Summer 1991

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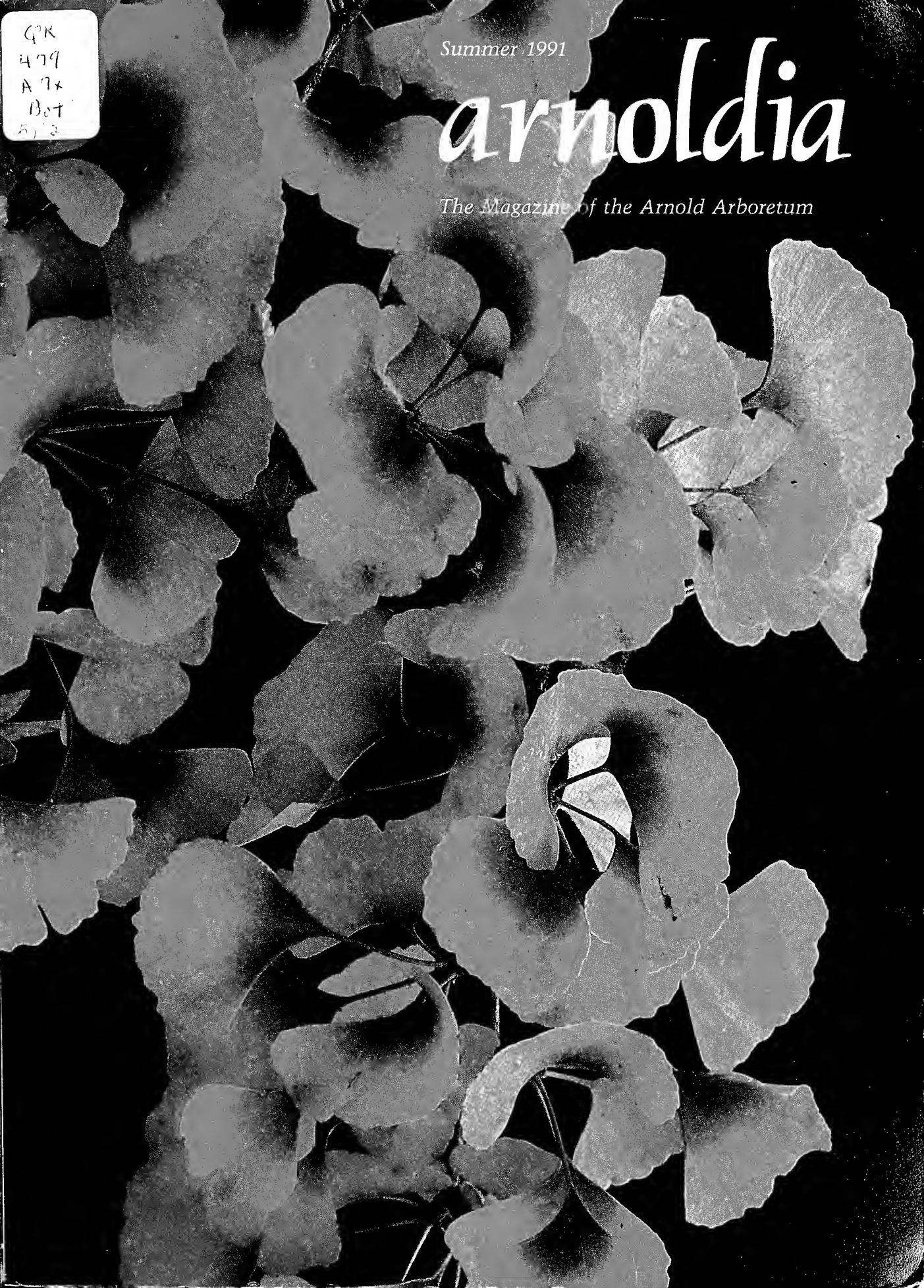

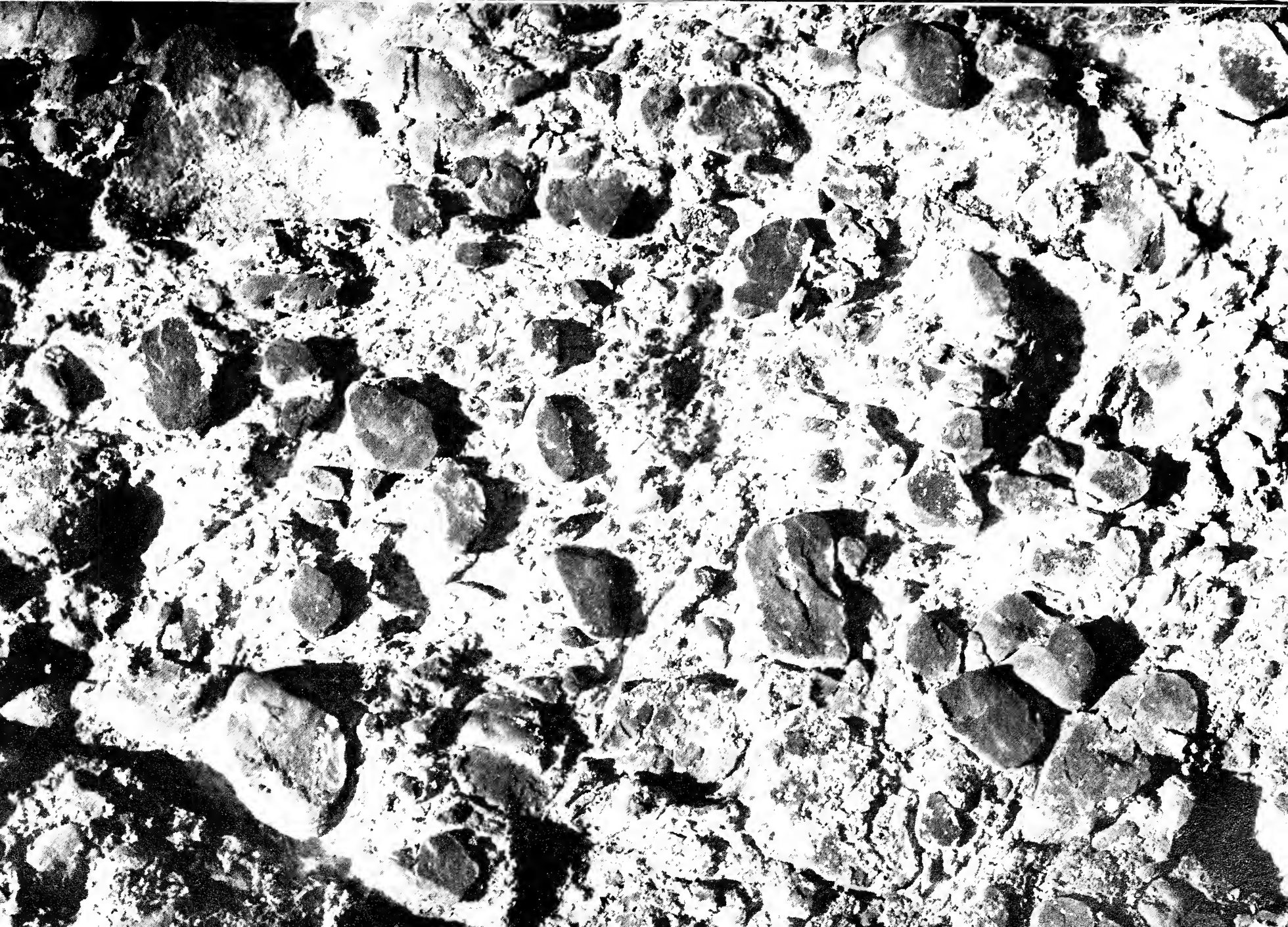

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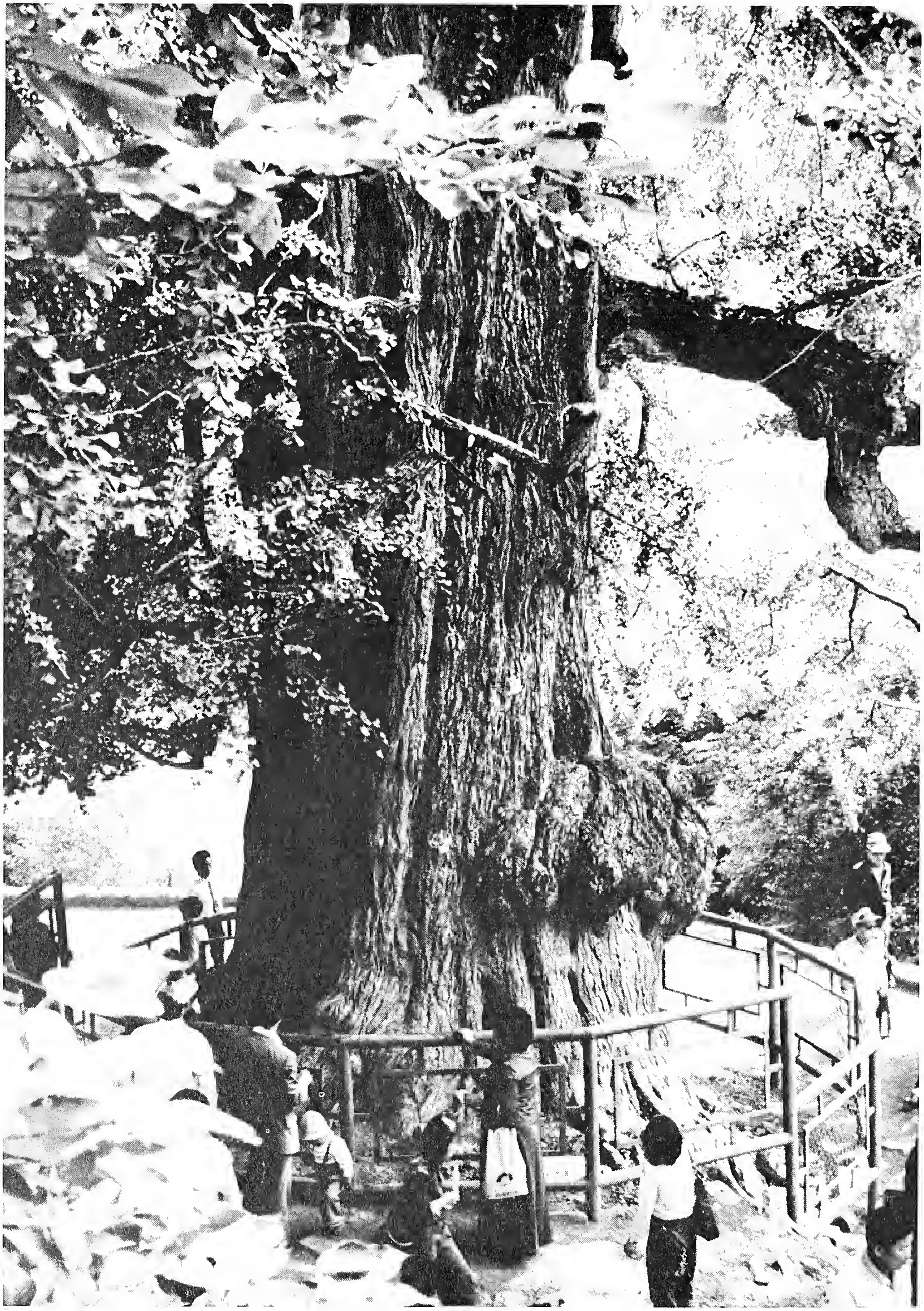
Front cover: *Ginkgo biloba* leaves just beginning to turn color in the fall. Photo by Al Bussewitz.

