrance turnaround. Besides enjoying the best design apprenticeship, young staff members also found themselves in one of the horticultural and botanical centers of the nation. Less than five minutes' walk up Warren Street lay Holm Lea, Charles Sprague Sargent's estate filled with botanical introductions from afar. The Arnold Arboretum, directed by Sargent, was located in neighboring Jamaica Plain, and not much farther away were the Cambridge Botanic Garden of Harvard University, Mount Auburn Cemetery, and the Boston Public Garden, all rich with horticultural collections. Reports of what was in bloom on a single day at any one of these places sometimes ran to fifty plants.[9]

Olmsted's Ideals Embodied at Fairsted

Olmsted's career was fueled by an optimism about human progress, but a guarded optimism. He looked to what were then progressive ideas:

fresh air, sanitation, new transportation methods, and contact with what he called "Nature," to preserve or restore the values of an older, vanishing society in a larger, more urban, more complex world. He looked back in time to the small town, in memory a golden Hartford, Connecticut, where he had grown up in the first half of the nineteenth century, in what was then the new republic, before the Civil War and the turmoil that accompanied industrialization. The "communitiveness," as he called it, of that tight-webbed life of shared values and efforts, which at the same time respected the individual, was his ideal.[10] For him, social engineering to create on a larger scale that healthy, thoughtful, neighborly state of mind began with the wise design of public space, which in turn was rooted in the design of the home and its surroundings. Air, light, orderliness, beauty, and easy access to the outdoors were all part of his program for domestic life.

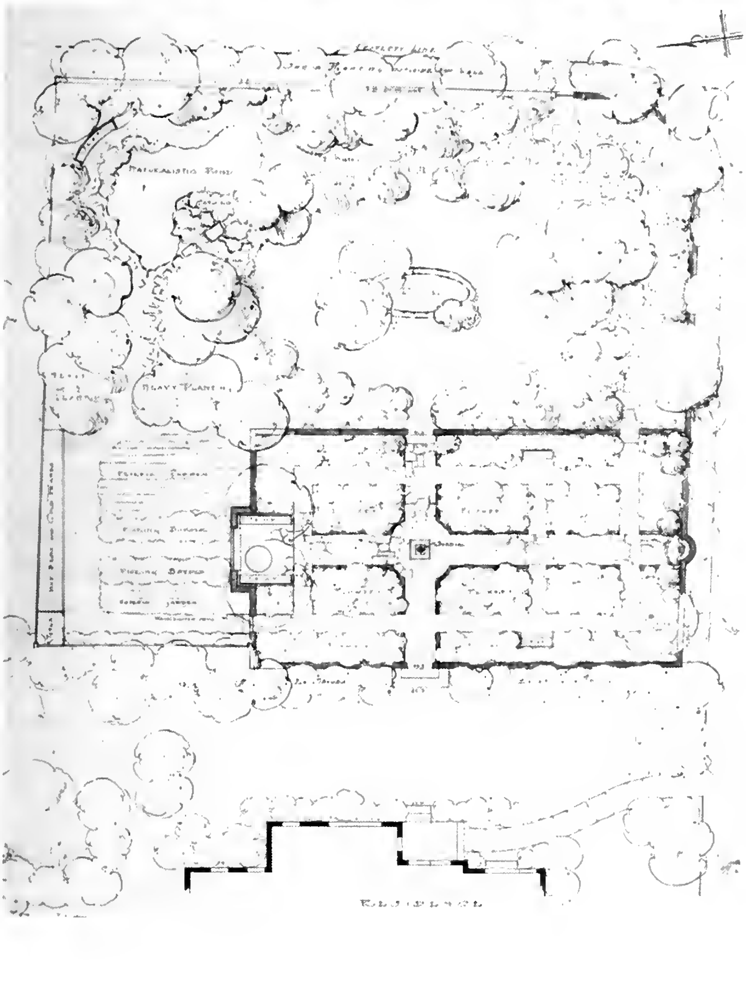
Olmsted's often-repeated desire to blend residential design into the larger surrounding while still preserving privacy emerges at Fairsted. It was to be a part of the town in its apparent openness, but also a family retreat. Two design elements ensured that this double purpose was served. The choice of a spruce pole fence to encircle the property was one such element. Sinuous, malleable, cut to fit over every root and rock it traversed, and made of the rustic, natural materials Olmsted preferred, the fence is airy, a screen rather than a wall, because the poles don't fit together tightly. The front entrance creates the impression of openness while actually preventing the passerby from seeing in. The arching driveway gate piled with vines is welcoming, but the little turnaround mound directly within, topped with a tree whose root crevices still sprout jack-in-the-pulpits in spring, hides the front door almost until the visitor arrives.

Interpreting Design

The design of residential landscape changed dramatically between the time that Olmsted created the Fairsted landscape—the 1880s—and the period to which it is now being restored—the late 1920s. The shift can be measured by comparing Fairsted with the landscapes made during the teens and twenties by the firm, as well as by other contemporary practitioners, such as Charles Platt, Albert Davis Taylor, or Ellen Shipman. In those fifty years, the American economic climate changed enormously, and with it the taste of the firm's residential clientele, who were the rich and influential, many of them newly rich. They traveled frequently to Europe, and they read magazines such as *House & Garden* (first published in 1901) and *House Beautiful* (1896), whose only subject was the life they could enjoy with their wealth. Photographs in these mass magazines promoted the use of historical architectural detail and gave to designed space a visual meaning that had never before been available to laymen unable to read a plan. A new professional class, landscape architects, stood ready to create such space. From the late 1890s up to the 1929 crash, lavish architectonic formality seemed imperative and there was money, talent, and labor available to achieve it. Even in Brookline, where the hilly topography of ledges and bogs is better suited to naturalistic treatments like that at Fairsted, great formal gardens were carved out, such as Charles Platt's designs for Mr. and Mrs. Charles F. Sprague's Faulkner Farm (1897) and Mr. and Mrs. Larz Anderson's Weld (1901).[11]

Fairsted had almost none of the garden features that from the turn of the century onward became standard in the designs of the Olmsted firm for this new clientele, on small properties as well as large. At Fairsted there was neither rose garden nor herb garden; neither Japanese garden, nor water garden. No extensive supporting facilities existed, such as a greenhouse or a hot bed. There was a vegetable garden, a cut flower garden, and at various times in different locations cuttings were grown on, plants heeled in, and bulbs and annuals tested. But a visitor did not find a walled court, a collection of boxwoods, an *allée,* or a formal vista. Garden seats, Chinese ornaments, stone or turf terraces with flights of steps and balustrades, mossy statues, clipped hedges—none. There was no summer house or pergola or shingled child's playhouse, no sundial, nor any trace of historically accurate—or even inaccurate—"period style"—no Colonial Revival, French, or English architectural details. There was no tall stone wall, no wrought-iron entrance gate with urn-topped posts, no landscape program that progressed from symmetry near the house to pastoral informality at the edges of the property.[12]

The difference between Olmsted Sr.'s work and the later work of the firm is not just a change in taste; it reflects differing ideas as to how best to achieve social and political ends through landscape architecture. Olmsted Sr., whose landscape philosophy was progressive and socialist, had always been reluctant to undertake private residential work for the very rich.



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Above, Mrs. Henry V. Greenough's formal garden, an Ellen Shipman project of 1926, exemplifies the trend towards compartmented design on smaller properties in Brookline and other suburbs. Brick walls, a controlling axis that ties the garden to the house, sculptural ornament, and richly planted perennial beds are typical of Shipman's work. Such features can also be found in many private gardens laid out nationwide by Olmsted Brothers in that same decade.

Below, the landscape plan, unlike Fairsted's, would not be a surprise today. The walled garden has a well-equipped vegetable-and-cutting garden tucked compactly behind it; steps lead down to a pool whose oval shape is echoed by the lawn. A winding path invisible from lawn or house circles the tree-screened property. Two pocket gardens fill the lot corners: a bank of naturalistic plantings and a wild pond. It's a brilliant solution for the owner of a small suburban property who wants it all: privacy, formal and natural beauty, changes in level, the use of water, and home produce. Compactness, symmetry, formality, and an absence of connection with the landscape beyond are what chiefly differentiate it from a home landscape of Fairsted's date.[13]

He did so ambivalently, and generally only when some aspect of it served a purpose beyond the client's personal satisfaction. For instance, he embarked on George Vanderbilt's Biltmore, in North Carolina, because he felt an arboretum and privately managed forest would exemplify national goals for conservation and arboriculture. While the Olmsted brothers certainly did not neglect the public sphere, they clearly felt no such ambivalence about expensive private display designed for its own sake, if one is to judge from the large body of elaborate estate work they executed.

At Fairsted, among the most striking original features (all of which still survive) are a great elm standing in an irregular pool of lawn, and the "borrowed scenery," a view over the meadow and groves of the adjoining property. But most significant of the original survivors is "the Hollow," a rugged little garden that lies next to and below the house entrance, a deep dimple in an outcropping of Roxbury puddingstone. Any "improver" except Frederick Law Olmsted would have filled it in when grading the grounds. He kept it—the kind of geological reminder of place that appears everywhere in his work.

If the Hollow stands as an emblem of Olmsted's respect for wild nature, then the continuity of the 1.74-acre landscape, which flows without breaks like a Japanese screen painting, illustrates how he viewed the relationship between interior and exterior—or between man and his manmade surrounding. The sense of unbroken flow persists even as one walks slowly through the former living quarters of the house, where the rock garden, lawn, borrowed pasture view, and shrub bank melt into one another through the old wavy window panes. It is Olmsted's ideal landscape, tamed and in miniature: a continuous whole, an ideal he expressed again and again in writing about both natural and designed landscape. Describing Yosemite in 1864 he said ". . . not in one feature or another, not in one part or one scene or another, not any landscape that can be framed by itself, but all around and wherever the visitor goes, constitutes the Yo Semite the greatest glory of nature."[14]

The landscape at Fairsted is indeed "all around," unlike the firm's later, more architectonic projects. When the Beaux-Arts concept of extending the axes and lines of the house outdoors took hold shortly after the turn of the century, compartment, or "room," gardening was the consequence. Each indoor room has its outdoor counterpart. This sequenced architectural feeling (one that still usefully rules in the small spaces of today) is very different from that of Fairsted's integrated, organic design.

Interpreting the Plantings

Fairsted's original plantings, so different from those found in large estate gardens of the early twentieth century, shaped the design as much as did the requirements of use, or any idea of ideal landscape form. By the twenties, hybridizers were producing compact forms of shrubs and dwarf or fastigiate forms of trees to suit smaller properties. By contrast, Fairsted's shrub plantings were species, or older cultivars, with wide-sprawling branches. Just a look at Fairsted's roses is telling. There is not a tea rose to be found. Instead there are big hardy shrub roses: American native *Rosa lucida* (now *R. virginiana*) with its clear yellow fall foliage; beautiful but dangerously invasive *Rosa multiflora*, with its staggering fragrance and huge bouquets of translucent single white flowers; *Rosa spinosissima*, the old "Scotch Briar," with its creamy flowers and ferny foliage. Native American shrubs—such as staghorn sumac *(Rhus typhina)*, inkberry *(Ilex glabra)*, and summersweet *(Clethra alnifolia)*—show up on the plan of 1904. Both these plants and the species roses were used by Olmsted in the Boston parks, perhaps indicating their presence at Fairsted in the 1880s as well. Generally, the landscape depended on contrasting plant forms and foliage textures for its effect, rather than on blossom.

In its use of large species forms and American natives for even the smallest suburban landscape, Olmsted's original planting aesthetic was indeed different from that of the 1920s. It had been equally distinct from that of his contemporaries. His taste as a young man had been formed at the same time that a taste for the picturesque in a domestic setting finally became popular in America, fifty years or so after its vogue in England. But Olmsted's version of the picturesque at Fairsted was even wilder, less


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In summer, perhaps as early as the twenties and certainly by 1935, the date of this photograph, a chair and table had appeared in the shade of the Hollow. The narrow foreground path circles a central bed and the ledge of Roxbury puddingstone looms beyond. The reconstruction of the wooden entrance arch can be seen at the upper left.

manicured than the American norm of its time. Vines grew everywhere. Photographs taken at the turn of the century show house walls and fences dripping with climbers, many of them fast growers to thirty feet or so: Dutchman's pipe *(Aristolochia macrophylla,* formerly *A. durior),* Japanese winter-creeper *(Euonymus fortunei* var. *radicans),* bower actinidia *(Actinidia arguta),* the American shrubby bittersweet *(Celastrus scandens),* Virginia creeper *(Parthenocissus quinquefolia),* and Boston ivy (*P. tricuspidata,* formerly *Ampelopsis tricuspidata*), wisteria (probably *Wisteria sinensis*), and English ivy *(Hedera helix).*

What such a display of almost tropical intensity meant to Olmsted is expressed in an 1863 letter to Ignaz Pilat, the Austrian horticulturist of Central Park. Writing from Panama, Olmsted describes the "jungled variety and density and intricate abundance" of the isthmus, saying it "excited a wholly different emotion from that produced by any of our temperate-zone scenery . . . excited it instantly, instinctively and directly. If my retrospective analysis of this emotion is correct, it rests upon a sense of the superabundant creative power, infinite resource, and liberality of Nature—the childish playfulness and profuse careless utterance of Nature."[15] How to duplicate this in the Ramble in Central Park, Olmsted asks himself. He cites the Virginia creeper, so much in evidence at Fairsted, as perhaps the best temperate-zone

Overleaf: Plan #33, the 1920s reworking of the Hollow, refreshed the green framework and groundcovers and saw the judicious removal of shrubs that had outgrown their original locations. The small garden was groomed as a display garden and, besides the plants listed here, quantities of other corms and bulbs were added for a continuous succession of bloom from early April through August.

OLMSTED BROTHERS
(F. L. Olmsted Estate)
Brookline, Massachusetts

PLANTING FOR "HOLLOW"
TO ACCOMPANY PLAN NO. 33
File No. 673

Olmsted Brothers — Brookline, Mass.
Landscape Architects — October 5th, 1923.

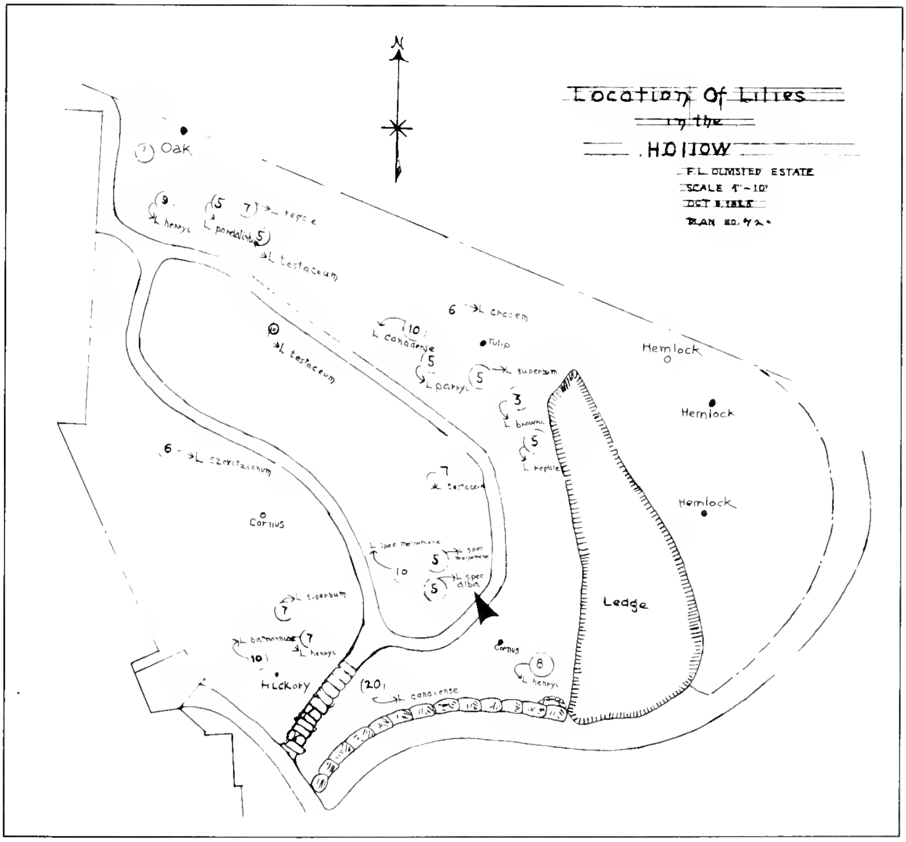
1. Cotoneaster horizontalis, 14 plants
2. Juniperus communis, 6 plants
3. Hosta sieboldiana, 2' apart, 30 plants
4. Taxus cuspidata, 10 plants
5. Taxus cuspidata capitata, 7 plants
6. Taxus repandens, 4' apart, 36 plants
7. Pachysandra terminalis, 9" apart, 1859 plants
8. Taxus repandens, small size, 25 plants
9. Epimedium macranthum, 9" apart, 756 plants (or other kinds)
10. Juniperus japonica, 11 plants (not used)
11. Juniperus chinensis pfitzeriana, 5 plants
12. Taxus cuspidata nana, 9 plants
13. Phlox subulata ~~nelsoni~~ (alba), 9" apart, 105 plants
14. Phlox subulata Vivid, 9" apart, 125 plants
15. Phlox subulata G. F. Wilson, 9" apart, 70 plants
16. Saxifraga cordifolia, large-leaved variety, 30 plants
17. Dryopteris marginalis, 1' apart, 50 plants
18. Dennstedtia punctilobula, 1' apart, 125 plants
19. Salix tristis, 1 1/2' apart, 170 plants
20. Diervilla trifida, 2' apart, 45 plants
21. Euonymus radicans acutus, 1 1/2' apart, 75 plants
22. Iris Prince Victor, 1 1/2' apart, 5 plants
23. Iris Ingeborg, 1 1/2' apart, 10 plants
24. Taxus canadensis, 3' apart, 50 plants
25. Hosta lancifolia, 1 1/2' apart, 80 plants

The list also included another 38 varieties of iris, a total of 639 corms. For instant effect, they were closely planted: for example, Iris cristata *on 9-inch centers.*

A. Add a few rocks.
B. The existing gap to be filled in with shrubs from place, preferably rhodotypos.
C. All of the rhododendrons to be taken out of here and used somewhere along southerly boundary of grounds. (Next Mrs. Gardner's)
D. Practically all of the existing shrubs on this slope to be eliminated, and perhaps used elsewhere on the grounds. The box, a crataegus, probably a pyrus are to be left; decisions will have to be made at the time of carrying out the work.
E. The vines growing up from the base of this rock probably to be eliminated. This is to be considered on the ground again.
F. It is worth considering rebuilding these steps.
G. It is worth considering rebuilding this walk and the platform with more artistic-looking material.
H. Leave Crataegus pyracantha.

LILIES — Planted Fall 1924

Superbum — bright reddish orange, spotted.
Canadense - funnel shaped flowers; varying from yellow to orange; spotted inside.
Croceum - Bright orange flowers.
Henryi - flowers a rich deep orange-yellow. Fine foliage.
Regale - flowers, white, shaded pink; canary-yellow center.
Speciosum album - large pure white fragrant flowers.
Speciosum melpomene - pink spotted flowers; last 3 weeks or longer.
Testaceum - dull apricot, orange anthers.
Pardalinum Californicum - deep orange, maroon spotted; tips of petals, intense scarlet.
Parryi - flowers of soft yellow ; conspicuous brown anthers.
Batemanni - clear glowing apricot flowers-Brown
Browni - large trumpet: inside, pure white; outside shaded chocolate-brown.
Monadelphum Szovitzianum - pale citron-yellow to deep yellow.



NATIONAL PARK SERVICE, FREDERICK LAW OLMSTED NATIONAL HISTORIC SITE

Circles indicate only approximate locations, not areas occupied, and the numbers in circles indicate the number of bulbs planted.

A group of tall, pure white Lilium speciosum *'Album' (see arrow) greets the visitor descending the steps and is then silhouetted against the Hollow's steep south wall of greenery and stone when seen from the far end of the central path.*

substitute. Years later, visiting England in 1892, he wrote to John Charles that the best ornamental grounds he saw were those in which the vines and creepers were outwitting the gardener.

Fortunately, in refurbishing this landscape after the turn of the century, the firm largely followed Olmsted's example by using common hardy plants like Virginia creeper or English ivy, all in great quantity. They grew well, quickly providing nature's "childish playfulness and profuse careless utterance." Quantities sometimes ran very large indeed: a memo of August 6, 1924, specifies ninety (!) sheep laurel *(Kalmia latifolia),* one to one-and-one-half-foot-tall, for "planting about path in southeast corner of lawn." One wonders what thinning procedures were used; perhaps the nineteenth-century practice, "Plant thick and thin quick," which Olmsted Sr. used in his parks, was used here as well. Similarly, for ferns in the same corner, the hardiest, easiest-to-grow ferns are specified, such as hay-scented fern (*Dennstaedtia punctilobula,* formerly *Dicksonia punctilobula*), which is exceptionally drought-resistant.

Planting Changes after Olmsted Sr.

The only areas where planting schemes did change in the forty years between the 1880s and the 1920s were in the Hollow and the rear courtyard. Both of these areas, which are on the office side of the grounds, were planted more elaborately. The additions were predominantly notable for the bloom and seasonal appeal provided by bulbs and annuals, rather than for their year-round form.

The man with the most direct responsibility for the horticultural development of the grounds from 1910 through 1930 was Hans J. Koehler, who worked for the firm for forty years. Not a landscape architect, Koehler was a horticultural specialist who made most of the plans and plant lists for the Hollow and the rear courtyard. (Another longterm presence was Greenwood Kitt, the gardener, who worked on the place from about 1897 through 1922 and probably helped shape its horticultural character.) Koehler's great familiarity with garden plants introduced wider horticultural variety at Fairsted during the years of his employment. This change was also impelled by the firm's desire to have a showplace for clients, and its need to experiment with plants that could produce an unbroken sequence of bulb and perennial bloom in clients' gardens—a new concept of planting that became the rule at the turn of the century.

By 1930 the Hollow was still the "mass of shrubs and flowers" reached by "rough rock steps" that the budding landscape gardener Beatrix Jones (Farrand) described in 1894. But there had been changes in garden architecture, use, and planting. The alteration of the steps is a metaphor for the changes in general: at Koehler's suggestion, they were rebuilt in 1924 for an easier descent so that, although their location and rustic nature were retained, their roughhewn appearance was reduced by regularizing the height and variety of the risers. The increased ease of access, and the use of a table and chairs for staff members at lunchtime, domesticated the Hollow in a way not envisioned before: it became a garden room instead of a remnant of nature that one glanced into or walked through for spiritual refreshment. By 1930 as many as forty-one different iris cultivars, twenty-three kinds of tulips (species, single early, cottage, and Darwin types are all represented), and thirteen lilies had been indicated for the Hollow. No planting list exists from the 1880s, but it seems doubtful that Olmsted Sr. would have included so many cultivated varieties of bulbs in this wild-looking place, given his expressed preference for keeping flowers in the garden and out of the landscape. Given his taste for subtle, overall effects would he have planted pure white, one-and-a-half-meter-tall *Lilium speciosum* 'Album' in the center of this diminutive wild garden as was done in 1924? Would he have proposed, as Koehler did in a 1911 memorandum to F. L. Olmsted, Jr., that "the coarse blackberry vines and some other coarse things on slope to the west of the rhododendron group under the Cornus florida are to be eliminated"? Cut back, perhaps; eliminated, no. Olmsted Sr. himself had written to John Charles in 1884 while the original landscape was being created, that he didn't "object to the cutting away of certain bramble patches if brambles are to take their place. . . ."

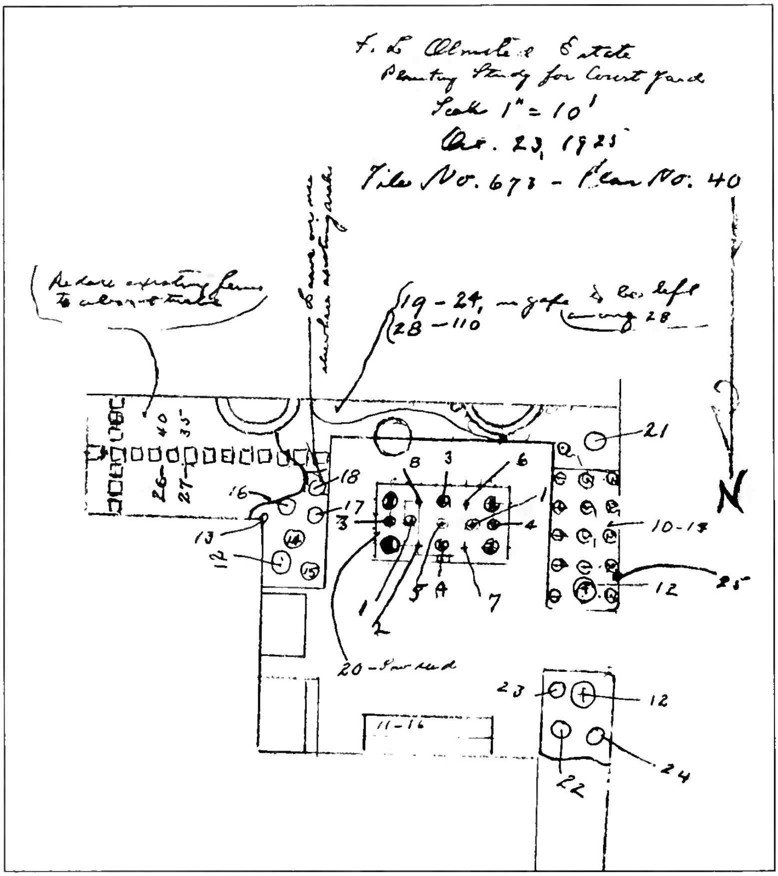
The reorganization of the employees' rear courtyard was even more radical in planting changes and design intent. Koehler did the final 1925 plan, but undoubtedly it was approved by Frederick Law Olmsted, Jr., then the firm's deciding voice on Fairsted matters. The yard was transformed from an unceremonious back areaway into a pleasant, modest entrance garden. Vines grew on the high walls of the new brick plan vault, and flowers bloomed in beds lining the sides of the courtyard and in a single bed set in a stone dust cement aggregate floor (presumably poured for practicality, before a garden was envisioned). Within the context of the firm's work, the new courtyard design and plantings were neither original nor beautiful. Nonetheless, they are interesting historically because they mirror changed attitudes towards the workplace and the profession of landscape architecture. Further, they demonstrate the emergence of certain design conventions, such as symmetry, not seen before at Fairsted.

These improvements to the courtyard certainly indicate a change in the status of the firm's employees. Their growing numbers and the recognition of landscape architecture as a respected profession endowed clerks and other support staff (both men and women by the 1920s) with enough importance to assure them of more than a naked "back door." Then too, the 1926 automobile parking lot on the site of the former vegetable garden brought more people through this rear entrance.


NATIONAL PARK SERVICE FREDERICK LAW OLMSTED NATIONAL HISTORIC SITE

What in the earliest years of the firm was an unceremonious back door used by the staff had become a cheerful though modest office garden by the late 1920s. The pyramidal yews at either side of the path mark not only an entrance but also the use of symmetry not seen before at Fairsted.

By comparison with the Hollow, such a landscape comes across as less sophisticated, less considered and permanent in its plantings; it had less to do with the natural site and more to do with human use. Unlike the Hollow, which was essentially the older "front entrance garden" to the same office space, the courtyard did not have a stone path and steps, nor a refined array of shrubs for year-round structure, nor a choice selection of small



NATIONAL PARK SERVICE, FREDERICK LAW OLMSTED NATIONAL HISTORIC SITE

Staff horticulturist Hans J. Koehler's planting study for the rear office courtyard makes the best of an unpromising space with an abundance of perennial border plants that are a hallmark of the firm's later style: iris, peonies, and a rambler rose, along with annuals such as sweet alyssum and tuberous begonias. In winter, yews and pachysandra make a sketchy evergreen framework.

bulbs and lilies. Instead, many of the courtyard plants were annual flowers, which provided the immediate appeal of summer color and fragrance for people hurrying in to work. Symmetry (more or less), tight pyramidal yews, the popular pink rose 'Dorothy Perkins' (introduced in 1902), and an edging of sweet alyssum marked it as a modest early twentieth-century suburban "cottage" garden whose planting aesthetic was very different from that of an earlier Fairsted.

John Charles Olmsted died in 1920, and the death of his mother followed in 1921. The house was rented in that same year, and Frederick Olmsted, Jr., moved to California with his family for most of the 1920s. Thus the early twenties became a turning point when the focus of Fairsted tipped away from the home and towards the needs of the firm. The emphasis turned now to the design elements that could illustrate possibilities for visiting clients. In the previous forty years, between 1883 and the early twenties, the Olmsted family's need for a soothing and private landscape had been equally important; it had served as a multiple-use, domestic fabric whose spatial patterns shaped and were shaped by daily life.

The National Park Service Restoration

The present restoration will return the design to its composition in the late 1920s. Those were the years when the firm's business was at its height but before the mechanical lawnmower had erased many of the subtle curves where greensward meets shrub border. Nor had the growth of seedling invaders and the death of many mature trees changed the composition of the family side.

In choosing the landscape of this period, the restoration intends to reestablish the delicate balance that still existed in the 1920s between the old residential landscape and that of the office, at the same time that it brings back the lush, profligate look so emblematic of Olmsted's original design and landscape philosophy.

Endnotes

This article is adapted from a longer essay written as part of a cultural landscape report prepared by the Olmsted Center for Landscape Preservation for the Frederick Law Olmsted National Historic Site of the National Park Service. It will be published in its entirety in 1997.

[1] Frederick Law Olmsted (hereafter FLO) gives his definition of civilization most completely in "Notes

NATIONAL PARK SERVICE FREDERICK LAW OLMSTED NATIONAL HISTORIC SITE

The Dudley Street entrance area reflects Fairsted's changing usage: first a vegetable garden for a family, then briefly considered as an experimental annual plot for the firm, it finally became in 1926 a parking lot for the expanded staff. The spruce pole fence, equally flexible in its own way, has been cut to fit the root flare of an Acer pseudoplatanus, *at left.*

on the Pioneer Condition, Section 2, Defining Civilization," in Ranney, 659.

[2] FLO expressed his ideal of the domestic landscape in "Plan for a Small Homestead," *Garden and Forest* (May 2, 1888) 1: 111.

[3] FLO, "Trees in Streets and in Parks, *The Sanitarian* (September 1882) X(114): 517.

[4] Alisa Belinkoff Katz, "From Puritan Village to Yankee Township: A Social History of Politics in Brookline, 1705–1875" in *Brookline, the Social History of a Suburban Town 1705–1850*, ed. David Hackett Fischer (Waltham, MA: Brandeis University, 1986), 264.

[5] *Atlas of the Town of Brookline* (Philadelphia: G. M. Hopkins, 1884), plate 15, and Town of Brookline Special Committee, *Report of Committee on Municipal Policy of the Town of Brookline, Massachusetts* (Brookline, MA: Riverdale Press, 1925), 3–13.

[6] For a discussion of women's psychological illness in the 19th century, see Barbara Ehrenreich and Deirdre

English, *For Her Own Good: 150 Years of the Experts' Advice to Women* (Garden City, NY: Anchor Books/ Doubleday, 1978), 102–140.

[7] Downing's book, which first appeared in 1841, was reissued in eight editions throughout the century.

[8] Catharine E. Beecher and Harriet Beecher Stowe, *American Woman's Home* (NY: J. B. Ford, 1869; Hartford, CT: Stowe-Day Foundation, 1975), 117, 294–296, 379–402; also see Jane Loudon, *Gardening for Ladies* (1840), *The Ladies' Companion to the Flower-Garden* (1841), *The Ladies' Flower-Garden* (1839–48), *Amateur Gardener's Companion* (1847), *The Lady's Country Companion* (1850).

[9] Hans J. Koehler, Blooming Date Notebook, March 6, 1910, to November 16, 1910, Frederick Law Olmsted National Historic Site Plant File.

[10] For "communitiveness," see "Notes on the Pioneer Condition, Section 2, Defining Civilization," in Ranney, 659.

[11] Keith N. Morgan, *Charles Platt: The Artist as Architect* (NY: Architectural History Foundation, 1985), 48–53, 56–58.

[12] Mac Griswold and Eleanor Weller, *The Golden Age of American Gardens: Proud Owners, Private Estates, 1890–1940.* (NY: Harry N. Abrams, 1991) 13–15, 45–48.

[13] Ellen Shipman, "Variety of Form and Abundance of Bloom Within a Small Area, The Garden of Mrs. Henry V. Greenough, Brookline, Massachusetts," *House Beautiful* (March, 1931), 259–262.

[14] FLO, "The Yosemite Valley and the Mariposa Big Trees: A Preliminary Report (1865)," in Ranney, 500.

[15] FLO to Ignaz A. Pilat, September 26, 1863, in Ranney, 85.

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For all the assistance offered in so many ways with this article, I would like to thank Robert Cook and Phyllis Andersen of the Arnold Arboretum; Lauren Meier and Joyce Connolly of the National Park Service, Frederick Law Olmsted National Historic Site; Cynthia Zaitzevsky, Karen Madsen, Robin Karson, Arleyn Levee, Keith Morgan, Victoria Ranney, Judith Tankard, and the staffs of the Brookline Public Library and the Brookline Preservation Commission.

Mac Griswold's most recent book is *The Golden Age of American Gardens* (1991), an illustrated history of turn-of-the-century plutocratic gardening in the U.S., written with Eleanor Weller. She is also the author of "A History of Gardening in the United States," in *The New Royal Horticultural Society Dictionary of Gardening* (1992), edited by Sir Aldous Huxley. Her articles and book reviews have appeared in *The New York Times, Vogue, House & Garden, Hortus, The Magazine Antiques, Landscape Architecture Magazine, Gardens Illustrated,* and *Garden Design,* where she is a contributing editor.

The Arnold Arboretum

S U M M E R · N E W S · 1 9 9 6

1872–1997: Celebrating 125 Years at the Arnold Arboretum

Robert E. Cook, Director

Nineteen ninety-seven will mark the 125th anniversary of the founding of the Arnold Arboretum. On March 29, 1872, the President and Fellows of Harvard College accepted from the trustees of the estate of James Arnold the gift of the Arnold Endowment to establish a scientific collection of shrubs and trees. It seems like an occasion for a year-long party.

The anniversary celebration will be launched this October 18th with the opening of our new permanent exhibit, "Science in the Pleasure Ground." Funded by grants from the National Endowment for the Humanities, the exhibit will feature four themes that mark the cultural history of the Arboretum: the design of the landscape; plant collecting around the world; American horticulture; and the conservation of forests at home and abroad. The exhibit will be anchored by an eight-by-sixteen-foot scale model of the Arboretum, complete with detailed vignettes depicting the history of the land and people, funded by a generous gift from Mr. and Mrs. Louis J. Appell, Jr.

Ernest J. Palmer

Haying near Center Street, 1931.

Donald Wyman

The meadow in flood, March 12, 1936.

In spring, 1997, we will further mark the anniversary with the release of our new lilac introduction, *Syringa* x *chinensis* 'Lilac Sunday', to be made available, appropriately enough, on Lilac Sunday, May 18, 1997. A large garden party to formally honor 125 years of achievement in science and education will follow later in spring. Other celebratory events will include a special exhibit at the New England Spring Flower Show, publication of a special edition of *Arnoldia*, summer tours of extraordinary gardens, and creation of an anniversary T-shirt and poster.