Back cover: *Rhododendron* 'Smoky Mountaineer.' This Arnold Arboretum introduction was selected from a group of *Rhododendron calendulaceum* seedlings in 1941, but was not named and distributed until 1966. The flowers, while similar to those of *R. calendulaceum* in size and shape, lack the characteristic yellow blotch on the inside of the corolla. The intense "Mandarin Red" coloration of the flowers seems to be unique among flame azalea seedlings. Photo by Rácz and Debreczy.

Inside front cover: Lichen-covered Roxbury pudding stone in the Allandale Woods. Photo by Peter Del Tredici.

Inside back cover: An old specimen of *Ginkgo biloba* growing in *Liu Yuan* (Lingering Garden) in Suzhou, China. The tree is 34 meters tall (102 feet); its trunk is one meter in diameter (3 feet). Photo by Peter Del Tredici.



Ginkgos and People—A Thousand Years of Interaction

Peter Del Tredici

Recent discoveries on the effects of *Ginkgo* leaf extract in promoting blood flow have stimulated renewed interest in this ancient plant.

Above all else *Ginkgo biloba* is a survivor, not only of the ravages of geological time, extending back at least 70 million years to the Paleocene, but also of the ravages of human time, the so-called Internecine. Indeed, the *Ginkgo* tree has a documented history of cultivation by the Chinese for close to a thousand years and an undocumented history that no doubt extends back much further.

As a result of this interaction, *Ginkgo biloba* has become so closely intertwined with human beings that its existence outside of cultivation has been the focus of an unresolved debate for over a hundred years. In the Western literature, Buddhist monks are widely credited with preserving *Ginkgo* from extinction by planting it in their temple gardens (Wilson, 1920), but little documented evidence supports this notion. The argument of H. L. Li (1956) that the tree was first cultivated for its edible and medicinally active seeds provides a more plausible, if somewhat less romantic, motivation for its preservation.

As a wild species in China, *Ginkgo* was probably a member of the temperate, mixed mesophytic forest that once covered the hill country bordering the Yangtze River valley for most of its three-thousand-kilometer length. Most of this forest has now been cut down except for remnants found in a few isolated valleys and on a few steep mountainsides (Wang, 1961). During the fall of 1989, the author and his colleagues, Professor Hsieh Ling of the Zhejiang Forestry Department and Guang Yang of the Nanjing Botanical Garden, visited one such area in eastern China, the famous Tian Mu Mountain in Zhejiang Province, where *Ginkgo biloba* still grows in a semi-wild state. Our ecological observations made on Tian Mu Shan indicate that *Ginkgo* is well adapted to growing on disturbed sites where light intensity is high, particularly along stream banks, on rocky slopes, and on the edges of exposed cliffs (Del Tredici et al., in press).

The purpose of this article, however, is not to examine the question of whether *Ginkgo* still exists in the wild but to examine the mutually beneficial interactions that have occurred between *Ginkgo biloba* and *Homo sapiens* over the last one thousand years. From the botanical perspective, these interactions have resulted in a tremendous expansion of the tree's range from its native Chinese home into every country in the temperate world. From the human perspective, the interactions

Figure 1. One of the largest Ginkgos *in Asia, growing on the grounds of Yongmun-san temple in Korea. The tree, about 60 meters tall and 5 meters in diameter, is reputed to be 1100 years old. Photograph by S. A. Spongberg.*

have yielded a beautiful ornamental tree that produces a nutritious food and a valuable medicine.

The Quintessential Survivor

Ginkgo is considered to be one of the toughest of all cultivated trees, a belief borne out by a famous specimen growing near the hypocenter of the 1945 atom bomb blast over Hiroshima, Japan. According to Michel and Hosford, the tree that still grows there today survived the bomb by sprouting from its base after its trunk was completely destroyed!

Another indication of *Ginkgo's* exceptional power of survival is its long life span. Throughout Asia there are many large and ancient specimens that are in excess of a thousand years old (Figure 1). (Miyoshi, 1936; Ling, 1965; Spongberg, 1978). According to Professor Ling of the Zhejiang Forestry Department, the largest and perhaps oldest *Ginkgo* in China is a specimen growing in Folaishan in Ju County, Shandong Province. It is an ovulate (female) tree, approximately three thousand years old, with a diameter at breast height (DBH) greater than 4 meters and a height of 26.5 meters. In Zhuji County, Zhejiang Province, the author saw one old ovulate tree with a DBH of 2.3 meters and a height of 33 meters (Figure 2). In 1988 this tree produced a remarkable 379 kilograms of cleaned nuts. If *Ginkgo* is indeed a pioneer species, as our work on Tian Mu Shan suggests, then it must be considered a *persistent pioneer* that can outlast several successional cycles.

Under cultivation, *Ginkgo* is considered highly adaptable, growing well in most parts of the temperate world with a distinct seasonality and moderate rainfall, including areas with a Mediterranean type of climate as well as those with a cold temperate climate, where the minimum winter temperatures can reach −30 degrees C. *Ginkgo* seems to grow best when planted in full sun, although it also shows the ability to persist indefinitely under conditions of low light, such as when planted along the cavernous, downtown streets of many cities in eastern North America.

Figure 2. An ancient ovulate Ginkgo *growing in Yang Tang village, Zhejiang province. The tree had a diameter of 231 centimeters and was 33 meters tall in 1989. In 1988 the tree produced 379 kilograms of cleaned nuts.*

According to reports in the horticultural literature, *Ginkgo* will grow in a wide variety of soil types (with the exceptions of those that are very wet or alkaline or show a pronounced hardpan) but it prefers soils with a pH of 5.5 to 6.5. Under typical conditions of outdoor cultivation, the roots of most *Ginkgos* are infected by vesicular-arbuscular mycorrhizae (VAM) that play an important role in the uptake of the element phosphorus (Bonfante-Fasolo and Fontana, 1985; Fontana, 1985).

In addition to its great powers of survival, another characteristic that makes *Ginkgo* a particularly successful street tree is its high degree of resistance to insect damage and to fungal, viral, and bacterial diseases, relative to other cultivated trees. Contrary to the

numerous anecdotal reports, however, *Ginkgo's* tolerance of air pollution, particularly sulfur dioxide and ozone, is not that much better than other trees, and the tree is no less susceptible to damage from ionizing radiation than other gymnosperms (Major, 1967; Hepting, 1971; Sharma, 1989).

Under conditions of moderate soil fertility, *Ginkgo* grows quite rapidly, averaging up to half a meter per year when young. With the onset of sexual maturity, between 20 and 30 years, height growth generally slows down as the tree fills in its rather sparsely branched juvenile framework. At full maturity, *Ginkgo* is not a particularly tall tree, reaching a maximum height of about 30 meters, although one specimen in Korea has been measured at 60 meters (Figure 1) (Spongberg, 1978).

In the fall of 1989, I interviewed horticulturists in Shanghai, China, who worked for a division of the Ancient Trees Management Group of the Shanghai Public Garden Administration. They had catalogued and measured the height and girth of all the large *Ginkgos* in the province, and had found a total of four hundred trees over one hundred years old, half of which were over three hundred years old. They were willing to share their findings concerning the growth of *Ginkgo* only in qualitative terms, and told me that the growth rate in *Ginkgo*, measured in terms of centimeters of girth increase per year, is rapid and increasing between the ages of 1 and 40 years. Growth rate slows down between the ages of 40 and 110 years, and between the ages of 110 and 150 to 200 years, it is more or less constant. From 150 to 200 years and beyond, the growth rate of *Ginkgo* appears to diminish.

Cultivation in the West

Ginkgo was introduced into Europe from Japan at the Botanic Garden in Utrecht, Holland, about 1730, where a tree that is probably one of the original introductions is still in very good condition (Dallimore and Jackson, 1966). In Kew Gardens, England, a *Ginkgo* is still growing that was planted in 1754 and was probably part of the original introduction into that country. The first *Ginkgo* reported to produce fertile seed in Europe was a large male tree growing in the Botanic Garden of Montpellier, France, in 1835. This anomalous situation was brought about by the fact that scions from a female tree (growing near Geneva, Switzerland) had been grafted onto it some years earlier. This "hybrid" tree was still alive and in good health when the author visited the garden in 1990.

The first report of a *Ginkgo* growing in North America comes from a letter by William Hamilton of Philadelphia to his private secretary, Mr. Smith, who was in charge of his estate, Woodlands, in his absence. Writing from London on November 2, 1785, Hamilton admonishes Smith:

> The Cistus's the Heaths, eleagnus, Ginkgo, Laurus's, Tamarisks, Yucca glorioso, the Carolina mahogany, Zantoxylon sempervirens &c, should be secured by skreens of Dry straw or some other means, but by [no] means let dung be put to their Roots for it will inevitably kill them . . . (Smith, 1905)

While one staminate individual from this original introduction of *Ginkgo* was still alive and well in 1981, growing on the grounds of what is now the Woodlands Cemetery in Philadelphia (Del Tredici, 1981), the tree has since been cut down. Although there are no records to prove it, a large *Ginkgo* growing nearby in William Bartram's garden is thought to be a sibling of Hamilton's tree (Harshberger, 1920) and is now assumed to be the oldest *Ginkgo* in North America (Figure 3).

In the early 1800s, *Ginkgo* began to be grown in many parts of the United States, primarily in the private gardens of wealthy individuals. Remarkably, many of these early introductions are still alive and healthy. In 1841, the nurseryman and horticulturist Andrew Jackson Downing was among the first Americans to advocate the use of the *Ginkgo* as an ornamental:

> As the foliage is of that kind which must be viewed nearby, to understand its peculiarity, and as the form and outline of the tree are pleasing, and harmonizes well with buildings, we would recommend that it be planted near the house, where its unique character can be readily seen and appreciated.

Figure 3. The Bartram Ginkgo, *presumably the oldest specimen in North America, planted circa 1784. When photographed in 1988, its height was 32 meters and its diameter at breast height was 103 centimeters.*

According to C. S. Sargent, the first *Ginkgo* to produce fertile seed in North America was a specimen growing on the grounds of the former Kentucky Military Institute in Frankfurt, Kentucky, in 1877. These trees were planted in the 1850s by Henry Clay, who, as an influential United States senator, had somehow acquired them directly from Japan (Del Tredici, 1981). Within the next ten years, many of the trees growing in Washington, D.C., were producing large quantities of seed, which were widely distributed to nurseries on the east coast (Falconer, 1890).

With the exception of a few saplings that came directly from Japan, it appears that most of the oldest *Ginkgos* growing in North America were imported from England as seedlings, which most likely had been raised from imported Japanese seed. By the late 1800s and early 1900s, after the original American introductions started producing seed in abundance, *Ginkgo* became popular as a street tree on the east coast, primarily in urban areas from Boston to Washington, D.C. (Corbett, 1903). Its tolerance of the particulate air pollution produced by burning coal was highly touted by horticulturists of the day, along with its high degree of resistance to fungal diseases and insect pests.

The horticulturist's love affair with the *Ginkgo* began to fade in the 1920s and 1930s when many of the widely planted seedling street trees began reaching sexual maturity. At this point, ovulate trees started producing large quantities of seeds, which, when crushed by passing foot traffic, resulted in a foul-smelling mess, reminiscent of the odor of vomit. In the horticultural literature, this scent is variously referred to as "disagreeable," "evil," "offensive," "disgusting," "repulsive," "nauseating," and "abominable." To make matters worse, the odoriferous sarcotesta contains anacardic acid, a compound known to cause a severe skin rash on those who happen to touch or walk barefoot on the seeds (Mitchell and Rook, 1979).

Vegetative Propagation

In response to the perceived litter problem posed by the production of seeds by female *Ginkgo*, Western horticulturists generally recommend the planting of vegetatively propagated male plants for street-tree use. Over the years, many male clones have been selected for this purpose, along with clones displaying a wide variety of distinctive leaf and habit characteristics (Santamour et al., 1983).