The celebration will continue into the fall with our traditional Fall Plant Sale and Auction on September 21, and a scientific symposium will wrap up the anniversary year in November.

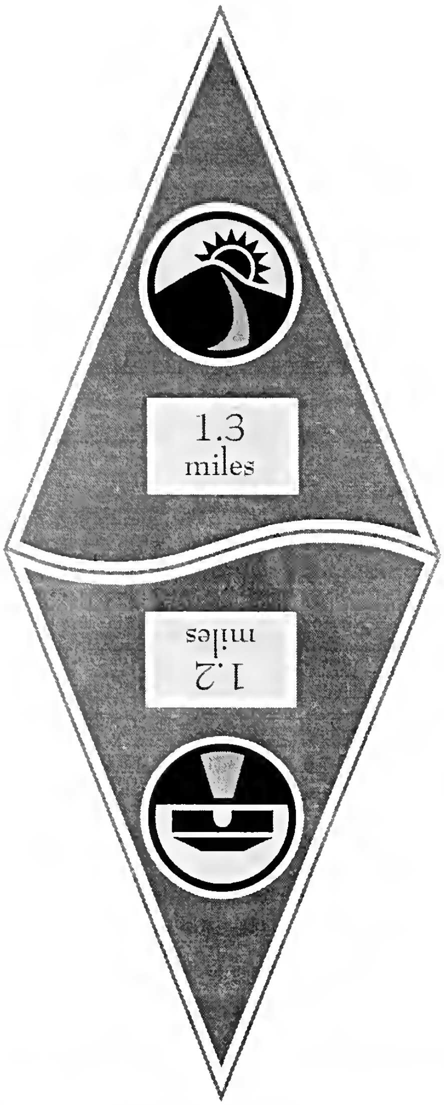
While acknowledging our notable past, the 125th anniversary will also provide a wonderful opportunity to enjoy the promise of the future. We hope you will join us.

Meyer Gift to Support Children's Education

Henry and Nod Meyer, longtime friends of the Arnold Arboretum, recently established the Nature Study Fund for City Children with a generous gift that reflects the Meyers' interests in horticulture and children's environmental education.

In 1994, the Meyers initiated and funded a project to enable schoolchildren from Chelsea, Massachusetts, to participate in the Field Studies Program at the Arboretum. The Field Studies Program introduces primary schoolchildren to science through a series of field trips to the Arboretum. "I firmly believe that the Arboretum is an ideal location for young people to learn firsthand their responsibility in preserving their and our environment," says Henry Meyer. "My primary interest is in helping the younger students while their minds are still open to positive inputs." The Meyers' gift to the endowment will support ongoing programs in children's education with preference given to primary schoolchildren from Chelsea.

Nod Meyer has been actively involved with the Arboretum for over 20 years. An avid horticulturist, she has collected plant material from around the world and is best known at the Arboretum for her ongoing volunteer work at the Dana Greenhouses. Nod is currently a member of the Visiting Committee and the Fall Plant Sale Committee.



Wherever You Go, There You Are: The New Orientation System

The qualities that make the Arboretum so beautiful can also make it hard to navigate. First-time visitors can be quickly confounded by the sinuous road and path system, the changes in topography ranging from a low-lying marsh to one of the highest points in Boston, and the collection of 15,000 curated trees and shrubs interspersed with native woodland. With this in mind, the Arboretum's Orientation Committee hired Clifford Selbert Design of Cambridge to design a wayfinding system that will meet the needs of both new and experienced visitors to the grounds. It will be in place this fall.

Early in the design process, director Bob Cook challenged the design team to create an orientation system that would minimize the intrusion of signs into the landscape. To paraphrase him, "you shouldn't see the signs until you need them." This aesthetic consideration resulted in a dual orientation system that uses "you are here" maps combined with markers at intervals of one-eighth mile. The maps will be located at each entrance gate and will show visitors where they are, what they can see, and how they can use the orientation system. Within the Arboretum, milestone markers will be embedded at ground level along the main road from the start at the Hunnewell Building to its end at Peters Hill. Each marker gives the distance to these two destinations.

This system has a real advantage for the visitor: you can leave the road to explore for plants, return to a marker at the road, and know exactly where you are relative to the Hunnewell Building or Peters Hill. At the same time, this new system preserves the visual serenity and naturalness that makes the Arboretum landscape an island of calm in a visually chaotic city.

Kim Tripp Goes to Smith College

Peter Del Tredici, Director of Living Collections

"It is that mind-boggling wealth of plants that brings someone like myself to the Arnold Arboretum." With these words, written in February 1994, Kim Tripp announced her arrival. And now, exactly two-and-a-half years and countless memories later, Kim is leaving us for the greener pastures of the Connecticut River valley. Dr. Tripp has recently begun work as Director of the Smith College Botanic Garden in Northampton, Massachusetts, where she will oversee the operations of the botanic garden, teach a year-long horticulture course to undergraduates, and conduct and supervise research as a faculty member in the Department of Biological Sciences.

As a Putnam Research Fellow at the Arnold Arboretum, Kim has been a whirlwind of activity: taking photographs, leading tours, rooting cuttings, measuring seedlings, evaluating plants, teaching courses, giving lectures, and writing articles for *Arnoldia*—all the while maintaining an active research program on the subjects of resource allocation in woody plants as it affects their performance in landscape situations; plant propagation; and woody plant evaluation.

The silver lining to her leaving is that she has become so intimately entwined with the Arnold Arboretum that she cannot really leave. In a special agreement worked out with Smith College, Kim will continue her collaboration with us as a research fellow. For this purpose, the Dana Greenhouses will serve as the base of operations for her ongoing research on propagation and resource allocation. With this arrangement in place, we can say that Kim isn't really leaving, she's just making a slightly longer commute.

Pam Thompson: Harvard Hero

In June the staff at the Arboretum congratulated Pam Thompson, coordinator of adult education programs, for her designation as a Harvard Hero in recognition of her exemplary service to Harvard. Two years ago Harvard's Vice President for Administration, Sally Zeckhauser, to whom the director of the Arboretum reports, created an employee recognition program that has informally come to be known as Harvard Heroes, after the theme song played at the first annual ceremony. The program allows each of the units managed by Mrs. Zeckhauser to recognize individuals whose service has demonstrated exceptional quality and commitment. In a celebration that included family and friends, Pam was cited for managing the program's day-to-day operations with unusual skill and creativity—as well as with her usual good cheer.

Peter Del Tredici

Cedrus libani stenacoma at the Arboretum.

Living Collections Memorial Fund

In response to a growing number of inquiries about planting memorial trees on the grounds, the Arboretum recently established the Living Collections Memorial Fund. Gifts to the Living Collections Memorial Fund in memory of family and friends support the ongoing maintenance and curation of our magnificent landscape and unique collections of trees, shrubs, and vines.

While memorializing specific trees is incompatible with the scientific mission of the Arboretum, gifts made to this fund support the annual spring planting of trees that represent new additions to the collections or repropagations of rare plants or of plants in decline. Gifts to this fund support not only the scientific mission of the Arboretum, but also the goal of maintaining an urban landscape open to the public, free of charge.

For information about memorial gifts and the Living Collections Memorial Fund, contact Lisa M. Hastings, Senior Development Officer, at 617/524–1718 x 145.

Summer Interns of 1996

This year's interns worked in four areas—science education, greenhouse and nursery, mapping and labeling, and grounds maintenance. Major tasks included digging plants in the nursery and planting them on the grounds. Interns also helped prune post-drought deadwood and clean up the rockery. Kneeling at left is Justin Grigg; counterclockwise from center left are Stacy Senflug, Nicole Sullivan, Ann Cook, Lauren Buckland, Kenneth Bray, Seth Cain, Chris McFadden, Dana Doyle, Jill Horton, Leslie Marty, Kyle Port, Jeffrey Rowan, Kristin McDonnell.

Karen Madsen

Kim Tripp

PIPD Workshop

Tom Ward, greenhouse manager, standing third from right, led participants of the first annual Subscribers' Propagation Workshop on an early-summer tour of the Arboretum's shrubs. The workshop is part of the Arboretum's new Plant Introduction, Promotion, and Distribution Program for professional and commercial horticulturists. The robust plant behind them is *Viburnum sargentii* 'Flavum', an 1872 introduction, that survived last year's drought very well.

Arboretum Cleanup

Luis Colon and Bruce Munch of the Arboretum grounds staff worked with 200 energetic City Year corps members who gave a day's service this past June to clean up the newly acquired Stony Brook Marsh. Thanks are due to them and to the Arnold Arboretum Committee for coordinating the effort.

Karen Madsen

"Manifestations of refined domestic life" ranked high on Frederick Law Olmsted's scale of values. He called them "unquestionably the ripest and best fruits of civilization." In 1888 he published his plan for a residence in East Greenwich, Rhode Island, in Garden and Forest, *Charles Sargent's journal of horticulture, landscape art, and forestry. Within this small site Olmsted accommodated many modes of outdoor living—a vine-canopied garden room, a tiny pleasure garden to be considered a part of the house, a "retired seat" for quiet pursuits—and with an artful planting design, connected the homestead to the larger landscape, achieving the sense of Nature's infinitude that the owner desired. Olmsted never put into writing his intentions for his own home in Brookline, but we can assume that the Rhode Island design exemplifies his ideal, combining "the enjoyment, the comfort, the tranquillity, the morality and the permanent furnishings, interior and exterior, of a home."*

Plan for a Small Homestead

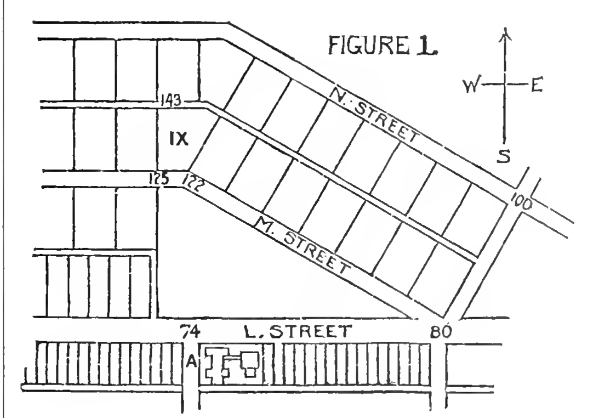
Frederick Law Olmsted

Conditions and Requirements.—The site is upon the south face of a bluff, the surface of which is so steep that the rectangular street system of the city, to the east and south, had not been extended over it. The diagonal streets, *M* and *N*, have been lately introduced and building lots laid off on them, as shown in Figure 1. The triangular space between *L* and *M* Streets is a public property containing the graves of some of the first settlers of the region. Its northern and western parts are rock and partly covered by a growth of native Thorns and Junipers, east of which there are Willows and other planted trees. At *A* there is a meeting-house and parsonage. Arabic figures show elevations above city datum.

The lot to be improved is that marked *IX*. The usual conveniences of a suburban cottage home are required, and it is desired that it should be made more than usually easy and convenient for members of the household, one of whom is a chronic invalid, to sit much and be cheerfully occupied in out-of-door air and sunlight. A small fruit and vegetable garden is wanted and a stable for a single horse and a cow, with carriage room and lodgings for a man. Water for the house, garden and stable is to be supplied by pipes. There is a sewer in *M* Street.

The problem is to meet the requirements thus stated so snugly that the labor of one man will be sufficient, under ordinary circumstances, to keep the place in good order and provide such gratification of taste as with good gardening management the circumstances will allow.

The north-west corner of the lot is 21 feet higher than the south-east corner, the slope being steeper in the upper and lower parts than in the middle. There is a small outcrop of a ledge of limestone about 30 feet from the south end, and the ground near it is rugged and somewhat gullied. *M* Street, which has a rapid descent to the eastward, opposite the lot, was brought to its grade by an excavation on the north side and by bank-



ing out on its south side, the bank being supported by a retaining wall. The excavation has left a raw bank two to five feet high on the street face of the lot.

Looking from the middle part of the lot over the roof of the parsonage a glimpse is had of a river, beyond which, in low bottom land, there is a body of timber, chiefly Cottonwood, over which, miles away, low, pastured hills appear in pleasing undulations.

The narrower frontage of lot *IX*, its irregular outlines, its steepness, its crumpled surface, the raw, caving bank of its street face and its apparent rockiness and barrenness, had made it slower of sale than any other on the hill streets, and it was, accordingly, bought at so low a price by its present owner that he is not unwilling to pay liberally for improvements that will give him such accommodations upon it as he calls for. From the adjoining lots and those higher up the hill to the north the view which has been referred to, over the roof of the parsonage, is liable to be curtained off by trees to grow, or houses to be built, on the south side of them. Either this liability has been overlooked or the view has been considered of little value by those who have bought them. "Most people," says the owner of lot *IX*, "find their love of Nature most gratified when they have a trim lawn and a display of flowers and delicacies of vegetation upon it in front of their houses. I find Nature touches me most when I see it in a large way; in a way that gives me a sense of its infinitude. I like to see a natural horizon against the sky, and I think that the advantage we shall have here in that respect will fully compensate us for the want of a fine lawn-like front, provided the place can be made reasonably convenient." Fortunately his wife is essentially like-minded. "I am a Western woman," she says, "and would not like to live in a place that I could not see out of without looking into the windows of my neighbors."

Controlling Landscape Considerations.—The only valuable landscape resource of the property lies in the distant view eastward from it. Looking at this from the house place, it can evidently be improved by placing in its foreground a body of vigorous, dark foliage, in contrast with which the light gray and yellowish greens of the woods of the river bottom will appear of a more delicate and tender quality, and the grassy hills beyond more mysteriously indistinct, far away, unsubstantial and dreamy. Such a foreground can be formed within the limits of lot *IX*, and, strictly speaking, the forming of it will be the only landscape improvement that can be made on the place. It is, however, to be considered, that when the middle of the lot is occupied by a house but small and detached spaces will remain to be furnished with verdure or foliage, and that anything to be put upon these spaces will come under direct and close scrutiny. Hence nothing should be planted in them that during a severe drought or an intense winter or in any other probable contingency is likely to become more than momentarily shabby. Further, it is to be considered, that when the eye is withdrawn from a scene the charm of which lies in its extent and the softness and indefiniteness, through distance, of its detail, the natural beauty in which the most pleasure is likely to be taken will be of a somewhat complementary or antithetical character. But to secure such beauty it is not necessary to provide a series of objects the interest of which will lie in features and details to be seen separately, and which would be most enjoyed if each was placed on a separate pedestal, with others near it of contrasting qualities of detail, each on its own separate pedestal. It may be accomplished by so bringing together materials of varied graceful forms and pleasing tints that they will intimately mingle, and this with such intricate play of light and shade, that, though the whole body of them is under close observation, the eye is not drawn to dwell upon, nor the mind to be occupied with, details. In a small place much cut up, as this must be, a comparative subordination, even to obscurity, of details, occurring as thus proposed, and not as an effect of distance, is much more conducive to a quiescent and cheerfully musing state of mind than the presentation of objects of specific admiration.

the distant view . . . can evidently be improved by placing in its foreground a body of vigorous, dark foliage, in contrast with which the light gray and yellowish greens of the woods of the river bottom will appear of a more delicate and tender quality, and the grassy hills beyond more mysteriously indistinct, far away, unsubstantial and dreamy.

Anatomical Plan.— The important common rooms of the family and the best chambers are to be on the southern side of the house, in order that the view over the river, the south-western breeze and the western twilight, may be enjoyed from their windows. (See figure 2.) It follows that the kitchen and the main entrance door to the house are to be on its north and east side. Were it not for excessive steepness, the best approach to the house would be on a nearly straight course between its east side and the nearest point on *M*

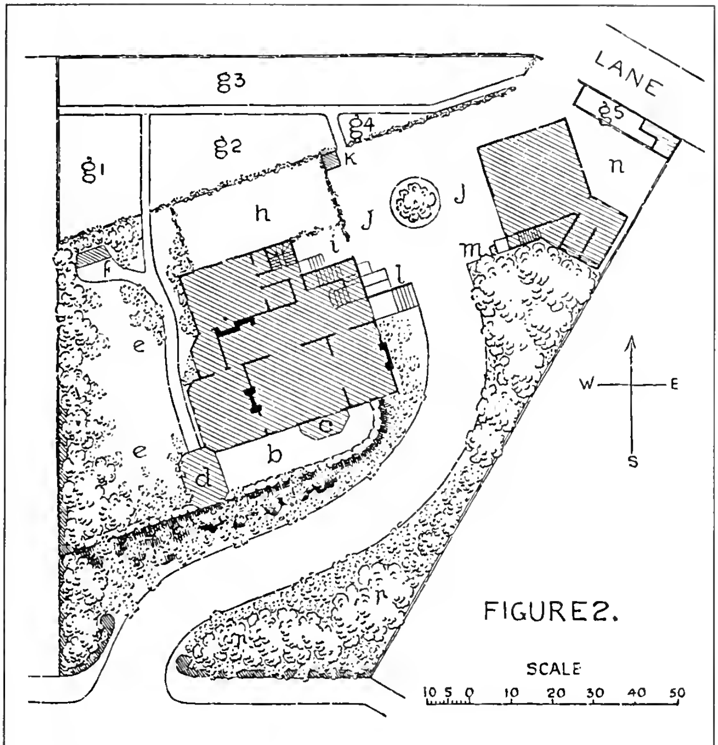


FIGURE 2.

Street—*i.e.*, the south-east corner of the lot; this partly because it would be least costly and most convenient, and partly because it would make the smallest disturbance of the space immediately before the more important windows of the house. But to get an approach of the least practicable steepness the place will be entered at the highest point on *M* Street—*i.e.*, the south-west corner; then a quick turn will be taken to the right, in order to avoid the ledge, then, after passing the ledge, another to the left. On this course a grade of one in twelve and a half can be had. (The grade on the shortest course would be one in seven.) Opposite the entrance to the house there is to be a nearly level space where carriages can rest.

The caving bank made by the cut for grade of *M* Street requires a retaining wall four feet high along the front of the lot. This will allow a low ridge, nearly level along the top, to be formed between the wheelway and the street, making the wheelway safer and a less relatively important circumstance to the eye.

Even in the part of the lot chosen, as being the least steep, for the house, a suitable plateau for it to stand upon can only be obtained by an embankment on the south and an excavation on the north. The embankment is to be kept from sliding down hill by a wall ten feet in front of the wall of the house. This retaining wall is to be built of stained and crannied, refuse blocks of limestone which have been formerly thrown out from the surface in opening quarries on the back of the bluff. They are to be laid without mortar and with a spreading base and irregular batter. Where the ledge can be exposed they will rest upon it, and the undressed rock will form a part of the face of the wall. A railing two and a half feet high is to be carried on the top of the retaining wall, and the space *(b)* between this and the wall of the house will be an open terrace upon which will open half-glazed French windows on the south of the library, parlor and dining-room. At *c* (figure 2) there is to be a little room for plants in winter, the sashes of which are to be removed in summer, when the space is to be shaded by a sliding awning. At *d* a roof covers a space large enough for a tea table or work table, with a circle of chairs about it, out of the house proper, forming a garden room. This roof is to be sustained by slender columns and lattice-work, and lattice-work is to be carried over it and the whole to be overgrown with vines (Honeysuckle on one side, Wistaria on the other, the two mingling above). The space *ee* is reserved for a tiny pleasure garden, to be entered from the house and to be considered much as if, in summer, it were a part of it carpeted with turf and embellished with foliage and flowers. At *f* there is to be a retired seat for reading and intimate conversation, and east of this an entrance to the service gardens, to be described later. The laundry yard, *h*, and the kitchen yard, *i*, are to be screened by high lattices covered by Virginia Creeper *[Parthenocissus quinquefolia]*. The court yard, *jj*, is to be smoothly paved with asphalt blocks or fire brick, which it will be easy to thoroughly hose and swab every day. In one corner of it is a brick ash house, *k*; in another a dog house, *m*. The stable and carriage house are entered from the court yard, but hay will be taken into the loft from a wagon standing in the passage to the back lane. At *n* is the stable yard.

Landscape Gardening.— The soil to be stripped from the sites of the house, terrace, stable, road and walks, will be sufficient, when added to that on the ground elsewhere, to give full two feet of soil wherever needed for turf or planting.

Trenches, nowhere less than two feet deep, are to be made on each side of the approach road south of the terrace and to be filled with highly enriched soil, the surface of which is to slope upward with a slight concavity as it recedes from the approach. The base of the wall is to merge irregularly into this slope. The space between the terrace and the street is so divided by the approach, and, in the main, is so steep and dry, that no part of it can be well kept in turf, nor can trees be planted in it, because they would soon grow to obstruct the southward view from the house and terrace. The steep dry ground and the rock and rough wall of this space are to be veiled with vines rooting in the trenches. The best vine for this purpose is the common old clear green Japan Honeysuckle *(Lonicera Halliana [*now *L. japonica* 'Halliana'*])*. In this sheltered situation it will be verdant most, if not all, of the winter, and blooming, not too flauntingly, all of the summer. It can be trained not only over the rough, sloping wall of the terrace, but also over the railing above it, and here to be kept closely trimmed, so as to appear almost hedgelike. Also it may be trained up the columns of the shelter and along its roof; the odor from its bloom will be pleasing on the terrace, and will be perceptible, not oppressively, at the windows of the second story. Other vegetation is to be introduced sparingly to mingle with it, the wild Rose and Clematis of the neighborhood; the Akebia vine *[Akebia quinata]*, double flowering Brambles [*Rubus ulmifolius* 'Bellidiflorus'?], and, in crevices of the wall, *Rhus aromatica*, dwarf Brambles, *Cotoneaster microphylla*, Indian Fig [*Opuntia* sp.], Aster, and Golden Rod, but none of these in conspicuous bodies, for the space is not too large to be occupied predominatingly by a mass of foliage of a nearly uniform character. Near the southwest corner of the pleasure garden, *Forsythia suspensa* is to fall over the wall, and, also, as a drapery in the extreme corner (because the odor to those near the bloom of it is not pleasant), Matrimony vine *(Lycium vulgare [*now *L. barbarum])*. Upon the walls of the house east of the terrace, Japanese Ivy *(Ampelopsis Veitchii [*now *Parthenocissus tricuspidata* 'Veitchii'*])* is to be grown, and before it a bush of the fiery Thorn *(Cratægus Pyracantha, [*now *Pyracantha coccinea])*. For the ground on the street side of the approach, *pp*, smooth-leaved shrub evergreens would be chosen were they likely to thrive. But both the limestone soil and the situation is unfavorable to them. Next, a dark compact mass of round-headed Conifers would best serve the purpose of a foreground to the distant view, but there are none that can be depended on to thrive long in the situation that could be kept within the required bounds except by giving them a stubbed and clumsy form by the use of the knife. The best available material for a strong, low mass, with such deep shadows on the side toward the terrace as it is desirable to secure, and which is most sure to thrive permanently in the rather dry and hot situation, will be found in the more horizontally branching of the Thorn trees *(Cratægus)*, which grow naturally in several varieties on other parts of the hill. Their heads may be easily kept low enough, especially in the case of the Cockspur *(C. Crus-galli)*, to leave the view open from the terrace without taking lumpy forms. But as a thicket of these spreading thorn bushes, fifty feet long, so near the eye, might be a little stiff and monotonous, a few shrubs are to be blended with them, some of which will send straggling sprays above the mass and others give delicacy, grace and liveliness, both of color and texture, to its face. Common Privet *[Ligustrum vulgare]*, red-twigged Dogwood *[Cornus sericea]*, common and purple Barberry *[Berberis vulgaris]*, *Deutzia scabra*, Spicebush *[Lindera benzoin]* and Snowberry *[Symphoricarpos albus]* may be used for the purpose. American Elms have already been planted on the lot adjoining on the east. The Wahoo Elm *(Ulmus alata)* and the Nettle tree *(Celtis occidentalis)* are to be planted in the space between the approach and the boundary. They will grow broodingly over the road, not too high, and mass homogeneously with the larger growing Elms beyond. Near the stable two Pecans *(Carya olivæformis [*now *C. illinoensis])* are to be planted. The three trees last named all grow in the neighboring country and are particularly neat and free from insect pests. A loose hedge of common Privet having the effect of a natural thicket is to grow along the boundary. No other shrub grows as well here under trees.

> *the natural beauty in which the most pleasure is likely to be taken . . . may be accomplished by so bringing together materials of varied graceful forms and pleasing tints that they will intimately mingle, and this with such intricate play of light and shade, that, though the whole body of them is under close observation, the eye is not drawn to dwell upon, nor the mind to be occupied with, details.*

As the pleasure garden is to be very small, to be closely associated with the best rooms, and to be not only looked at but used, it must be so prepared that no excessive labor will be needed (as in watering, mowing, sweeping and rolling), to keep it in superlatively neat, fresh and inviting condition. No large trees are to be grown upon or near it by which it would be overshadowed and its moisture and fertility drawn upon to the injury of the finer plantings. It must be easy of use by ladies when they are shod and dressed for the house and not for the street. Its surface is to be studiously modeled with undulations such as might be formed where a strong stream is turned aside abruptly into a deep and narrow passage with considerable descent. It will be hollowing near the house and the walk, and will curl and swell, like heavy canvas slightly lifted by the wind, in the outer parts. Wherever it is to be left in turf the undulations are to be so gentle that close mowing, rolling and sweeping will be easily practicable. The upper and outer parts are to be occupied by bushy foliage compassing about all the turf; high growing shrubs next the fences and walls; lower shrubs before them; trailers and low herbaceous plants before all. But there must be exceptions enough to this order to avoid formality, a few choice plants of each class standing out singly. The bushes are to be planted thickly, not simply to obtain a good early effect, but because they will grow better and with a more suitable character in tolerably close companionship. As the good sense of the lady who is to be mistress of this garden ranges more widely than is common beyond matters of taste, it may be hoped that due thinnings will be made from year to year and that the usual mutilation of bushes under the name of pruning will be prevented.

the pleasure garden['s] . . . surface is to be studiously modeled with undulations such as might be formed where a strong stream is turned aside abruptly into a deep and narrow passage with considerable descent. It will be hollowing near the house and the walk, and will curl and swell, like heavy canvas slightly lifted by the wind, in the outer parts.

The following little trees and bushes may be used for the higher range: The common, trustworthy sorts of Lilac *[Syringa vulgaris]*, Bush-honeysuckle *[Diervilla sessifolia]*, Mock-orange *[Philadelphus]*, Forsythia, Weigelia, the Buffalo-berry *(Shepardia)*, common Barberry, the Cornelian Cherry *[Cornus mas]* and the red twigged Dogwood. In the second tier, Missouri Currant *[Ribes odoratum]*, Clethra *[C. alnifolia]*, Calycanthus *[C. floridus]*, Jersey Tea *[Ceanothus americanus]*, Japanese Quince *[Chaenomeles japonica]*, Japanese Mahonia *[M. japonica]*, Spiræas, and the Mezereon Daphne *[D. mezereum]*.

In the third tier, *Deutzia gracilis*, Oregon Grape *[Mahonia aquifolium]*, flowering Almond (white and red) *[Prunus triloba]*, *Spiræa Thunbergii* and *S. Japonica*, Waxberry *[Myrica pensylvanica?]*, *Daphne Cneorum*, small-leaved Cotoneaster, and the Goatsbeard Spiræa *[Aruncus dioicus]*. The Virginia Creeper is to be planted against the walls of the house, Chinese Wistarias near the garden room. Oleanders, Rhododendrons, Figs, Azaleas and Bamboos, grown in tubs, are to be set upon the terrace in summer. They are to be kept in a cold pit during the winter.

The service garden (*gg*, Fig. 2) will have a slope of one to five inclining to the south. It is intended only for such supplies to the house as cannot always be obtained in the public market in the fresh condition desirable, and is divided as follows:

g 1. Roses and other plants to provide cut flowers and foliage for interior house decoration;

g 2. Small fruits;

g 3. Radishes, salad plants, Asparagus, Peas, etc.;

g 4. Mint, Parsley, Sage, and other flavoring and garnishing plants for the kitchen,

g 5. Cold-frame, wintering-pit, hot-beds, compost-bin, manure-tank, garden-shed and tool-closet.

Brookline, Mass., 14th April, 1888

"Plan for a Small Homestead" was published in Volume I of *Garden and Forest* (May 2, 1888), pages 111–113. The first two quotations in the editor's introduction are from "Report Upon a Projected Improvement of the Estate of the College of California, at Berkeley, Near Oakland," June 19, 1866, in *The Papers of Frederick Law Olmsted*, Volume V, *The California Frontier, 1863–1865*, edited by Victoria Post Ranney, Gerard J. Rauluk, and Carolyn F. Hoffman (Baltimore: Johns Hopkins University Press, 1990), 548. The last quotation is from a letter of April 28, 1864, to Henry Whitney Bellows, ibid., 226.

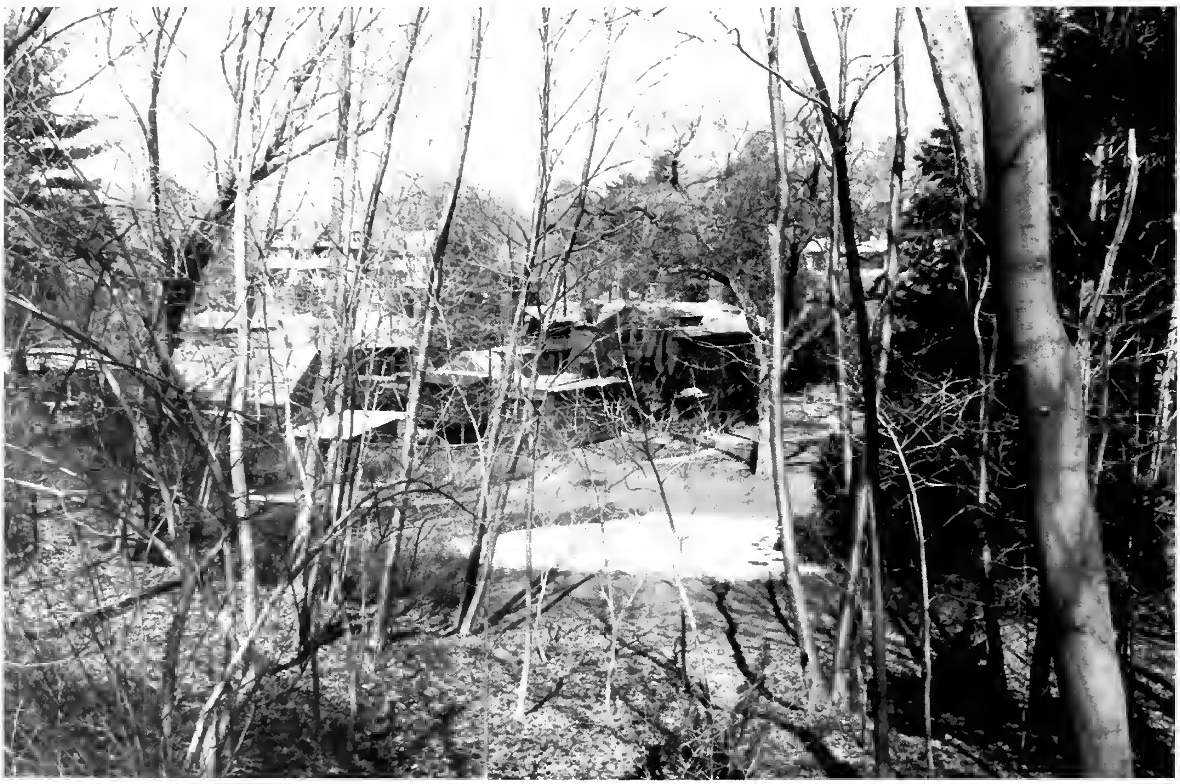
Notes on Restoring the Woody Plants of Fairsted

Lauren Meier

The restoration of the Olmsted landscape at Fairsted is a complex undertaking, requiring extensive historical research and documentation, landscape analysis and planning, and finally, implementation and maintenance. In this article, the project manager reviews the part of the process that deals with woody plants.

In 1991 the National Park Service began restoring the 1.74-acre landscape of Frederick Law Olmsted's home and office in Brookline, Massachusetts, with a view to creating a living exhibit of his design process and principles. This project has enabled us to study in a very detailed way Olmsted's use of woody plants in a small-scale residential landscape. The project has also served as a testing ground for methods and techniques of vegetation management that may be applied at historic sites around the United States.

Olmsted incorporated many plants already on the site into his design, most notably a magnificent American elm, as well as a broad range of other woody plants, both natives and non-natives. The final design—a diverse landscape of undulating lawn (the south lawn), a rustic



ELIOT FOULDS, NPS, OLMSTED CENTER FOR LANDSCAPE PRESERVATION

Volunteer trees—predominantly Norway maples (Acer platanoides) *with some Japanese maples* (A. palmatum) *and sweet birch* (Betula lenta)*—on the west slope of Fairsted as they appeared in the spring of 1994.*

dell (called the Hollow), a rocky outcropping (the rock garden), a bank of trees and shrubs (the west slope), a circular drive, and service areas—illustrates in miniature his own domestic landscape ideals. (For a plan of the property, see page 6.)

Rich documentation exists for both the original design of the landscape at the Frederick Law Olmsted National Historic Site and for changes that occurred over time. Plans, photographs, and planting lists, when combined with the results of tree coring and archeology, reveal the history of most plants on the site. This wealth of documentation has been compiled into a two-volume cultural landscape report by landscape historian Cynthia Zaitzevsky and the staff of the National Park Service with technical assistance from the Arnold Arboretum. It is on the basis of this documentation that the National Park Service is restoring the landscape to its appearance at the end of the 1920s, when the Olmsted Brothers firm was at the height of its activity and the landscape still retained the overall organization and design created by Olmsted Sr. before his death in 1903.

ELIOT FOULDS, NPS, OLMSTED CENTER FOR LANDSCAPE PRESERVATION

Restoration of the west slope began in October, 1994. On the property overall, some two hundred trees and shrubs not present in 1930 were removed.

The documentation shows that the landscape changed after 1930 in ways that obscured some of its original qualities. Most notable was the reduction in diversity and numbers of shrubs. Volunteer trees, primarily Norway and Japanese maples *(Acer platanoides* and *A. palmatum),* altered the canopy and the site's spatial organization, while growth in all trees and shrubs altered sun and shade conditions and reduced available growing space. Where seven vines had been growing on the building walls and spruce pole fence in 1930, only two *(Wisteria sinensis* and *Actinidia arguta)* remained in 1991. Later additions, such as the 1960s plantings of rhododendrons, hemlock, and yew, had also altered the original design.

At the start of the renovation in 1994, all trees and shrubs not present in 1930—some two hundred plants—were removed, and many of the remaining plants were pruned to greatly increase sunlight penetration. Organic compost was added to the soil to overcome years of nutrient depletion in a landscape dominated by exposed bedrock. An above-ground, seasonal irrigation system—a field pipe buried a few inches under leaf mulch with spigots at every fifty feet—was installed around the site periphery for watering new plantings.

Olmsted's planting designs were typically lush and diverse in species. The task now underway is to reestablish the plants present in the late 1920s but since lost. Rich though the documentation is, it is not definitive, and gaps have had to be filled by informed assumptions. Nor has it been possible to carry out an entirely pure restoration: alterations in planting designs have been required—especially in quantities of plants—to allow for plant growth and to create a sustainable design. Following is an overview of some of the types of problems confronted by the restoration team.

Scale

Many of Fairsted's woody plants have grown dramatically since the landscape was developed between 1883 and 1930. Some of these plants, such as the cucumber magnolia *(Magnolia acuminata)*, blend gracefully into the landscape, while others, especially certain shrubs, have outgrown their location. In the Hollow, which was both heavily planted and limited in space, this problem was especially acute at the start of the restoration. One solution was to lightly prune the rosebay rhododendrons *(Rhododendron maximum)* to encourage new, vigorous growth and to make space for other shrubs included in the original plans but now absent.