Most *Ginkgo* clones are remarkably easy to propagate vegetatively either from cuttings or by grafting. The author has had good success rooting cuttings of *Ginkgo* at virtually any time of the year, including: (1) softwood cut-

Figure 4. Topophytic effects in Ginkgo biloba. *This rooted cutting was originally collected from a mature tree in February 1989. The photograph, taken in May 1991, clearly shows the "fixed" horizontal orientation of new growth.*

tings collected in summer and placed under intermittent mist; (2) hardwood cuttings taken in the fall at the time of leaf drop; and (3) hardwood cuttings taken in the spring just prior to bud break. While treatment with indolebutyric acid (IBA) does not seem to be necessary in order to achieve a high percentage of rooting (Doran, 1954), there does seem to be some variation in the rooting response of different individuals, perhaps due to the age or vigor of the tree they were taken from (Vermeulen, 1960). Despite their high degree of rootability, *Ginkgo* cuttings usually grow slowly the first season following propagation, producing only rosettes of leaves and little extension growth. It is not until their second growing season that they will produce long shoots. For this reason most nurseries prefer to propagate *Ginkgo* by grafting scions of selected cultivars onto seedling rootstocks, a procedure that results in abundant extension growth during the first season of growth.

Although the preferential planting of male clones is widely recommended in the horticultural literature, one very important fact has made this goal largely unattainable: the vegetative propagations of *Ginkgo*, whether from cuttings or grafts, generally suffer from a developmental problem known as topophysis. Topophysis is defined as the organizational status of a meristem that is determined by its position on the plant and that remains stable through vegetative propagation (Hallé et al., 1978). In other words, if a lateral branch of *Ginkgo* is rooted or grafted onto a seedling rootstock, the resulting propagule will continue growing in the direction it maintained while it was still attached to its parent trunk (Figures 4 and 5). This means that vegetatively propagated *Ginkgos* seldom show the dominant central leader and whorled branch arrangement typical of seedlings. Instead, the branches grow out at erratic angles, producing low-branched trees with poor form from

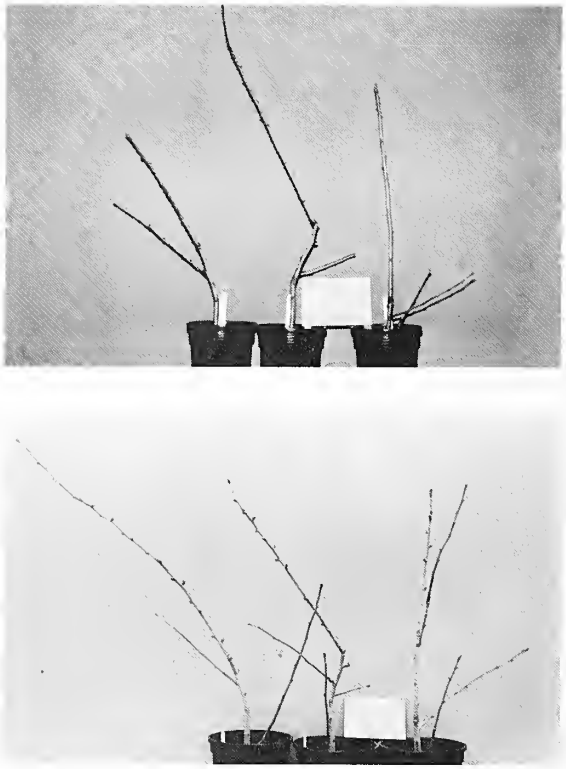


Figure 5. Rooted cuttings from a single branch of Ginkgo biloba *'Fastigiata' AA #144-39-A. Softwood cuttings were taken in August, 1981 and rooted under intermittent mist. (top) The two cuttings on the left were taken from diagonally growing lateral shoots, while the one on the right was taken from the vertical terminal shoot. Photographed in December 1985. (bottom) The same cuttings photographed in February 1991. For scale, the index card is 7 centimeters by 13 centimeters.*

the point of view of street-tree plantings.

The only way that nurseries have been able to circumvent the problem of topophysis is through the practice of "stooling" in which young stock plants are repeatedly cut back low to the ground to stimulate the production of numerous vertical replacement shoots. When these vigorous terminals are used as propagation material, they will produce a vertically growing tree. According to William Flemer of Princeton Nurseries, this technique seems to work particularly well with fastigiate (upright) clones of *Ginkgo* in which many of the laterals tend to possess a vertical orientation to begin with. At the present time such fastigiate trees are the only male *Ginkgo* selections that are widely available to the general public.

Cultivation for Nut Production

While Western horticulturists have concentrated on the ornamental uses of *Ginkgo*, Asian horticulturists have focused their attention primarily on the cultivation of the tree for its edible nuts. According to Dr. Frank Santamour and his colleagues (1983), Chinese horticulturists have selected at least 28 varieties based solely on the size and shape of the edible nut. *Ginkgo* nuts are highly nutritious and, when fresh, consist of 37.8 percent carbohydrate, 4.3 percent protein, and 1.7 percent fat (McCarthy and Matthews, 1984). While most of the carbohydrate is in the form of starch, small amounts of sucrose, glucose, and fructose are also present, giving the nuts a sweet taste.

When *Ginkgo* is cultivated for its edible nuts, the cultivar is generally grafted onto a seedling rootstock. As is the case with vegetatively propagated cultivars in North America, the grafted Chinese trees show strong topophytic effects (Figure 6). When the author was in eastern China during the fall of 1989, he visited Dongting Mountain on the shores of Lake Tai in Jinagsu Province. This well-known *Ginkgo* nut-producing area is the home of the famous cultivar 'King of Dongting Mountain,' which produces the largest nut of all *Ginkgo* cultivars (Figure 7). Old grafted trees in Dongting Shan were scarcely more than five meters tall and were branched low to the ground. They tended to lack both a central leader and whorled branches. While such a shape would be undesirable in a tree cultivated for ornamental purposes, it is considered advantageous in terms of nut production because it facilitates harvesting. This situation provides a clear example of the "domestication" of a plant by selective propagation.

In conversations with agriculturists who cultivated *Ginkgo* for its nuts in Zhuji Xian in Zhejiang Province, the author learned the

Figure 6. A grove of grafted Ginkgos *cultivated for their edible nuts on Dongting Shan, Jiangsu Province, China.*

following about the commercial production of *Ginkgo* nuts:

1. *Ginkgo* bears a heavy crop of seeds every other year, with relatively light crops in alternate years.

2. The grafted female trees produce nuts three to five years after grafting, as opposed to the twenty to thirty years it takes for seedlings to begin bearing.

3. In the older *Ginkgo* nut plantations, the male/female ratio was about 1 per 100. This ratio has been raised to 3 to 5 per 100 in recent times, leading to more effective pollination and greater nut production.

4. For successful pollination of female trees, the distance of the nearest male tree to the females is not as critical as (a) the size of the male tree—the taller it is, the better the pollination; (b) the direction of the wind—male trees should be planted upwind of females to achieve maximum seed set; and (c) the presence of barriers, such as buildings, which can inhibit the flow of pollen.

5. Seed production can be increased by manually placing branches of male trees within the crown of female trees during the time of pollination (Ling, 1983).

In China, the processing of the nuts for market is a very straightforward process. Either they are knocked off the trees in mid-September with long bamboo poles, or they are collected from the ground shortly after they fall. After collecting, they are allowed to sit for a few days in plastic containers, until the fleshy outer coat begins to soften (and smell). At this point the seeds are washed in running water so that the fleshy outer coat rises to the top and can be poured off, leaving the heavy nuts to sink to the bottom. It is imperative to wear gloves during this process since the fleshy coat contains anacardic acid, which causes a severe rash in many people.

Figure 7. The exceptionally large nuts produced by the Ginkgo *cultivar 'King of Dongting Mountain' on the top, with a more or less typical* Ginkgo *nut on the bottom. Scale is in millimeters.*

After the seeds are washed, they are spread out to air-dry for one to two weeks, at which point they are bundled up and put in a cool environment for storage.

Raw *Ginkgo* nuts, which are rich in lipid compounds, are considered toxic to humans, and it is in this state that they are used in traditional Chinese medicine (Perry, 1980). For purposes of nonmedicinal consumption, the seed must be cooked. Usually they are boiled in water until the hard shell cracks open and the kernel can be removed. Traditionally either these kernels are boiled in sugar water to make a sweet soup or they are pan-fried and eaten plain. They can also be mixed in with other ingredients. The flavor and texture of the *Ginkgo* nut are reminiscent of the sweet chestnut, *Castanea sativa*. In several places I visited in China, I was warned not to eat more than seven *Ginkgo* nuts at one sitting; otherwise I would experience toxic side effects. Young children, in particular, are warned about eating too many *Ginkgo* nuts.

Because *Ginkgo* nuts are considered a delicacy throughout Asia, they sell for a considerable amount of money per kilogram. Most of the seeds that are produced in China are sold to foreign buyers, who, in 1988, paid 5 yuan per kilo (approximately $1.50). The price was depressed to 3 yuan per kilo in 1989 as a result of a lack of foreign buyers caused by the Tiananmen Square disturbances in the spring of that year.

Chinese living in other Asian countries are the principal consumers of the crop, although a substantial amount of seed is also shipped to Chinese population centers in Europe and North America. While the author was unable to obtain exact figures on total seed production for China, he was told that in 1984 the yield was more than 5 million kilograms of dried seeds.

Ginkgo as Medicine

The *Ginkgo* tree is apparently mentioned in the oldest Chinese herbal, *Shen Nong Ben Cao Jing*, dating from 2800 B.C. (Michel and Hosford, 1988). Specific reference to the medicinal use of the leaves, however, does not come until 1436 (in Lan Mao's *Dian Nan Ben Cao*), which recommends the *external* use of the leaves for treating skin and head sores, as well as freckles. The first mention of the *internal* use of *Ginkgo* leaves comes in 1505 in a text by Liu Wen-Tai, *Ben Cao Pin Hue Jing Yao*r. In modern Chinese medicine *Ginkgo*

leaf preparations are recommended as "benefiting the brain," as an astringent to the lungs, and to relieve symptoms of asthma and cough (Foster, in press).

Numerous pharmacologically active constituents have been extracted from the leaves of *Ginkgo*, such as flavones, biflavones, organic acids, and flavonoid glycosides, including kaempferol, quercetin, and isorhamnetine. It is the diterpene lactones, however, including ginkgolides A, B, C, J, and M, and the sesquiterpene, biloablide, that have aroused the most interest and have been the focus of most modern research. A, B, and C are found both in the leaves and the "bark" (cortex) of the root, while J is found only in the leaves and M only in the root cortex (Boralle et al., 1988).

The ginkgolide compounds are unique 20-carbon cage molecules that possess an electron-rich cavity ideally suited for the binding of cations or polarized molecules (Figure 8). Recently, Professor E. J. Corey and his colleagues at Harvard University have synthesized ginkgolide B under laboratory conditions, but the prohibitive cost of the procedure makes it unlikely that a synthetic product will ever replace the natural extract.

The ginkgolides also show varying degrees of potency as specific antagonists of platelet-activating factor (PAF), a compound identified as a crucial mediator of a wide range of physiological processes and pathological conditions. Of the five naturally occurring ginkgolides, B is considered the most active from the point of view of antagonizing PAF (Braquet, 1988, 1989).