The existing yews proved more challenging, especially along the Dudley Street bank. The English yews *(Taxus baccata)* were heavily pruned to make way for rejuvenated growth within a much smaller area. The upright form of the Japanese yew *(T. cuspidata)*, on the other hand, adapts less well to hard pruning. An especially large specimen (18-foot canopy) was removed and will be replaced with a smaller one. In the rock garden, where space is less constrained, another large Japanese yew was successfully pruned to make room for underplanting without sacrificing its picturesque form.

Competition Between Old and New Plants

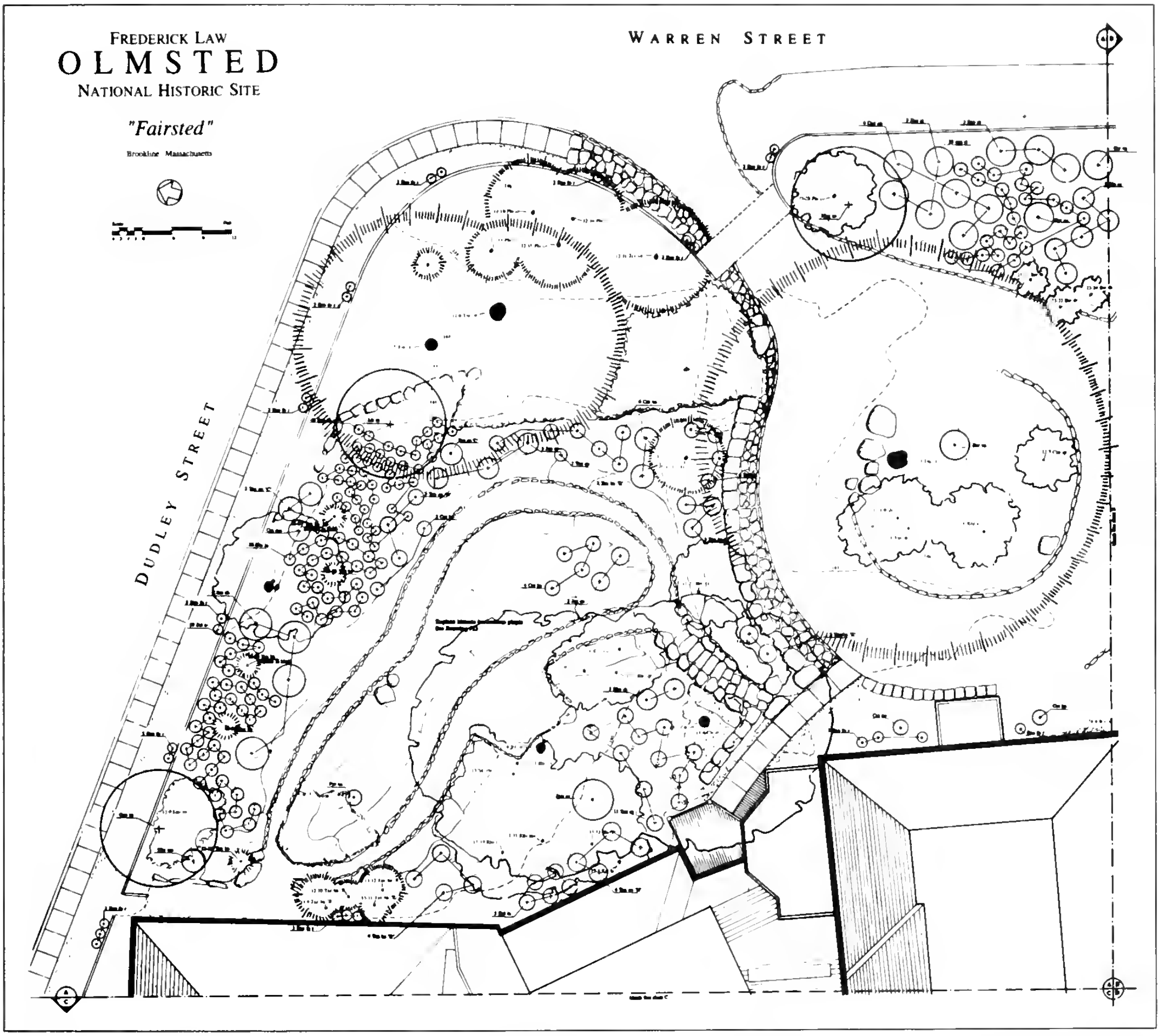
Over the years, root space had also become limited, and the numbers of plants to be reintroduced is so voluminous (66 trees, 632 shrubs, 129 vines, and 2,875 herbaceous plants), that careful analysis of available space and sunlight was required. In some instances, the restoration required either pruning or removing existing shrubs, such as the Japanese yew. In other locations, the design's intended effect was achieved by reducing the numbers of plants from that indicated on historic plans. This was the case with certain shrub massings, such as a group of English weeping yew *(Taxus baccata* 'Repandens') in the Hollow and a large collection of drooping leucothoë *(Leucothoë fontanesiana)* and mountain andromeda *(Pieris floribunda)* along the south lawn.

Availability of Original Plants

The woody plant species at Fairsted include those native to the Northeast as well as exotic species in cultivation between 1883 and 1930. In any restoration project, locating the exact historic species or cultivar is a difficult task. For example, *Salix tristis* was identified on a 1923 plan and on the planting order for the Hollow, but the plants seen in historical photographs were not consistent with specimens currently available in commercial nurseries. Since willow species hybridize freely and are typically variable, it is possible that the *Salix tristis* of the mid-1920s was renamed. Consultation with staff of the Arnold Arboretum and research in published floras of the northeastern United States confirmed that it is now known as *Salix humilis* or *S. humilis* var. *tristis*, a shrub willow native to coastal shores in northern New England. However, it has not yet been located in commercial cultivation, so custom propagation of plants from the wild or from a botanic garden may be required.

Susceptibility of Old Plants to Disease or Other Problems

The goal of the restoration of the Olmsted National Historic Site is to reestablish an example of Olmsted's rich planting design with a high degree of historical accuracy. Especially important are certain individual trees and shrubs that are crucial to the overall design. For this reason—and because the level of maintenance



DRAWN BY CATHERINE MORRIS, NPS, OLMSTED CENTER FOR LANDSCAPE PRESERVATION

The planting plan for the restoration of the Hollow and part of the front drive at Fairsted is based on many historic plans, planting lists, and photographs, as well as surviving plants. Plants and their quantities are:

Common boxwood *(Buxus sempervirens)* 1
Native barberry *(Berberis vulgaris)* 1
Rock cotoneaster *(Cotoneaster horizontalis)* 14
Common quince *(Cydonia oblonga)* 4
Downy hawthorn *(Crataegus mollis)* 1
Dwarf bush honeysuckle *(Diervilla lonicera)* 26
Bush honeysuckle *(Diervilla sessifolia)* 5
Winged euonymus *(Euonymus alata)* 6
Wintercreeper euonymus *(Euonymus fortunei* var. *radicans)* 74
Chinese juniper *(Juniperus chinensis)* 4
Common juniper *(Juniperus communis)* 5
Mountain laurel *(Kalmia latifolia)* 5
Tulip tree *(Liriodendron tulipifera)* 1
Cucumber magnolia *(Magnolia acuminata)* 1
Scarlet firethorn *(Pyracantha coccinea)* 1
Red oak *(Quercus rubra)* 1
Rosebay rhododendron *(Rhododendron maximum)* 1
Schlippenbach rhododendron *(Rhododendron schlippenbachii)* 2
Shrub willow *(Salix tristis)* 39
Common lilac *(Syringa vulgaris)* 2
English yew *(Taxus baccata)* 5
English weeping yew *(Taxus baccata* 'Repandens'*)* 11
Canadian yew *(Taxus canadensis)* 16
Japanese yew 'Capitata' *(Taxus cuspidata* 'Capitata'*)* 3
Japanese yew 'Nana' *(Taxus cuspidata* 'Nana'*)* 7
Yellowroot *(Xanthorhiza simplicissima)* 25

JOHN FURLONG

The Hollow in its present state of restoration. Plants not present in 1930 have been removed and some of the missing ones have been replaced. The planting in this small garden was enhanced in the mid-1920s to create, as Hans Koehler wrote to Frederick Law Olmsted, Jr., "a place that we should be proud to take clients into, and a place of interest to and for study by the men in the office."

will be very high—the restoration will include species with higher susceptibility to pests and diseases than would be acceptable where the historical integrity of the woody plants is less important. For example, to ensure consistency with the original landscape, the American elm missing from the northern edge of the circular drive will be replaced with another American elm in spite of its susceptibility to Dutch elm disease. Similarly, the white ash *(Fraxinus americana)* that was originally located east of the rock garden will be replaced in kind despite the species' vulnerability to rust, borers, and ash yellows. Like the American elm, this tree will be carefully monitored; if the replacements do not prove viable, the decision to replace these individuals with the original species will be reevaluated.

Landscape vs Architecture

Vines presented one of the most challenging aspects of the restoration. Olmsted covered all structures with a profusion of climbing plant material. This constitutes an essential feature of the site's historic character, but it also damages the clapboard building walls, which must be preserved as well. The solution is a trellis system constructed of spiraled steel strapping that provides a substrate for the twining vines *(Wisteria* and *Actinidia).* Snap hooks allow for the vines to be lifted away from the house when repair work or painting is required. The trellis thus provides sufficient distance between the wood facade and plant material to allow for air circulation, thereby minimizing moisture damage. Other vines that will be replaced on the arch and fence as well as the buildings are wintercreeper euonymus *(Euonymus fortuneii* var. *radicans),* Dutchman's pipe *(Aristolochia macrophylla),* Boston ivy *(Parthenocissus tricuspidata),* Virginia creeper *(Parthenocissus quinquefolia),* and English ivy *(Hedera helix).*

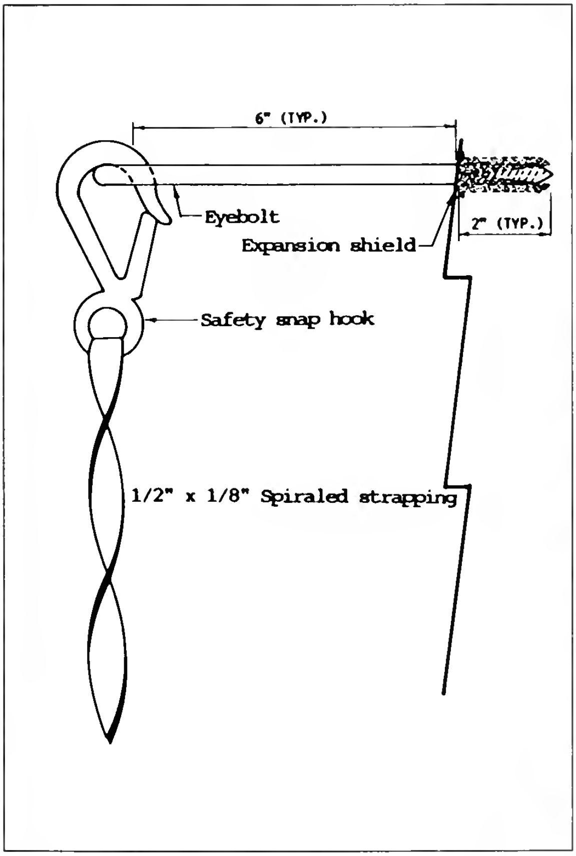
Planning for the Replacement of Significant Plants

Several of the plants at Fairsted are character-defining features of great historical significance. First and foremost, because of its association with Olmsted as well as its great age, is the American elm on the south lawn. Already a large tree when Olmsted acquired the property, he planned the entire landscape around it. Other plants on the site are significant for their horticultural characteristics. Plants such as these that are in decline or potentially unavailable for replacement are being vegetatively propagated at the Arnold Arboretum. Cuttings or grafts were propagated at the Dana Greenhouses and are kept in a special nursery to grow until a replacement is needed.

Restoring Fairsted's landscape with an exactitude that can communicate the design principles of the Olmsted firms has required the combined efforts of historians, landscape architects, taxonomists, horticulturists, and grounds staff. A wealth of historical documentation together with a very high level of technical expertise has permitted an attention to detail that would be difficult to duplicate in most restoration projects. An important byproduct will be the reports published by the Olmsted Center for Landscape Preservation on the methods and techniques that have been developed for this project. But in the end, perhaps the most valuable result—for both interested professionals and casual visitors alike—will be the reestablishment of a living example of Olmsted's principles of planting design.

Lauren Meier is a historical landscape architect with the Olmsted Center for Landscape Preservation of the National Park Service, which is based at Fairsted. This article is adapted from her contribution to *A Forum on Vegetation Management for Historic Sites*, to be published in 1997 by the Arnold Arboretum and the Olmsted Center for Landscape Preservation of the National Park Service.

COURTESY OF THE NATIONAL PARK SERVICE, FREDERICK LAW OLMSTED NATIONAL HISTORIC SITE



JOHN FURLONG

The drawing and photograph illustrate the trellis system that was developed at Fairsted to support the twining vines Wisteria sinensis *and* Actinidia arguta. *Constructed of spiraled steel strapping, snap hooks permit the vines to be lifted away from the house for maintenance.*

'Rose Lantern': A New Cultivar of *Koelreuteria paniculata*, the Golden-Rain Tree

Frank S. Santamour, Jr., and Stephen A. Spongberg

Modern techniques of molecular biology can be a valuable tool in unravelling the confusion that occasionally surrounds important horticultural plants.

The discovery of a new cultivar sometimes involves a degree of serendipity, particularly when one has known the plant in question for many years and has assumed that it was correctly identified when it was received. These circumstances certainly apply to the situation recounted here, and we hope that this article will help to resolve any confusion that may have arisen surrounding two very prominent trees growing in the collections of the Arnold Arboretum.

On October 7, 1994, the senior author (FSS, Jr.) was visiting the Arnold Arboretum, and the junior author (SAS) was pleased to be able to accompany his colleague from the United States National Arboretum through the Arboretum's collections and to help locate plants of particular interest. Two accessions of *Koelreuteria paniculata* Laxmann were pointed out, along with plants of the same species of a somewhat smaller stature that had been grown from seed collected in Korea in 1977 by Spongberg and Richard E. Weaver, Jr. (Spongberg, 1978). While the plants of Korean provenance were of interest because of their habit, the senior author was truly astonished by the two older accessions (AA 577-66 and 771-68), which were labeled as the cultivar 'September'. Knowing this cultivar only from the Arboretum accessions, the junior author was likewise surprised to hear that the Arboretum plants differed from the true 'September' by virtue of their rosy-red capsules. He wondered how this could possibly be, particularly since the older accession had been received from the National Arboretum, the institution that had helped to make 'September' widely available in the mid-1960s. The explanation requires that we start at the beginning and trace the history of *Koelreuteria paniculata* 'September' as well as the "discovery" of 'Rose Lantern', the cultivar name we have chosen for the two Arnold Arboretum trees.

Between August 25th and 27th of 1958, the late Joseph C. McDaniel of the University of Illinois' Department of Horticulture, attended a meeting of the American Institute of Biological Sciences on the campus of Indiana University in Bloomington. While there, he was surprised to see two mature trees of *Koelreuteria* in full flower so late in the growing season: most golden-rain trees flower in late June and early July, and the capsules on their large infructescences have already developed by mid-August. McDaniel continued to observe these trees for several years and found that they consistently flowered from late August into early September.

Seeds from these trees were subsequently distributed to several attendees at the 1960 meeting of the International Plant Propagators Society, Eastern Region. In addition, on December 5, 1960, seeds of the more floriferous of the two trees were supplied to Sylvester G. March at the National Arboretum, where the seed lot was given the accession number NA 16548. Several seedlings of this accession were planted in a nursery at the National Arboretum in 1961. The first of these plants flowered and fruited in 1965, and all of the them flowered in 1966; in both years none flowered earlier than August 20. In 1966, according to National Arboretum records, six seed-grown plants of this accession were growing in the nursery, ranging between nine and eleven feet in height. The records show that the plants varied in the size of their capsules, but no other attributes were recorded, and none

STEPHEN A. SPONGBERG

The large inflorescences of the golden-rain tree produce hundreds of bright yellow flowers and enliven any landscape in which the tree is planted. Normally, the trees flower in late June and July, but the cultivars 'September' and 'Rose Lantern' postpone their floral display until late August and early September when few other trees are in flower.

has ever been given a cultivar name.

In a letter to March dated January 28, 1966, Professor McDaniel suggested that these trees, as well as the parent trees at the University of Indiana, might conform to *Koelreuteria apiculata* Rehder & Wilson. In his response that September, March noted that Frederick G. Meyer of the National Arboretum staff believed that the trees were merely late-flowering variants of *K. paniculata.* Indeed, in his subsequent monograph of the genus, Meyer (1976) placed both the specific and varietal designations of *apiculata* in the synonymy of *K. paniculata.*

The late Donald Wyman, then Horticulturist at the Arnold Arboretum, had received a carbon copy of McDaniel's 1966 letter to March, and in February of that year he wrote to March requesting seeds or seedlings from the National Arboretum trees for the Arnold Arboretum collections. Since neither seeds nor seedlings were available, March offered root cuttings for propagation. In his typical fashion, Wyman penned his response to this offer on the original letter and returned it to March, commenting, "We can certainly try root cuttings, if you can spare them, but don't hurt the tree." Sixteen root pieces from one or more of the six seed-grown plants at the National Arboretum (NA 16548) were subsequently sent to Wyman on March 21. At the Arnold Arboretum these materials were accessioned as "*K. paniculata*—Special," and given accession number AA 577-66.

In 1967 McDaniel and March described and proposed the cultivar name 'September' for the most floriferous of the two late-flowering trees growing at the University of Indiana, which by that time was being propagated by softwood cuttings. This cultivar name was duly registered with the Arnold Arboretum (which at that time served as International Registration Authority for cultivar names of otherwise unassigned woody genera), and a fruiting specimen collected from the Indiana tree on September 28, 1966, was deposited in the Arboretum's Jamaica Plain herbarium to document the plant to which this cultivar name was applied. It was not until November, 1968, that the National Arboretum received a plant of 'September' vegetatively propagated from the University of Indiana original. The four-inch-tall rooted cutting that Professor McDaniel sent was accessioned as NA 31132. Four additional individuals of 'September' were subsequently incorporated into the National Arboretum's collections, but accession records for these plants are missing.

Meanwhile, only a single plant resulted at the Arnold Arboretum from the sixteen root pieces that had been received from the National Arboretum and accessioned under number AA 577-66. And once McDaniel and March had published the cultivar name 'September', the assumption was made that the Arnold Arboretum's solitary plant represented this clone. Consequently, its name in the Arboretum's records was changed from "Special" to 'September' in 1969, and the sole representative was planted adjacent to other golden-rain trees in a prominent position along Meadow Road, across from the *Cotinus* and *Acer* collections. One additional plant, propagated in 1968 as a rooted softwood cutting from AA 577-66 and given accession number AA 771-68, was incorporated into the Arboretum's collections in another prominent location, on the edge of Bussey Hill Road where the birch and cherry collections merge. Both of these trees begin flowering during the last weeks of August and continue to please visitors to the Arboretum with their bright yellow floral display into the month of September, followed by their equally handsome display of reddish pink capsules into October and November. (The capsules can be seen on the inside front cover.)

The next sequence of events began in 1984, when the senior author, along with his colleague at the National Arboretum, Alice J. McArdle, attempted to hybridize *Koelreuteria paniculata* and *K. bipinnata* Franchet. The latter species is native to areas south of the 30th parallel in China and is not as cold hardy as *K. paniculata*. In 1984 the National Arboretum collections included two thirty-foot trees of *K. bipinnata* (NA 34048) as well as four smaller specimens (NA 44305). Both of these accessions had been received from the Los Angeles State and County Arboretum in Arcadia, California, in 1972 and 1980, respectively, and the trees of the older accession were vigorous plants with upright crowns. Meyer (1976) had described the color of the capsules of *K. bipinnata* as "rose-purple while young," and in some years the fruiting display on the National Arboretum trees was truly spectacular.

The goal of the interspecific hybridization program was to combine the upright growth habit and reddish capsule color of *Koelreuteria bipinnata* with the cold hardiness of *K. paniculata*. Because *K. bipinnata* normally flowers in late August and early September, *K. paniculata* 'September'—in flower during the same period—was the obvious choice for the *paniculata* parent in the hybridization experiments. Hybrids between the two species were indeed obtained, and McArdle and Santamour (1987) were able to verify the hybrid status of the seedlings using a process known as gel electrophoresis on isoperoxidase enzymes extracted from tissue at the base of leaf petioles. This process is similar to the DNA analysis of human tissue that is increasingly used in today's forensic laboratories. The researchers analyzed hundreds of hybrid plants and found only three major anodal peroxidase bands—"A," "B," and "C." The enzyme profile of 'September' proved to be "AC," while that of all six plants of *K. bipinnata* used in the hybridization program was "B."

Twelve of the progeny from crossing 'September' as the seed parent with *K. bipinnata* as the pollen parent were identified as "true" hybrids inasmuch as they exhibited enzyme patterns of either "AB" or "BC," with the "B" band inherited from *K. bipinnata* and either the "A" or "C" band coming from *K. paniculata*. Further confirmation came from later studies of isoperoxidases in cambial tissue (Santamour, unpublished), which yielded enzyme banding patterns identical with those obtained earlier from petiolar tissue. The interspecific hybrids,

PETER DEL TREDICI

The oldest plant of Koelreuteria paniculata *'Rose Lantern' in the Arnold Arboretum grows along Meadow Road across from the* Cotinus *and* Acer *collections. As can be seen in this photograph, it has a rounded habit. It measured 34 feet in height with a crown spread of 40 feet in July of 1996. Note that the* K. paniculata *on the left is in fruit while 'Rose Lantern' is in flower.*

planted at the United States Department of Agriculture Station at Glenn Dale, Maryland, in 1986, have exhibited hybrid vigor in their growth rate (they were twice as tall as equal-age seedlings of the parent species in 1994), yet unfortunately, the hoped-for capsule color had not been captured.

It was because of the senior author's failed attempts to produce a hardy, red-fruited plant of the golden-rain tree through hybridization of the normally red-fruited *Koelreuteria bipinnata* with *K. paniculata* that he was literally dumbfounded when he visited the Arnold Arboretum in the fall of 1994. For there, growing along Meadow and Bussey Hill Roads, were two golden-rain trees with rosy-red capsules glowing like Japanese or Chinese lanterns in the October sunshine—the very plants he had hoped to synthesize through hybridization, except that the Arnold Arboretum trees exhibit a rounded rather than an upright growth habit. And both of these trees, as explained above, were labeled as representing the cultivar 'September'. Not convinced of their identity, the senior author collected material from the younger tree (AA 771-68) for enzyme analysis. There was the outside possibility that these Arnold Arboretum trees did indeed represent 'September', and that geographic location and climatic differences between Boston and Washington, DC, were responsible for the development of their rosy-red capsules, which are most highly colored on the surfaces exposed to the sun. (This phenomenon is a typical response to sunlight of anthocyanin pigments, which are frequently responsible for imparting a red coloration in plant tissues and structures.)

Since electrophoretic analyses of cambial tissue confirmed that the oldest National Arboretum specimen of 'September' (NA 31132) carried the enzyme phenotype "AC," as did the other four trees known as 'September' at the National Arboretum, the question became: Did the Arnold Arboretum tree have the same enzyme profile? No! It produced only one enzyme band in electrophoretic analysis, the "A" band. The six unnamed seed-grown plants at the National Arboretum accessioned as NA 16548—the plants from which the root pieces sent to the Arnold Arboretum originated—showed three enzymatic profiles: two plants with "A," two plants with "C," and two plants with "AC." Further analysis of stem cambium of Arnold Arboretum accession AA 577-66 and root cambium of both AA 577-66 and AA 771-68 confirmed the "A" enzyme phenotype for both Arnold Arboretum trees. It seems reasonable to assume that the root pieces of NA 16548 sent to the Arnold Arboretum in 1966 were taken from tree number 6, at the end of the National Arboretum's nursery row, since it has the same enzyme profile ("A") as the Arnold Arboretum trees and would have been the easiest tree from which to collect root pieces. However, tree number 6, like all the others, produces green immature capsules.

The one likely explanation for the rosy-red capsules on the Arnold Arboretum trees is that a rare somatic mutation—a genetic change, in this instance affecting capsule color—occurred during the process of bud initiation on the root piece that developed into the original Arnold Arboretum tree. This seems quite possible in view of the fact that shoot meristems produced by roots normally have a different structure from those produced by stems (Peterson, 1975).

The distinctive coloration of the Arnold Arboretum's trees is the attribute on which we base the naming of this genotype as a distinct cultivar. The name 'Rose Lantern'—given because the papery rosy-red capsules look like miniature Japanese lanterns—has been submitted to the Brooklyn Botanic Garden, which now serves as the International Registration Authority for otherwise unassigned woody genera, and specimens from both trees have been deposited in the Arboretum's Jamaica Plain

Size and Shape

The cultivar 'September' is not a well-formed or robust plant, its only special virtue being its late flowering period. In October of 1994, measurements were made of all the specimens at the National Arboretum that had been derived from the University of Indiana original. By then, the tree labelled 'September', received in 1968 as a propagated plant (NA 31132), was 26 years old. It measured 16.7 feet in height, with a crown spread of approximately 20 feet, and its trunk was 7 inches in diameter at one foot above ground level. According to the Royal Horticultural Society's color chart, its immature fruit capsules are a yellow-green, ranging from RHS 145-B to 150-C. At the same time, the six trees grown from seeds of the original Indiana tree—received at the National Arboretum in 1960 (NA 16548)—ranged in height from 34 to 39 feet, with trunk diameters measuring from .5 to 14.6 inches. Since these trees are growing in a short nursery row, crown spread was difficult to measure, but the trees at either end averaged a 39-foot spread. The color of the immature capsules was similar to that of 'September'.

The two Arnold Arboretum trees, now christened 'Rose Lantern', are also of rounded habit. The older of the two trees (AA 577-66) has a single trunk with a diameter of 1 foot 7 inches at one foot above ground level, but at 2 feet 6 inches the trunk diverges into three main limbs. Its crown spread measures 40 feet, and the tree is 34 feet in height at thirty years of age. The younger tree (AA 771-68) is 28 feet in height with a crown spread of 35 feet. It has three trunks growing from the base, with diameters at one foot above ground level of 5.5, 10, and 11 inches. Both of these individuals, like *Koelreuteria paniculata* 'September', flower at the end of August and into the first weeks of September, but their immature capsules are a decided rosy-red (RHS 180-A).

herbarium. On a cautionary note, however, it should be kept in mind that the plant we are now calling 'Rose Lantern' has been growing on the grounds of the Arnold Arboretum under the name 'September' since 1969, and that propagation material has been shared with growers under that name. Depending on the source of propagation material, then, some of the plants being sold as 'September' could, in fact, be the newly named cultivar 'Rose Lantern'. The pink immature fruit capsules would be the telltale trait.

The next question that arises concerns the most efficient and effective way to propagate the two Arnold Arboretum trees to ensure that their flowering and fruiting attributes are maintained in subsequent progeny. More than likely, a high percentage of the seedlings arising from self-pollination of the two trees would produce rosy-red capsules. We can assume for simplicity's sake that there is one gene (with two alleles) for fruit color. Any mutation would likely occur in only one allele, and even though that mutation might be dominant—as the red pigmentation appears to be—the plant would be heterozygous at that locus (that is, with both the dominant and recessive alleles present). Self-pollination would then result in a seedling population that is 25 percent homozygous red (two dominant alleles), 50 percent heterozygous red, and 25 percent homozygous green (two recessive alleles). Seedling populations from the Arnold Arboretum's trees should obviously be grown to sexual maturity to test this hypothesis. Such a trial would also provide the opportunity for further selection of outstanding plants from within these populations and their naming and introduction into the horticultural trade. However, because of the possibilities outlined above, seed propagation of 'Rose Lantern' would not necessarily guarantee late-flowering and rosy-red fruited trees.

Ideally, *Koelreuteria paniculata* 'Rose Lantern' would be vegetatively propagated by rooting stem cuttings. However, this has proved to be a difficult procedure, typically successful only in low percentages. To date, commercial production of the cultivar 'September', or 'Rose Lantern', is done mainly by midsummer budding on seedlings of *K. paniculata.*

Currently, propagation trials of *Koelreuteria paniculata* 'Rose Lantern' are underway at the Arnold Arboretum's Dana Greenhouses using both root and softwood cuttings. In the meantime, budwood and scions of 'Rose Lantern' are scheduled for distribution to commercial nurserymen and sister institutions via "PIPD," the Arboretum's Plant Introduction, Promotion, and Distribution Program (Tripp, 1995). We hope that this late-flowering, rosy-red fruited variant of the golden-rain tree will gain the popularity in the horticultural marketplace we feel it deserves, and that those now growing 'Rose Lantern' under the misapprehension that it is 'September' will note the distinction between the two late-flowering cultivars.

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Dugout Canoes, Arrow Poisons, and the Cure for Cancer: Book Review

Todd Forrest

Ethnobotany: Evolution of a Discipline. Edited by Richard Evans Schultes & Siri von Reis. Dioscorides Press/Timber Press, 1995. Hardcover, 414 pages, $49.95

Plants, People, and Culture: The Science of Ethnobotany. Michael J. Balick & Paul Alan Cox. Scientific American Press, 1996. Hardcover, 228 pages, $32.95

Since I occasionally give tours of the Arboretum to friends and relatives who are not entirely convinced that plants are either interesting or relevant, I have developed a two-part strategy for persuading them of the joys of botany. The first part of the strategy is an appeal at the visceral level. I have my guests inhale the fragrance of a *Magnolia tripetala* flower, lick the inner bark of a *Betula lenta,* sniff a root from a *Sassafras albidum* sucker, or eat the fruits from *Amelanchier laevis, Actinidia arguta,* or *Vaccinium corymbosum.* If these gastronomic and olfactory treats fail to pique their interest, I switch to a topic that seems to hold universal appeal: the human uses, both traditional and modern, of the plants we grow. This part of the strategy is almost always successful—I've had visitors shrug impatiently at a *Cornus florida* in full bloom only to light up with intense curiosity when I explain that the wood of this species was once used to make wheels for roller skates and shuttles for industrial looms.

The anthropocentrism that guarantees my success on Arboretum tours might account for the recent rise in the mainstream popularity of ethnobotany, a science that focuses on the role of plants in human societies. Ethnobotanists employ the observational techniques of anthropology and the analytical tools of botany and chemistry with the broad aim of understanding both the people and plants they study. Since most unknown plants and little-studied cultures are found in the nonindustrialized regions of the world, ethnobotany often entails travel to exotic destinations far away from the world's largest cities, creating an aura of adventurous romance that appeals to those of us who missed out on the Age of Discovery. This romantic view of the science inspired a movie about an ethnobotanist working in the field (*Medicine Man,* starring Sean Connery), but it is not just desire to experience the exotic or nostalgia for a simpler way of life that motivates real ethnobotanists in their work. In addition to expanding our knowledge of people and plants, the information they accumulate might eventually provide solutions to some of the world's most vexing health problems and aid in the preservation of rapidly disappearing traditions.

Plants, People, and Culture: The Science of Ethnobotany, written by Michael J. Balick and Paul Alan Cox, and *Ethnobotany: The Evolution of a Discipline,* edited by Richard Evans Schultes and Siri von Reis, discuss ethnobotany's growth and change from the simple cataloging of useful plants to a complex, multidisciplinary science. In their well-illustrated and clearly written text, Balick and Cox illuminate a general introduction to ethnobotany with examples of their own fieldwork and some classic stories of plant research and discovery. Schultes and von Reis have edited a collection of somewhat technical essays by leading ethnobotanists and professionals from the many fields that overlap within the science, ranging from chemist Albert Hoffman to classicist Carl Ruck. On their own, each of these books presents a different image of ethnobotany; together they give a thorough and engaging view of this fascinating and continually evolving science.

As a person who is deeply interested in plants but often impatient with stolid academic prose, I was pleasantly surprised by the readability of *Plants, People, and Culture.* Balick and Cox have written their text for a broad audience without presupposing much knowledge of either botany or anthropology. The result is a lucid, beautifully illustrated tour of historical and current ethnobotanical research. Instead of simply describing the science, the authors let plants and people tell the story. Each chapter focuses on a different way people use plants (as medicines, building materials, food, spiritual aids) and gives examples of these uses from all over the world. Balick and Cox describe the manufacture of arrow poison, the use of plant-based hallucinogens, the domestication of some of our most important food crops, the construction of boats, and many other interesting and unusual uses of plants. These detailed descriptions are infused with the authors' obvious enthusiasm for their field, making reading the book seem like participating in an ethnobotanical expedition.

While *Plants, People, and Culture* is informative and entertaining, it is also something of a polemic. Balick and Cox argue that the issues ethnobotanists tackle are relevant to all of us. Using the stories of the discovery of reserpine, digitoxin, quinine, and vinblastine—drugs developed from plants using clues obtained from ethnobotanical research—they show that even in these days of gene-splicing and chemical engineering, plants still have the potential to provide us with new cures. The authors claim that because of their botanical training, their complete immersion in the cultures they study, and their respect for indigenous peoples' knowledge, ethnobotanists are singularly qualified to find these cures.

But if ethnobotanists are going to find "new" medicines, foods, or building materials, they're going to have to do it quickly. Balick and Cox point out that many of the cultures described in their book exist in places where the environment and therefore the cultures themselves are endangered by development. In some cases, the threat is so immediate that ethnobotanists drop the role of impartial observer and act to preserve both plants and traditional knowledge. Two examples of such efforts come directly from the authors' own research. Residents of the Fijian island of Kabara were known throughout the Pacific for their shipbuilding skills, but as European colonists brought their own ships and technology to the island these skills started to vanish. Ethnobotanists, fearing the complete disappearance of this knowledge, commissioned one of the last skilled boat builders among the Kabara islanders to build a traditional ship, employing dozens of islanders and keeping the ancient industry alive. When people in Falealupo, a village on Savaii Island in Samoa, were faced with selling logging rights to their forest to pay for a new school, Paul Cox and some colleagues, recognizing the cultural and biological importance of the forest, raised money to help pay for the school, saving the land from development. The book ends with the caveat that in order to achieve their goals, ethnobotanists must respect and work closely with the people they study.

If *Plants, People, and Culture* is an engaging overview of ethnobotany, then *Ethnobotany: The Evolution of a Discipline* is an in-depth analysis of its raisons d'être. More academic than entertaining, *Ethnobotany* is divided into sections, each of which includes essays concerning different aspects of ethnobotany written by a variety of social and natural scientists. There are sections on such diverse topics as the history of ethnobotany, the relevance of ethnobotany to anthropology, the contributions ethnobotany has made to medicine and agriculture, and the role of ethnobotany in conservation. Since the book is a collaborative effort, each essay is written in a different style, from Janis Alcorn's pedantic analysis of the philosophy of ethnobotany to Edward Anderson's lively discussion of the role of the liberal arts in the field. As a result, *Ethnobotany* is an informative, if somewhat arrhythmic, read.

It wasn't until 1895 that the term ethnobotany was coined by University of Pennsylvania botanist John Harshberger, but the true beginnings of the science extend much further into the past. According to E. Wade Davis, in its early days ethnobotany was indistinguishable from general botany, involving no more than the description and classification of useful plants.

Herbals such as *De Materia Medica* by Dioscorides, the *Codex Badianus* of the Aztecs, or the Chinese herbal *Sheng Nong Ben Cao Chien* can be viewed as ethnobotanical texts because they are compilations of traditional knowledge of plant uses. As Europeans started exploring Asia, Africa, and the Americas, ethnobotany became a means of identifying new commodities for import into the West. The spread of corn, tomatoes, tobacco, peppers, and other important plant products was a direct result of this early version of the science. Although they are still concerned with discovering new and useful plants, contemporary ethnobotanists interpret their observations of plant use from a broader perspective that involves not only systematic botany but linguistics, anthropology, and chemistry as well. Weston La Barre, for example, argues that ethnobotanical data have given anthropologists insight into the way cultures obtain and structure their knowledge of the surrounding world. Ethnobotany is no longer simply the description of useful plants or a means of exploiting of the world's resources: it has become a tool for general cultural interpretation with the goal of recording disappearing ways of life.

Articles by Mark Plotkin, Ghillean Prance, and C. Earle Smith discuss how ethnobotanists can aid conservation efforts by creating lists of species to target for protection. Due to the overwhelming diversity of flowering plants, the hope of protecting all plant species from extinction is probably unrealistic. Ethnobotanists can help narrow the field by determining which wild species have the most cultural importance in areas threatened by development. Some of these plants are generally unknown in the West, others are wild populations of important food crops such as sweet potato, corn, and rice that may represent new sources of genes for disease and pest resistance. And, just as Balick and Cox argue in their book, it is clear that in preserving useful plants we aid in the preservation of the cultures that depend on them.

Ethnobotany is not written primarily for the layperson with a passing interest in the field, though many of the essays would be of interest to the general reader. I particularly enjoyed the sections titled "Historical Ethnobotany" and "Ethnobotany and Geography," but in many cases the book gave me the sense of listening to a panel of experts called in to defend the legitimacy of ethnobotany against skeptical "hard" scientists. Part of this effort involves coming up with an unambiguous definition of the science (and dispelling the notion that ethnobotany is simply a newer form of romantic exploration), but because of the complexity of the issues ethnobotanists address, this task is more difficult than it might seem. Most of the definitions given are some variation of "the description of the various methods by which local peoples utilize plants"[1] or "the study of plants in relation to people."[2] In spite of this somewhat defensive tone, the essays in *Ethnobotany* taken together paint a comprehensive picture of both the long history and broad scope of field.

As the ethnobotanists in both of these books tell us about plant use in indigenous cultures, they also remind us of the debt our society owes to the observational and experimental skills of these cultures. Imagine our society without quinine, morphine, rubber, corn, or chocolate—all in use long before they were "discovered" by Europeans. Knowledge of the origins of these essential plant products should convince the reader of the importance of continuing ethnobotanical research. *Plants, People, and Culture* and *Ethnobotany* explain the methodology of and ideas behind this research and should appeal to anybody with an interest in plants or anthropology, or even in the history of science.

Endnotes

[1] J. O. Kokwaro, "Ethnobotany in Africa," *Ethnobotany: The Evolution of a Discipline*, 1995, page 216.

[2] C. B. Heiser, "The Ethnobotany of Domesticated Plants," *Ethnobotany: The Evolution of a Discipline*, 1995, page 200.

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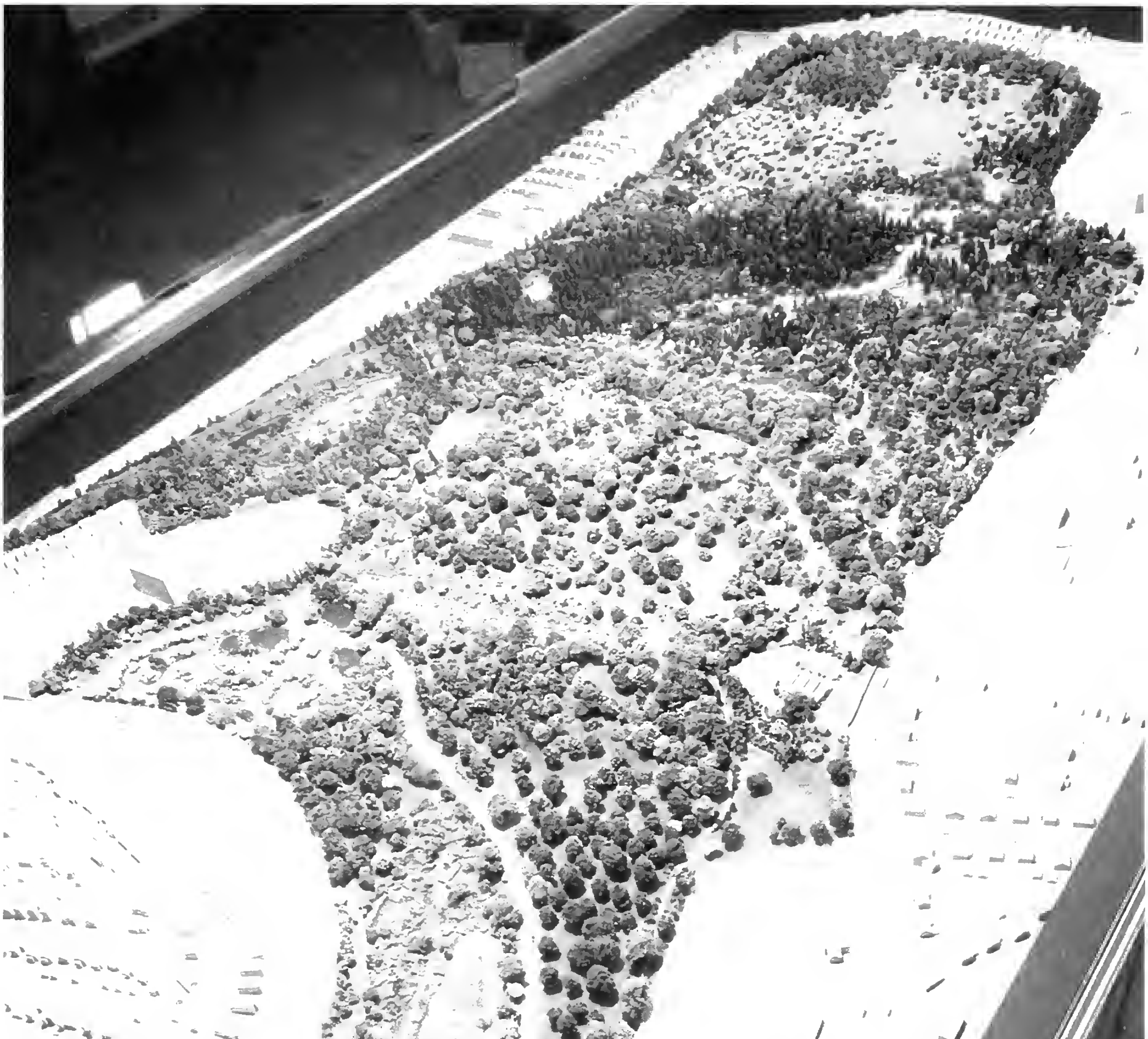
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Page

Front cover: After the flood, October 1996. Photograph by Peter Del Tredici.

Inside front cover: The centerpiece of the Arboretum's new exhibit is a striking 8-by-10-foot scale model of the landscape that replicates more than 4,000 trees in 40-to-1 scale. Photograph by Jim Harrison.

Inside back cover: Observatory and swing on the grounds of J. S. Potter, Arlington, Massachusetts, 1866. From Alan Emmet's *So Fine a Prospect: Historic New England Gardens*. Courtesy of the Boston Athenaeum.

Back cover: The five-millionth specimen of the Harvard University Herbaria. Photograph by David Boufford.

Liquidambar asplenifolium.
Farrenkrautblättriger Storaxbaum.

Bulldozers and Bacteria: The Ecology of Sweet Fern

Peter Del Tredici

Comptonia peregrina, a common roadside plant in eastern North America, provides a case study both of how nature copes with disturbance to the land and of just how convoluted the study of this process can be.

Sweet fern, *Comptonia peregrina*, is a shrubby member of the Myricaceae, or bayberry family. Its common name is derived from the pleasing fragrance that its tiny, resin-filled, glandular hairs give off when crushed or rubbed, and from its coarsely lobed, somewhat fern-like leaves. *Comptonia*, a distinctly unprepossessing plant, has a natural range that covers a large portion of eastern North America. Forming a rough triangle, the eastern flank of this range extends from Prince Edward Island and Nova Scotia south into the mountains of north Georgia; the western edge reaches from the southern Appalachians north through Tennessee and Minnesota all the way to central Manitoba; and the northern edge runs from the Canadian plains through central Ontario and Quebec to the Atlantic (Elias 1971). Sweet fern typically grows to three or four feet in height and, over time, forms extensive colonies—up to twenty feet across—from suckers produced by its roots.

As to habitat, sweet fern shows a strong preference for dry, sandy soils with full exposure to the sun. These sites, which include dry, piney woods, exposed mountain slopes, abandoned pastures, pine barrens, highway bankings, gravel pits, weathered mine tailings, and cut-over forested land, have typically experienced some form of disturbance in either the recent or distant past (Schramm 1966; Schwintzer 1989).

Two attributes equip *Comptonia* for the pioneering role of a colonizer of disturbed soils. The first is its use of nitrogen gas from the atmosphere to produce nitrates—a feat it accomplishes by forming root nodules in symbiotic association with nitrogen-fixing bacteria. The second is an ability to propagate itself vegetatively by means of long, thick roots that run an inch or so beneath the soil surface. These shallow roots form numerous buds in the fall that grow into shoots the following spring. Under the right conditions, *Comptonia* behaves as a shrubby groundcover, spreading over large areas by means of these root suckers.

Historical Considerations

Sweet fern's distinctive form and pungent odor made a strong impression on the early European settlers of North America. Nowhere is this more apparent than in a passage from a book written in 1654 by one Edward Johnson, *Wonderworking Providence of Sion's Saviour in New England*. Johnson was presenting a secondhand account of the arduous journey made in 1636 by the first English settlers of Concord, Massachusetts, led by Captain Simon Willard. Starting from Boston, they traveled by boat as far as Watertown and then made their way overland, more or less following the meandering Charles River. Johnson describes (and undoubtedly embellishes) a scene in which the wearied pilgrims confront "a scorching plaine, yet not so plaine, but that the ragged bushes scratch their legs fouly, even to wearing their stockings to

The characteristics that inspired the common name sweet fern—tiny, resin-filled hairs and fern-like leaves—can be seen in this plate from Franz Schmidt's Osterreichs Allgemeine Baumzucht *(Vienna, 1792). The plant we know as* Comptonia peregrina *is labelled under a hybrid of the two names given it by Carolus Linnaeus in his* Species Plantarum. *It was Charles L'Heritier who demonstrated that the plant did not belong in either of the genera suggested by Linnaeus.*

their bare skin in two or three hours." Those without "bootes or buskings . . . have had the bloud trickle downe at every step." And injury was compounded when "the sun casts such a reflecting heate from the sweet ferne, whose scent is very strong, that some herewith have beene very nere fainting, although very able bodies to undergoe much travel."

John Josselyn's reference to sweet fern in his classic work *New-Englands Rarities Discovered,* written in 1672, is considerably more benign: "Sweet Fern, the Roots run one within another like a Net, being very long and spreading abroad under the upper crust of the Earth, sweet in taste, but withal astringent, much hunted after by our Swine: The Scotch-men that are in New-England have told me that it grows in Scotland." Josselyn was an astute observer, as his description of the spreading roots of the plant clearly indicates. His Scottish informants, however, were dead wrong; sweet fern is native only to eastern North America.

It was Carolus Linnaeus who assigned the first modern scientific name to sweet fern, which he did in *Species Plantarum,* published in 1753. Unfortunately, he confused the situation by accidentally giving the plant two names, *Liquidambar peregrina* on page 999 and *Myrica asplenifolia* on page 1024. Subsequent authors were left to choose which name to use. The currently accepted name of sweet fern's genus, *Comptonia,* was established in 1789 by the French botanist Charles L'Heritier, who demonstrated that the plant did not belong in either of the genera suggested by Linnaeus. L'Heritier's name commemorates Henry Compton (1632–1713), Bishop of London, a lover of trees and an early supporter of botanical research and exploration.

Linnaeus' student Peter Kalm, who may well have collected the specimens on which Linnaeus' original description was based, provided a particularly interesting reference to sweet fern in his book, *Travels into North America,* written in 1770. In this work, a report of his travels between 1747 and 1750, Kalm noted the medicinal use of sweet fern by indigenous people: "Among the Iroquois, or Five Nations, on the Mohawk River, I saw a young Indian woman, who by frequent drinking of tea had gotten a violent toothache. To cure it she boiled the Myrica aspleniifolia, and tied it, as hot as she could bear it, on the whole cheek. She said that remedy had often cured the toothache before." The medicinal use of sweet fern must have been widespread, given that later authors and travelers make frequent reference to its use not only by various tribes of Native Americans, but also by European settlers (Erichsen-Brown 1979).

William Bartram mentions sweet fern only once in his *Travels,* but more significantly, he offered it for sale in his famous *Catalogue of American Trees, Shrubs, and Herbaceous Plants,* published in 1783 (Fry 1996). In this broadside, Bartram listed sweet fern under a hybrid of the two Linnaean names, *Liquidambar Aspleni Folia,* noting that it grew on "Light dry sandy Ridges." Two years later, Humphrey Marshall produced the first detailed description of the sweet fern in his book, *Arbustrum Americanum,* also using Bartram's hybrid name, *Liquidambar asplenifolia.* Marshall's publication, which is considered the first book by an American about American trees and shrubs, brings to a close the early history of *Comptonia.* Later botanical authors continued tinkering with the name, but added little original information to the basic understanding of the plant itself.

Desperately Seeking Sweet Fern

My own involvement with sweet fern began in 1971 when I started working for the late Dr. John Torrey at the Harvard Forest in Petersham, Massachusetts, just after he had shifted the focus of his research from root physiology to nitrogen fixation. He selected *Comptonia* as his experimental subject and hired me to grow it in the laboratory. At that time, the symbiosis of legumes with the nitrogen-fixing *Rhizobium* bacteria was well understood, but almost nothing was known about nitrogen fixation by the so-called nonlegumes that form a symbiotic association with a totally different type of bacterium in the genus *Frankia.* When Dr. Torrey's project started, no one, despite seventy years of trying, had succeeded in isolating the causative bacterium from a nonleguminous root nodule or in culturing it independent of its host. This

Sweet fern is seen with quaking aspen growing along Route 2 in Concord, Massachusetts.

failure was the block that held up progress in researching the subject.

With an overabundance of enthusiasm and a dearth of experience, I was hired to bring sweet fern into the greenhouse—domesticate it, if you will—so that we could study the nitrogen-fixation process in a controlled environment. To cultivate *Comptonia* under laboratory conditions, we couldn't just dig up plants from the field because the roots were always contaminated with fungi and bacteria other than the one we wanted to study. No, Dr. Torrey insisted, we had to grow the plant from seed in sterile sand. In central Massachusetts, sweet fern's seeds, technically considered to be fruits, ripen around the fourth of July. They are light brown in color, four-to-five millimeters long, and, as they mature, they become enveloped in a burrlike structure that is covered with long, green bracts. The burrs are soft to the touch and give off a delicious, almost spicy scent when one rubs them between the thumb and the forefinger to extract the seeds.

Once we had managed to collect enough seeds to work with, the next hurdle was to get them to germinate. We tried all the standard techniques for stimulating seed germination in woody plants and all of them failed. Subsequent research with excised embryos grown in a sterile culture demonstrated that the failure resulted from the presence of chemical inhibitors located in the innermost seed coat. These inhibitors are not unique to *Comptonia.* In most temperate plants, however, chilling effectively counteracts the inhibitors—not the case with sweet fern seeds. It was only when Dr. Torrey suggested treating the seeds with gibberellic acid, a naturally occurring plant growth regulator, that we were able to get any of them to sprout. Eventually we learned that soaking scarified seeds in a dilute solution of gibberellic acid for twenty-four hours would produce up to

80 percent germination (Del Tredici and Torrey 1976). While these results were satisfying in that they allowed the research program to move forward, they were also frustrating because we could not relate the gibberellic acid treatment to the way the seeds behaved in nature.

The problem stumped me for some time. In four years of studying *Comptonia* I had examined thousands of plants all across New England but had never found a wild seedling. Invariably, every small plant I found was attached to a root that emanated from an established plant. For whatever reason, I never found *Comptonia* seedlings under an existing clump of sweet fern. In frustration, I stopped thinking about the problem of seed germination in nature until one day in the spring of 1976, on a walk in the woods in northwest Connecticut, I came upon a site where hundred-year-old white pines *(Pinus strobus)* had been clearcut and then bulldozed the autumn before. Among all the weeds and whatnot that were emerging, I was amazed to see seedlings of sweet fern growing, their cotyledons still attached. There were no adult plants to be found, just seedlings. In all, I counted 194 of them in an area of less than an acre (Del Tredici 1977).

According to my reasoning, these seedlings must have arisen either from dormant seeds buried in the soil (the so-called seedbank) or from seeds brought in by some dispersal agent. Given the relatively large size of the sweet fern seed and its lack of any specialized dispersal structures, transport by rain or wind could be ruled out; and its inconspicuous appearance and lack of fleshy coverings make dispersal by animals extremely limited. Indeed, the only animal ever reported to eat the sweet fern seeds is the yellow-shafted flicker *(Colaptes auratus)*, a ground-feeding member of the woodpecker family. One F. E. Beal examined 684 flicker stomachs in 1911 and found an undisclosed number of *Comptonia* seeds in one of them. However, in order to explain by animal dispersal the 194 seedlings that appeared just one year after clearcutting, one would need to postulate a sizeable flock of flickers roaming the countryside, eating sweet fern and defecating exclusively on this one acre in the woods.

The lack of any obvious dispersal mechanism left buried seeds as the only likely explanation for the seedlings in the Connecticut clearcut. The question was, how did they get there? In nature, most *Comptonia* seeds come to rest within a half meter of the parent that produced them and are soon buried in the leaf litter that collects beneath the plant. As I see it, deep chemical inhibition prevents germination for several years, by which time the seeds are well covered. The litter contributes to delayed germination either indirectly, by excluding light, or directly, by giving off specific chemicals that suppress germination. In either case, a buried seed will not sprout unless brought to the surface after its own internal dormant state has been neutralized. In the Connecticut woods where I found my sweet fern seedlings, this resurrection was facilitated, albeit inadvertently, by the state forester who upon completion of the logging operation had the whole area bulldozed to encourage the "natural" regeneration of white pine seedlings.

Clearly bulldozing was just what the sweet fern seeds needed. They had been deposited in the soil before the pines grew up, while the land was in pasture, and then germinated after the logging operation brought them to the surface. On the basis of ring counts of the cut pine trees, I estimated that the canopy of pines had closed about seventy years before I came on the scene, the point when sweet fern would have disappeared from the site because of insufficient sunlight. Seventy years, then, is a minimum estimate of the time the seeds could survive in the soil. I have no idea what the maximum is.

It is clear, however, that soil disturbance is an absolute requirement for the germination of *Comptonia* seeds. Henry David Thoreau made essentially the same observation in his journal on October 22, 1860: "I notice that the first shrubs and trees to spring up in the sand on railroad cuts in the woods are sweet-fern, birches, willows, and aspens, and pines, white and pitch; but all but the last two chiefly disappear in the thick wood that follows." All of the above species, save *Comptonia*, have wind-dispersed seeds that exhibit no capacity for long-term survival in the soil. Clearly sweet fern's buried seed

PETER DEL TREDICI

Sweet fern in fruit at the height of summer.

strategy, which evolved in response to natural disturbance such as fire and erosion, had adapted well to the human-induced changes of the twentieth century. Sweet fern, as a pioneer species, can play an important role in revitalizing land that has been traumatically stripped of its plant cover.

Nitrogen Fixation

Eventually, after seven years of work, Dr. Torrey's research team succeeded in isolating the bacterium that is responsible for nitrogen fixation in *Comptonia*. Using gibberellic acid to stimulate germination, we were able to produce abundant nodule growth on vigorous seedlings that were grown with their roots dangling in a nutrient mist (aeroponics). This system, unlike water culture (hydroponics), allowed the plant roots to develop the hairs through which the bacteria penetrated the root itself (Zobel et al. 1974). By repeatedly subculturing the nodules from one mist box to the next, we eventually were able to produce "clean" nodules that were relatively free of other microbial contaminants (Callaham and Torrey 1977; Bowes et al. 1977). These nodules were then surface-sterilized, macerated together with special digestive enzymes, and incubated on an elaborately formulated nutrient agar. After three weeks of culture, Dale Callaham, who did the isolation work, observed several small colonies of bacteria with filamentous growth. While the unusual morphology of this organism clearly resembled that of an actinobacterium, it was unlike any that had been previously described. It was not until we had obtained a second generation of functional nodules by re-innoculating fresh *Comptonia* seedlings with a culture of the isolated bacterium that we knew we had the real thing.

This conclusion was corroborated when we isolated the filamentous bacteria from the second-generation nodules and found them to be identical to those of the first generation. It was only by following this elaborate procedure—referred to as fulfilling Koch's postulates—that we could prove that we had the causative organism in hand. These successful results, published

A micrograph of the Frankia *bacteria showing its long, branching filaments under Nomarski phase interference optics at a magnification of 1500x.*

in 1978, marked the conclusion of nearly seventy years of frustrated attempts to isolate a *Frankia* bacterium from its host plant.

This breakthrough opened wide the floodgates of research on actinorhizal plants, whose important role in colonizing bare, nutrient-poor ground was just starting to be appreciated. Most of the nitrogen fixed by these plants enters the nutrient cycle slowly through the decomposition of fallen leaves, twigs, branches, and fine roots, but over time the contribution of actinorhizal plants to the total ecosystem nitrogen budget can be substantial. Research on red alder *(Alnus rubra)* in the Pacific Northwest, for example, has shown that pure stands of the tree can add up to 280 pounds of nitrogen per acre per year to the forest (Schwintzer and Tjepkema 1990). It is important to keep in mind, however, that nitrogen-fixing plants can typically hold their own against competition only when soil conditions are poor. On fertile ground they seem to lose some of their competitive advantage to other trees and shrubs. In a very real sense, nitrogen-fixing plants sow the seeds of their own replacement by elevating the nitrogen content of the soil.

Propagation and Cultivation

Sweet fern's ability to propagate itself from root suckers is another important component of its colonization strategy. Once the plant gets a foothold in a location to its liking, it comes to dominate the area by sending up numerous root suckers. The ever-observant Henry Thoreau made note of this on March 18, 1860: "The sweet fern grows in large, dense, more or less rounded or oval patches in dry land. You will see three or four such patches in a single old field. It is now quite perfect in my old bean-field."

William Bartram's 1783 offering of sweet fern notwithstanding, the plant has never made much of an impression in the nursery industry. There are several reasons for this, not least the plant's reputation for being difficult to propagate. Germination from seed, as shown above, is virtually impossible, and digging the plant up from the wild is seldom successful, given the ropy nature of its root system. It wasn't until the early 1970s that a research team at the University of Massachusetts, Amherst, developed techniques that allowed for the plant's commercial production (Hyde et al. 1972).

The authors of that study were seeking to identify plants that would rapidly cover highway bankings, and sweet fern was one of the plants that interested them. They designed an experiment to determine both the best time of year to take root cuttings as well as their optimal size. Two different-sized cuttings were collected twice a month for a period of one year: three inches long by one-quarter-inch diameter and three inches long by one-eighth-inch diameter. Forty-five days after the cuttings had been stuck in individual pots, they were checked to see whether they had produced leafy shoots.

No significant difference was found in the number of shoots produced by the two different cutting sizes over the course of the year, but the time of cutting was highly influential. At least

80 percent of the root cuttings taken between February 24 and May 1 produced shoots, while those taken between May 15 and August 1 produced few or no shoots. Cuttings taken between August 15 and December 10 produced good-to-poor percentages of shoots, depending on the date the cuttings were made. (No cuttings were taken between December 10 and February 24 because the ground was frozen.) Based on these results, the authors recommended that root cuttings be taken before the parent plant started to leaf out, around May in the Boston area. Root cuttings made after the stock plant's leaves emerged produced shoots in very low percentages. Their observations clearly suggest the existence of an inhibitory hormone produced by the leaves that suppressed the development of the root buds into shoots.

Landscape Uses: A Community Approach

Frank Egler, working with researchers at the Connecticut College Arboretum in New London, was among the first to recognize the potential role that sweet fern, as well as other suckering shrubs, could play in the formation of low-maintenance, naturalistic plantings along highway bankings and power company rights-of-way (Kenfield 1966; Niering and Goodwin 1974). In the course of their studies of old-field succession in the Northeast, the authors developed techniques—specifically the use of herbicides to selectively kill trees—to "arrest" the successional process at the shrub stage of development. Their goal was to manage existing vegetation to form a distinctively beautiful, low-growing landscape that would not interfere with power lines or highway sightlines. In New England, these low-maintenance associations commonly include, along with sweet fern, the following woody plants: pitch pine *(Pinus rigida),* red cedar *(Juniperus virginiana),* gray birch *(Betula populifolia),* meadowsweet (*Spirea* sp.), bayberry *(Myrica pensylvanica),* sumacs (*Rhus* sp.), low and highbush blueberries *(Vaccinium angustifolium* and *corybosum),* and quaking aspen *(Populus tremuloides).*

The University of Massachusetts group took the Connecticut College concept further by working out specialized techniques for actually planting—as opposed to simply managing—the shrub cover on fresh roadcuts and bankings. The authors found that root pieces of sweet fern could be stuck directly into a bare bank in early spring. According to recommended procedure, root cuttings of *Comptonia,* which can be anywhere from one-sixteenth to one-quarter of an inch in diameter and four to six inches long, should be planted an inch deep and six inches apart and mulched with two to three inches of wood chips. If this "direct stick" procedure is followed, sweet fern will produce a closed, weed-resistant canopy within three to six years.

A Pathological Problem

The final chapter in the *Comptonia* story pits one plant against another in a battle to the death. It concerns a disease that I became aware of only after publishing an article advocating sweet fern for landscape use. To my surprise, several plant pathologists wrote to chide me for my recommendation. Sweet fern, it turns out, is the alternate host of a fungus, *Cronartium comptoniae,* that causes sweet fern blister rust on hard pines with needles in bundles of two or three. In the Northeast, jack pine *(Pinus banksiana)* and pitch pine *(P. rigida)* can be infected, as well as other introduced hard pines. In the South, shortleaf pine *(P. echinata)* and loblolly pine *(P. taeda)* can be seriously infected.

During the course of its life cycle the blister rust has two hosts, the susceptible pine species and either sweet fern or its swamp-dwelling relative, sweet gale *(Myrica gale).* The fungus lives one stage of its life on the leaves of the sweet fern and the second inside the stem of the pine tree. Although *Comptonia* is only slightly affected by the fungus, the susceptible pine can be seriously damaged or even killed.

Control of the disease is difficult, given sweet fern's wide natural range, but the forestry literature makes a few simple recommendations, including taking care not to plant infected pine trees and clearing out sweet fern colonies within a quarter mile of any commercial hard pine plantation. In a report on the susceptibility of loblolly pine to sweet fern blister rust, J. D. Artman and T. N. Reeder (1977) observed that sweet fern "may become a major ground cover when dry sites are intensively prepared for planting." What the authors mean by intensive

PETER DEL TREDICI

A few last leaves cling to the stems of Comptonia peregrina *even through the snows of winter.*

site preparation is, of course, bulldozing before planting trees. This observation, buried deep within a technical report, confirmed once again the intimate relationship between *Comptonia* and catastrophic disturbance.

Conclusion

No discussion of *Comptonia* would be complete without saying something about its effect on the human senses. As the first settlers of Concord learned all too well, the scent of *Comptonia* on a warm summer's day can be overwhelming—a thick, resinous pungency that borders on the unpleasant. More spicy than sweet, the warm scent conjures up the fullness of summer, which no doubt explains why *Comptonia* foliage is often dried for use in sachets and potpourris. I suspect, too, that the use of *Comptonia* as tea by Native Americans and Europeans may have had as much to do with its pleasing fragrance as with its supposed medicinal attributes.

A second trait of sweet fern, one that catches the eye rather than the nose, is its tendency to hold onto its leaves late into the growing season. Even in the middle of winter one can find a few leaves clinging to the stems of the plant. Thoreau described this feature in his journal entry for January 14, 1860, along with his response to it: "Those little groves of sweet-fern still thickly leafed, whose tops now rise above the snow, are an interesting warm brown-red now, like the reddest oak leaves. Even this is an agreeable sight to the walker over snowy fields and hillsides. It had a wild and jagged leaf, alternately serrated. A warm reddish color revealed by the snow." And finally, in a passage that moves from mundane detail into emotional description, Thoreau writes of the sweet fern stem, densely covered with fine hairs: "As nature generally, on the advent of frost, puts on a russet and tawny dress, so is not man clad more in harmony with nature in the fall in a tawny suit or the different hues of Vermont gray? I would fain see him glitter like a sweet-fern twig between me and the sun" (October 16, 1859).

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A Park and Garden in Vermont: Olmsted and the Webbs at Shelburne Farms

Alan Emmet

With the Adirondacks as a backdrop across Lake Champlain, the W. S. Webbs, with guidance from Frederick Law Olmsted, entirely transformed their property to accord with their own vision. Owing to a continuity of ownership and planning, the landscape of the Webbs has lasted now for over a century.

Anyone who walks through the woods in New England can hardly miss the stone fences. Lichen-covered, often half-buried in pine needles, they thread their way up hill and down, now and then meeting each other at odd sharp angles. These fences are such an obvious sign of a drastically altered land use that you begin to wonder how the land once looked. And then you marvel at the sheer strength and determination of the region's first farmers.

The terrain at Shelburne Farms is different. Here, beside Lake Champlain in northern Vermont, you could walk through a thousand acres of woods and pastureland without encountering even a remnant of the typical old stone fences. The landscape is idyllically pastoral, with Brown Swiss cows browsing in verdant rolling meadows. This bucolic setting, unique now in the rapidly developing periphery of Burlington, Vermont's largest city, has long been an anomaly. The truth is that Shelburne Farms was deliberately made to look different from the surrounding countryside. The boundary walls of the old agricultural order were removed, stone by stone, in the 1880s, and the terrain was reshaped on a new and grand scale.

William Seward Webb (1851–1926) had grown up in New York City, where his father was the "pugnacious" editor of a New York paper.[1] Seward Webb studied medicine in Europe and at Columbia. He practiced for only three or four years before turning to finance on Wall Street, where he established his own brokerage house. Before long he became involved in railroad business with William Henry Vanderbilt, oldest son and chief heir of "Commodore" Cornelius Vanderbilt.[2]

Dr. Webb travelled to Vermont in 1880 to look at the Rutland railroad with an eye to annexing it to the Vanderbilt empire. Although he did not favor acquisition of the railroad, he liked what he saw of Burlington and the Champlain Valley. He also liked the Vanderbilts. In 1881, Seward Webb married Lila Vanderbilt, the next-youngest of William Henry's eight children. Not long after his marriage, Dr. Webb was named president of the Wagner Palace Car Company, suppliers of sleeping cars to the Vanderbilt-controlled New York Central Railroad.

For a wedding present, Lila's father gave her a house on Fifth Avenue at 54th Street, just a block from his own mansion and those of other family members. Their Fifth Avenue house was to be the Webbs' primary residence for thirty years. As the location for their requisite country house, they promptly settled upon the remote and unfashionable part of Vermont that had appealed to Dr. Webb.

On the shores of Lake Champlain at Burlington, the Webbs built a rustic summer cottage called Oakledge.[3] This was all very well for a young couple, but the Webbs had something grander in mind. Scouting out the area, Seward Webb decided the most desirable land lay along the lake in Shelburne. The farms there may have been worn out, but the topography and the scenery were special. The shoreline was irregular, with rocky promontories and curving

SHELBURNE MUSEUM SHELBURNE VERMONT

Steamer off Shelburne Point, *oil by Charles Lewis Hyde. This midcentury painting illustrates the view that Olmsted admired in 1845. The typical agrarian Vermont landscape in the foreground later became part of William S. Webb's Shelburne Farms and was subjected to a grand reordering.*

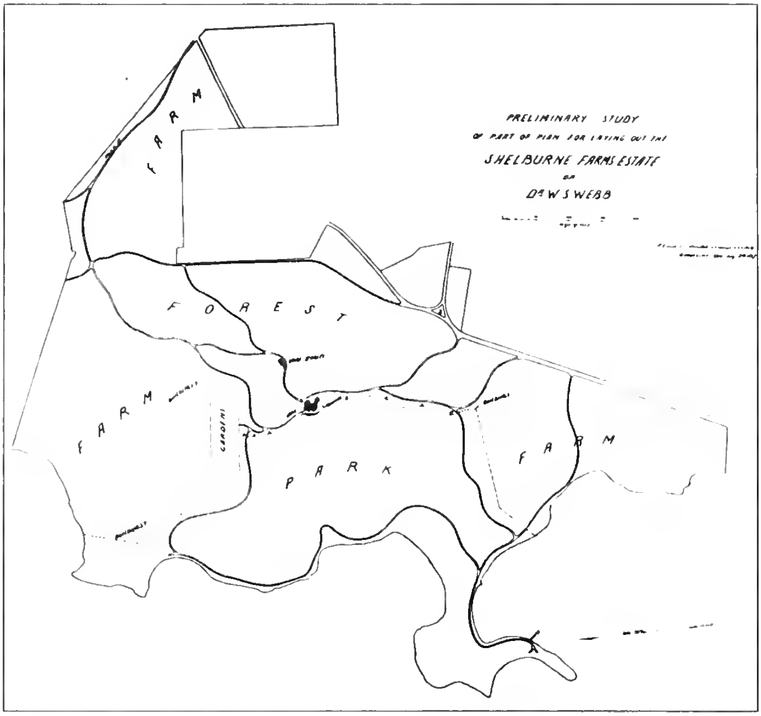
bays. From any point along that stretch of shore, one had the extraordinary view of the blue Adirondack mountains, rising tier on tier, on the far side of the lake. From Lone Tree Hill in Shelburne, three hundred feet above the water, the view to the west was even more impressive.

Webb began negotiating in 1885 to buy up parcels of land in Shelburne. In December of that year, his father-in-law William Henry Vanderbilt died, having doubled the fortune that *his* father, Cornelius, had bequeathed to him a mere eight years earlier.[4] Lila's inheritance was only a small fraction of her father's $200-million estate, but added to Seward Webb's own rapidly growing fortune, the couple's means seemed limitless. The Webbs could have almost anything they wanted. Dr. Webb enlarged the scope of his plans for Shelburne and accelerated the pace of his land purchases. Through an agent, he negotiated with local farmers, many of them impoverished, but not all of whom were pleased to learn that they had granted sales options to the same mysterious buyer.[5] By 1891, Webb had purchased all or portions of twenty-nine farms, covering 2,800 acres. The prices Webb paid varied widely, but the average was less than $150 per acre over a six-year period. Existing farm buildings added little if any value; Webb was interested only in land.[6] Still he continued to buy. Eventually he owned almost 4,000 contiguous acres.

Dr. Webb intended all along to reshape the separate farms he was buying into one great unified whole. His first move was to hire an architect to design a suitable house and major farm buildings. His choice of R. H. Robertson was a happy one for both men. Robertson was known to Webb as a designer of railroad stations and as architect of the Gothic Revival Church of Saint James in Manhattan. He worked for Webb for years. With Webb as his patron, Robertson's major work was done at Shelburne.