Numerous pharmacological and clinical studies with *Ginkgo* leaf extract have demonstrated a positive effect in increasing vasodilation and peripheral blood-flow rate in the capillaries of patients suffering from a variety of circulatory dysfunctions. In Europe, the *Ginkgo* leaf extract is most popular among the elderly, who take it either to treat the minor symptoms of aging, such as dizziness, ringing in the ears, and short-term memory loss, or to treat the side effects of major disorders, such as Alzheimer's disease. In one series of

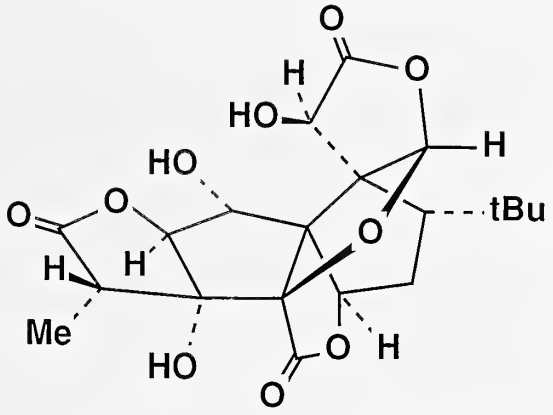


Figure 8. The chemical composition of ginkgolide B, a unique 20-carbon cage molecule with a tert-butyle group (tBu) and methionine (Me) incorporated into the framework. The electron-rich cavity, formed by the three lactonic groups (–OC=O), is ideally suited for the binding of positively charged cations.

tests, *Ginkgo* extract has been shown to increase short-term memory function in both healthy, young volunteers and elderly patients suffering from vascular disorders (Hindmarch, 1988).

Positive results with the extract have also been achieved in the treatment of the inflammation of the bronchial airways associated with asthmatic attacks. The extract was more effective in the treatment of asthma when administered directly into the lungs as an aerosol rather than taken orally (Roberts and Barnes, 1988).

Ginkgo leaf extract has also been proven effective in the treatment of arthritis, airway hyperactivity, thrombosis, endotoximea, poor blood circulation, and gastrointestinal ulceration. It has also been shown to be useful in the treatment of various eye, ear, and skin diseases. After nearly fifteen years of clinical trials in Europe, there are no reports of toxic side effects.

Ginkgolide Cultivation

Ginkgo has been cultivated specifically for the purposes of leaf production for ginkgolide extraction since 1982, when large-scale plantings were established in Bordeaux, France, and

Figure 9. The Ginkgo *plantation in Sumter, South Carolina, in early spring. For scale, the individual segments of the irrigation system are about 45 meters long.*

in Sumter, South Carolina. Seedlings are planted 40 centimeters apart in rows one meter apart, comprising a stand of approximately 25,000 trees per hectare. For the 400 hectare (1000 acres) plantation in Sumter, this amounts to an amazing 10 million *Ginkgos* —surely the largest *Ginkgo* forest on earth, at least since the Paleocene (Figure 9).

In Sumter, the leaves are harvested from mid-August to mid-September while they are still bright green, and the resulting yields are between 3,000 to 4,000 kilograms of dried leaves per hectare (2,640 to 3,520 pounds per acre). The trees are severely pruned in the winter following the harvest to induce multiple branching and to keep the plant small enough to make it possible to harvest the leaves mechanically (Figure 10) (McClintic, 1991).

Freshly havested *Ginkgo* leaves have a moisture content of about 75 percent. Moisture is reduced to 12 percent by passage through a gas-fired, 15-meter-long rotary drum drier. The dried leaves are then compacted into 180-kilogram bales, wrapped in burlap and polyethylene, and then loaded into containers and trucked to Charleston, South Carolina, where they are loaded on a ship that takes them to extraction plants in Europe.

In Europe, the extract is marketed under the brand names "Thebonin,©" "Tanakan,©" and "Rökan,©" and gross annual sales in 1988 amounted to about $500 million (Corey et al., 1988). While the use of *Ginkgo* leaf extracts has proved to be very popular both in Asia and in western Europe as a prescription drug, the product has yet to be marketed to any great extent in the United States. This unavailabil-

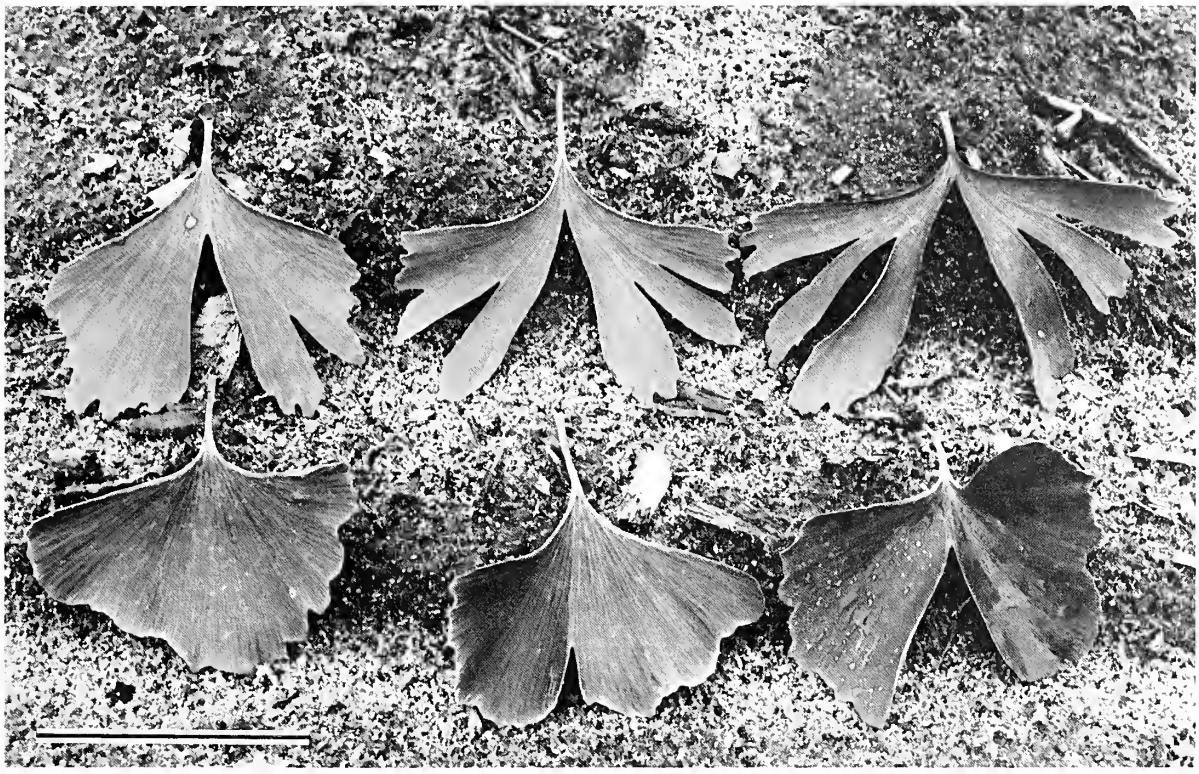


Figure 10. Some of the highly variable, and exceptionally large, leaves produced by the heavily fertilized Ginkgos *growing on the plantation in Sumter, South Carolina. Scale bar at the lower left is 10 centimeters long. Some leaves are so highly dissected that they might almost be considered compound.*

ity is primarily due to the fact that the extract does not meet the purity standards of the United States Food and Drug Administration for prescription drugs. As a result, the extract is only available in health food stores as a rather expensive herbal remedy. It is sold under a wide variety of names, but mainly these products are just a repackaging of the products produced in Europe. At this point, it is unclear if *Ginkgo* leaf extract will ever receive FDA approval as a prescription drug available to consumers in the United States.

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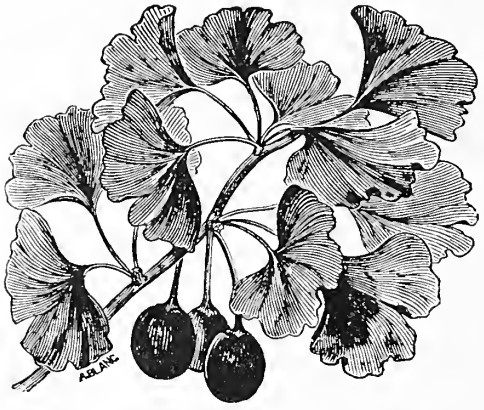

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Peter Del Tredici is editor of *Arnoldia.*

The distinctive foliage of Ilex glabra. *Photo by Rácz and Debreczy.*

Ilex glabra—The Inkberry Holly

Michael A. Dirr and John H. Alexander III

This native evergreen shrub has finally stepped into the landscape limelight.

Ilex glabra (L.) Gray, the inkberry or gallberry, is a wallflower among the hollies, lurking in the shadows where few gardeners now notice its existence. Such a pity, for the species, a broadleaf evergreen shrub, is an under-utilized native, with wide geographical adaptability and a plethora of other admirable landscape attributes. A quote from the *Holly Letter*, October 1974, puts it aptly: "If inkberry had come from Japan, people would rave about it."

Several nurseries have introduced compact cultivars with improved foliage such as 'Compacta,' 'Nordic,' and 'Shamrock,' all of which have helped raise the species to a higher level of consumer acceptance. However, these cultivars are scarcely garden buzz words compared to the better-known 'Convexa,' 'Helleri,' and 'Hetzii' cultivars of *Ilex crenata* (the Japanese holly), or the 'Nana' and 'Stokes Dwarf' cultivars of *Ilex vomitoria* (the yaupon holly). *Ilex glabra* offers great opportunities for future selection and some of the best forms may still be in the crystal-ball stage.

Usually found in moist to wet soils, *Ilex glabra* has an extended distribution from Nova Scotia to as far south as Florida and west to Missouri. In the deep South, Godfrey (1988) describes the species as growing in pine savannas and flatwoods, shrub-tree bogs and bays, open bogs, seepage areas in woodlands, and on the lower slopes and bottoms of wooded ravines. It also occurs near the ocean and displays a high degree of salt tolerance. In controlled studies (Eberwine and Dirr, 1978), it was found to be essentially resistant to soil-applied sodium chloride.

Characteristics of the Species

To our knowledge, inkberry is one of the few stoloniferous evergreen holly species (*I. coriacea* is another), and colonies a century or more old have been described (Hume, 1953). As colonies increase in size, billowy masses of green are formed that create a soft, pleasing texture foreign to most of the *I. crenata* and *I. vomitoria* cultivars. Size is extremely variable within the species, but 1.5 to 2.5 meters tall (5 to 8 feet) and 2 to 3 meters wide (8 to 10 feet) encompass reasonable biological boundaries. For years, an elegant, dark green-foliaged compact form that graced a display bed in front of Longwood Gardens in Kennett Square, Pennsylvania, was a suspected "named selection." Inquiring as to its exact identity, we were informed that proper pruning was the reason for the shape.

Nurseries from Massachusetts to Georgia are experiencing increased demand for inkberry and are increasing production in response. As part of the native plant movement, and with its superior adaptability, *I. glabra* is a natural for increased landscape use. Recent emphasis on wetland mitigation is another plus for the species. Inkberry has been utilized around the Cape Cod National Sea Shore Visitor Center in Eastham, Massachusetts, where the large irregular foliage masses make the building look as if it were set among them rather than the reverse.

Frequently confused with *I. crenata* and *I. vomitoria*, inkberry has a longer leaf, 2 to 5 centimeters, with a few serrations, often oppo-

site one another at the apex of the leaf. The other two species have smaller leaves and are serrated from the apex to near the base of the leaf. The leaves are a lustrous medium to dark green throughout the year; however, in excessively sunny or windy locations, some yellowing (bronzing to purplish tints) may result.