One of Dr. Webb's first directives to Robertson was to ask Frederick Law Olmsted, then the nation's preeminent landscape architect, to come as soon as possible to Shelburne to confer in regard to the "landscape department."[7] In his June 1886 letter to Olmsted conveying Webb's invitation, Robertson wrote that he had been retained to design "a most important Country house, stock barns—stables etc." for the 1,700 acres that Webb had by that time purchased along the lake. To make sure that

SHELBURNE FARMS



Preliminary Study for Part of Plan for Laying Out the Shelburne Farms Estate for Dr. W. S. Webb, *by F. L. and J. C. Olmsted, 1887. The lake shore is at the lower edge of this plan; the house, shown at the center, with its "home grounds" and "home stables" on top of Lone Tree Hill, was actually built close to the lake, contrary to Olmsted's advice. The plan indicates Olmsted's division of the estate into separate areas of farm, park, and forest.*

Olmsted realized the significance of the project, Robertson wrote that "if justice is done to the situation and conditions it will without doubt be one of the most important and beautiful country places in America and in view of this fact I *hope you can undertake the problem.*" Olmsted wrote to Dr. Webb immediately, arranging to make an inspection trip to Shelburne the very next week, adding that his charge for a preliminary visit would be $100 and traveling expenses.[8] Within a month after his first visit, Olmsted had formulated the basis for his proposal, which, as he outlined it to his colleague, Charles Eliot, was to be "a perfectly simple park, or pasture-field, a mile long on the lake, half a mile deep, the house looking down over it."[9]

Olmsted was at the peak of his career when he agreed to advise Dr. Webb. Ten years earlier, having completed his work on the New York City parks, he had moved his office to Brookline, Massachusetts. Since then, his practice had taken him all over the country. He continued to design public parks for cities, including Boston, Detroit, and Washington, DC. He advised on campus plans, ranging from Groton School to Stanford University. He collaborated with prominent architects such as H. H. Richardson on designs for private estates. At about the same time that he took on Dr. Webb as a client, he was working for other members of the extended Vanderbilt family in Newport, Lenox, and Bar Harbor. Biltmore, by far his largest undertaking for a private client, was still ahead. Olmsted's connection with the Vanderbilts had even included laying out the grounds for the family mausoleum on Staten Island.[10]

Staten Island, as it happened, had been the site of Olmsted's first contact with the Vanderbilts. In 1848, aged twenty-six and unsure of his life work, Olmsted had attempted to run a farm bought for him by his father. He lasted only two years on Staten Island but did get to know a neighboring farmer, William Henry Vanderbilt (the father, much later, of Lila Webb).[11] Vanderbilt was exactly the same age as Olmsted. He had been rusticated to farming by his father, Cornelius, who at the time considered him "an improvident dolt."[12] Dolt or not, Vanderbilt's farm, unlike Olmsted's, was quite prosperous.

Throughout his career as a landscape architect, one of Olmsted's primary goals was to improve the environment of the burgeoning cities where more and more people spent their lives. At the same time, he perceived the importance of planning to preserve wilderness areas and places of particular natural beauty. Olmsted worked to protect Yosemite and Niagara Falls, places he deemed to be national treasures, the birthright of all Americans. His work for rich private clients was just as firmly grounded in his belief in the necessity for conserving natural resources.

Wherever he worked, Olmsted was keenly aware of the character and scenery of the locale.

The Arnold Arboretum

FALL · NEWS · 1996

New Exhibit Opens: Science in the Pleasure Ground

For 125 years, the Arnold Arboretum, the country's oldest arboretum, has been a source of enjoyment and education in and beyond its 265 acres in Jamaica Plain. In October, as the first event in a milestone anniversary celebration, the Arboretum unveiled a new, permanent exhibit in the Hunnewell Visitor's Center. Titled "Science in the Pleasure Ground," the exhibit looks back at the Arboretum's history and reflects on the value of its landscape as a resource for exploring both cultural and natural history. It illustrates a range of topics that include the Arboretum's role in plant conservation, exploration, and research as well as in the evolution of landscapes, both private and public.

An 8-by-16-foot model of the Arboretum takes center stage in the exhibit. In 40-to-1 scale, more than 4,000 miniature trees replicate the living collections. The model also features historical vignettes of various periods, forming a "mosaic of time." For instance, one vignette portrays the mansion and landscape plantings of the mid-19th-century merchant and gentleman farmer Benjamin Bussey, whose estate later became the Arnold Arboretum. Another vignette depicts the archeological dig that confirmed the existence of prehistoric habitation on the grounds many thousands of years ago. A rail around the perimeter of the model accomodates further

Janet Stearns

In the Arboretum's new 8-by-16-foot model, a vignette of the devastation wreaked by the hurricane of 1938 can be seen on the slopes of Hemlock Hill. High winds knocked down 1,500 trees. Across the road is a replica of the sawmill known to have stood on Bussey (then Sawmill) Brook in 1654.

interpretation of the landscape's evolution.

Surrounding the model, five exhibits illustrate other aspects of the Arboretum's history: the design of the landscape; plant-collecting explorations; forest conservation here and abroad; American horticulture; and the various uses of wood. The exhibit's combination of historic photographs, plans, and drawings as well as physical artifacts, video clips, and interactive features is designed to appeal to viewers of varying interest levels. In the plant exploration exhibit, visitors can test their knowledge of the origin of trees in the "plant-matching game," which provides clues about some of America's most popular plants. Another exhibit tells the story of the design collaboration between Charles Sprague Sargent, the Arboretum's first director, and Frederick Law Olmsted, America's preeminent landscape architect and designer of Boston's Emerald Necklace park system. Features in this part of the exhibit include a replica of Olmsted's drafting table, original landscape drawings dating to 1872, and then-and-now photos of the landscape.

Funded by the National Endowment for the Humanities and by private donations, the exhibit grew out of an earlier NEH-funded book trilogy about the Arboretum published between 1991 and 1995: *A Reunion of Trees* by Stephen A. Spongberg, *New England Natives* by Sheila Connor, and *Science in the Pleasure Ground* by Ida Hay. It is from the wealth of information generated by this trilogy that the "Science in the Pleasure Ground" exhibit, in addition to a program of tours, signage, and children's field study, developed.

Karen Madsen

The participation of Living Collections staff ensured that all 4,000-plus miniature trees were planted in their proper places on the new model. Just before completion, Stephen Spongberg organized a tree-planting opportunity for all staff members. Seen here from left are Sheila Baskin, Perry Rivera, Stephen Spongberg, Kyle Port, and John Del Rosso.

Surrounding the new model are five exhibits that illustrate the history of the Arboretum in images, artifacts, video clips, and interactive features. Above is Gilbert Stuart's 1809 likeness of Benjamin Bussey, a Boston businessman who pursued scientific farming and experiments in reforestation at "Woodland Hill," one of Boston's grand country estates.

"Bussey's Woods," seen at right in an 1892 etching, was a popular destination for Bostonians seeking fresh air and natural scenery. When Bussey died in 1842, he bequeathed his Jamaica Plain farm to Harvard University for purposes of agricultural research.

Above is E. H. Wilson, one of the Arboretum's most famous plant explorers, seen in 1907 on one of his collecting expeditions to China. On trips to Japan, Korea, and Formosa (Taiwan) as well as China, he collected more than two thousand plants that were new to Western gardens. Above at right is a travel permit issued to Wilson in western China.

Over the years the Arboretum has sponsored many expeditions to Asia and continues to do so. The herbarium specimen at right documents a plant collected in Sarawak, Borneo, by John Burley, Arboretum Research Director, in 1987. National Cancer Institute researchers, in a test designed to identify properties that inhibit the AIDS virus, discovered that under laboratory conditions an extract of the plant, *Calophyllum lanigerum* var. *austrocoriaceum,* "essentially halted HIV-1 replication."

Janet Stearns

Friends of the Arboretum explored the new exhibit at an October gathering to celebrate the opening of "Science in the Pleasure Ground."

Professor Xue Ji-ru Visits Arboretum

Stephen A. Spongberg, Horticultural Taxonomist

Karen Madsen

Stephen Spongberg, Professor Xue, and Peter Del Tredici in the shadows of the Arboretum's original *Metasequoia glyptostroboides.*

On the afternoon of October 11, the staff of the Arnold Arboretum was honored by a visit from Professor Xue Ji-ru from Kunming in Yunnan Province, China. Professor Xue (who has published many botanical studies under the name Hsueh Chi Ju) was the Chinese forester who in 1946 visited the remote hamlet of Modaoqi in Hubei Province and collected the type specimens on which the Chinese botanists H. H. Hu and W. C. Cheng based their 1948 description of *Metasequoia glyptostroboides.* In January of that year E. D. Merrill, then director of the Arnold Arboretum, received the first shipment of *Metasequoia* seeds from China. Merrill was largely responsible for distributing the seeds of this "living fossil," frequently known as the dawn redwood, to sister institutions and interested individuals around the world.

While Professor Xue has devoted his long and fruitful career to the study of Chinese bamboos, he was particularly interested to examine the many dawn redwoods growing in various locations in the Arboretum. Earlier in the day he visited the Arboretum's collections in the Harvard University Herbaria in Cambridge where he saw one of the specimens of *Metasequoia* he had collected fifty years earlier. At a small reception held in his honor in the late afternoon, Professor Xue met many Arboretum staff members and reminisced about his plant discoveries in China.

Amy L. C. Wilson

Open House

The highlight of the 1996 Fall Open House was the opening of the new Arboretum exhibit, but the event also featured tours of grounds and greenhouses, a bucket truck and backhoe demonstration, and refreshments. Once again this year, children's program staff and volunteers guided a maple-tree treasure hunt for families. Despite brisk winds and threatening skies, it was very well attended.

Harvard University Herbaria Incorporate 5,000,000th Specimen

The Harvard University Herbaria celebrated a major milestone in October—the addition of the 5,000,000th specimen to their collections of dried plant and fungal material. The Herbaria—which include those of the Arnold Arboretum, the Gray Herbarium, the Farlow Herbarium, the Botanical Museum, and the New England Botanical Club—now form the eighth largest such plant collection worldwide, with the largest collection of Asian plants in the United States, the second largest orchid collection in the world, and more than 150,000 type specimens. In each of the past five years, the Harvard Herbaria have acquired approximately 20,000 specimens and have sent out an additional 7,500 specimens in exchanges with other herbaria. The Herbaria also make over 300 loans (25,000 to 30,000 specimens) annually to researchers at other institutions throughout the world.

Harvard's rich and varied botanical collections can be traced back to Asa Gray who, after coming to Harvard in 1842, described and catalogued the wealth of plant samples that were being collected in the American West and in the Old World. Many of these plants were new to science, and Gray's activities led to the founding of the herbarium that bears his name.

Charles Sprague Sargent, first director of the Arnold Arboretum, was one of several of Gray's students and associates who also developed separate botanical institutions at Harvard. A systematic collection was founded at the Arboretum soon after its establishment in 1872. This herbarium now contains approximately 1,307,000 specimens; those of cultivated origin are housed in the Hunnewell Building in Jamaica Plain, those of wild-collected origin are in Cambridge. The Arboretum collections are especially strong in material from Indo-Malesia (India to the Philippines and Papuasia), China, and eastern and southeastern Asia in general. The Chinese and Philippine collections are probably as comprehensive as any in the world. The collections are rich in type specimens largely due to the work of staff members such as Richard A. Howard, E. D. Merrill, E. J. Palmer, A. Rehder, C. S. Sargent, and E. H. Wilson. Several special collections reflect the interests of former staff members. Among them are the Susan McKelvey *Agave* and *Yucca* spirit collection and the Shaw collection of the genus *Pinus*. The herbarium of cultivated plants in Jamaica Plain contains approximately 160,000 specimens and, as might be guessed, is especially strong in woody plants cultivated in temperate regions.

New Plant Inventory Available

The 1996 edition of the Arnold Arboretum's *Inventory of Living Collections* has just been published. This 172-page, bound volume lists all the names and locations of the more than four thousand different plant taxa found in the Arboretum's living collections. In addition, this new edition of the inventory contains over fifty full-page illustrations of many Arboretum plants.

Copies of the inventory can be obtained by sending a check made out to the Arnold Arboretum in the amount of $20.00 to:

Arnold Arboretum Inventory, The Arnold Arboretum
125 Arborway, Jamaica Plain, MA 02130–3519

Arnold Arboretum Tot Trot

Chris Strand,
Outreach Horticulturist

Jim Gorman

More than a hundred runners with strollers lined up in front of the Hunnewell Building on Sunday, September 8, for the start of the Tot Trot, a race to benefit the Italian Home for Children and the New England Home for Little Wanderers. When Boston mayor Thomas Menino punched the starter's horn, the runners surged forward like a scene out of *Chariots of Fire* crossed with *Mr. Mom.* Fathers, mothers, and grandparents pushed their tiny passengers over a 3-mile course that wound its way through the Arboretum.

Prizes were awarded for fastest single, double, and triple stroller as well as to runners in different age categories. No one walked away emptyhanded: raffle prizes and chrysanthemums were given to those who didn't finish at the top of their class. All were happy to be supporting two worthwhile charities.

The race was organized by Liza Draper with the help of dozens of volunteers. They plus several sponsors, including the City of Boston and the Baby Jogger Company, were responsible for the race's success. More than $3,000 was raised for the two charities for their work with at-risk children.

Field Study Experiences
Tried-and-True Arboretum Visits for Elementary Schoolchildren

Diane Syverson, Manager of School Programs

Describing the Arboretum's field study program for schoolchildren has never been simple. To call them field trips minimizes the rich contribution these visits can make to a classroom's science curriculum. Consider, for example, the experience of Ann Glick, a teacher at Dorchester's Ellis Mendell School. Last year, Ms. Glick brought her fourth- and fifth-graders for three field study experiences, outdoor investigations used in tandem with her classroom science units. In the fall her students concluded several weeks of seed study with the Arboretum's "Plants in Autumn" program. Back at school, they developed a seed-dispersal classification system using ideas and seeds gathered during the Arboretum visit. Ms. Glick is especially pleased that the field study activities build on the children's knowledge, validating their opinions and experience.

The program schedule fills early each year, and many teachers return annually. The approximately 3,000 participants are accompanied by more than 300 teachers, teacher aides, and parents. Field study programs are "Plants in Autumn," "Seeds and Leaves," "Hemlock Hill," "Around the World with Trees," and "Flowers." New this year are "Native Plants, Native People" and "Landscape Explorers."

Karen Madsen

Lauren Mofford, Field Study Coordinator, joined the staff this spring to replace California-bound Annette Huddle. Lauren's work experience includes both classroom teaching and volunteer coordination. Thus she comes well prepared both to teach elementary school groups and to work with a staff of forty-two volunteers. Lauren holds degrees from Simon's Rock of Bard College and Lesley College, the latter a B.S. in environmental studies.

New Staff in Living Collections

Kyle Port, a recent graduate in environmental horticulture from Washington State University in Pullman, Washington, joined the staff in July of this year as Curatorial Assistant for Plant Records. He replaces Todd Forrest, who began graduate studies this fall at the Yale University Forestry School.

Karen Madsen

In his new position, Kyle is responsible for the computerized database, BG-BASE, that records and monitors each accession (and individual plant) throughout its life at the Arboretum. Kyle also assists Susan Kelley with the computerized mapping of the collections and Stephen Spongberg and Peter Del Tredici with the day-to-day curation and development of the collections. He is also expected to play a major role in implementing the Institute of Museum Services grant recently awarded for a yearlong, in-depth survey of the Arboretum's current holdings of shrubs and woody climbers that will begin in 1997. Kyle was a horticultural intern in grounds maintenance this past summer.

1996 Fall Plant Sale A Great Success

Lisa Hastings, Senior Development Officer

Take one beautiful fall day, add thousands of choice plants, and the result is a festive, busy, and very successful Fall Plant Sale. The line of members waiting to enter the barn wound behind the schoolhouse, up the hill, and through the auction tents; by end of day, not a plant remained.

Over 1,300 plants were given to the 800 members who came to collect their plant dividend(s). They also took the opportunity to purchase Arboretum plants at member discounts. The plant sale preview permitted early entrance to the barn to 150 upper-level members. Overall attendance was up 45% over our rainy day last year and 20% over 1994.

The sale raised $30,000 to benefit the Living Collections at the Arboretum, a 16% increase over last year. A variety of factors account for the increase, not least the return of the silent auction and a larger straight sales area. Over 100 nurseries, plant organizations, and individuals supported the event with donations of plants.

The Annual Fall Plant Sale remains the Arboretum's largest member event, and our primary vehicle for providing members with access to unusual plants. Mark your calendar for the 1997 sale scheduled for Sunday, September 21, 1997.

Karen Madsen

Metasequoia glyptostroboides **and, from left, Diana Parker, Henry Meyer, Jr., Sheila Magullion at the 1996 Fall Plant Sale.**

This, to him, was what the word "landscape" meant. He realized that this concern set him apart from others in his field. Most designers, he observed, were unfortunately attuned only to elements, incidents, and features, rather than the landscape itself. This he held to be the direct result of their training as gardeners. "A training which is innocently assumed to be a training in landscape gardening is a training in fact away from it."[13]

At a time when there were no academic programs in landscape design and planning, Olmsted's own education had depended on his remarkable powers of observation. Even as a young man, he had been keenly aware of scenery and well able to describe what he saw. In an 1845 letter to his father, he had by chance described the actual setting of what, forty years later, was to become Shelburne Farms. Exploring that part of Vermont on a horse, he had observed the marginal state of the region's agriculture. He rode past burnt stumps, patches of mullein, and so little grass that "I should think the poor sheep would find it hard work enough to live, without troubling themselves with growing wool." South of Burlington, standing probably on Lone Tree Hill, the highest point at Shelburne Farms, Olmsted encountered one of the finest views he had ever seen. He admired Lake Champlain with its bays and islands, but the "chief charm" was the mountain backdrop across the lake.

> I never saw mountains rise more beautifully one above another the larger ones seeming to cluster round and protect the smaller, nor did the summer veil of haze ever sit on them more sweetly. Back of all rose some magnificent thunderheads and they rose fast too, compelling me at 5 o'clock to take refuge and toast and eggs in a little road-side inn.[14]

The setting was certainly no less impressive in 1886, when Olmsted responded to Dr. Webb's summons.

Relations between Webb and Olmsted were unfailingly polite, but not entirely harmonious. Both were men of strong character, with firmly held convictions. Despite disagreements, however, their respect for each other never wavered. Dr. Webb, the client, always sought and demanded the best of everything. He employed Olmsted because Olmsted was unquestionably the foremost landscape architect in the country. Olmsted, in turn, was impressed by the breadth of Webb's vision, the grand scope of his scheme, and, doubtless, the apparently unlimited extent of Webb's resources for carrying out an idea. When he first embarked on the project for Webb, Olmsted, like Robertson, was convinced that, when completed, the design of Shelburne Farms "would be the most interesting and publicly valuable private work of the time on the American continent."[15]

One of Olmsted's proposals for Shelburne farms, the one that he most ardently promoted, was that the estate include an arboretum of all the trees and shrubs native to Vermont. The arboretum was to accord with the guidelines established by Harvard professor Charles Sprague Sargent in planning the Arnold Arboretum. To stock this "Arboretum Vermontii," Olmsted urged Webb to take advantage of the distinguished nursery of Pringle and Horsford, located just six miles south of Shelburne.[16] After discussing the idea with his superintendent, Arthur Taylor, who would be responsible for planting and care, Webb agreed to proceed with the arboretum.[17]

As envisioned by Olmsted, the arboretum was to follow the curving roadways he had laid out, being set back from the road on both sides. Such a scheme meant that the arboretum would be an integral and very visible part of Shelburne Farms, which was exactly Olmsted's intent. He placed orders with nurseries all across the country for species that Pringle and Horsford were unable to supply in sufficient quantity. Thousands of trees and shrubs were planted under Taylor's supervision, beginning in 1887. For the sake of economy, a vast number were grown to planting-out size in an extensive nursery established on the Shelburne property.

As was his custom, Olmsted had recommended native and hardy plants, based on his analysis of the site. His plant lists included most of the northeastern native trees: ashes, basswood, birches, elms, hickories, oaks, and willows, as well as the American chestnut and the American elm.[18] Balsam fir, hemlock, and various native pines were ordered in quantity.

Olmsted expected Pringle and Horsford to collect many shrub species by the hundred from the wild: alders, swamp azalea, blueberry, buttonbush, elderberry, pussy willows, black and red raspberries, wild roses, viburnums, witch hazel, and others. He also ordered native vines, including bittersweet, clematis, and wild grape. Olmsted asked for wildflowers, such as twinflower *(Linnea borealis)* and trailing arbutus *(Epigaea repens)*. The plants ordered for Shelburne Farms were certainly far different from the typical ornamentals with which gardeners and estate managers were decorating most other country places at the time. Olmsted's ultimate aim seemed to be to reproduce the plant diversity that the region might have supported a century or two earlier, before the land was cleared for farming. The only alien plants he ordered were western evergreens from P. Douglass & Sons: Colorado spruce *(Picea pungens)* and Douglas-fir *(Pseudotsuga menziesii)*.

Webb's ideas for planting began to diverge from Olmsted's as soon as he fully undertood what Olmsted was proposing. Webb *wanted* to include ornamental varieties; the greenery indigenous to Vermont seemed too stark for the Shelburne Farms he envisioned. He began to request tender and exotic species, such as rhododendrons, weeping willows, tea roses, and gardenias. Olmsted pointed out that these would not survive at Shelburne and would be entirely out of character with the landscape.[19] He refused to involve himself with the growing of tropical flowers under glass, if that were Webb's desire.

A great deal of planting was done according to Olmsted's recommendation, but the Vermont Arboretum was never completed. This may have been Olmsted's greatest frustration at Shelburne. He had believed strongly that Shelburne Farms, although privately owned, would have a public purpose. As he wrote when he submitted his preliminary plan to Webb in July, 1887,

> I have satisfied myself by personal examination of the feasibility of such an arrangement and that a beautiful, interesting, instructive and publicly important arboretum can be so obtained, the present natural woods forming an appropriate and harmonious background for it and adding directly to its scientific value.[20]

Olmsted lost his enthusiasm for Shelburne Farms when he realized that Webb did not share his belief in the educational and scientific importance to the public of the work they might have accomplished there together. After the summer of 1888, Olmsted's sons and associates attended to the work at Shelburne. The senior Olmsted, meanwhile, was becoming deeply involved with an even larger private project, and a much more sympathetic patron. At Biltmore in the North Carolina mountains, George W. Vanderbilt, Lila Webb's brother, granted Olmsted the trust and the latitude that he had not received from the Webbs.

Much of Olmsted's preliminary plan was implemented, as were his carefully articulated principles of design and the separation of conflicting uses. Olmsted divided the property into three areas: "1st Tillage and pasture lands in rotation; 2nd Park or permanent pasture lands; 3rd Forest Arboretum Vermontii."[21] He insisted that cattle should be kept from the home grounds, the main roads, and the forest, but without the continual nuisance of gates. To this end, Olmsted proposed the use of sunk fences with retaining walls, like the unobtrusive ha-has of the English landscape school, to confine the livestock. Fences, particularly near the house, were to be as inconspicuous as possible. Even the main entrance gates to the estate could generally be left open, under Olmsted's plan. The existing "straight and graceless" roads were to be changed in course and character to suit the terrain and the lush farmland through which they would run.

The new trees and shrubs were to be set back from the roads, with here and there a grouping brought forward in an apparently random way. "Fine specimen trees of the old spontaneous growth are to be preserved," Olmsted wrote.[22] Groups of trees and the undergrowth were to look as natural as possible.

Olmsted emphasized to Webb the importance of having a definite plan before proceeding. Ongoing land purchases made this difficult, if not impossible. In 1889 after purchasing five pasture farms to the south of his original tract, Webb finally agreed to plant the hilly northern part of the estate in trees, as Olmsted had recommended all along.[23]

SHELBURNE FARMS

A stretch of one of the new roads, here passing between old-growth forest trees interspersed with recent planting. Photo by T. E. Marr, ca. 1900.

SHELBURNE FARMS

The Webbs' house at Shelburne Farms, designed by R. H. Robertson, photo by T. E. Marr, Boston, ca. 1900. The rooms on this western side face Lake Champlain and the Adirondack Mountains.

The English parks that Olmsted had so admired on his first trip abroad as a young man in 1850 were the chief source of his inspiration throughout his long career. The design principles on which he based his public and private work came from his interpretation of English landscape styles. The idyllic pastoral landscape of Shelburne Farms is typically Olmstedian. The main road rolls through broad meadowland, then up a gentle rise into a stretch of deep woods. Upon emerging again into the open, one glimpses at a distance the lake, or, at another point, the great house. Then the road bends away, and the distant vision is hidden once again. The views that seem so accidental were arranged with care. Transitions from forest to pasture to lawn and flower garden are smooth and gradual. There is a sense of fitness and inevitability about this landscape.

Webb devoted much attention to agriculture at Shelburne Farms, using the latest scientific techniques, which he hoped would set an example for Vermont farmers. Close to the manor house, the Webbs had an ornamental flower garden. There is no indication that the Olmsted office was involved in its design. The earliest garden was laid out in geometrically patterned beds, reportedly modelled after the garden at Hampton Court.[24] The beds were planted each year with massed annuals that had been raised in the estate's greenhouses. By 1911, Lila Webb was taking more interest in the garden. She was dissatisfied with what she had. Apparently, she herself planned the Italianate garden on which work began in 1912.[25] The new garden ran the entire length of the house, between it and the lake. Long, low brick walls divided the gentle declivity into shallow terraces. At one end of the upper level, a pergola curved around an oval basin. On the lowest terrace, between the arms of a balustraded double stairway, was a lily pool. The garden ended at a parapet, bowed out above the cliff at the lake's edge. Each season, tubbed bay trees were put out along the balustrade. The scene looked for all the world like Isola Bella at Lake Maggiore or like the Italian-inspired garden of 1850 at Bantry House in Ireland that overlooked a bay of the sea, with mountains all around. In northern Vermont such a garden was definitely unusual.

A garden of this style and magnitude was not uncommon, however, on the estates of the rich in pre-World War I America, when formality

SHELBURNE FARMS

From the flower garden, steps descended to a lily pool and a curved parapet overlooking Lake Champlain. Bay trees in Italian pots were set out each summer along the balustrade. Photo by A. A. McAllister, 1916.

SHELBURNE FARMS

The Webb family in the flower garden, ca. 1916. Dr. and Mrs. Webb flank their grandchildren in the front row. The delphinium display was a feature of the perennial borders. In the background is a long, curved pergola. Photo by A. A. McAllister.

was fashionable and European prototypes were valued. The Webbs, on their frequent trips abroad, had statuary and a sundial shipped home. Stanford White allegedly brought them an antique fountain sculpture from Italy.[26] The Webbs had a mason who worked full-time to maintain the walls and stonework while a troop of gardeners managed the flower beds. There were peony beds, a rose garden, and deep perennial borders backed by majestic spires of delphiniums that echoed the shades of blue in the mountains across the lake.

Lila Webb amassed a comprehensive garden library as her interest grew. Her 1847 copy of (Samuel B.) *Parsons on the Rose* is inscribed "Lila from Seward, 1912." She had English books, already classics, by John Sedding and Gertrude Jekyll, as well as the recent works of Helena Rutherfurd Ely, Louise Beebe Wilder, and Mrs. Francis King, among others. Her books included at least three on Italian gardens, those by Charles Platt, Edith Wharton, and George S. Elgood. A tiny 1914 diary by Lila Webb reads as if it were intended to be a calendar of practical hints to other gardeners. If she had filled it with authoritative "dos and don'ts" for each month or week of the year, her book could have followed a time-honored tradition: "Plant Sweet Peas as soon as the frost is out of the ground." Unfortunately, Lila Webb's literary efforts petered out not long after the frost would have been out of the Shelburne ground that year.

Seward Webb died at Shelburne Farms in 1926. The following year, by act of God or as an indicator of the insidious onset of neglect, all the potted bay trees along the parapet were killed by an early frost.[27] The glory days were over. Shelburne Farms had been built up very quickly. In typically American fashion, it flourished as long as did its creator. Its decline was precipitous—to a point. The survival and rebirth of Shelburne Farms could be a case study in preservation. Dr. Webb's descendants have shown as much determination, and as much devotion to Shelburne Farms, as their progenitor.

Endnotes

[1] Seward Webb Dead in Vermont," *New York Times*, 30 Oct. 1926.

[2] Wayne Andrews, *The Vanderbilt Legend* (NY: Harcourt Brace, 1941), 147.

[3] Joe Sherman, *The House at Shelburne Farms* (Middlebury, VT: Paul S. Eriksson, 1986), 9–11.

[4] John Tebbel, *The Inheritors: A Study of America's Great Fortunes and What Happened to Them* (NY: G. P. Putnam's Sons, 1962), 30.

[5] Sherman, *The House at Shelburne Farms*, 16.

[6] Land records of the Town of Shelburne; William C. Lipke, ed., *Shelburne Farms: The History of an Agricultural Estate* (Burlington, VT: Robert Hull Fleming Museum, University of Vermont, 1974), 16.

[7] R. H. Robertson to Frederick Law Olmsted, 17 June 1886, Job File 1031, Box B-74, Frederick Law Olmsted Papers, Manuscript Division, Library of Congress.

[8] Frederick Law Olmsted to William Seward Webb, 18 June 1886, Olmsted Papers.

[9] Frederick Law Olmsted to Charles Eliot, 20 July 1886, quoted by Joan Wiecek, "Shelburne Farms," Master's Degree Project, Dept. of Landscape Architecture, University of Massachusetts, 1984, 21.

[10] Albert Fein, *Frederick Law Olmsted and the American Environmental Tradition* (NY: Braziller, 1972), 166–69.

[11] Laura Wood Roper, *FLO: A Biography of Frederick Law Olmsted* (Baltimore: Johns Hopkins University Press, 1973), 55–66.

[12] Andrews, *Vanderbilt Legend*, 25.

[13] Quoted in Frederick Law Olmsted, Jr., & Theodora Kimball, *Frederick Law Olmsted, Landscape Architect, 1822–1903* (NY: G. P. Putnam's Sons, 1922), 128.

[14] Ibid., 64–65.

[15] Frederick Law Olmsted to William Seward Webb, 11 April 1888, Olmsted Papers.

[16] Frederick Law Olmsted to William Seward Webb, 17 March 1887, Reel A1:68, Olmsted Papers.

[17] William Seward Webb to Frederick Law Olmsted, 26 March 1887, Olmsted Papers.

[18] The Olmsted firm placed orders with Pringle & Horsford and nine other nurseries in the spring of 1887. See Olmsted Papers and "List of Trees and Shrubs Proposed to be ordered for Dr. W. S. Webb," 22 April 1887, Frederick Law Olmsted National Historic Site, Brookline, MA.

[19] F. L. Olmsted & J. C. Olmsted to William Seward Webb, 24 Jan. 1889, Reel A3:140; Frederick Law Olmsted to William Seward Webb, 7 March 1888, Reel A2:249, Olmsted Papers.

[20] Frederick Law Olmsted to William Seward Webb, 12 July 1887, Reel A1:887, Olmsted Papers.

[21] Frederick Law Olmsted to William Seward Webb, 12 July 1887, Olmsted Papers.

[22] Ibid.

[23] William Seward Webb to Frederick Law Olmsted, 20 Feb. 1889, Olmsted Papers.

[24] Wiecek, "Shelburne Farms," 44.

[25] Susan Cady Hayward, "Gardens of a Gilded Age," *Vermont Life* 42 (Summer 1988): 6.

[26] Isabell H. Hardie, "The Garden of Mrs. W. Seward Webb," *Country Life in America* 32 (Oct. 1917):62–63; "The Garden at Shelburne Farms," *Arts and Decoration* 11 (June 1919):66-67.

[27] Sherman, *The House at Shelburne Farms*, 76.

This article is excerpted from the chapter on Shelburne Farms in Alan Emmet's *So Fine a Prospect: Historic New England Gardens*, newly published by the University Press of New England. Her article on the Boott family's garden in Boston, a subject she returned to in her new book, appeared in *Arnoldia* 47(4). The author is a consultant in garden history as well as a writer. Her book is reviewed on page 26.

Itea 'Beppu': The Return of the Native

Peter M. Mazzeo and Donald H. Voss

A "garden variety" observation suggests a taxonomic puzzle. The authors sort it out.

In a 1980 article in *Arnoldia*, Arnold Arboretum horticulturist Gary Koller gave a cultivar name—'Beppu'—to a deciduous *Itea* growing on top of a stone wall below the Dana Greenhouses in dry, acid soil and full sun. Having grown in that location for six years, the Arboretum's three plants were then about 0.7 to 0.9 meters (two-and-a-half to three feet) tall. In addition to their compact habit, Koller noted their vigor, graceful summer flowers, and the wine-red to reddish purple color of their autumn foliage. These features, he thought, added up to an *Itea* better for gardens in the Northeast than any other then available.

The plants, accessioned as AA 144-74, came to the Arnold Arboretum from the U.S. Department of Agriculture's Regional Plant Introduction Station at Experiment, Georgia, identified as *Itea japonica* Oliv. and "Kyushu 226131." In 1955 USDA plant explorer John Creech, later director of the National Arboretum, had collected six specimens of a compact form of *Itea japonica* growing outdoors at Hot Springs Utilization Station, Beppu, Kyushu, Japan. These were subsequently designated as USDA Plant Introduction 226131 and given the notation "dwarf." Eventually they were propagated and distributed to a number of testing locations, including the Arnold Arboretum. Thus, the complete name of the cultivar designated by Koller was *I. japonica* 'Beppu'.

However, observation of the habit and flowers of two plants of *Itea*, each nearly 1.8 meters (six feet) tall, growing side by side in a private garden in northern Virginia led us to question the species identification of *I.* 'Beppu'. One is *I.* 'Beppu', the other an unnamed selection of *I. virginica* that was received in a 1980 Arnold Arboretum distribution of plants propagated from a specimen found near Sharpsburg, Georgia. These plants are so similar in foliage, flower, fruit, and autumn color as to support the hypothesis that they are members of the same species, namely the North American *I. virginica*, not *I. japonica*.

The generic name, *Itea* (the Greek word for willow) derives from a resemblance of the leaves of *I. virginica* to those of willows. A member of the saxifrage family, its common name is sweetspire, or Virginia willow. *Itea* includes about ten species of evergreen or deciduous shrubs and trees ranging in the wild from the Himalaya through China to Japan, the Philippines, and western Malesia, plus one species in the eastern United States (Mabberley 1989; Ohwi 1965). Valued for their evergreen, holly-like leaves, as well as for long, pendulous flowers in summer, the Chinese *I. ilicifolia* and *I. yunnanensis* are cultivated in warm temperate climates. The only deciduous *Itea* widely cultivated in North America is *I. virginica*, which includes the cultivars 'Beppu' and 'Henry's Garnet'.

The native ranges of *Itea* species are warm-temperate to tropical; hence cold-hardiness limits their use as ornamental plants in the

Overleaf: This illustration of Itea virginica *from* Curtis's Botanical Magazine *(50[1823]: t.2409) includes an atypical trilobed leaf and, on opened flowers, the "starry" petal orientation sometimes found in the southern United States. More generally, petal orientation is nearly erect, giving the inflorescences a "bottlebrush" appearance. The branches bearing inflorescences are usually arching, not upright, as depicted in this plate.*


N 2409

northern United States. In the wild, *I. virginica* thrives in moist soils on the coastal plain from southern New Jersey to Florida, along the Gulf Coast to east Texas, and up the Mississippi valley to southern Illinois. The plant will survive in the Boston area but not without winterkill of branches. The native habitats of *I. japonica* reach from the southern part of Japan's Kinki district (including Mie, Nara, and Wakayama prefectures) on Honshu southwestward to Shikoku and Kyushu (Ohwi 1965). Thomas Everett (1981) comments that *I. japonica* is "probably hardy in sheltered locations in the vicinity of New York City" but that the evergreen *I. ilicifolia* is not hardy north of the Washington, DC, area.