The dioecious flowers are produced in the axils of the current season's growth from mid- to late June in Boston, and in late May in Athens, Georgia. On male plants, the flowers occur in groups of threes; on females, they occur singly or in clusters up to three. Five to eight cream-colored petals are present in the small flowers, which are a source of pleasant-tasting honey in the South. Unlike the fruit of many other hollies, the flattened, globose drupes of the inkberry are a lustrous black color but seldom a cause for celebration. In fact, they are generally produced underneath the foliage and remain obscure from an ornamental point of view. Fruits generally ripen in October, persist throughout the winter, and are often still present when the new flowers emerge. White- and red-fruited forms are known and will be discussed in the cultivar section below.

Compelling reasons for the rebirth of interest in *I. glabra* are its landscape toughness and environmental adaptability. The species displays a penchant for survival under conditions ranging from full sun to moderate shade and from wet to dry, clayey to sandy soils of acid to neutral pH. Inkberry is easily transplanted, literally by pulling it out of the ground and relocating it. Jim Cross of Environmentals Nursery of Cutchogue, New York, relates that it is one of the few broadleaf evergreens that survive in heavy clay soils where irrigation systems continue to operate whether needed or not. Most cultivars, as well as the species, are both field- and container-grown, and are easily transplanted on a year-round basis. Dr. Donald Wyman (1970) mentioned the rejuvenation of weak and spindly plants at the Arnold Arboretum: plants 2.5 meters tall (8 feet) were cut to about 15 centimeters (6 inches) from the ground in April,

The glossy black fruit of inkberry. Photo by Rácz and Debreczy.

and by fall these plants were 30 to 45 centimeters (12 to 18 inches) and quite dense.

Ilex glabra, at least the northern forms, should be cold-hardy to −15 to −20 degrees F. Contributing factors of winter sun and wind may compound low-temperature injury. It would be worthwhile to compare the cold hardiness of selections from the New England, Middle Atlantic, and Southeastern provenances. Surprisingly, the white-fruited forma *leucocarpa* from Florida is hardy to at least −15 degrees F.

Propagation

Propagation is frighteningly easy, and firm cuttings root year-round when provided with 1000-parts-per-million indolebutyric acid (IBA) quick dip (five seconds), or a commercial rooting powder under either mist or polyethylene tent. Even without such treatments, a somewhat lower percentage of cuttings will root. The species can also be propagated by transplanting the suckering shoots that develop around the base.

Since cuttings are easily rooted, seed propagation is not routinely practiced. In general, seeds of the genus *Ilex* have immature embryos at the time of ripeness, necessitating a period of after-ripening before germination will occur. Experiments performed at the Arnold Arboretum by former propagator Alfred Fordham in 1963, and again in 1973, suggest that the best results are obtained by sowing the seed in a warm greenhouse and then waiting for germination to occur. After eight months, 57 percent of the freshly collected, cleaned seeds germinated. The seeds of the inkberry are easier to germinate than those of many *Ilex* species, which have germination times of eighteen months or longer.

Significant variation in growth habit, foliage color and retention, and fruit color has encouraged nurseries and plant collectors to select forms for greater uniformity and increased consumer palatability. The following cultivar list is based on the authors' personal observations, discussions with nursery people, and a review of the literature.

Cultivars

'Bronze'— According to Hume (1953), this form has closely spaced, coriaceous, bright green leaves (2.5 to 4 centimeters long and 1 to 1.5 centimeters wide), that assume a pleasing bronze color in winter. The glossy black, globose fruits are produced abundantly on compact plants, 1.5 to 1.8 meters tall (5 to 6 feet). The plant was selected by Elizabeth C. White of Whitesbog, New Jersey, but the authors have no idea whether or not this cultivar remains in cultivation.

'Compacta'— This clone, selected and introduced by Princeton Nursery of Princeton, New Jersey, is notable for its (1) compact, oval-rounded habit, (2) fine-textured branches, (3) dark green leaves (3 to 4 cm long by 1 cm wide), and (4) lustrous, jet-black fruits that persist through the winter. Originally described as maturing to between 1.5 and 1.8 meters tall (4 to 6 feet), we encountered a specimen 3 meters tall (10 feet) and 5 meters wide (15 feet) on the campus of Swarthmore College outside Philadelphia. So much for plants reading their press releases! This form, like the species, becomes leggy at the base and loses a portion of the lower foliage, but if pruned in a timely and artistic manner, it will remain a handsome plant. The original plant grows next to the Princeton Nursery office and was described by William Flemer III in recent correspondence:

> The Princeton clone of *Ilex glabra* 'Compacta' was selected in 1937 by William Flemer II from a block of seedlings on our nursery. These seedlings came from seed collected in the New Jersey pine barrens near Whiting, New Jersey. The parent plant was planted near the nursery office for further observation.
>
> It proved to be of interest as a compact, very hardy, broadleaf evergreen shrub and was first listed for sale in the Princeton Nursery's wholesale price list for the fall of 1948. Some plants may have been sold a couple of seasons earlier than this, but no record of such sales survives.
>
> It has been successfully grown in northern Vermont and Maine. It has also been shown to be somewhat more resistant to winter feeding of deer than regular seedling-grown *Ilex glabra*, as well as being much more resistant than *Ilex crenata* plants. However, it is by no means totally immune to deer damage in areas with a very high deer population.

'Densa'— This clone develops an oval-rounded uniform outline with upright branches. The

Ilex glabra *'Densa,' photographed at Longwood Gardens by M. Dirr.*

leathery dark-green leaves average 4 centimeters long and 1.5 centimeters wide. Sparse fruit set was observed on Arnold Arboretum plants. Longwood Gardens has a planting in front of the west side of the conservatory complex that is reasonably full and dense; however, on a visit in April, 1991, we noticed slightly naked lower branches. In the Arnold Arboretum collections, a 2- to 3-meter-tall (6- to 10-feet) specimen is devoid of leaves over the lower 30 to 40 percent of the plant.

Frederick (1975) notes that 'Densa' was selected by Bert Flemer at F & F Nursery from a batch of five hundred seedlings planted in 1938. He mentioned its mature size as around 2.5 meters by 2.5 meters (8 feet by 8 feet).

'Georgia Wine'— This selection develops lovely burgundy winter foliage coloration. The leaves, 4 centimeters long by 2 centimeters wide, are lustrous dark green in summer. The plant was discovered and named by William Craven, Twisted Oaks Nursery, Waynesboro, Georgia, and will be released to the public within the next few years. The parent colony ranges from 0.8 to 1.0 meter high (2.5 feet to 3 feet) and 2 to 2.3 meters wide (6 to 7 feet). The plant is female and produces abundant black fruits.

Forma *leucocarpa*— This unusual white-fruited form was discovered by Frank W. Woods in Jackson County, Florida, in 1955, and was distributed by the U.S.D.A. as #275847 and by the U. S. National Arboretum as #14278. This form has been cultivated at the Arnold Arboretum since 1961. The leaves are a lustrous medium to dark green and average 4.5 centimeters long by 1.5 centimeters wide. The habit is distinctly broad-rounded, and a specimen at the University of Georgia's Experiment Station in Griffin is 2.6 meters tall (8 feet) and 4 meters wide (12 feet).

Forma *leucocarpa* 'Ivory Queen'— This white-fruited selection was discovered by C. R. Wolf of the New Jersey Silica Sand Company of Millville, New Jersey. It was apparently a branch sport, and the fruit is ivory white with a black dot at the apex of the fruit due to the stylar scar. We originally considered this a rename of the above-mentioned forma *leucocarpa*, but after examining both herbarium and living specimens, realized that they were distinct. 'Ivory Queen' has leaves that are more leathery, darker green, and more densely set than those of f. *leucocarpa*; leaves average about 5 centimeters long by 1.5 centimeters wide.

'Nigra'— Although this selection is described as having purple foliage in winter, this is not the case on the specimen of 'Nigra' at the Arnold Arboretum. Indeed, its foliage color is a lustrous dark green, and the plants, relatively compact, do not appear to be as leggy as other clones. Wayne Mezitt of Weston Nurseries mentioned that 'Nigra' was not as cold-hardy as 'Compacta' or 'Viridis.' The leaves are 3 to 4 centimeters long by 1 to 2 centimeters wide.

'Nordic'— James Zampini of Lake County Nursery Exchange, Perry, Ohio, selected this patented clone for its compact growth habit and dark green foliage. Mr. Zampini relates that while surveying a field of more than two thousand inkberry seedlings in early March, he noticed one plant in the middle of the field that was distinct from the others. This plant had the best foliage color and a distinct broad, pyramidal growth habit. 'Nordic' has a mature height and width of about 1.7 meters (5 feet). The leaves, slightly larger than those of the species, maintain their dark-green color through the winter. Mr. Zampini also mentioned that 'Nordic' has performed admirably in areas where the winter temperatures range from −20 to −30 degrees F.

'Shamrock'— This cultivar is receiving considerable attention from gardeners, designers, and producers. It was selected in 1977 from a block of approximately five hundred seedlings by John Tankard, Tankard Nursery, Exmore, Virginia. Distinguishing characteris-

NEWS
FROM THE ARNOLD ARBORETUM

Summer Interns Arrive at the Arnold Arboretum

Every year, sometime between the last blooms of Arnold's Promise and the first lilacs, a new crop of horticultural interns arrive at the Arboretum. Their arrival is as sure a sign of spring here as the magnolias and in many ways, as welcome by the staff. They are eager and full of enthusiasm; a diverse group who come to the Arboretum with a wide range of objectives. "Looking for practical hands-on training," "to get a background in the skills that go into the making of a public garden," and "an opportunity to explore possible career choices," are among the reasons why they apply to our horticultural training program. Many are students of horticulture, botany, or landscape design. Some are career changers—people who are finally able to realize their dream of working with plants. They come from all over—Germany, Canada, Wisconsin, Tennessee, Washington—and they range in age from eighteen to over fifty. But despite these apparent differences they have one important factor in common, a love of plants and a desire to learn more about them.

From the back, left to right: Diana Drake, Ken McCallum, Darrell Sullivan, Angela Jones, John Merrill, Carol Keaney, Todd Burns, Nicholas Slabyj, Andrea Murmann, Joseph Jurek, Angelika Speckhard, Julane Fagnant, Jacqueline Kuhn, Aaron Piacentini, Amy Salvadore, James Wallace. (Not in the photo: Paul Callahan, Becky Joyner and Suzanne Kennedy.)

The Arboretum's Horticultural Training Program is designed to give people interested in careers in horticulture an opportunity to learn about plants and public garden maintenance in both a hands-on and a classroom setting. This year's program offered eighteen positions in several different areas: the Dana Greenhouse, the library, the plant records department, the Hunnewell Pinetum in Wellesley, grounds maintenance positions at the Case Estates and Jamaica Plain and the Federal Reserve Bank of Boston. The new positions at the Federal Reserve Bank will enable two interns to learn about the special challenges involved in maintaining a city roof

Continued on page 4

From The Director

By Bob Cook

The Linda J. Davison Rhododendron Path

On a warm Sunday morning in early June, we took a walk in the Arboretum. One year after the dedication of the Linda J. Davison Rhododendron Path, I join Terry Colligan along with family and friends of Linda Davison to tour the new plantings at the north base of Hemlock Hill. Gary Koller, our chief horticulturalist, gave a wonderful portrait of the design of the Path including the collections of rhododendrons and groundcovers that we planted the week before. Walking along the path, we could hear the babbling of Bussey Brook as it gently rippled over stone dams beneath a whispering canopy of tall hemlocks and white pine.

In the midst of this setting of tranquil beauty, my mind kept conjuring up quite a contrary vision: the rusting hulk of an abandoned Volkswagon half submerged in a swamp. As noon approached, we left the Rhododendron Path and walked the short thirty yards to the edge of the Arboretum at the South Street Gate. Four or five autos were parked outside, litter decorated the roadside weeds, and broken glass sparkled in the sunlight. A pair of cars racing down South Street flashed past the gate as I began to speak.

"In back of us lies the Davison Rhododendron Path, a contemplative space of wonderful serenity. In front of us, on the other hand, lies a derelict, rubble-strewn tract of swampland, into the midst of which someone, many years ago, drove a stolen Volkswagon to set it afire among the cattails. There is no better contrast of images to embody our critical need to have a master plan for the future of the Arboretum."

The "urban wild" known as the South Street Tract is half owned by Harvard University and half by the City of Boston. It will be one of a number of knotty urban issues addressed by Sasaki Associates, Inc., the consulting firm working with us on long-range planning. Together we will be identifying ways to bring this forbidding terrain under the control of the Arboretum, and integrate it into our existing landscapes.

Sounds complicated, and it will be. That is why we sought the quality and experience that Sasaki can bring to a master plan. Not surprisingly, producing this plan for the whole of the Arboretum will be expensive. But then, you get what you pay for; and we want a plan as far-sighted as the original vision created by Olmsted and Sargent.

Fortunately, for the third year in a row, the Institute of Museum Services has awarded the Arboretum a General Operating Support grant for $75,000 which we will allocate to partially cover the costs of creating the master plan. We will need to raise more money to complete the job. However, preserving the immeasurable qualities of the Arnold Arboretum, symbolized by the Davison Rhododendron Path, is far too important to be constrained by financial considerations.

Mike Dirr teaching his class ***Woody Landscape Plants for the Landscaper***

MICHAEL DIRR AT THE ARNOLD ARBORETUM

A Putnam fellowship has provided the opportunity for the staff of the Arnold Arboretum to benefit from Mike's exuberant and knowledgeable presence. Author of *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses*, the most widely use teaching text in the country, and its companion volume, *Photographic Manual of Woody Landscape Plants*, Mike is an old friend of the Arboretum. While here as a Mercer Fellow in 1978-1979, Mike worked with Gary Koller to write *Street Trees for Home and Municipal Landscapes*, and the third revision of his manual.

Currently on sabbatical from his position as Professor of Horticulture at the University of Georgia, Mike is here to study the Arnold Arboretum's "fabulous living collections," work on a fourth edition of his *Manual of Woody Plants* and a revision of *Street Trees*, interact with staff, and teach in our education program. He is also considering projects on cold hardiness testing and a photo essay book on the Arnold Arboretum's most notable trees.

In addition to being an active and well appreciated teacher and graduate student advisor at the University of Georgia, Mike also continues his research on the cold hardiness, stress tolerance, and propagation of woody plants. He has developed a tissue culture program which is investigating the micro propagation of ornamental woody landscape plants which are difficult to propagate by seed or cutting and thus difficult to obtain in the commercial nursery trade.

Beyond his vast knowledge and love of trees, Mike brings a personal vision and enthusiasm which are inspiring the staff to focus on the essential values of the Arnold Arboretum and move ahead with challenging projects. Dirr's passion for gardening is best summarized by the old Chinese proverb, "A garden cannot be made in a day or week or year, it must be planned for, waited for and loved into being."

Bookstore New Arrivals

Spring Poster

Our 1991 Spring Art Exhibition winner captures the beauty and timeless appeal of lilacs in a trompe l'oeil style painting by artist Lydia Martin.

A poster produced from the painting is available for $19.20 ppd. (postage paid) members, $21.00 ppd. non members.

Arnold Arboretum Suncatchers

These colorful additions to any window are molded of recycled glass and were designed especially for us to depict some of our most notable trees and shrubs in bloom.

Available by mail in sets of four; Forsythia, Lilac, Magnolia, and Rhododendron; $20.95 ppd. members, $22.95 ppd. non members.

New Arboretum Mug

This elegant white mug features a traditional lilac bloom with the words "Arnold Arboretum Lilacs" and an excerpt from Amy Lowell's wonderful poem "Lilacs".

A set of 2 mugs is available by mail for, $13.70 ppd. members, $14.90 ppd. non members.

FLORA OF THE LESSER ANTILLES

The Arnold Arboretum is proud to offer for sale the six-volume *Flora of the Lesser Antilles*, a long-term project of Dr. Richard Howard, former director of the Arnold Arboretum.

These six volumes constitute the first comprehensive flora of the area, presenting keys to the genera as well as species. For each genus and species a complete modern description is given which includes color as well as measurements of floral parts. The descriptions are followed by a listing of each plant's general distribution and its distribution within the Lesser Antilles. All volumes are profusely illustrated with

Brunfelsia americana. *Drawing by Dr. Ihsan Al-Shehbaz.*

line drawings that are both highly artistic and accurate. All known species reported from the Lesser Antilles, both introduced and native, are included.

All volumes in the series are available, either individually or as part of a full set which is available at the special price, including shipping, of $260 (add $5 for shipping outside the US). For volumes 4, 5, and 6 only, the special price is $205.

Vol. 1	*Orchidaceae*	$20
Vol. 2	*Pteridophyta*	$25
Vol. 3.	*Monocotyledoneae*	$35
Vol. 4	*Dicotyledoneae*, 1	$75
Vol. 5	*Dicotyledoneae*, 2	$85
Vol. 6	*Dicotyledoneae*, 3	$85

Checks should be made payable to the Arnold Arboretum and all orders should be addressed to the attention of: *Frances Maguire, Arnold Arboretum, 125 Arborway, Jamaica Plain, MA 02130-3519.*

Summer Interns

Continued from page 1

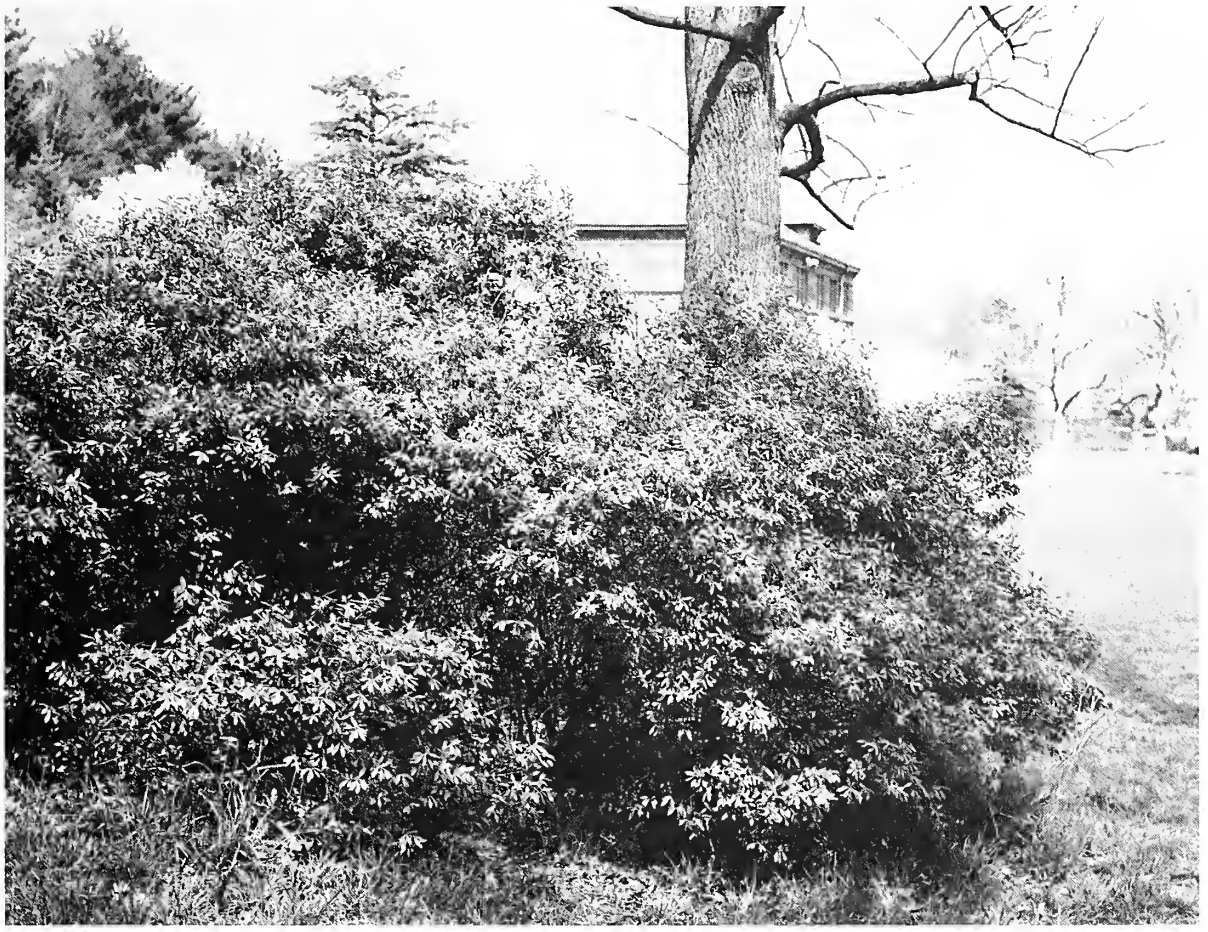
garden and to gain some experience in interior plantscaping.

All of the interns are required to attend a series of classes on Woody Plant Identification, Landscape Design, and Horticultural Maintenance offered by the Arboretum's education department. There are also a number of field trips and garden tours and this year, three walks with Michael Dirr to supplement their classroom learning. This year the interns will have the opportunity for two week rotations to one or two departments other than their main assignment.

What happens to summer interns when they leave the Arboretum? Many return to school to complete their degrees–Doug Cygan '89 returned to the University of Main at Orono; Amory Haight '89 is currently studying Landscape Architecture at Sheffield University in Sheffield, England; Carol Kohler '90 and Mary Altermatt '90 will begin Longwood Garden's graduate program this fall. Others find employment in their fields: Dennis Harris '67 and Mark Walkama '71, Arboretum grounds crew, are both former interns; Jim Allen '82 is employed as Senior Horticulturalist for the National Fire Protection Association; Ellen Meyers '82 is Education Coordinator at the New England Wildflower Society; Deborah Cahill '80 is a partner in a New York design firm; Tom Ward '86 is the Assistant Plant Propagator at the Dana Greenhouse.

Over the years the internship program has helped many people find their "horticultural niche."

If you are interested in learning more about the program, please write to Laurel Landers '89 at the *Education Department, Arnold Arboretum, 125 Arborway, Jamaica Plain, MA 02130-3519.*



Ilex glabra *growing under the tulip trees at the Arnold Arboretum. Photo by Rácz and Debreczy.*

tics include compact habit and bright, glistening new green foliage that overlays the previous year's mature dark green foliage, the leaves averaging 4 centimeters long by 1.3 centimeters wide. Mature plants are 1.5 meters tall (5 feet) and equally wide. Mr. Tankard feels that 'Shamrock' holds its lower leaves better than other forms.

'Viridis'— This plant has a distinct pyramidal form with upright branches and dense foliage. The leaves, 3.5 centimeters long by 1 centimeter wide, are distinctly lighter green than those of 'Compacta' and 'Densa.' We estimate a maximum height of 1 to 1.3 meters (3 to 4 feet) for the plant, and slightly less in spread for a mature landscape specimen. At Weston Nurseries and the Arnold Arboretum, plants held their lower branches better than 'Compacta,' but did develop slight legginess.