To test our hypothesis regarding the identification of 'Beppu', we compared herbarium specimens of it with specimens of *Itea japonica* and *I. virginica* collected in the wild. The typical herbarium specimen consisted of the terminal 20 to 30 centimeters (eight to twelve inches) of a flowering branch. Because leaf size varies greatly on individual plants of *Itea*, we averaged the petiole (leaf stalk) length and the length and width of the lamina (leaf blade) from the four or five largest leaves on each herbarium sheet. Measurements of floral parts were also averaged. The tabulation below summarizes the typical sizes and shapes of the structures measured; the lower and upper ranges of measurements have been placed in parentheses.

	Itea japonica	*Itea virginica*	
		'Beppu'	Other
Leaves			
Petiole length	(5–) 7 (–10)mm	3 (–7)mm	3 (–7)mm
Lamina length	(71–) 83 (–95)mm	(33–) 52 (–65)mm	(44–) 59 (–81)mm
Lamina width	(31–) 37 (–50)mm	(13–) 21 (–27)mm	(13–) 23 (–29)mm
Lamina shape	broadly lanceolate to elliptic to ovate	elliptic to slightly obovate	elliptic to slightly obovate
Lamina apex	acuminate to long-acuminate	acute to short-acuminate	acute to short-acuminate
Lamina base	broadly cuneate to rounded	cuneate	cuneate
Flowers			
Raceme width	(8–) 10mm	(11–) 14mm	(13–) 14 (–16)mm
Calyx length	1.2 – 1.4mm	2.5 – 3.0mm	2.2 – 3.3mm
Petal length	1.8 – 2.4mm	(3.5–) 4.2 (–4.8)mm	(4.3–) 5.2 (–6.2)mm

Note: 25.4 millimeters equals 1 inch.

When English botanist Daniel Oliver described *Itea japonica* in 1867, he indicated that smaller flower size distinguishes the species *I. japonica:* "The petals, stamens, and styles are much shorter than in *I. virginica.*" German botanist Camillo Schneider later noted that the flowers of *I. japonica* are scarcely half as large as those of *I. virginica.* Also distinguishing the species is the amount of leaf serration: the leaves of *I. japonica* average five to seven per centimeter while those of *I. virginica* average eight to ten near the widest part of the lamina.

Koller especially admired the compactness of 'Beppu'. The plant's siting—in dry, acid soil in full sun—may have had something to do with its stature. Moreover, this dryish moisture regime occurs in an area well north of the climatic range native to either *Itea japonica* or *I. virginica.* Dr. Stephen Spongberg, horticultural taxonomist at the Arnold Arboretum, tells us that *I. japonica* 'Beppu' "is only marginally hardy here at the Arboretum, and consequently it dies to the ground each winter. However, each growing season our plants put on new growth to about three feet in height, and they have formed a clump about four feet in diameter."

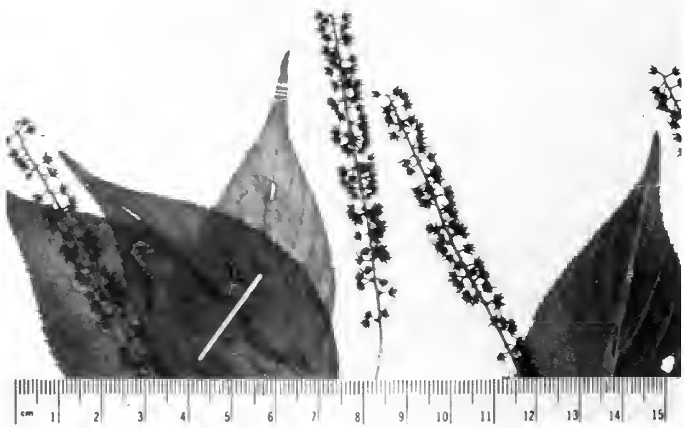
In contrast, plants of this clone observed growing in the Washington, DC, area approach a height of 1.8 meters, indicating that *Itea* 'Beppu' is hardly "dwarf." Nor do they die back to the ground in winter, and unlike the plant in Jamaica Plain they receive at least some artificial watering. These factors undoubtedly contribute to their greater height.

On the matter of autumn color, we suggest that it undoubtedly develops more reliably in the Boston area than in Washington, DC, where warm weather sometimes results in persistence of green color and leaf retention into early winter. And that leaves us with one last

DONALD H VOSS

(1) Itea virginica*'Beppu' [labelled* I. japonica 'Beppu'*] (S. Elsik & L. Makepeace, 1260, 20 June 1984, at map location 42A-b, Arnold Arboretum, Jamaica Plain, MA [A])*

(2) Itea virginica *(R. W. Tyndall & K. McCarthy, Maryland Natural Heritage Program, 87261, 7 June 1987, Carolina Bay within 5 km of Goldsboro, MD [NA])*



(3) Itea japonica *(Y. Tateishi & J. Murata, 4217, 4 June 1978, Japan: Honshu, Nara Prefecture [NA])*

piece of the puzzle: was *I. virginica* growing in Japan in 1955? Had it been introduced prior to Dr. Creech's collecting trip? The answer is yes. One of the herbarium specimens we examined was dated 1929, attesting to the presence of *I. virginica* in Japan well before the introduction into the United States of USDA P.I. 226131. Judging by the printed heading ("Flora Japonica") on the label of yet another herbarium specimen, this one dated 1910, it too was presumably collected in Japan. Indeed, Dr. Yotaro Tsukamoto, Professor Emeritus of Kyoto University, believes that *I. virginica* may have been in Japan as early as 1887.

That said, we feel confident in concluding that USDA Plant Introduction 226131 from Beppu, Japan, is indeed *Itea virginica*, not *I. japonica*, and that the Arnold Arboretum's 'Beppu' is, in truth, a clone of *I. virginica*. But we note that, independent of species association, this returned native remains the same attractive landscape plant with interesting flowers, good foliage, and fall color that caught the attention of both Dr. Creech and Gary Koller.


R. E. WEAVER, JR.

The pendent racemes of Itea virginica *appear in midsummer.*

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Peter Mazzeo is a botanist, now retired from the U.S. National Arboretum and residing in Winter Haven, Florida. Donald Voss is a horticulturist and a volunteer in the herbarium of the National Arboretum.

Lives of New England Gardens: Book Review

"The Kingdom of England don't afford so Fine a Prospect as I have."

—Thomas Hancock (1702–1764)

Phyllis Andersen

So Fine a Prospect: Historic New England Gardens. Alan Emmet. University Press of New England, 1996. Hardcover, 238 pages, $45.00

Regionalism, as defined by Marc Treib in a recent Dumbarton Oaks publication, is based on the interaction of geographical, biological, environmental, and cultural factors. Regionalism in Treib's definition is a dynamic entity constantly evolving and modifying garden form. Building a case for regional identity on too sweeping or static a construct can lead to perilous scholarship. Alan Emmet avoids this pitfall in her admirable new book on historic New England gardens by her very careful rendering of the physical character of site and the personal visions of the garden creators. Certainly there are themes in New England gardenmaking: Anglophilic models, the need for a country seat to balance lives based in commerce, the valuing of horticultural pursuits in a region with a rich nursery tradition. In her elegant style Emmet renders the life of over fourteen gardens—some our grand masterworks: Wellesley, the Hunnewell estate; Shelburne Farms, the Webb family country home, Edith Wharton's The Mount. Others, small, eccentric: Potter's Grove in Arlington, Massachusetts; Roseland in Woodstock, Connecticut; Celia Thaxter's garden on Appledore Island. Of the gardens covered, four are lost and recreated through documentation, most are extant and open to the public in some form of preserved condition, still others remain in private use.

Emmet reflects on the definition of "garden" and establishes her own: "The best gardens convey this sense of their own separateness, a feeling of seclusion and sanctuary from the workaday world. . . . their appearance owes as much to what they exclude as to what they contain." Like Olmsted, Emmet values the garden as prospect as well as refuge, albeit a prospect that is controlled and exclusive. She is precise in her selection criteria: the garden must typify a particular period or exemplify an innovation and must have a sufficient written record. She begins with the gardens of the early republic in Boston and in Portsmouth, New Hampshire, and ends with Eolia, the Harkness estate in Connecticut, completed just before World War I.

One of the most interesting early gardens is that of the Boott family in Boston. In a chapter aptly titled "Radishes and Orchids," Emmet describes the fascinating and sometimes sad saga of a family of amateur horticulturists with ties to England. The Boott garden was located in Bowdoin Square on the site of what is now the twenty-two story state office building on Cambridge Street in downtown Boston. Kirk Boott, the founding father, marked his success as an importer of English goods with a substantial mansion and attached greenhouse. With an amateur's zeal he grew tender flowers and fruit. His sons added orchids to the family collection. Emmet captures the spirit of horticultural competition that affected the Boott family and that was supported by such role models as Theodore Lyman and his estate, the Vale, in Waltham and Gardiner Greene and his exquisite terrace garden at the foot of Beacon Hill.

Emmet's rendering of the "lost gardens" is poignant because their loss had as much to do with the fickleness of the second generation as it had with failing fortunes and the imposition of the personal income tax. The ghostly garden traces of Vaucluse, the classically inspired landscape built by the Elam family near Newport, Rhode Island, owes much to Rousseau's romantic, melancholy retreat at Ermenonville. Several families were associated with Vaucluse, none

Geometric topiary in the Hunnewells' Italian garden, Wellesley, Massachusetts, ca. 1870.

capable of sustaining its beauty. Sadder yet is the story of the spectacular "Bellmont," the 117-acre Cushing estate garden in Watertown, Massachusetts. Downing described it as a "residence of more note than any other near Boston" on account of its extensive range of glasshouses and the "high culture of the gardens." The mansion and glasshouses were designed by Asher Benjamin, but the garden was designed for the most part by its owner, John Cushing, whose fortune was made in the opium trade in China. Using a vaguely Reptonian model, Cushing focused on display: fruit trees, rose and flower gardens, fountains. His interest in technical innovation was as strong as his desire for plants of rare and exotic origin. Cushing's fortune and social and business connections made his garden the setting for extravagant entertainments for prestigious visitors. Four years after Cushing's death his sons sold the property for $100,000, not because they needed the money but because their interests were elsewhere.

Emmet notes that even today enormous trees loom up in unexpected places in this corner of Watertown, evidence of Cushing's lost garden.

In addition to high-style gardens, Emmet includes several that could only be called personal, highly individual to their owners/creators. Roseland, the Gothic Revival cottage and garden of Henry Bowen in Woodstock, Connecticut, is pictured with its resplendent flower parterres that were planted to be at peak bloom when Bowen hosted a Fourth-of-July party of huge proportions. Roseland, now owned by the Society for the Preservation of New England Antiquities, was evidence of personal patriotism and love of small town civic life. Potter's Grove in Arlington, Massachusetts, was a three-acre parcel just off the main street. Joseph Potter, an individual whose career in commerce and politics was as eclectic as his garden tastes, developed this parcel of land as a private indulgence in a personal rendition of the picturesque. The quirky assemblage of viewing tower, classical urns, mini-cascade, and a pair of dozing lions quickly attracted the public's interest. Potter encouraged public visitation, especially photographers; hence Potter's Grove, now long gone, is memorialized through stereopticon views.

Emphatically in this category of personal creation is the garden of Celia Thaxter on Appledore Island in the Isles of Shoals off the coast of Maine. This garden, well known in its day to a coterie of writers and artists who gathered in cultish form around Thaxter, is equally popular today through the reissue of her book, *An Island Garden,* and its Childe Hassam watercolor illustrations.

Leon Edel, the noted biographer of Henry James, has noted that "no lives are led outside history or society." Emmet has produced a series of garden biographies that are as enlightening in their rendering of ideas about garden design and social history as they are in their revelations about personal character. Garden creation is a messy business. Books are read, friends give advice, travel inspires new ideas, plants die. Emmet has breathed life into archival documentation to produce a work of scholarship that will inform our garden visits as well as broaden our knowledge of this important segment of New England culture.

Phyllis Andersen is Landscape Historian at the Arnold Arboretum.

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PLANTS OF CHINA

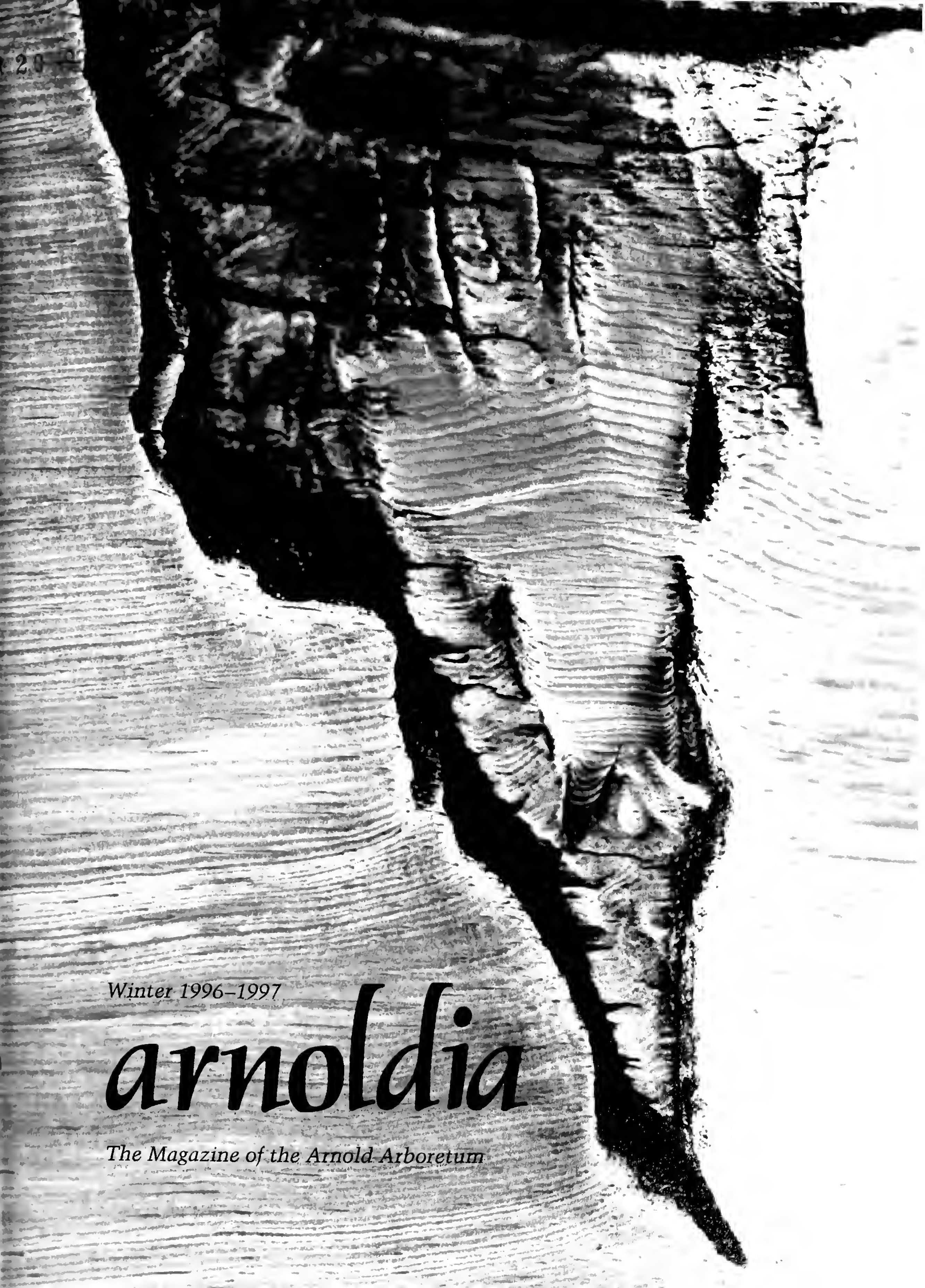
Ranunculaceae

Trollius Stapf

Qinghai Province. Nangqen Xian: ca. 30 km W of the town of Nangqen along the Xiao-Qu River in Xiao-Long Gou; 32°15'21"N; 96°19'33"E. Elevation 4100-4200 m. Narrow gorge through steep, limestone cliffs. In moist, overgrazed terraces beside stream. Growing with *Primula flava*, *Cardamine macrophylla*, *Lamiophlomis* and *Lancea tibetica*. Tepals bright yellow, tinged reddish abaxially; anthers with conspicuous nectaries; plants locally abundant.

D. E. Boufford, M. G. Donoghue, X. F. Lu, B. C. Tan & T. S. Ying 26568 20 June 1995

HARVARD UNIVERSITY HERBARIA



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Karen Madsen, *Editor*

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Page

Front cover: An irregular pattern in a radial section of weathered wood from an ancient bristlecone pine, caused by the juncture of a large branch with the trunk. Photograph by Peter Del Tredici

Back cover: Annual growth rings—100 per inch—in the naturally weathered wood of an ancient specimen of *Pinus aristata*, growing at 9,000 feet on a mountaintop outside Denver, Colorado. There are about 250 growth rings in this radial section. Photograph by Peter Del Tredici

Inside front cover: An ancient savanna at Yegua Creek, Texas. These post oaks *(Quercus stellata)* are 250 to 300 years old. Photograph by David W. Stahle

Inside back cover: *Taxodium distichum* (baldcypress) in the 400-to-600-year age class are protected at Wakulla Springs State Park, Florida. Photograph by David W. Stahle

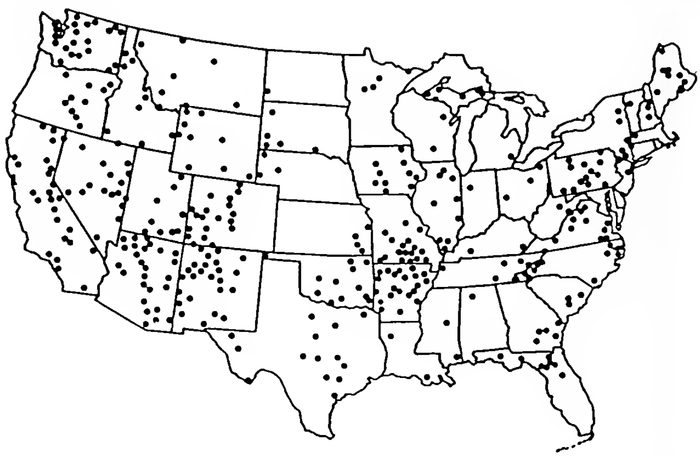
Tree Rings and Ancient Forest Relics

David W. Stahle

Centuries-old trees persist in thousands of forest remnants across the United States. Small and weathered, they preserve, in a fragmentary pattern, one stratum of our presettlement forest ecology and biodiversity.

It is widely believed that the ancient forests of the eastern United States have been completely destroyed by successive waves of European settlement, commercial logging, agricultural development, and urban sprawl. However, the search for presettlement forests in North America by specialists in tree-ring analysis has produced surprising findings. Tree-ring research suggests that literally thousands of ancient forests survive throughout the United States. These forest relics are often small and unimpressive but nevertheless preserve centuries-old trees.

Forest distribution and productivity in presettlement North America was dictated by climate, topography, and soil fertility, and included marginal stands as well as the majestic. Marion Clawson has estimated that the contiguous United States were covered with some 950 million acres of forest just prior to European settlement, but that this total included an estimated 100 million acres of noncommercial forests. Dendrochronologists have dated thousands of trees in more than four-hundred ancient forest sites located in all forty-eight contiguous states except Delaware and Rhode Island (Cook et al. 1996). These records of tree growth extend hundreds to thousands of years into prehistory and are particularly useful for estimating past climate change. These relics emphasize that the disturbance waves unleashed following European settlement were largely driven by economic motives, and the commercially valuable stands of ancient timber were indeed decimated. For the few surviving examples of magnificent marketable timber, we owe a debt of gratitude to individual landowners and to the early state and federal preserves such as Adirondack State Park and Great Smoky Mountains National Park. But forest disturbance often bypassed stands of remarkably old trees found on noncommercial sites. These for-



This map locates most of the tree-ring chronologies developed from ancient forest sites in the United States.Undisturbed or relatively undisturbed ancient forests with trees dating from at least A.D.1700 to 1979 were present at most of these locations at the time of sampling (mainly from the 1970s through the 1990s), but the size of these forests varies tremendously from less than one acre to thousands of acres. The true distribution of surviving ancient forests in the United States is of course much greater because only a small fraction of the ancient forests actually known have been sampled for tree-ring analysis.

ests, sometimes described as "decrepit" and "overmature," do not fit the stereotype of "the forest primeval" as cathedral forest and have largely failed to interest forest scientists, managers, or advocates. Nonetheless these are authentic examples of one part of the primeval forest mosaic and deserve to endure.

Tree-Ring Study of Ancient American Forests

For nearly a century, tree-ring experts have specialized in the location of ancient forests and in the biological and ecological processes that drive their growth, longevity, and sensitivity to climatic variations. American work began with Andrew E. Douglass in the semiarid Southwest. Douglass discovered that the width of annual growth rings in living Ponderosa pines *(Pinus ponderosa)* could be synchronized for centuries across the entire Colorado Plateau. Douglass developed the technique of crossdating, the fundamental tool for tree-ring dating. In many species, annual ring series form unique, nonrepetitive patterns of wide and narrow rings that can be compared and synchronized among hundreds of trees in a given region. Using the outermost ring in living trees as the known datum in time, exact calendar years can be assigned to every cross-synchronized growth ring, whether in living or long-dead trees.

GRAHAM HAWKS

The exact age of trees can be readily and harmlessly determined by using a Swedish increment borer to extract a small-diameter core from bark to pith and then carefully polishing the core to reveal the minute anatomy of the annual growth rings. The author is seen here coring a 300-year-old eastern red cedar (Juniperus virginiana) *in Elk River, Kansas. In most cases, tree-ring data provide the best information on the maximum longevity for tree species.*

Douglass also demonstrated that climatic fluctuations were responsible for most of the interannual variations in tree growth quantified in these tree-ring chronologies. Today, tree-ring analysis is widely used to date the construction of ancient buildings, prehistoric volcanic eruptions and earthquakes, to document the presettlement fire ecology of forests, to recon-

DAVID W. STAHLE

This canopy of a pondcypress (Taxodium distichum *var.* nutans) *at Topsail Hills, Florida, typifies the flat-topped crowns reduced to a few heavy, craggy limbs often found in cypress trees of great age.*

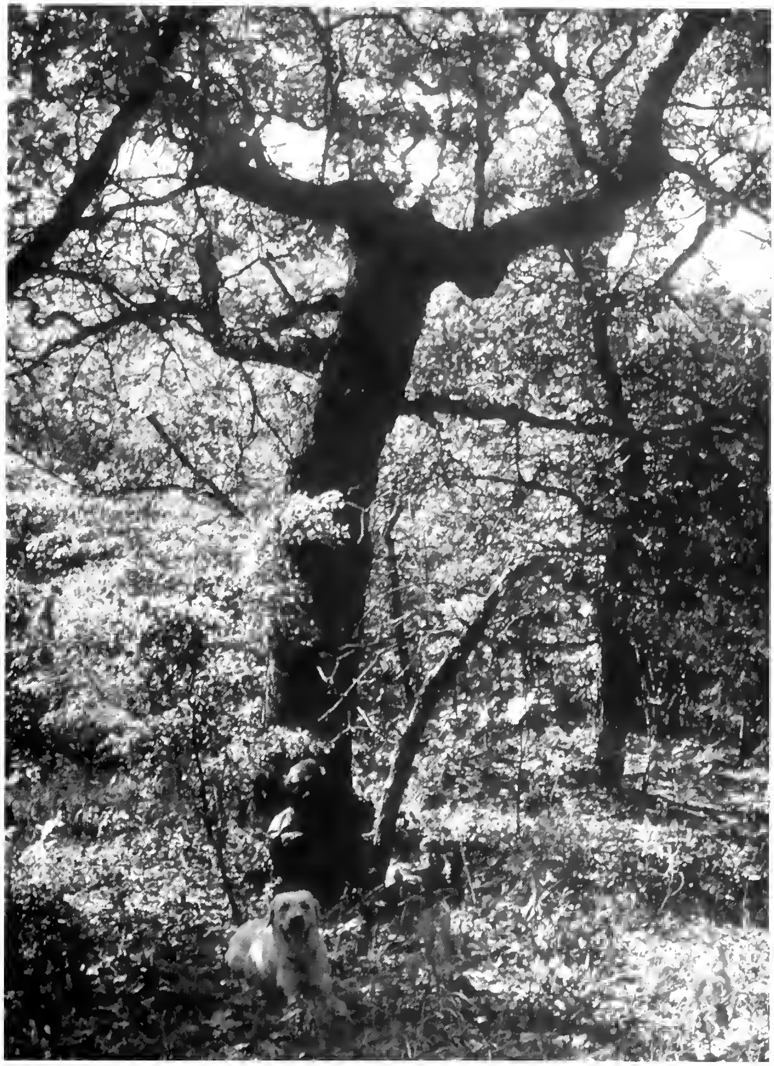
struct past climate fluctuations, and to study the carbon budget of the earth. With a remarkable degree of precision, it can test theories of anthropogenic climate change.

It was A. E. Douglass' longtime colleague Edmund Schulman who suggested the concept of "longevity under adversity," used by dendrochronologists to locate ancient trees worldwide. He had found that the oldest conifers tend to grow under the most adverse ecological conditions, such as the arid lower forest border in the western United States or the cold windswept forests at the subalpine treeline. For instance, the oldest known continuously living organisms on earth, the bristlecone pine *(Pinus longaeva)* of California's Inyo National Forest, are found at 9,000 feet above Death Valley in the rainshadow of the Sierra Nevada, one of the most hyperarid forest sites on earth. The steep dolomite slopes receive an average of only five to ten inches of precipitation annually. Bristlecone growth can be as slow as one radial inch per century and individuals as old as 5,000 years have been identified.

External Attributes of Ancient Trees

Based on analysis of thousands of ancient trees throughout the world, dendrochronologists have described a suite of external physical attributes often associated with ancient conifers and hardwoods (Schulman 1956, Stahle and Hehr 1984, Swetnam and Brown 1992). Experienced dendrochronologists can often identify ancient trees visually and can readily segregate individuals into approximate age categories. These external attributes are not precise or infallible, of course, and microscopic analysis of the annual growth rings is the only way to obtain certain age evidence.

Perhaps the most reliable attribute associated with great age in trees is a pronounced longitudinal twist to the stem, which is also evident as spiral grain in the wood of ancient trees. Other attributes include crown dieback (also referred to as a spike top, stag top, or dead top); a reduced canopy often restricted to a few heavy, craggy limbs; branch stubs and other bark-covered knobs on the stem; hollow voids or heart rot; partial exposure of massive roots and root collar; leaning stems; heavy lichen and moss growth on stems; thin and patchy bark; strip bark in conifers; wind-sculpted bark or exposed wood; flat-topped crowns; fire or lightning scars; and size—not absolute size, but size relative to other trees of the same species growing on similar sites.


DAVID W. STAHLE

Tree-ring analysis demonstrates that this post oak near Keystone Lake, Oklahoma, began growth well before 1610 and is the oldest post oak known. However, there are literally thousands of acres of ancient post oak throughout the Cross Timbers and elsewhere in the oak-hickory forest, and older individuals no doubt survive.

The Network of Long Tree-Ring Chronologies in the United States

On my first collecting trip in northwest Arkansas, I was surprised at how easily ancient forest remnants could be located in the heavily cutover eastern United States. We found 250-to-300-year-old post oak *(Quercus stellata)* dominating a narrow, but largely undisturbed corridor of forest winding around the dry upper slopes of Wedington Mountain. At first I believed that this was just a lucky find, but the hundreds of ancient post oak discoveries we have made since in Arkansas, Missouri, southeastern Kansas, Oklahoma, and Texas clearly demonstrate that this particular forest type has often been left uncut.

Ancient hardwood stands have been found on steep and dry upland sites throughout the eastern deciduous forest, among them chestnut oak *(Quercus prinus)* along the Blue Ridge Parkway and white oak *(Q. alba)* on ravine slopes near the western limit of upland deciduous forests in Illinois and Iowa. A variety of ancient conifers have also been found, including northern white cedar *(Thuja occidentalis)* over 1,000 years old on the Niagara Escarpment and pitch pine *(Pinus rigida)* up to 450 years old in the Schawangunk Mountains only sixty-five miles from Manhattan.

Noncommercial stands are not restricted to dry upland sites; they include an interesting variety of bottomland and swamp forests. Relatively undisturbed old-growth timber in the East includes the pine pocosins of the Carolinas,

DAVID W STAHLE

This Pinus rigida *near Mohonk Lake, New York, is in the 450-year age range and is the oldest pitch pine yet discovered.*

the pitch pine bogs of New Jersey, and a few scattered northern white cedar bogs and wetlands. None of these wetland forests support particularly large trees, but some are surprisingly old and undisturbed in spite of their unimpressive size.

The many baldcypress *(Taxodium distichum)* swamps with trees from 500 to over 1,500 years old are certainly among the most notable ancient forests left in eastern North America. The natural range of baldcypress was restricted to excessively wet forests and swamps in the southeastern United States. This habitat contrasts vividly with the adverse upland sites usually associated with longevity in trees, but the specific environmental stresses responsible for slow growth and longevity can vary dramatically among species and forest types. For baldcypress and other wetsite species, these environmental stresses include excessive moisture and acidic, nutrient-poor swamp waters.

Bottomland hardwood forests along many southern streams have also been heavily exploited for timber and cleared for farmland, but again not all bottomland hardwood species produce quality lumber and some species tend to be restricted to the lowest and wettest positions, which are poorly suited for agriculture. The best example might be overcup oak *(Quercus lyrata)*, which can achieve impressive size, but its lumber is often twisted, defective, and prone to rot. We have occasionally found 200-to-350-year-old overcup oak growing on slightly higher positions in or adjacent to ancient cypress swamps. Small tracts of marketable timber of a variety of species have also survived in a few areas surrounded by noncommercial forests or rough, inaccessible terrain.*

(continued on page 10)

* These can include beech *(Fagus grandifolia)*, post oak, white oak, chestnut oak, chinkapin oak *(Quercus muehlenbergii)*, blackjack oak *(Q. marilandica)*, Texas live oak *(Q. virginiana* var. *fusiformis)*, shin oak *(Q. mohriana)*, overcup oak, swamp chestnut oak *(Q. michauxii)*, black gum *(Nyssa sylvatica)*, tupelo gum *(N. aquatica)*, ashe juniper *(Juniperus ashei)*, eastern red cedar *(J. virginiana)*, pitch pine *(Pinus rigida)*, table mountain pine *(P. pungens)*, jack pine *(P. banksiana)*, yellow poplar *(Liriodendron tulipifera)*, eastern hemlock *(Tsuga canadensis)*, baldcypress, and pondcypress *(Taxodium distichum* var. *nutans)*.

A Portfolio of Ancient Trees

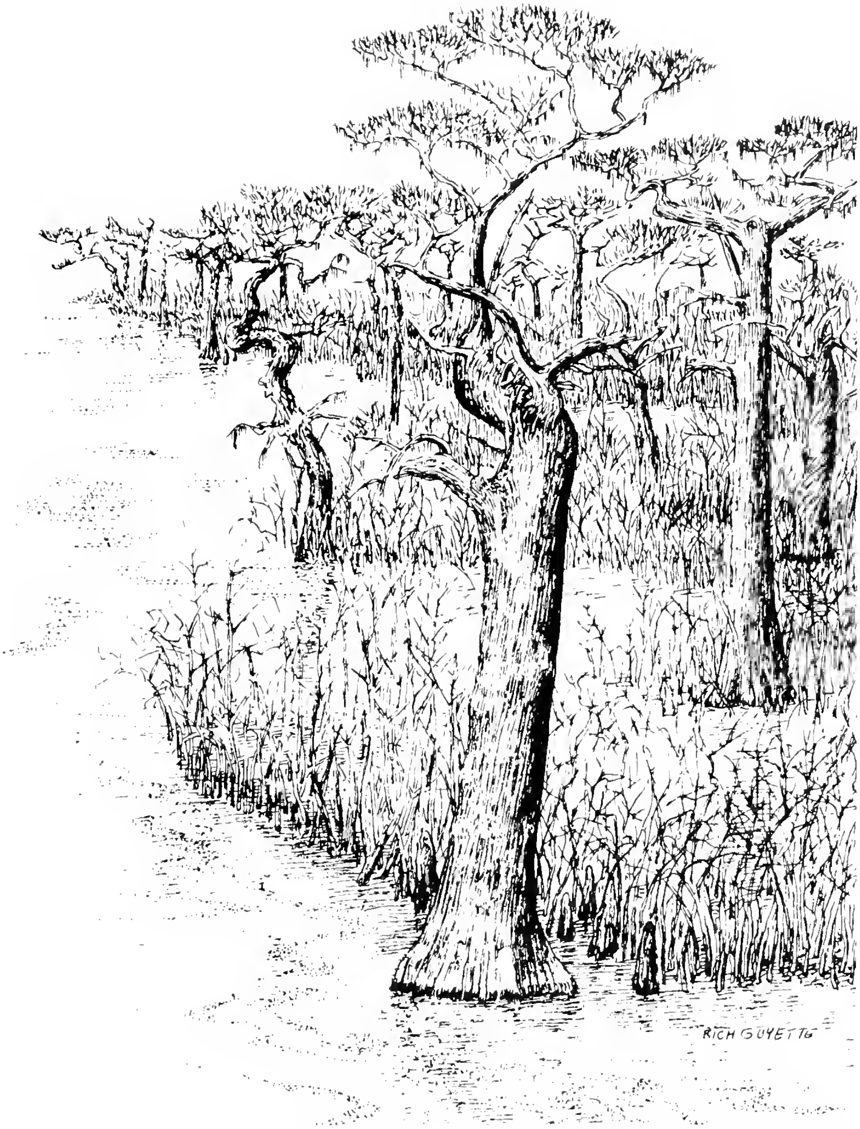
An ancient *Quercus stellata* forest of the Ozark Plateau drawn by Richard P. Guyette, an accomplished artist and dendrochronologist. This drawing illustrates many of the external attributes typical of ancient hardwoods and gives some impression of the aesthetic qualities that distinguish these authentic presettlement forest survivors. Richard has illustrated the details of a post oak-dominated forest on the Ozark Plateau, including twisted stems, dead tops and branches, exposed root collar, hollow voids, and canopies restricted to a few heavy muscular limbs. Leaning trees, branch stubs, irregular bark texture, fire and lightning scars, and fallen logs in various stages of decay are also evident.

These weathered relics are found on steep slopes and poor soils broken by small glades and picturesque blufflines. Post oak tends to dominate these dry infertile positions in the Ozarks, but blackjack oak, black oak, northern red oak, white oak, winged elm, white ash, bitternut and mockernut hickory, serviceberry, dogwood, dryland blueberry, little bluestem, and a variety of mosses and lichens are variously present in these forest remnants. Although stunted by the adverse environment, these noble post oak trees often exceed 300 years in age.

Ancient spike-top and strip-bark *Juniperus virginiana* on a bluffline in the Missouri Ozarks drawn by R. P. Guyette. The old-growth attributes illustrated here are typical of ancient *Juniperus* trees worldwide. The classic spike top of these red cedars, particularly the massive twisted spike top at right, are virtually a universal indicator of old-growth conifers and can often be identified from a considerable distance. Notice that this spike top is free of delicate branching, which was broken off after years of exposure to wind, ice storms, perching birds, and climbing animals. The mildly intoxicating fragrance of cedarene can permeate these bluff-edge red cedar, making the collection of tree-ring samples from these high blufflines a precarious experience.

In strip-bark trees only thin filaments of living cambium connect the canopy and root systems. Strip-bark growth is a hallmark of the ancient bristlecone pine forest along Methuselah Walk in California's Inyo National Forest and is common in many other high-elevation and drought-stressed conifers. However, strip-bark growth is not common in old pines of the eastern or southern United States

The oldest red cedars on the Ozark Plateau are often found growing on rocky pinnacles detached from the main cliff escarpment, where they may have enjoyed a measure of protection from the occasional ground fires that swept the hardwood forest floor. The oldest red cedars are 600 to over 900 years old and have been found by Richard Guyette on dolomite-derived soils along the Jack's Fork and other scenic streams in Missouri. In fact, a number of the oldest known trees of several species have been discovered on dolomite or gypsum-derived soils. Other very ancient dolomite- or gypsum-grown trees include bristlecone pine at Methuselah Walk, California (up to 5,000 years old); ancient Rocky Mountain Douglas fir at Eagle, Colorado (up to 900 years old); and northern white cedar on the Niagara Escarpment, Ontario (up to 1,000 years old).



Ancient *Taxodium distichum* typical of blackwater streams in the Carolinas, Georgia, and Florida, drawn by R. P. Guyette. Note the blunt and bent silhouette on the stout cypress in the foreground, which would be in the 800-year age class. The mature tree in the middle distance on the right would be in the 400-year age class, and the stunted and twisted tree at the right margin resembles a specific tree at Black River that is over 1,500 years old.

These nutrient-limited blackwater swamps are frequently dominated by slow-growing baldcypress in an open canopy and by Carolina ash in the understory, often to the near exclusion of other species of trees and shrubs. The canopy cypress are rarely over 60 feet tall or over 36 inches in diameter above the buttress; we have measured radial growth in some ancient blackwater cypress at less than one inch per century. The frequently broken main stem, flat-topped crowns, and recently sprouted fine branches on the stem and broken branches seen in the foreground all bear mute testimony to the pruning effects of past hurricanes in these near-coastal cypress swamps.

(continued from page 6)

Ancient noncommercial forest remnants are sometimes discounted in the debate over eastern old growth because they do not answer our desire for large as well as old trees. These relics are not our lost cathedral forests, but they are the authentic remains of our oldest forests; they represent an important part of the presettlement forest mosaic that once graced eastern North America. Their growth rings faithfully record a natural history of the virgin forest and may hold the answers to questions of environmental change we have yet to pose.

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David W. Stahle is associate professor of geography and director of the Tree-Ring Laboratory at the University of Arkansas. He documented the oldest known trees in eastern North America, the baldcypress at Black River, North Carolina, which are over 1,600 years old. Currently he is conducting tree-ring research in the United States, Mexico, and Africa.

Tree Transplanting and Establishment

Gary W. Watson

Both experience and research make it clear that almost any size tree of any species can be transplanted. Success depends on the reestablishment of a normal spreading root system. An understanding of how roots grow and take up water can aid the process, even on difficult sites.

Many aspects of transplanting change over time. Modern equipment has made it possible to transplant larger trees with "soil balls" more affordably. Containerized production has grown in popularity for many reasons, including the ability to plant in any season. One thing remains the same—plants must quickly establish or reestablish a normal, spreading root system on the new site to minimize susceptibility to stress and assure survival.

Stress after transplanting, often called transplanting shock, is caused primarily by drought stress. Field-grown trees can lose up to 95 percent of their roots when they are dug from the field. This small portion of the root system has difficulty absorbing enough water to meet the needs of the tree. Plants grown in containers are also subjected to drought stress after planting, not because of root loss, but because water drains out of the light soilless container media much faster after it is planted in the ground than when it was in the pot. To compound the problem, irrigation is typically less frequent than it was in the container nursery. All newly planted trees will be subjected to stress until a normal spreading root system has developed.


GARY W. WATSON

When the root ball is planted high to improve drainage, the soil should slope from the existing grade to the top of the root ball.

Planting Site Preparation

Not every site requires extensive preparation before planting. The soil in undisturbed sites and landscapes in older neighborhoods is often of very good quality. Site preparation must be more intensive on disturbed sites or sites with naturally poor quality soils. Soil conditions on urban planting sites can be very difficult for root growth.

Planting site preparation can provide an optimum environment for root growth for only a limited time. Considering that the roots of a tree can normally spread two to three times as far as the branches, the long-term needs of even a small tree cannot be completely provided for at planting time. Long-term survival will depend more on selecting a species that will be able to survive, and thrive, under the existing site conditions.

Planting site preparations should focus on providing the highest quality environment possible for initial root growth during the first year or two after transplanting—possibly longer for trees over 4 inches (10 cm) in caliper. Even in cool northern climates, tree roots with average growth rates may extend 3 feet (1 m) or more from the root ball after two years. Though it would be desirable to prepare a larger area, in most cases it would be impractical.

Planting Hole Size and Shape

Trees are expensive. Planting the tree properly and maintaining it until it is established will protect the substantial investment in the tree. To emphasize the need for adequate site preparation, gardeners often advocate preparing a five-dollar planting hole for every fifty-cent tree.

The primary objective of planting site preparation is to provide a quantity of backfill soil that promotes rapid initial root development and does not restrict root spread beyond the planting hole. Ideally, these objectives should be achieved with a minimum of cost and effort. To prevent settling, the root ball must be supported by undisturbed soil. Since most new roots will grow horizontally from the sides of the root ball, compacted soil at the bottom will not substantially affect overall root growth.

When a deeper planting hole is not an option, widening the planting hole is the only way to increase its size. Most tree roots are concentrated within the top foot of soil. Since the most vigorous root growth is likely to occur near the surface, efforts should be concentrated there. In many compacted urban soils, root growth from the bottom half of a 12-to-18-inch (30-45 cm) deep root ball will be inhibited by inadequate drainage and aeration. In these soil conditions, a wide hole for the entire depth of the root ball may not be as useful or efficient as a hole with sloped, or stepped, sides. With this configuration, the majority of the effort is directed towards surface soils where the new roots will grow most vigorously. A hole with sloped sides will not restrict root spread. Deeper roots will grow towards the surface soils and continue to spread if they are unable to grow into the compacted subsoil (Figure 1).

A planting hole that is two to three times the width of the root ball at the surface, with sides sloping towards the base of the root ball, is optimum for most situations. The root ball can hold less than 5 percent of the original root system. A hole only 25 percent greater in diameter than the root ball will allow the root system to reach less than 10 percent of its original size before poor-quality site soils slow root growth. A hole three times the width of the root ball with sloped sides will allow the root system to grow rapidly to 25 percent of its original size before being slowed by the poorer quality site soil. The well-aerated surface soil is increased up to tenfold by the wide, shallow configuration. This increased volume of high quality backfill soil promotes rapid root growth and will make the tree less subject to severe drought stress than the tree in a smaller hole. Trees transplanted with a tree spade also benefit from a larger planting hole. The tree spade's metal blades dig cone-shaped holes whether extracting a tree or creating its new home. In this situation, cultivation around the root ball after planting may be the only practical method.

Backfill Soil Modifications

The change in soil type at the interface between backfill soil and the surrounding undisturbed soil is often blamed for poor root development in the undisturbed soil, but this stems from a confusion between inability of roots to cross the

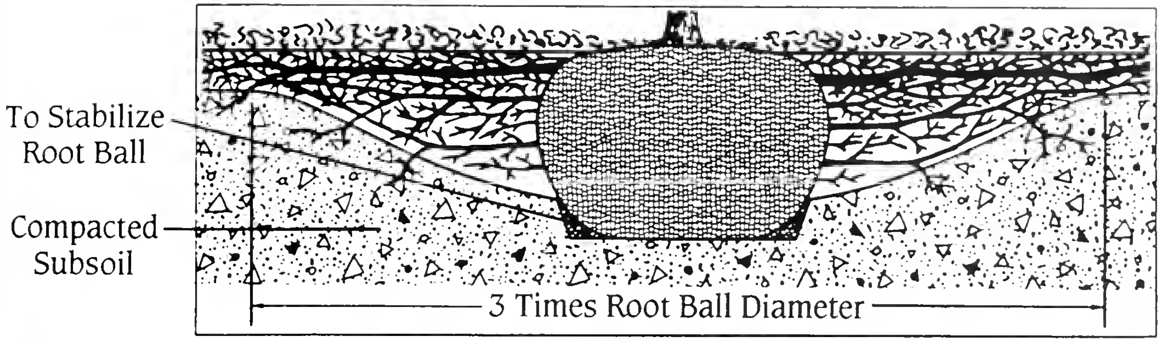

Figure 1. Where roots have difficulty penetrating compacted site soils, sloped sides allow roots to continue to grow vigorously towards the better soils near the surface. Roots that do penetrate the site soil along the sloping interface will probably grow more slowly.

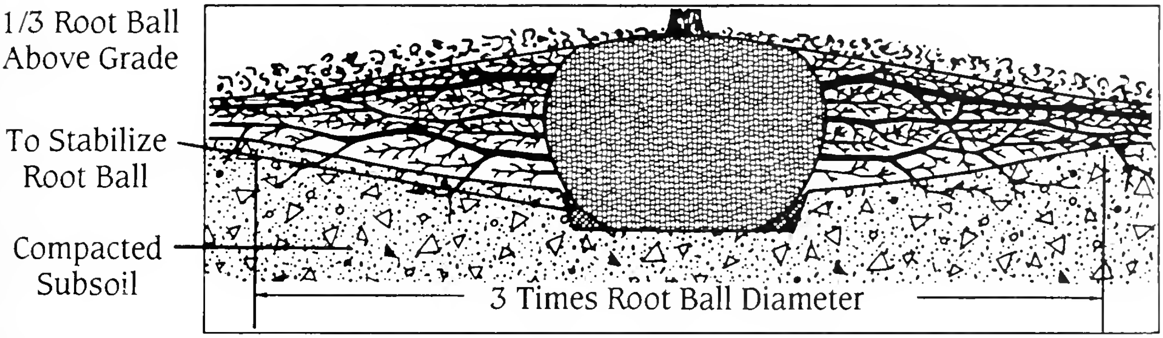

Figure 2. Planting the root ball so that approximately one-third of it is above grade can help to provide better drainage and aeration for roots.

interface and inability of roots to grow vigorously in the soil material on the other side. While the interface can have a major effect on soil water movement, it usually does not affect roots. If the backfill soil has been amended, the abrupt change in soil texture can affect soil properties such as water movement but probably not root growth.

When three types of backfill soils were used on a compacted urban planting site, including unamended soil, there was no difference in root development in any of the backfills. (Note that unamended soil is not the same as unaltered soil.) Root development in the soils outside of the planting hole was lower than in any of the backfill soils, but this appeared to be due to the overall reduced root growth in the compacted clay site soil, rather than an inability of the roots to grow across the interface between the soils.

On moderate sites, amending the soil may be unnecessary, but not harmful. On extremely poor quality sites, soil amendments may be more important, but still probably not as important as digging a large planting hole.

Drainage

Adequate drainage from the bottom of the planting hole is very important for root regeneration. Gravel in the bottom of the planting hole can make drainage worse. Water will not move from the finer textured soil above to the layer of coarse gravel below until the fine-textured soil is completely saturated. This results in waterlogged soil above the gravel.

Drainage tubing may be used to drain water from the bottom of the planting hole if the water can be discharged at a lower level nearby. Planting with the top of the root ball slightly above grade can also increase survival on poorly drained sites. No more than one-third of the root ball should be above grade, and the soil should be gradually sloped between the top of the root ball and the original grade (Figure 2).

Establishment After Transplanting

The establishment period can be defined as the period required for a plant to grow a normal root system. During this period the plant is susceptible to extreme stress. The length of the establishment period is affected by many environmental and cultural factors. Growth rate also provides an indication of stress (Figure 3). Growth will slow immediately after transplanting and recover to pre-transplanting levels as the root system regenerates and stress is reduced.

Plant growth is always limited by something—temperature, light, nutrients, genetics—but after transplanting, water is usually the most limiting factor. Transplanted trees rely heavily on moisture in the root ball throughout the first growing season. For balled-and-burlapped trees, the moisture contained within the root ball represents only a small fraction of the water that was available to the tree before transplanting, and it is small relative to the transpiration demands of the tree. Root ball soil moisture can be depleted very quickly, even while backfill soil just outside the root ball stays very moist, because there are few roots to absorb the water there. The water from the backfill soils is not able to move into the root ball quickly enough to effectively replace what is being removed by the tree. Just two days after watering, the root ball soil can become dry enough to stop new root growth and to reduce the capacity of the existing root tips to absorb water. (In experiments with trees of two-inch caliper transplanted into backfill soil, it took four to five months to develop roots just outside the root ball that were sufficiently dense to allow significant amounts of soil moisture.) It may take several days for growth to resume after watering. With frequent, repeated soil drying, root growth may be halted for long periods.

Calculating the amount of water held in the root zone in relation to usage by the plant is another way to estimate the water needs of new plantings. The supply of soil moisture available to the expanding root system of a recently planted shrub increases more rapidly than does water use by the slower growing crown. Twenty-one weeks after planting, the soil water

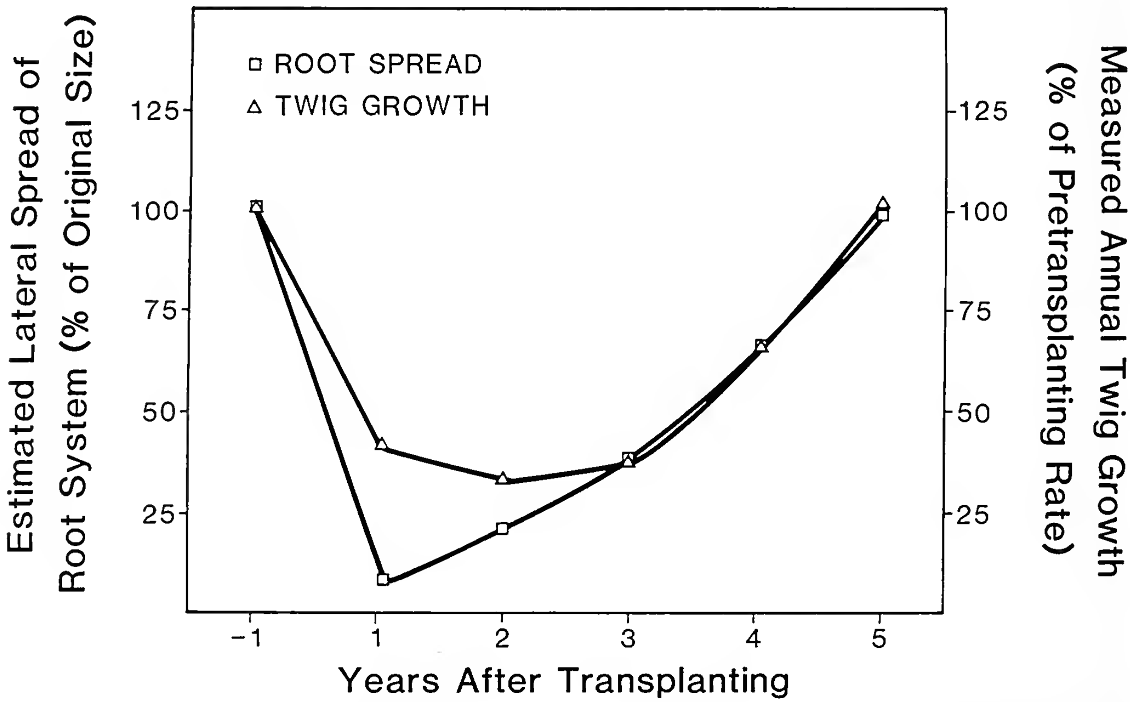

Figure 3. Root loss as a result of transplanting causes a corresponding decrease in twig growth. Recovery of twig growth rate is closely related to regeneration of the root system.

*Figure 4. Trunk sections of transplanted spruces (*Picea *sp.) show that growth of the larger transplanted tree (size at the time of transplanting is shown by the circle) is slowed for several years, while normal growth of the smaller tree resumes more quickly. By the time both of the trees are established, the relative size of the two trees may be equal or reversed.*

supply of small shrubs was only eleven days. Two-inch caliper trees may require two growing seasons before attaining a large enough root system for a similar soil water supply.

Duration of Transplanting Stress

To be considered fully established after transplanting, the tree must develop a full root system on the new site. The partial root system in the root ball, or the confined root system of the container, must develop into a normal spreading root system that can utilize soil moisture and nutrient resources from a large soil volume. This will take several years.

Root establishment takes longer for large trees than for small trees. When standard specifications are followed, the size of the root ball or container is proportional to the size of the plant. Regardless of size, the root ball holds only this same small percentage (4 to 18) of the root system. The root system in container plants is likewise confined to a proportionately small soil volume. Moreover, root growth rates are similar for large and small trees. What is very different is the distance that roots must grow to develop the full spreading root system necessary for complete establishment. A smaller tree requires fewer increments in annual root growth after transplanting than a large tree in order to replace the original root system. Since the smaller tree recovers vigor faster, it may one day be nearly the same size as a larger tree transplanted at the same time (Figure 4).

Soil temperature also affects root growth after transplanting. In climates where the soils are warm year round, roots will grow faster and plants will become established sooner. In the north temperate climate of the upper midwestern United States, twig growth of a four-inch caliper tree is reduced for four years after transplanting. In other words, the establishment period is approximately one year per caliper inch. In the subtropical climate of northern Florida, where roots grow much faster, trees reestablish at a rate of approximately three months per caliper inch.

During the second half of the establishment period, stress may not be as apparent. Nevertheless, the reduction in growth can be measured. At this time, monitoring should be continued, but it may be possible to limit supplemental watering to periods of drought.

Comparisons Among Growing Methods

Researchers have compared the establishment of traditional field-grown trees with conventional root balls to that of container-grown trees and of trees grown in in-ground fabric bags. Based on data on water stress, trees that were transplanted from field soil or from fabric bags establish more quickly than trees planted from plastic containers. Container plants were smaller and sustained very little root loss at transplanting and yet took longer to establish. Although measurable, the differences were not great enough to warrant avoiding container-grown plants. Adequate irrigation will easily overcome the difference, and container plants have many other advantages. The need for regular watering of all trees cannot be overemphasized. As long as the roots stay primarily confined to the root ball soil, they will be susceptible to rapid drying when irrigation or rainfall is absent for even a short period.

Both periodic and chronic stress can reduce growth in any plant. If a high level of care and a consistent environment is maintained above and below ground, the plant will establish faster. Water stress reduces photosynthesis and root growth and also increases susceptibility to certain disease and insect problems. Adequate site preparation and judicious watering throughout the growing season will do more to assure survival and maximize vigor than anything else, with the possible exception of high-quality, site-appropriate plant material.

The successful establishment of transplanted trees is dependent primarily on the reestablishment of a normal spreading root system on the new site. This process can be slowed by inadequate site preparation and difficult sites. Root growth is naturally slower in colder climates. Larger trees have larger root systems and take longer to regenerate after transplanting. Both experience and research make it clear that almost any size tree of any species can be transplanted. Large and small trees transplanted at the same time may eventually be similar in size. The choice may depend on size of budget and willingness to wait for a small tree to grow.

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The Arnold Arboretum

WINTER · NEWS · 1996–1997

Spongberg Is Awarded the RHS Gold Veitch Memorial Medal

Sheila Connor, Horticultural Research Archivist

Karen Madsen

Stephen A. Spongberg, Arboretum horticultural taxonomist, recently traveled to London to receive the Gold Veitch Memorial Medal, one of the foremost honors of the horticultural world. Recipients of the medal are selected by England's Royal Horticultural Society for their outstanding contributions to the field and are deemed "persons who have helped the advancement of the science and practice of horticulture." Presented annually since 1873, the medal commemorates James Veitch (1792–1869) of the famous and influential family of British nurserymen.

By all accounts, the man who inspired the award was not only a skilled plantsman and accomplished cultivator but a generous supporter of horticultural charities. In fact, a medal was selected

• *continued on page 2*

Celebrating 125 Years of Discovery

Mark these events on your calendar and join Arboretum staff and friends for our 125th anniversary celebration.

Yesterday, Today, and Tomorrow Bonsai at the Arnold Arboretum

An artistic display of three eras of Arboretum bonsai at the New England Spring Flower Show

March 8 through 16, 1997—Bayside Exposition Center, Boston

Harvard University Herbaria Open House

A rare behind-the-scenes view of the work of Herbaria staff in the areas of plant collection, scientific research, and biodiversity conservation, highlighting the historic and current significance of the University's botanical collections

Thursday, May 8, 1997—Harvard University Herbaria, Cambridge

Lilac Sunday

An Arboretum tradition celebrating one of North America's premier lilac collections

Sunday, May 18, 1997—Arnold Arboretum, Jamaica Plain

Annual Fall Plant Sale

Our most popular event for members, this year featuring a new plant introduction—*Syringa* x *chinensis* 'Lilac Sunday'

Sunday, September 21, 1997—Case Estates, Weston

Arboretum Open House & Lecture

Tour the Hunnewell Building, view our new exhibit, meet the staff, and join us for a lecture by renowned British plant hunter, horticulturist, and author Roy Lancaster

Friday, October 17, 1997—Arnold Arboretum, Jamaica Plain

• *from page 1*

as a suitable memorial to Veitch only after the Society's subscribers had considered—and subsequently rejected—the establishment of a club, an almshouse, and pensions for either disabled plant collectors or for aged gardeners. However, James Veitch was also an astute and venturesome businessman. Fiercely competitive in the arena of plant introduction, under his aegis the nursery of Messrs. James Veitch & Sons rose to prominence by being one of the first commercial enterprises to compete with royalty and learned societies in the sponsorship of far-off plant-hunting expeditions.

While the Veitch medal is the highest accolade that the Royal Horticultural Society bestows on a foreign national, half a century would elapse after its inception before the medal would first cross the Atlantic. With Steve's recent honor he has joined a very exclusive group—to date only fifteen medals have gone to North Americans with Steve being the fourth member of the Arboretum staff to be so honored.

In 1926, the Arboretum's famous plant explorer Ernest Henry "Chinese" Wilson, then a British subject, received the Veitch medal inscribed for "his introductions to gardens and his books." On that occasion, newspaper accounts exclaimed, "British Award Won by Boston Horticulturist . . . This medal has never before been given to any person in America!" Almost twenty years later, when the second Arboretum recipient William H. Judd, born in England but a naturalized American citizen, received the medal for "exceptional work in propagation," he wrote in his journal, "I believe that this is the first time by any man other than English to receive it." Donald Wyman, horticulturist extraordinaire, but with no obvious British ties, accepted the coveted award "for his contribution to the science, to the practice, and to the literature of horticulture" upon his retirement from the Arboretum in 1969.

While Steve has won the medal for his "major contribution to horticultural taxonomy at an international level," he could have easily been recognized, like Wilson, for his plant exploration in China. Steve has participated in several plant-collecting expeditions to eastern Asia and was a member of the U.S. team of botanists who took part in the 1980 Sino-American Botanical Expedition to western Hubei Province in the People's Republic of China, the first cooperative venture between Chinese and American scientists after China opened its doors to the West in the late 1970s. The Arboretum's collections and American gardens have been made richer through the introduction of *Magnolia zenii, Heptacodium miconioides,* and *Sorbus yüana,* among other new plants collected during the 1980 expedition. Or like Wilson and Wyman, Steve might have been recognized for his contributions to the field of horticultural and botanical literature. He has written many articles both popular and scientific on north temperate woody plants, and his acclaimed book on the introduction of ornamental plants into North American and European landscapes, *A Reunion of Trees,* has become the standard on the history of plant exploration. On a more personal level, Steve is valued by his colleagues here at the Arboretum for the scholarship, dedication, and love he brings to the herbarium, library, and living collections. We join in congratulations with Roy Lancaster who has written to Steve, "Welcome to the club, one of the horticultural world's most exclusive. I'm sure E. H. Wilson and all those other luminaries will be smiling up there."

Karen Madsen

Living Collections Apprentice Arrives

Alistair Yeomans has joined the staff as Arboretum apprentice. A native of western Scotland with a bachelor's degree in horticulture from Strathclyde University, Alistair specializes in pathology. In research on *Botrytis cinerea,* a common mold that is destructive to plants, he tested the effectiveness of Dichlofluanid, an ingredient in various commercial treatments for the disease.

Alistair will be working with all the units of the living collections department for a well-rounded view of the maintenance of a scientific collection of woody plants. During his year here he'll study the broad range of host-pathogen interactions that a collection like the Arboretum's can provide.

IMLS Conservation Grant for Shrub and Vine Review

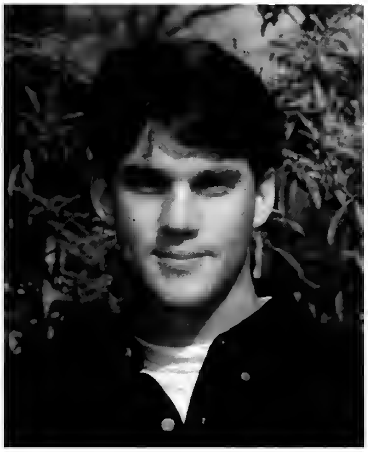
With the recent award of an Institute of Museum and Library Services conservation grant, the Arboretum began the first step in a long-range plan to develop a special, synoptic shrub and vine collection to be located near the Dana Greenhouses. The IMLS, a federal agency that strengthens museums to benefit the public, has provided funding for a complete curatorial review of the Arboretum's shrub and woody vine collections over the course of calendar year 1997. Under the supervision of horticultural taxonomist Stephen Spongberg, each shrub and woody vine accession in the Arboretum's living collections will be individually inspected and evaluated, and observations will be recorded in the Arboretum's living collections database (BG-BASE).

For verification of each accession's identity, existing voucher specimens will be located in the herbarium and, if necessary, added to the curatorial database; missing herbarium specimens will be made as required. Lists of species needed for the collections will also be developed, map locations verified for accuracy, and candidates for repropagation identified. In the long term, the results of this survey will ensure that the Arboretum's collections of shrubs and woody climbers will both be accurately identified and comprehensive and that attention will be given to the cultural requirements of these accessions.

Joining Steve Spongberg in this team effort are Andrew C. Bell, curatorial associate; Susan Kelley, curatorial associate for mapping and labeling; Kyle Port, curatorial assistant for plant records; and Patrick Willoughby, grounds superintendent. Additional support will be provided by volunteers Sheila Magullion and Robert Reynolds and this summer's horticultural interns.

Curatorial Associate Rejoins Staff

Karen Madsen



Andrew C. Bell has returned to the Arnold Arboretum for a third time to join the curatorial staff in its IMLS-supported survey of the shrub and vine collections. Andy served his first stint as a horticultural intern in 1994, helping with mapping and labeling in the curatorial office. Following graduation with a bachelor's degree in ornamental horticulture and botany from the University of Tennessee in 1995, he returned for another summer, as a Putnam Fellow assisting Stephen Spongberg in his taxonomic research.

This time Andy returns after having completed a one-year program for the master's degree in science at the University of Edinburgh and the Royal Botanic Garden, Edinburgh. While his plans for the future after this year at the Arboretum are yet to be finalized, they do focus on plants (particularly woody plants) and either further graduate study or work at a botanical institution.

Arboretum Collaborations

Peter Del Tredici, director of the living collections, recently presented a program at the **Boston Museum of Science** on Leonardo Da Vinci's contributions to botany. His lecture was part of a series presented to the docents who will be interpreting the museum's new exhibit on Leonardo Da Vinci to visitors. Peter pointed out that Leonardo was interested in more than just the accurate depiction of nature—he was concerned with how structure and function were interrelated, and he was a master of deducing function from careful observation of structure.

The Arboretum was a co-sponsor of this year's **New England Grows**, the Northeast's largest green industry trade show, which brings together thousands of participants from the nursery, landscape, and garden design professions. Staff members Peter Del Tredici and Tom Ward, greenhouse manager, presented programs on plant collecting in China and viburnums, respectively. During the course of the

continued on page 4

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show the Arboretum distributed more than 1,000 complimentary back issues of *Arnoldia* and answered numerous questions about Arboretum projects and programs.

Stephen Spongberg, Arboretum horticultural taxonomist, hosted a mini-symposium on taxonomic problems in the Maloideae, a subfamily of the Rosaceae. It was held at the Harvard University Herbaria in conjunction with the *Flora of China* translation project, which operates out of the Missouri Botanical Garden. HUH houses one of the *Flora's* editorial centers, which is coordinated by David E. Boufford, assistant director for herbaria collections. The project will publish the first modern English-language account of the vascular plants of China, based on the Chinese language *Flora Republicae Popularis Sinicae.*

For a more complete account, visit HUH's *Flora of China* web site (http://flora.harvard.edu/china/).

1997 American Landscape Lecture Series

READING THE AMERICAN LANDSCAPE

Lectures in memory of John Brinckerhoff Jackson

This fifth year of the American Landscape Lecture Series is dedicated to the memory of the late John Brinckerhoff Jackson, pioneer in the cultural interpretation of landscapes. Each speaker will offer a unique reading of the American landscape. The series is a collaboration among the Arnold Arboretum, Olmsted National Historic Site, the Harvard Graduate School of Design, and other landscape-oriented sponsors. We thank the Massachusetts Foundation for the Humanities for its support.

All lectures are free and begin at 6:30 pm at the Harvard Graduate School of Design, 48 Quincy Street, Cambridge. For information, call the National Park Service at 617/566–1689 x 220.

Thursday, February 13: Social Connections as Clues to Cultural Landscape Health
Paul Groth, Associate Professor of Architecture and Geography, University of California, Berkeley

Thursday, February 27: Prospects Aplenty: Scale, Identity, and Change in Regional Landscapes of America
Michael P. Conzen, Professor of Geography, University of Chicago

Thursday, March 13: The Midwest: America's Homegrown Utopia
Peirce Lewis, Professor Emeritus of Geography, Pennsylvania State University

Thursday, April 3: Reinventing Eden: Landscape as Narrative
Carolyn Merchant, Professor of Environmental History, Philosophy and Ethics, University of California, Berkeley

PROGRAMS & EVENTS

The Arboretum's Education Department offers a wide variety of courses, programs, and lectures in horticulture, botany, and landscape design. A selection of spring courses is shown here. For a complete catalogue of programs and events at the Arboretum, please call 617/524-1718 x 162. Note that fees shown in **boldface** are for Arboretum members. For information about becoming a member, call 617/524-1718 x 165.

ART 120 Botanical Perceptions: Drawing from Plants

Jan Arabas, Artist and Art Instructor

What do the artists Leonardo DaVinci, Claude Monet, and Georgia O'Keeffe have in common? They all turned to the botanical realm for instruction and inspiration. In this course we will emulate these artists and observe plants carefully, working toward good technical skills in a variety of art media, aiming to draw clearly what we see, and to learn about plant structure in so doing.

Fee: **$93**, $112

6 Mondays, April 7, 14, 21, 28, May 5, 12/ 10:00–noon (DG)

BOT 343 Reading the Forested Landscape: Making Sense of Place

Tom Wessels, Director, Environmental Biology Program, Antioch New England Graduate School

You may know how to identify your neighborhood trees but not know why pines are dominant in one place and maples in another. You may notice fungus growing on a beech trunk but not know the devastating impact of the blights on our forests over the centuries. Unlock the mysteries of the forest in this slide-illustrated lecture by the author of *Reading the Forested Landscape: A Natural History of New England.*

Fee: **$12**, $15

Tuesday, April 29/ 7:00–8:30 pm (WCC)

A Kind of Botanic Mania

Joan W. Goodwin

The simplicity of Linnaeus' classification system opened the field of botany to amateurs and its study was soon seen as "peculiarly adapted to females."

"I have this summer paid some attention to Botany," wrote seventeen-year-old Sarah Alden Bradford (1793–1867) to fourteen-year-old Abigail Bradford Allyn (1796–1860). "It is not a very useful study, although a very pleasing one," she continued. "It is however an innocent amusement, and enables us to discover Divine Wisdom, even in the construction of the smallest flower." Anticipating her family's move later that year of 1810 from Boston to Duxbury, where her third cousin Abigail lived, Sarah added her intention "to try to persuade you to join with me, in examining plants, and arranging them under their respective classes."[1]

Apparently she succeeded. Soon Sarah's father was writing to her brother at Harvard that "Sarah & Abba are studying Botany and one would think they hold converse only with the flowers for they in a manner seclude themselves from human observation & from communication with animal nature. I dont know what flower they affect to emulate but I dare say they are known to each other under some order or class of the Lin[na]ean system." If the Harvard student should write to his sister, Bradford advised him to "talk about calyx, corolla, & petals & I will engage you will be read."[2]

Without realizing it, Sarah and Abba were part of a fashionable trend that was drawing many young women into the study of botany. The simplicity of the new binomial system of classification devised by Swedish botanist Carolus Linnaeus (1707–1778)—which categorized plants according to the number and position of the stamens and pistils of their flowers—opened the field of botany to amateurs, many of whom made major contributions in describing and classifying plants. Wives and daughters were introduced to the study as helpers of botanist husbands and fathers. Linnaeus's daughter Elizabeth Christina saw her report on phosphorescence in nasturtiums published in the *Transactions* of the Royal Swedish Academy of Sciences in 1762.[3] In this country, Jane Colden (1724–1766) was introduced to botany by her father, Cadwallader Colden, who wrote the first local flora of New York based on the Linnaean system. Jane corresponded with experts in the field on both sides of the Atlantic, was widely praised for her botanical drawings, and was commended to Linnaeus himself.[4]

From the mid-eighteenth century on into the nineteenth, the study of botany was considered especially appropriate for young women who, it was assumed, liked flowers, were nurturing by virtue of their gender, and would benefit from healthful but not strenuous outdoor exercise. As Almira Phelps wrote in her *Familiar Lectures on Botany* (1829), "the study of Botany seems peculiarly adapted to females; the objects of its investigation are beautiful and delicate; its pursuits, leading to exercise in the open air, are conducive to health and cheerfulness."[5] However, there was some concern that since the Linnaean system was based on the sexual characteristics of plants, it might offend delicate sensibilities. In Britain, "desexualized" texts were created for female audiences, and in France Jean Jacques Rousseau omitted the Linnaean system in his 1771 *Lettres élémentaires sur la botanique*, written for a mother to use with her daughter. Thomas Martyn's English translation, *Letters on the Elements of Botany, addressed to a lady*, on the other hand, suggested that the Linnaean system be used for classification.[6]

Though much has been written about botany as "the female science," the letters of Sarah Alden Bradford provide a rare record of the

This portrait of Sarah Alden Bradford Ripley at fifty-three, drawn by Cheney in 1846, now hangs in the Old Manse in Concord, Massachusetts.

observations of a particular young woman caught up in the general excitement during those years. Sarah read French as well as English, and Gamaliel Bradford, her broad-minded sea captain father, had even permitted her to learn Latin along with her brothers. When Sarah and Abba were not botanizing, their heads would be close together over the *Aeneid,* for John Allyn, Abba's father and Duxbury's minister and schoolteacher, also believed in educating daughters as well as sons. Sarah found another mentor in Judge John Davis, a Boston neighbor whose avocation was natural history. He welcomed Sarah to his library and his extensive natural history collections. It may well have been Judge Davis who first interested her in botany. Martyn's version of Rousseau was available to Sarah in Judge Davis's library, along with Linnaeus's own *Genera Plantarum* (1754), *Philosophia Botanica* (1790), and *Flora Lapponica* (edited by J. E. Smith, 1792), and James Lee's popular exposition of the Linnaean system, *Introduction to Botany* (Edinburgh, 1797).[7]

Back in Boston after a happy year in Duxbury, Sarah continued her literary and botanical correspondence with Abba. From Judge Davis she borrowed *The Botanic Garden* (1789–1791), in which Charles Darwin's grandfather Erasmus Darwin combined mythic and scientific elements in verse. The first part, "The Economy of Vegetation," depicts the goddess Flora and numerous spirits as directing the vegetable kingdom. The second part, "The Loves of Plants," dealt with the Linnaean system in metaphors of courtship and marriage. Sarah described the first part to Abba as "very beautiful" though "highly figurative" and "splendid perhaps even to a fault." She did not expect to like the second part so well because "[i]t is founded on the sexual system of Linnaeus, that the dust of the anthers is absorbed by the pistil, and is absolutely necessary to the production of perfect seed, which system has since been exploded, and proved to have been but a fanciful idea of that great botanist."[8]

She praised Linnaeus for "making the number and situation of the stamens and pistils the ground of distinction between the classes, orders, &c" and for reducing the number of classes, "which were before very numerous depending on differences in the leaves &c of vegetables." However, she thought that "[t]he idea of sexual distinction in plants, forming so striking an analogy between the animal and vegetable kingdoms, giving so important a part in the economy of vegetation, to the dust of the anthers, which otherwise appears entirely useless to the plant, so caught the imagination of Linnaeus, that he overlooked difficulties in the way of his favorite system, which have since been proved conclusive arguments against it."[9]

Indeed, the Scottish professor Charles Alston, among others, disputed Linnaeus's claim that the "dust of the anthers" was essential to reproduction in plants and instead likened pollen to excrement, thrown off by the plant as superfluous.[10] Sarah would soon learn, however, that Linnaeus's system had not been "exploded." In this instance and in others that follow, it is interesting to see the scientific controversies of the time from the viewpoint of this young devotee.