The Future

Exciting activities are occurring in holly breeding, and while wandering through Rutgers University Ornamental Test Garden, we spotted what we thought was a rose-red-fruited form of *Ilex glabra*. Dr. Elwin Orton, who hybridized this unusual form, crossed *I. serrata*, the fine-tooth holly, a red-fruited deciduous species, with a white-fruited *I. glabra*. While Dr. Orton had hoped to produce a non-leggy *Ilex glabra*, he ended up with a

plant 2 meters tall by 3.2 to 4 meters wide (6 by 10 to 12 feet), with more or less red fruit. Fifty-eight years ago J. K. Small (1933) reported finding a red-fruited form of the inkberry in Florida, but he did not name it, and apparently it has never been cultivated.

Other cultivar names found in the literature but elusive in the nursery trade include 'Cole's Compacta' and 'Steed,' both compact-growing plants, and 'Hatfield,' an upright hybrid between *I. glabra* and *I. crenata*, described by Robert Clark in *Holly Letter* No. 5 (1974) (this cross occurred at the Hunnewell Estate, Wellesley, Massachusetts).

Undoubtedly, the selection story of *Ilex glabra* is not yet complete. The species and its current cultivars are highly functional landscape plants, and the renewed interest in their use assures continued selection and improvement.

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The Daisies of Autumn

Judy Glattstein

While the fall-blooming asters and goldenrods are native to North America, they are gaining acceptance in their homeland only after domestication in Europe.

Daisies must be a very efficient kind of flower because, as the reader may or may not be aware, there certainly are a lot of them. The family Compositae (or Asteraceae) has a cosmopolitan distribution, with members in Asia, Australia, the Mediterranean, North and South America, South Africa, and Europe. Its roughly 20,000 species are dispersed into 950 genera and include such diverse examples as annuals (*Cosmos bipinnatus*), bulbs (*Dahlia coccinea*), vegetables (artichokes and lettuce), shrubs (*Artemisia tridentata*, the sagebrush of the west), and, of course, the ornamental perennials (*Achillea, Anthemis, Aster, Boltonia, Chrysanthemum, Chrysogonum, Coreopsis, Doronicum, Echinacea, Echinops, Erigeron, Eupatorium, Gaillardia, Helenium, Helianthus, Heliopsis, Liatris, Matricaria, Ratibida, Rudbeckia, Santolina, Senecio, Solidago, Stokesia,* and *Vernonia*—to name just a few of the more popular genera commonly grown in the herbaceous border).

There are so many members of this huge family that even taxonomists are perplexed by it. They divided the family into about a dozen tribes, simply to categorize the genera into manageable units. This classification is based upon: the presence or absence of bristles, the scales on the enlarged end of the stem that bears the flowers, the sap (whether it is milky, colored, or clear), the type of corolla, and on and on. But to a gardener, most of the composites are usually recognizable as daisies. Sometimes there are only ray flowers, as in chicory, *Cichorium intybus*, or the dandelion, *Taraxacum officinale*, and sometimes only disc flowers, as in *Santolina chamaecyparissus*. More often than not, the central group of disc flowers is surrounded by a ring of ray flowers.

The flowers of the Compositae star in American grasslands, meadows, prairies, and roadsides, creating a display worthy of the world's finest gardens. But all too often we ignore these local residents in favor of exotic imports, under the mistaken notion they are "weeds." We buy back from abroad selected cultivars of our finest natives only after they have been "domesticated" in Europe. As specific examples, contemplate the situation with regard to those glorious flowers of late summer and autumn, the Michaelmas daisies and the goldenrods.

Our Native Asters

The fall-blooming asters are important herbaceous perennials in gardens throughout England and Europe. Their English name, Michaelmas daisies, commemorates the fact that their peak bloom period occurs around the feast of St. Michael the Archangel, celebrated on September 29th. The principal parent of these showy garden cultivars is the New York aster *Aster novi-belgii*, a plant that is generally considered a weed in its native

Aster novae-angliae, *from* How to Know the Wild Flowers *by Mrs. W. S. Dana. Scribner's Sons, New York, 1900.*

North America. Once again it is clear that the British are more appreciative of our own flora than we are.

Miss Gertrude Jekyll was fascinated with Michaelmas daisies, using them creatively in her own garden. In *Color Schemes for the Flower Garden*, published in 1908, she devotes an entire chapter to the September flower border:

> There is another range of double border for the month of September alone . . . This border is mainly for the earlier Michaelmas Daisies; those that bloom in the first three weeks of the month . . . There is also, in quite another part of the garden, a later border of other Michaelmas Daisies that will follow this in time of blooming.

The appeal has not diminished to this day. The Royal Horticultural Society conducted trials of Michaelmas daisies at Wisley in autumn 1990, exhibiting numerous cultivars in a diversity of color—shades of lavender, blue and purple, pink, violet and red, a few whites. Flower forms varied from those with a small golden central boss offset by long narrow petals to those with shorter petals surrounding a larger, heavy center. Petals might be arranged in a single star-like row, or fully double, or anything between. To stand on the upper level and look onto the trial grounds at this wonderful display on a September day was to appreciate what has been accomplished in England with this meadow plant from New England.

A charming garden in Wraxall, near Bristol, which I had the pleasure of visiting that same autumn, belongs to the Misses Allen and Huish. It contains the so-called National Collection of Asters. Their garden embraces a lifetime of devotion to these plants. These two women have produced a little catalogue that enumerates 240 cultivars of Michaelmas daisy, *Aster novi-belgii*. An additional section lists 38 cultivars of New England asters, *Aster novae-angliae*. To round the collection out, 48 other aster species and their cultivars are listed. By comparison, the spring 1991 catalogue of a noted mail-order nursery in northwest Connecticut lists 5 tall-growing and 4 dwarf forms of *Aster novi-belgii*, 4 *Aster novae-angliae*, and 2 species of asters. Realistically, 240 cultivars of Michaelmas daisies must contain many varieties that are quite similar, or that vary by subtle differences of color, form, and habit. But surely there must be more than a dozen asters worthy of cultivation in American gardens.

Aster novi-belgii *and* Aster tradescanti. *This drawing and all others in the article were taken from* Familiar Flowers of Field and Garden *by F. S. Mathews. G. P. Putnam's Sons, New York, 1927.*

Perhaps it is familiarity that breeds not so much contempt as a lackadaisical attitude. These plants enliven the late summer and autumn meadows and roadsides of New England and the prairies of the Midwest. If they grow wild, why bother to cultivate them? Unless, of course, they are British plants that we purchase at nurseries, order through the mail, or in some way describe as an "herbaceous perennial" as distinct from a "native plant."

I am not the first and certainly not alone in my plea for appreciation of our native flora. In 1914, Liberty Hyde Bailey in *The Standard Cyclopedia of Horticulture* wrote:

> In North America, where the asters are such abundant plants in the autumn flora, the species are not much known as cultivated plants, most of the specimens in gardens being the wild species transplanted. In Europe, however, there are numbers of named garden kinds, some of them derived from American species that have long been cultivated there . . . The native asters are amongst the very best plants for borders and roadsides. They should be better known.

Aster novi-belgii is a variable plant that in the wild generally grows anywhere from 2.5 to 4.5 feet tall, with a multi-headed, corymbose-paniculate inflorescence, each daisy about 1 inch in diameter, with 15 to 25 rays of rich blue-violet. It spreads quickly by means of wide-ranging underground tillers. Often the center of a clump dies out, so division and replanting of an outer portion in spring every few years will provide the best-looking plants.

Cultivars exist anywhere from six inches to six feet tall, with the latter needing some kind of mechanical support. In addition, the taller varieties need to have their buds pinched two or three times a season—with the last pinch in early July. This serves two purposes: it reduces the height, and it increases branching, which results in a more floriferous display. Gardeners should fertilize these taller plants with caution, however, since too much nitrogen can result in weak stems and increase the tendency to tilt away from the vertical. I've yet to find a successful method of resurrecting toppled plants, so staking ought to be done before it becomes necessary. Generally the foliage withers on the lower portion of the stems by the time the plants bloom; therefore it is best to grow these tall asters in combination with other lower-growing, earlier-blooming plants, which will conceal their bare shanks.

I enjoy combining the taller cultivars with *Solidago* species, the tall and late-blooming *Liatris scariosa* 'September Charm,' large ornamental grasses, and other perennials with late-season ornamental effect. They can be used in a formal perennial border as did Gertrude Jekyll. Alternatively, they fit in a looser, more informal naturalistic style, now becoming popular with the desire for reduced maintenance.

A Few of the Popular Cultivars of *Aster novi-belgii*

Dwarf—under 18 inches
'Buston Blue,' 6 inches, small dark-blue
'Jenny,' 12 inches, red
'Prof. Kippenburg,' 12 inches, lavender-blue
'Snowsprite,' 15 inches, white

Dwarf—under 4 feet
'Ada Ballard,' 3 feet, lavender-blue
'Boningale White,' 3.5 feet, white
'Crimson Brocade,' 3 feet, crimson-red
'Eventide,' 3 to 4 feet, violet-blue
'Ernest Ballard,' 3 feet, reddish-pink
'Patricia Ballard,' 3 feet, rose-pink

Tall—4 feet or more
'Climax,' 5 feet, light blue
'Coombe Violet,' 4 feet, violet-purple
'Fellowship,' 4 to 5 feet, clear pink

The Goldenrods

Goldenrods (*Solidago* species) are even more neglected than the asters. To begin with, there

The Neglected American Plants

[*The following editorial appeared 140 years ago, in the May 1851 edition of the* Horticulturist. *It was written by Andrew Jackson Downing, the father of American horticulture. More than anything else, this article reflects the depth of the inferiority complex that American gardeners have always felt about themselves and their plants in comparison to their European counterparts.*]

It is an old and familiar saying that a prophet is not without honor, except in his own country, and as we were making our way this spring through a dense forest in the state of New Jersey, we were tempted to apply this saying to things as well as people. How many grand and stately trees there are in our woodlands, that are never heeded by the arboriculturist in planting his lawns and pleasure-grounds; how many rich and beautiful shrubs, that might embellish our walks and add variety to our shrubberies, that are left to wave on the mountain crag or overhang the steep side of some forest valley; how many rare and curious flowers that bloom unseen amid the depths of silent woods, or along the margin of wild water-courses. Yes, our hothouses are full of the heaths of New Holland and the Cape, our parterres are gay with the verbenas and fuchsias of South America, our pleasure-grounds are studded with the trees of Europe and Northern Asia, while the rarest spectacle in an American country place is to see above three or four native trees, rarer still to find any but foreign shrubs, and rarest of all, to find any of our native wild flowers.