In 1813, though longing to return to the woods and fields of Duxbury, Sarah was reconciled to spending the summer in Boston by her father's offer to take her to a series of botanical lectures by William Dandridge Peck. "[T]hey commence next week," she wrote excitedly to Abba, "and we are besides to have the privilege of visiting the Botanic garden as often as we please."[11]

Professor Peck, appointed to Harvard's newly created chair in natural history, was also director of the Botanic Garden, bounded by the present Linnaean, Garden, and Raymond Streets and augmented by a gift of land from the adjoining Andrew Craigie estate.[12] According to Peck, the garden was "intended for the cultivation of plants from various parts of the world, to facilitate the acquisition of botanical knowledge. It was also intended to receive all such indigenous trees, shrubs, and herbaceous plants, as are worthy of attention, as being useful in domestic economy, in the arts, or in medicine." Begun with contributions from nearby greenhouses, it was gradually enlarged by travelers to the East and West Indies and Africa.[13]

Soon Abba was treated to a secondhand version of the Peck lectures. In fact, Sarah's letters over the next few years offer a striking parallel to contemporary botanical texts written for young people in epistolary form. The British author Priscilla Wakefield, for example, used the device of letters between two teenage sisters, Felicia and Constance, one of whom is learning botany and explaining her lessons to the other.[14] Whether or not Sarah had read the American edition of Wakefield (1811), she was as eager as the young woman in the book to share her discoveries.

"I warn you before you begin you will hear nothing except de classe et ordine et genere, for there prevaileth hereabouts a kind of Botanic mania," Sarah wrote. She had obtained "our great desideratum a work almost wholly confined to Genera and species, so that if I find a flower whose name is unknown to me, I have only to turn to the page where its particular class and order (whatever they may be) are written above after the manner of a dictionary, and compare it with the descriptions of the several Genera under that class, which are so exact that it is almost impossible to mistake them, and when I find one agreeing with it exactly, I have its Generic name, I then turn to that Genus in another volume on species and find its common or trivial name as botanists say, its properties, the places where it usually grows &c."[15]

Sarah shared her new knowledge of willow trees ("which you know are of the class Dioecia"), giving a meticulous description of the blossoms, including "a nectarium scarcely discernable to the naked eye but very plainly seen with the help of that microscope we had last summer." She urged Abba to examine the willows in Duxbury and instructed her further about the nectarium "which varies very much in different flowers and in some makes almost their whole bulk, as in the Columbine, which you will find in the swamp at the back of your house, those four hollow tubes resembling horns are the nectaria which I know by experience for I have sucked the honey out of them many a time."[16]

She also learned about Cryptogamia when "Mr. Peck, our lecturer gave us a curious plant called Equisetum or horsetail, it bears its fructifications in a spike, which is composed of little plates in the form of shields supported on short foot stalks, their edges hung round with bags which when viewed with the microscope resemble the fingers of a glove, when they are ripe they burst open and drop out balls which are supposed to be the seeds, to which are affixed four strings resembling and supposed to be antherae."[17]

Another friend of Sarah's to receive accounts of the lectures was Mary Moody Emerson, one of whose young nephews would later become famous. "We have been attending a course of Botanical lectures, and have found them numerously frequented by the beau-monde," Sarah informed Mary, adding archly that "we are pleased to see so rational an amusement in fashion; by exciting a taste for nature it may perhaps render the country supportable to some of our fine ladies." "Linnaeus was the lady's man," she observed later, "and the ladies have just found it out."[18]

For Mary, Sarah described henbane: "Its lurid and disagreeable aspect and foetid smell would repel all but the botanist. The whole plant is covered with a fine kind of glutinous hair. The colour of its blossom is a dirty yellow striped with dark purple. It is a most deadly poison, but as is generally the case with plants of its affinity has been discovered to possess great medicinal virtue." Knowing that Mary was more interested in the state of her soul than in her newly acquired knowledge, Sarah added a religious note. "Instances like these daily multiplied are unspeakably delightful," she wrote. "They vindicate the ways of God to man. What a world of wonders the vegetable creation unfolds to the enquiring eye! If the grand, magnificent, stupendous frame of some parts of the Divine scheme have oft compelled the exclamation 'what is man that thou art mindful of him' how instantly is the doubt relieved when we behold the admirable and complicated provision for the preservation, multiplication, and disperson of the most minute and to limited human knowledge apparently most useless species of vegetation!" She went on with a poetic description of the variety of seed dispersal: "those furnished with silken wings soar aloft wafted by some propitious breeze to their destined spot. Those armed with hooks avail themselves of passing travellers' aid for conveyance. Some confined in an elastic case, when ripe burst their prison, and are propelled abroad with amazing force; others borne as it were in a light balloon cut the liquid air, or skim the surface of the wave!"[19]

As the lectures came to an end, Sarah was bursting with things to tell Abba. She was particularly struck with Professor Peck's account of Linnaeus's discovery of the sleep of plants. "He [Linnaeus] was presented with some unknown plants in blossom, and not having time to examine them, he ordered the gardener to set them out, and take particular care of the blossom. At evening being at leisure he visited them and to his chagrin and disappointment the flowers were not to be found. The gardener was reprimanded and promised to be more careful in future. The next morning they were visible and Linnaeus engaged again deferred visiting them till evening when the flowers had disappeared as before. This was done thrice, and at length examining them more closely, he found the floral leaves at the base of the blossoms had risen and completely enveloped them. Struck with the idea that some such change might take place in all plants, at midnight with a lantern he visits his greenhouse, and there sure enough he finds his dear family all <u>sound</u> [asleep]. The solemn hour of night combined with the silence and novelty of the scene affected Linnaeus even to <u>tears</u>. They were the tears of admiration and gratitude we may suppose a parent might shed at the development of some new faculty in a beloved offspring." As a demonstration to his class, "Mr Peck brought a plant asleep one morning, which was very carefully wrapped up in cotton wool to keep it from the light; the leaves were curiously folded together, but by exposing it to the influence of the sun's rays, before lecture was over it had begun to recover."[20]

When Professor Peck lectured on Linnaeus's experiment with the fig tree, Sarah was convinced, if she had not been before, of the sexual function of flowers. She described for Abba "an exhibition with the solar microscope of the flowers of the fig tree which grow within the fruit, and are curious also as being an example of the 23 class. The fig was quoted and termed <u>fructussine</u> flore in contradiction to an assertion of Linnaeus that flowers were absolutely necessary to the production of fruit. [However, Linnaeus] discovered the hiding place of the blossoms and taught his opponents that in many cases, in order to form an accurate judgment it is necessary to look beyond the surface."[21]

William Dandridge Peck, professor of natural history and founding director of the Harvard Botanic Garden in Cambridge (1805–1822), credited his interest in natural history to an "imperfect" copy of Linnaeus's Systema Naturae that he retrieved from a ship wrecked near his home in Newbury, Massachusetts. Almost immediately on being named director of the yet-to-be-created Harvard Botanic Garden in 1805, William Peck set sail for Europe, where for three years he visited the great gardens, collecting seeds, plants, books, and ideas.

GRAY HERBARIUM ARCHIVES OF HARVARD UNIVERSITY

The following summer found Sarah still enthusiastic about botany. She encouraged Abba to visit her, writing, "Craigie's swamp will be full of flowers, Smith's botany will be published, and we will enjoy ourselves finely together."[22] In 1814, Jacob Bigelow, founder and president of Boston's Linnean Society, brought out the American edition of James Edward Smith's popular English botany text, trusting that "the present edition will not be unacceptable to the public, particularly to students attending the botanical lectures in this place, for whose use it was originally undertaken."[23] He added notes on American plants and an expanded glossary of botanical terms. In Smith Sarah could read the full account of the "luminous experiment" in which Linnaeus removed the anthers from a flower, destroying the rest of the day's blossoms, and another day repeating the process but sprinkling pollen from another flower on the stigma of one from which he had removed the anthers. When the first flower produced no fruit while the second produced perfect seed, Linnaeus had proved his point, according to Smith.[24]

In Smith's eyes, the facts of plant life did not detract from the delight of botanical study. "The natural history of animals, in many respects even more interesting to man as an animated being, and more striking in some of the phenomena which it displays, is in other points less pleasing to a tender and delicate mind," he wrote in his preface, while "[i]n botany all is elegance and delight. No painful, disgusting, unhealthy experiments or inquiries are to be made. Its pleasures spring up under our feet, and, as we pursue them, reward us with health and serene satisfaction. . . . The more we study the works of the Creator, the more wisdom, beauty and harmony become manifest, even to our limited apprehensions; and while we admire, it is impossible not to adore."[25]

As we have seen, Sarah, with her Unitarian upbringing, had already found botany to be a religiously illuminating experience. "If you have never examined a dandelion flower," she wrote Abba, "you will find it very curious, the

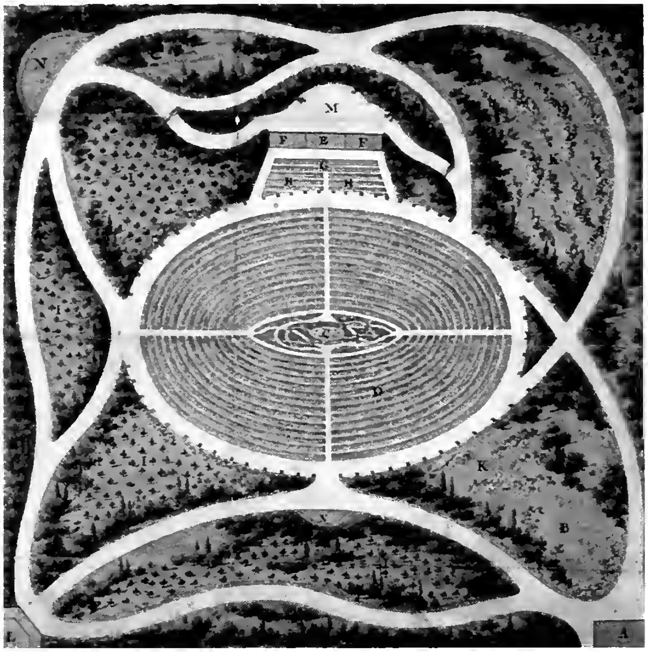
A Plan for the Botanic Garden at Cambridge

The idea for "a large well-sheltered garden and orchard for students addicted to planting" was broached at Harvard as early as 1672, and in 1784 the King of France offered "to furnish such [botanic] garden with every species of seeds and plants which may be requested from his royal garden, at his own expense." Finally, in 1805, a collaboration between the College and the Massachusetts Society for Promoting Agriculture provided for a professorship of natural history; among the duties of the professor was the formation of a "Botanic Garden on the grounds that shall be provided for that purpose."* William Dandridge Peck promptly set sail for a lengthy tour of western Europe.

At Uppsala Peck acquired seeds of 150 species of plants and 500 herbarium specimens that "are such as are rare and valuable, especially as they are from persons of the most correct information." He was told there "that the arrangement of plants in a garden according to Classes and orders in the [Linnaean] System is both difficult and inconvenient; but the disposition of them according to their natural orders in concentric circles is much more commodious."

In 1808 he sent a plan (top right) from Paris that grew out of several conversations at the Jardin des Plantes with M. Thouin, "a gentleman of eminence in the profession of ornamental gardening." It provided for various trees and flowering shrubs; small lawns with flowers and shrubs; hothouse, greenhouses, cold frames, and hotbeds. The "garden of Arrangement or Botanic School" forms the large central oval *(D)*. From Kew Peck had written, "A reservoir of water fed and kept sweet by a small spring is the best situation for aquatic plants." Accordingly, "Bason or reserves with running and stagnant waters" are designated at center *(C)*.

Peck had seen the Garden's site only briefly before his European trip, and although he remembered the wetland, he did not recall the shape of the grounds. In the 1888 plan (bottom right) some of the elements of the 1808 scheme can be seen, including a pool for aquatic plants at the center of the concentric planting beds. Native and exotic trees and shrubs were planted at once, and later came a conservatory; native herbs around a spring in the southwest corner; seedplots, cold frames, and hotbeds screened by a hedge of European beech; a gardener's cottage.



GRAY HERBARIUM ARCHIVES OF HARVARD UNIVERSITY

GRAY HERBARIUM ARCHIVES OF HARVARD UNIVERSITY

* Goodale, George L. 1991. The Botanic Garden at Cambridge. *Harvard Register*, Vol. 3 (Jan.).

downy wings of the seeds by which they are scattered far and wide. The perfect uniformity of the little flowers, each with its pistil and five stamens united by the anthers, the filaments separate, almost too small to be distinguished with the naked eye. The same order, regularity and beauty are as visible in the least as in the greatest of the works of creation. Do you think a dandelion could have been the work of chance? Surely that study cannot be entirely useless which can make even this most despised of flowers a source of admiration and entertainment, a demonstration of the hand of a Creator."[26]

Two years after the lecture series, Sarah wondered if Abba was reading Smith and recommended the sixteenth chapter on the functions of leaves. "It is amusing," she wrote, "to trace the striking analogies between the animal and vegetable kingdoms in respiration, secretion & all the similar and diversified effects of the vital principle in each. Theories which pretend to explain these effects in vegetation on chemical or mechanical principles are unsatisfactory." Smith had mentioned heat and wind as possible causes for the flow of sap from root to branch.[27] It seemed to Sarah that "[t]he attraction of cohesion may account for the ascent of fluids to small heights, but not for the propulsion of the sap from the spreading roots of the oak throughout the unnumbered ramifications of its towering limbs; that this most important function should depend on the agitation of the inconstant breeze is equally inconceivable; if you ascribe it to the vital energy and suppose some action of the spiral coated sap vessells similar to the pulsation of the arteries, a distinction sufficiently broad is marked between organic and inorganic bodies, and the operations of animal and vegetable organs analogous in their curious structure and combinations, are explained from similar causes. How regular the gradation too from species to species in the long series of organized existance!"[28]

Continuing her line of thought, she confronted Abba with a botanical extension of the popular philosophical idea of the Great Chain of Being supposed to link deity and the hierarchy of heavenly spirits with humans and the lower animals. "I suppose your ladyship would not feel her dignity much impaired by kindred with the majestic elm or delicate sensitive plant," she wrote, "but how would you receive the hand of fraternity extended by a potato or toadstool? Distinctions which appear so striking and marked when extremes are compared blend insensibly into each other as we descend, and genus is linked with genus in a chain which the delighted philosopher cannot nor does not wish to dissolve. Nature never disturbs us with abrupt transitions in any of her operations; broad day softens into twilight, twilight deepens into the shades of evening; the process of vegetation, from the first swelling of the seed till the perfect plant appears in all the luxuriancy of foliage and beauty of fructification, is so imperceptible that we are affected with no wonder or admiration at the secret agency of Divine power in the successive stages of its progress and are astonished only when we compare what it is with what it was."[29]

Sarah continued botanical study throughout her life. Three years after she wrote the letter just quoted, she married the Rev. Samuel Ripley, the Unitarian minister in Waltham who also kept a boarding school to prepare boys for Harvard. In addition to teaching Latin, Greek, and mathematics in the school, Sarah raised her own seven children and an adopted niece and managed the large household with only sporadic help. Collecting excursions to Prospect Hill and visits from an expert amateur botanist, the Rev. John Russell, provided much-needed recreation during those busy years.

When Asa Gray was appointed Fisher Professor of Natural History at Harvard in 1842, he was told about "a learned lady in these parts, who assists her husband in his school, and who hears the boys' recitations in Greek and geometry at the ironing-board, while she is smoothing their shirts and jackets! . . . reads German authors while she is stirring her pudding, and has a Hebrew book before her, when knitting. . . . Even my own occupation may soon be gone; for I am told that Mrs. Ripley (the learned lady aforesaid) is the best botanist in the country round."[30]

Soon Gray was sharing his books with this learned lady. One, "a beautiful edition of a french work on botany," gave Sarah "great pleasure in getting at the mind of a man of genius through his scientific method." She found it "much more satisfactory to begin from the root and study upwards, than to pick open a flower, count the stamens refer it to a class and give it a name."[31] When a book on European mosses came to the botanical library, Gray promised to loan it to her as soon as he had finished with it himself.[32]

Sarah spent her last years in retirement at the Old Manse in Concord, Massachusetts, where some of her mounted specimens may be seen. In her seventies, she was still teaching botany, writing to a young grandson, "I long to have the bright days of summer come for you and dear little Ezra to gather flowers of all kinds. . . . And poor old GrandMa will tell him all she knows, and put them in a book that has pretty flowers, which have been pressed and kept a great while, and are still bright and beautiful."[33]

Endnotes

1 SAB to ABA, n.d. (1810?), Sarah Alden Bradford Ripley Papers, MC 180, Schlesinger Library, Radcliffe College, hereafter cited as SABR.

2 Gamaliel Bradford to Gamaliel Bradford, Jr., "Thursday" (1810?), Bradford Papers, bMS Am 1183.32, by permission of the Houghton Library, Harvard University.

3 Ann B. Shteir, "Linnaeus's Daughters: Women and British Botany," in Barbara J. Harris and Jo Ann K. McNamara, eds., *Women and the Structure of Society* (Durham, NC: Duke University Press, 1984), 69.

4 See Mary Harrison, "Jane Colden: Colonial American Botanist," *Arnoldia* (Summer, 1995) 55(2): 19–26.

5 Quoted in Vera Norwood, *Made From This Earth: American Women and Nature* (Chapel Hill: University of North Carolina Press, 1993).

6 Ann B. Shteir, *Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England, 1760–1860* (Baltimore: Johns Hopkins University Press, 1996), 19–20, 23.

7 *Catalogue of the Private Library of the Late Judge Davis* (Boston: Alfred Mudge, 1847), 17, 20, 43.

8 SAB to ABA, Nov. 3 (1812?), SABR.

9 Ibid.

10 Shteir, *Cultivating Women, Cultivating Science*, 17. James Edward Smith, *An Introduction to Physiological and Systematical Botany*, First American, from the Second English Edition, with notes by Jacob Bigelow, M.D. (Boston: Bradford & Read, 1814), 253. Smith names Tournefort and Pontedera as being of the same opinion.

11 SAB to ABA, n.d. (1813), SABR.

12 Jeannette E. Graustein, Harvard's Only Massachusetts Professor of Natural History, *Harvard Alumni Bulletin* (December 13, 1958), 243.

13 William Dandridge Peck, *A Catalogue of American and Foreign Plants Cultivated in the Botanic Garden, Cambridge, Massachusetts* (Cambridge: University Press, 1818).

14 Priscilla Wakefield, *An Introduction to Botany, in a Series of Familiar Letters* (1st British ed., 1796; 6th ed., Philadelphia: Kimber & Conrad, 1811).

15 SAB to ABA, n.d. (1813), SABR. Sarah offers no authors or titles for the books she was using prior to the publication of the American edition of Smith.

16 Ibid.

17 Ibid.

18 SAB to MME, n.d. (1813); Sept. 5 (1817?), SABR.

19 SAB to MME, n.d. (1813), SABR.

20 SAB to ABA, n.d. (1813), SABR.

21 Ibid.

22 SAB to ABA, n.d. (1814), SABR.

23 Jacob Bigelow, "Advertisement to the American Edition," Smith, v.

24 Smith, 253.

25 Ibid., 18–20.

26 SAB to ABA, n.d. (1812?), SABR.

27 Smith, 54–55.

28 SAB to ABA, Sept. 30 (1815), SABR.

29 Ibid.

30 Jane Loring Gray, ed., *Letters of Asa Gray* (Boston: Houghton, Mifflin, 1893), I: 289.

31 SAR to George F. Simmons, June 26, 1844, SABR. Unfortunately, Sarah failed to mention the name of this "man of genius" or the title of his book.

32 Ibid., Dec. 12, 1844.

33 SAR to William Sydney Thayer, n.d. (winter, spring, 1867?), MS Storage 296 (#51), by permission of the Houghton Library, Harvard University.

Acknowledgments

The author wishes to thank Peter Stevens of the Harvard University Botany Department and Mary Harrison, Arnold Arboretum volunteer, as well as *Arnoldia* editor Karen Madsen for their helpful comments.

Joan W. Goodwin, who lives in Brookline, Massachusetts, is an independent scholar now completing a biography of Sarah Alden Bradford Ripley.

A Multitude of Botanies: Book Essay

Peter Stevens

Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England 1760 to 1860. Anne B. Shteir. Baltimore: Johns Hopkins University Press, 1996. Hardcover, 312 pages

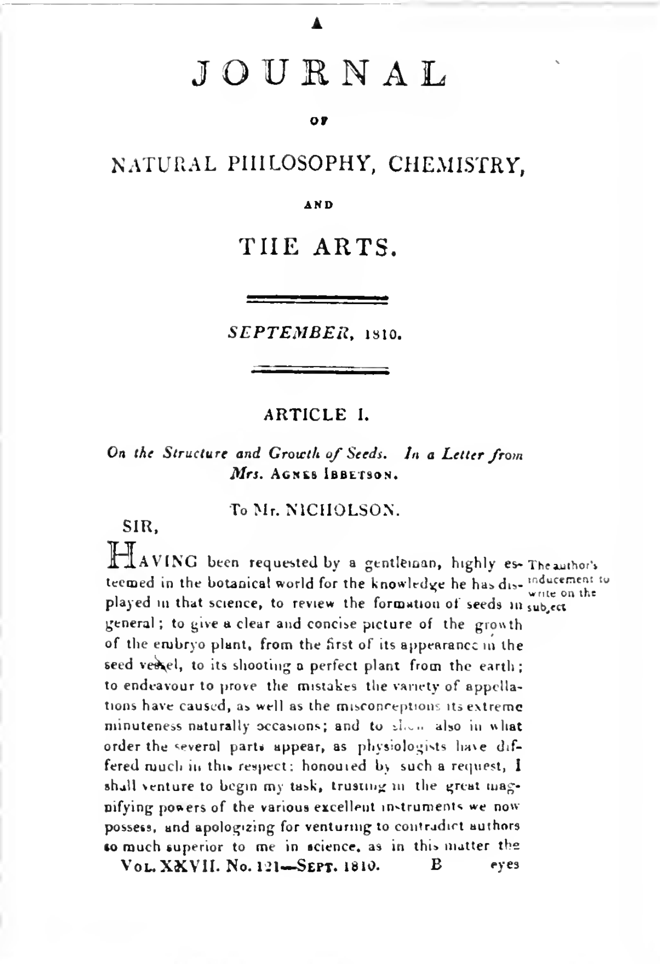
What does the word *botany* bring to mind? A nosegay held by a young girl? Field studies by amateurs that result in finds of new plants subsequently reported in the proceedings of botanical clubs using sesquipedalian words with Latin and Greek roots? Classificatory studies carried out in the cavernous halls of a large herbarium? Physiological and ecological studies of a prairie grass? In the nineteenth century these were seen by many as being competing ideas, and what we call botany in the twentieth century—and different people still define it in different ways—owes much to debates in the late eighteenth and nineteenth centuries. These were between professional botanists promoting very different visions of their discipline, and between what we might call amateurs and professionals, both men and women, as they, too, strove to shape public interest in a particular area of botany, or simply responded to what they saw as a market for particular kinds of botanical works.

Shteir's *Cultivating Women, Cultivating Science*—clearly written and well-illustrated—helps us understand the issues involved. Her subject is women in both popular and more scientific cultures of botany in the period 1760–1860, and she summarizes some of the topics that will engage her as she outlines how Linnaeus's classification, all the rage in the 1760s, came to be perceived at the beginning of the nineteenth century: "Teachers continued to explicate Linnaean botany for students, but increasingly it was seen as the gateway, or the lower rung of the ladder of botanical knowledge, associated with children, beginners, and women. During the 1790s commentators began distinguishing between the 'botanist' and 'botanophile', between the scientist and enthusiast . . . the botanist was male and masculine and the botanophile usually female and feminine. As a result, during the 1820s some botanists began to generate strategies to 'defeminize' the public image of the science."[1]

Botany proper, these male botanists thought, was not simply the Linnaean system; botany was not a subject that interested women alone; botany was an exciting science worthy of attention by men. Much ink was to be used in defining what botany was all about, yet the same arguments were being made at the end of the century, as we will see.

Shteir first summarizes how Linnaean botany—the identification and naming of plants using Linnaeus's system—became part of the social culture of women by the early nineteenth century. This was despite criticism by those who found the Linnaean sexual system offensive, and by some Romantic poets who felt that the rigidity of Linnaeus's approach was antithetical to their artistic concerns. Shteir then focuses on two groups of women writers responsible for the integration of Linnaean botany with popular middle- and upper-class culture. A group of these women wrote botanical books that specifically addressed mothers and governesses of children, especially girls. Such books were much in demand, judging by the numbers of times many of them were reprinted.

She then discusses the work of three women, Maria Jacson, Agnes Ibbotson, and Elizabeth Kent, who made careers in botanical writing, whether or not they made a living by their work. Agnes Ibbotson, who died in 1823, is particularly interesting. Her interests were in more "philosophical" botany, that is, botany that


A

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OF

NATURAL PHILOSOPHY, CHEMISTRY,

AND

THE ARTS.

SEPTEMBER, 1810.

ARTICLE I.

On the Structure and Growth of Seeds. In a Letter from Mrs. AGNES IBBETSON.

To Mr. NICHOLSON.

SIR,

HAVING been requested by a gentleman, highly esteemed in the botanical world for the knowledge he has displayed in that science, to review the formation of seeds in general; to give a clear and concise picture of the growth of the embryo plant, from the first of its appearance in the seed vessel, to its shooting a perfect plant from the earth; to endeavour to prove the mistakes the variety of appellations have caused, as well as the misconceptions its extreme minuteness naturally occasions; and to shew also in what order the several parts appear, as physiologists have differed much in this respect: honoured by such a request, I shall venture to begin my task, trusting in the great magnifying powers of the various excellent instruments we now possess, and apologizing for venturing to contradict authors so much superior to me in science, as in this matter the

The author's inducement to write on the subject

VOL. XXVII. No. 121—SEPT. 1810. B eyes

suggest that Smith felt challenged by Ibbotson's work, or to compare her work with that of the Nobel Prize winner Barbara McClintock.

John Lindley is the next to figure in Shteir's narrative. More than any other botanist in Britain in the first half of the nineteenth century, Lindley linked what might be called professional botany, polite middle- and upper-class amateur botany, and gardeners and horticulturists. He is still remembered for his work on orchids (the recently founded orchid journal, *Lindleyana,* attests to this), and he was closely associated with the Horticultural Society for almost his entire working life. However, his activities seem almost contradictory. Shteir notes both that Lindley attempted to rescue professional botany from women yet at the same time in his copious writings, perhaps most notably his *Ladies' Botany, or a Familiar Introduction to the Study of the Natural System in Botany* of 1834–1837, he introduced the natural system to popular audiences in general and women in particular. Furthermore, David Mabberley, in his recent biography of the great botanist Robert Brown, tends to dismiss Lindley's

included physiology, anatomy, and work with microscope, and they engrossed her energies for over twenty years at her home near Exeter, in the southwest of England. Largely without contact with metropolitan botanical colleagues, she nevertheless contributed to periodicals such as *The Philosophical Magazine* and *Annals of Philosophy.* However, when she sent a summary of her life's work to the doyen of British botanists, Sir J. E. Smith, president of the Linnean Society and owner of Linnaeus's collections, she received no encouragement. I would love to know more about Ibbotson's work and to see some of the illustrations she drew and to find out about Smith's own ideas about philosophical botany. (Staunch upholder of the Linnaean system though Smith was, Shteir notes he wrote *An Introduction to Physiological* [philosophical] *and Systematical Botany.*) Without such information, it seems premature to

efforts, suggesting that Lindley "tamed" botany, making it palatable to Victorian England—"Floras had to be written, Science left by the back door."[2] Robert Brown had taken the lead in the introduction of a classification system that reflected ideas of nature to British professional circles barely a generation before Lindley wrote his book, and Brown's achievements inform Mabberley's judgment. But in an anecdote recounted by Shteir, we find Lindley, holed up in his summer house on a rainy day with family and visitors, forced to play indoor games, and indisposed to start botanical conversations with the botanical author Mary Kirby. The author of *Ladies' Botany* is here not even a popularizer of botany, although the conditions for any sort of botanical tête-a-tête on that occasion would seem hardly ideal.

The place of women in society was not static, and Jane Loudon changed the title of *Botany for*

Ladies (1842) to *Modern Botany* (1851). Shteir suggests that in the middle of the nineteenth century "women's spaces disappeared as the site of [botanical] science" with the disappearance of books written specifically for them. Shteir links this change to changing ideas of education—women's and men's education should not differ. However, even by Shteir's own telling, women had never been more than marginal contributors to the masculine, professional world of botanical science, however defined; they did contribute to a broader science culture, but very little to then-current classification systems. And in the last two chapters we find women later in the nineteenth century still very active in botany, as illustrators, collectors, and writers, but mostly of juvenile or general popular literature.

Shteir shows clearly that there were several groups of people interested in botany in the middle of the nineteenth century. (She also mentions the work of Anne Secord on British artisan botanists—another semi-independent community of botanical devotees with their own particular interests and customs.) We can relate these groups to the equally diverse ways in which zoology, natural history, and in particular, botany were perceived. Lindley wasn't jumping into a field dominated by women; professional botany, which at that time in England was largely synonymous with systematic studies, was dominated by men. But there is guilt by association—women and plants, especially flowers, were connected in the public mind[3]—and thus he wanted to disassociate women from the *philosophical* botany that he considered most exciting. Yet philosophical botany itself was not botany *toute courte,* as Sir J. E. Smith himself acknowledged in his opening address to the fledgling Linnean Society in 1798 and as Smith's and Lindley's contemporaries such as Lamarck and the great Swiss botanist Alphonse de Candolle also made clear. Similarly, the Victorians for whom Lindley "tamed" botany were a rather different group of people from those for whom Brown wrote earlier in the century, and both are different from Secord's artisan botanists. Some of the contradictions noted above disappear.

Indeed, throughout the century, botany as a science remained almost synonymous with classification studies, and botany in the eyes of the public remained associated with women and flowers. In 1895 John Merle Coulter, a major figure in the introduction of Lindley's philosophical botany (in its late nineteenth-century garb) into the United States wrote, "recommended especially to ladies as a harmless pastime . . . it [botany] was an emasculated science, which regarded merely the cut of the clothes rather than the man beneath. In spite of the subsequent revelation of the botanical man, the capacity of plants for usefulness in the domain of aestheticism still brands botany in certain quarters as an emotion rather than a study . . . But the botanical man has been liberated, and his virile strength is becoming daily more evident."[4]

Coulter may have thought the virility of botany (and he did not mean classificatory botany) was self-evident; he certainly acknowledged, albeit unwittingly, "the pervasive factor of gender in shaping the scientist, science education, and science writing," to quote Ann Shteir in the Epilogue.

If in this review I have taken a rather narrower view of botany-as-science, and of botany itself, than Shteir does in her admirable book, it is because I find this the easiest way to work towards the much-needed "broader conversation about the culture of botany"—again quoting the Epilogue—by emphasizing its subcultures. Both views are essential if we are to understand where botany stands at the end of the twentieth century.

Endnotes

[1] Shteir, 30–31.

[2] D. Mabberley, Jupiter botanicus: *Robert Brown of the British Musuem* (Braunschweig: J. Cramer, 1985), 399.

[3] Jack Goody's recent *The Culture of Flowers* (Cambridge: Cambridge University Press, 1993) discusses this.

[4] *The Botanical Outlook* (Lincoln: University of Nebraska Press), 4.

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Arnold Arboretum Weather Station Data — 1996

	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Max. Temp. (°F)	Min. Temp. (°F)	Precipi-tation (in.)	Snow-fall (in.)
JAN	35	18	27	58	−2	7.51	39.6
FEB	37	20	29	58	−6	3.05	17.3
MAR	44	24	34	63	4	3.78	20
APRIL	57	38	48	83	29	5.93	8
MAY	69	46	58	93	31	3.96	0
JUNE	81	58	70	92	45	1.87	0
JULY	83	61	72	93	54	5.45	0
AUG	83	62	73	97	56	2.17	0
SEPT	72	54	63	90	41	9.05	0
OCT	64	40	52	77	29	13.18	0
NOV	47	30	39	71	16	2.68	2.3
DEC	45	30	38	61	17	4.35	2.7

Average Maximum Temperature	60°
Average Minimum Temperature	40°
Average Temperature	50°
Total Precipitation	62.98 inches
Total Snowfall	89.9 inches
Warmest Temperature	97° on August 7
Coldest Temperature	−6° on February 5
Date of Last Spring Frost	31° on May 13
Date of First Fall Frost	32° on October 5
Growing Season	144 days

Note: According to state climatologist R. Lautzenheiser, 1996 was an extremely wet year with temperatures slightly below normal and sunshine well below normal. This was the ninth wettest year on record. January, July, and September were double the norm for precipitation, while October was triple the norm. The 9.99 inches that accumulated in October from the 19th to the 22nd was the second greatest rainfall on record and is considered a hundred-year storm.

The snowfall totaled 89.9 inches, which is more than double the past average for the year. This was due to the glut of snow that fell early in the year. At year's end, the new snow season had brought less than normal snow. January broke the snow record for that month, and it was the second snowiest month recorded in 106 years. Only fifty percent of possible sunshine was measured, down four percentage points from the average.

Index to Volume 56 (1996)

*Numbers in parentheses refer to issues, those in **boldface** to illustrations of the entries.*