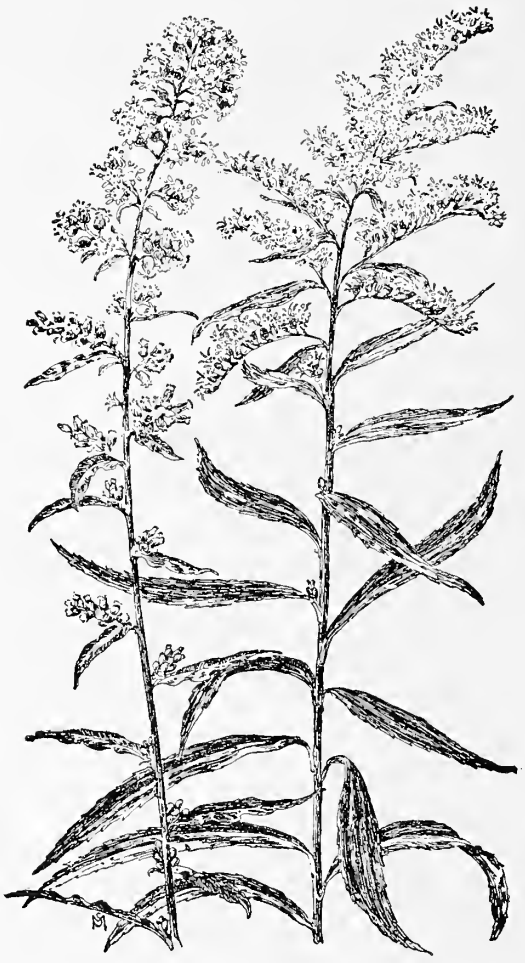
Nothing strikes foreign horticulturists and amateurs so much as this apathy and indifference of Americans to the beautiful sylvan and floral products of their own country. An enthusiastic collector in Belgium first made us keenly sensible of this condition of our countrymen . . . by telling us that amateurs and nurserymen who annually import from him every new and rare exotic that the richest collections of Europe possess, could scarcely be prevailed upon to make a search for native American plants, far more beautiful, which grow in the woods not ten miles from their own doors. Some of them were wholly ignorant of such plants, except so far as a familiarity with their names in the books may be called an acquaintance. Others knew them, but considered them "wild plants," and therefore, too little deserving of attention to be worth the trouble of collecting, even for curious foreigners. "And so," he continued, "in a country of azaleas, kalmias, rhododendrons, cypripediums, magnolias, and nyssas—you never put them in your gardens, but send over the water every year for thousands of dollars worth of English larches and Dutch hyacinths. *Voilà le goût Republique!*"

In truth, we felt that we quite deserved the sweeping sarcasm of our Belgian friend. We had always, indeed, excused ourselves for the well known neglect of the riches of our native Flora, by saying that what we can see any day in the woods is not the thing by which to make a garden distinguished—and that since all mankind have a passion for novelty, where, as in a fine foreign tree or shrub, both beauty and novelty are combined, so much the greater is the pleasure experienced. But, indeed, one has only to go to England, where "American plants" are the fashion (not undeservedly) to learn that he knows very little about the beauty of American plants . . . Perhaps the finest revelation of this is the clumps and masses of our mountain laurel, *Kalmia latifolia*, and our azaleas and rhododendrons, which embellish the English pleasure-grounds. In some of the great country-seats, whole acres of lawn, kept like velvet, are made the ground-work upon which these masses of the richest foliaged and the gayest flowering shrubs are embroidered. Each mass is planted in a round or oval bed of deep, rich, sandy mould, in which it attains a luxuriance and perfection of form and foliage, almost as new to an American as to a Sandwich Islander. The Germans make avenues of our tulip-trees, and in the South of France, one finds more planted magnolias in the gardens than there are, out of the woods, in all the United States. It is thus, by seeing them away from home, where their merits are better appreciated, and more highly developed, that one learns for the first time what our gardens have lost by our having none of the "American plants" in them.

is the widespread misconception that goldenrods cause hay fever—an outright fallacy in view of the fact that plants that produce showy, colorful flowers in order to lure insect pollinators will also make heavy, sticky pollen for the insect to carry away. Fall hay fever is caused by light, wind-borne pollen produced by plants with inconspicuous flowers, such as ragweed, while plants with conspicuous flowers such as goldenrods often take the blame.

The genus *Solidago* contains about 130 species, most of which are native to North America, with a few found in Europe, Asia, and South America. They flower in summer or in autumn, are good for cut-flower use, are easily raised from seed, and can readily be propagated by division. If it sounds like a nursery's dream, I can only assume that it is the public's perception of all goldenrods as noxious weeds that eliminates their use as garden perennials. It is time to reassess the garden worthiness of goldenrods, and this is slowly happening, especially in that segment of the horticultural world interested in native plants. Perhaps other gardeners will catch up with them—and sooner rather than later.

There is tremendous variation (and consequent taxonomic confusion) within the genus *Solidago* regarding bloom time, shape of the flower head, overall height, and cultural needs. Nearly all the goldenrods have bright golden-yellow flowers, small individually, but clustered on a spiky raceme, a flat-topped corymb, or a plume-like panicle whose numerous flowers make a bright display. Following are some recommendations of species, largely unselected wild plants, valuable for their bright floral displays. Except where noted, I have chosen to follow the taxonomy presented in *Hortus III*.



White Golden-rod.
Solidago bicolor.

Late Golden-rod.
Solidago serotina.

Solidago altissima has the appropriate common name of tall goldenrod, as it will reach 80 inches. It has long (up to 6 inches), rough, gray leaves with hairs on the stems and the underside of the leaves. This is one species that should be pinched back to encourage stout, sturdy growth, because in its native meadow habitat it grows among a host of other plants that provide mutual support. In the garden, it might be necessary to provide support in the form of stakes and string. This species is so vigorous that it looks better in a naturalistic setting than in a more manicured herbaceous border, and it looks particularly good in combination with tall grasses, such as the various *Miscanthus* cultivars.

Solidago bicolor is a goldenrod with, surprisingly, white rather than golden flowers, and hence its common name of silverrod. It grows two to three feet tall, with unbranched gray,

hairy stems. The blooms have creamy-white ray flowers surrounding a yellow disc, and appear from August to September. The soil in which *S. bicolor* is planted should be well drained, with only average or poor fertility. Short-lived, this species is quite possibly biennial.

Solidago caesia has several common names—wreath goldenrod, blue-stem goldenrod, and woodland goldenrod. The slender arching stems, about three feet tall, are glaucous purplish-blue. In September, the stems are wreathed with clusters of yellow flowers in the leaf axils, terminating in a loose, leafy panicle. Growing in deciduous woodlands, this species is an excellent choice for late color in the shady garden, and is easily propagated by division in the spring.

The lance-leaved goldenrod, ***Solidago graminifolia***, is unlisted in *Hortus III* but is mentioned in one of the best native plant books, *Handbook of Wildflower Cultivation*, by Kathryn S. Taylor and Stephen F. Hamblin (1963). A branching, bushy plant, this species grows two to four feet tall, with numerous, narrow, grass-like leaves. The many small, flat, clustered flower heads appear from midsummer through autumn on short branches at the top of the stem. Tolerant of a range of soil conditions, lance-leaved goldenrod will grow in wet or dry sites, and it is also easily propagated by division in spring.

Lance-leaved Golden-rod. Solidago graminifolia.

The gray or old field goldenrod, ***Solidago nemoralis***, is among the earliest goldenrods to flower. Growing only one to three feet tall, this clump-forming plant has mottled, gray-green leaves. Its graceful, arching, one-sided flower stalk first appears in August, a sure sign that summer is drawing to a close. This species is somewhat short-lived, possibly biennial, and grows best on poor dry sites.

The sweet goldenrod, ***Solidago odora***, has fragrant, anise-scented foliage. Growing three to five feet tall, the one-sided panicle of flowers is attractive from late summer into autumn. It will grow well not only in average soil, but even in poor sandy sites. The leaves can be used for tea if harvested before flowering begins, as the intensity of flavor will then decline.

Solidago pinetorum is not listed in *Hortus III* but is offered for sale in catalogues. Commonly called early goldenrod, it flowers in midsummer. The bright green foliage grows in a low clump, with a four-foot-tall, rather arching flower stalk. This species is valuable for its handsome foliage and early bloom.

Solidago rugosa.

Stiff-leaved goldenrod, ***Solidago rigida***, has flat-topped corymbs of golden flowers in either summer or early autumn. The plants grow three to five feet tall, with yellow-green leaves as much as a foot long at the base of the plant, diminishing to four inches as they ascend the stem.

Solidago rugosa is commonly called rough-stemmed or, more accurately, rough-leaved goldenrod, since the specific name refers to the wrinkled, veiny rugose leaves. Another large goldenrod, growing four to six feet tall or more, its spectacular flowers appear in late summer or early autumn, with curving sprays of vivid yellow flowers atop vase-shaped plants. This species appreciates moist to average soil conditions, and combines well with *Eupatorium purpureum*, Joe-pye weed, for a lovely display in wet meadows. Given its height, it is best used at the back of the border. It will seed about and "volunteer" in the garden. Division in late winter is another means of propagation.

The seaside goldenrod, ***Solidago sempervirens***, has adapted to harsh coastal conditions of sandy soil and strong winds, and reveals a waxy coating on the somewhat succulent leaves. Not insistent on beach conditions, this species will grow perfectly well in average soil in the perennial border. Variable in bloom time and height, different plants can be seen in bloom from summer into October, anywhere from two to six feet high. The individual florets, large compared to most goldenrods, are carried in large flattened panicles. As this species tends to have a deep root system, especially in light soils, it is best to transplant it when small.

Solidago speciosa is also unlisted in *Hortus III*. Growing two to three feet tall, it has twelve-inch-long wands of vivid yellow flowers. Growing in average soil conditions, it also tolerates nutrient-poor sandy soils and is a good selection for xeric landscapes.

Solidago sphacelata 'Golden Fleece,' cordate-leaf goldenrod, is a 1990 introduction from Mt. Cuba Center for the Study of Piedmont Flora in Delaware. Selected by Dr. Dick Lighty, the plant was discovered in a North Carolina garden where its spreading growth habit suggested its possible use as a groundcover for large areas. The heart-shaped, semi-evergreen rosettes of leaves provide good foliage interest, with 18- to 24-inch-tall, wiry flower stems in September and October. Another of Dr. Lighty's recommended goldenrods is ***Solidago flexicaulis***, which he saw in

Seaside Golden-rod Solidago sempervirens

Germany, used as a woodland groundcover in fairly heavy shade. The flowering pattern is similar to *S. caesius*, with secondary flower clusters in the leaf axils, strung out along the stem.

There are those of us who refuse to give up gardening with the Labor Day holiday, who expect more gratification from the late season garden than planting bulbs. The dedicated gardener welcomes the display provided by our native asters and goldenrods and invites them into cultivation from the roadside, to brighten the fall of the year and to lead the garden into its winter rest.

Some Nurseries Offering a Selection of Asters and Goldenrods

Holbrook Farm and Nursery, Route 2, Box 223B, Fletcher, NC 28732

Little River Farm, Route 1, Box 220, Middlesex, NC 27557 (catalogue $2.00)

Native Gardens, Route 1, Box 494, Greenback, TN 37742 (catalogue $1.00)

Niche Gardens, 1111 Dawson Road, Chapel Hill, NC 27516 (catalogue $3.00)

Prairie Nursery, P.O. Box 306, Westfield, WI 53964 (catalogue $3.00)

Sunlight Gardens, Rt. 1, Box 6000A, Hillvale Road, Andersonville, TN 37705 (catalogue $2.00)

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Allandale Woods: A Fragment of the First Families of Boston

Richard Heath and Richard B. Primack

Weeds, wildflowers, and history come together in this little-known corner of the city.

A turn down Allandale Street from the bustle and traffic of Center Street in Jamaica Plain is a turn down a country road, crowded with trees and lined by sturdy stone walls. Boston's last working farm, Allandale Farm, can be seen from the road. In the summer it sells fresh sweet corn; in the autumn it sells sweet cider mashed from its own apples. The road straightens out past the farm, and on the left is a deeply shaded, wooden gate that leads into Walnut Hill Cemetery, the resting place of Professor C. S. Sargent, the first director of the Arnold Arboretum, and his good friend, the architect H. H. Richardson.

Also located on the road is the very private, early twentieth-century Brandegee estate with its decaying Italianate gardens. The centerpiece of the estate is an enormous Georgian house set on a great hilltop terrace overlooking sweeping green meadows. Opposite the former stables and the carriage house of the Brandegee estate, now the stables of the Boston Police Department, is a seemingly nondescript clump of woods, the Allandale Woods, the subject of this article. It is typical of the secondary growth that invades old fields, once they are no longer used for grazing. This fragment of land, along with much of the present-day Arnold Arboretum, was the ancestral grounds of a number of old Boston families, including the famous Weld family of Roxbury, once again prominent because of the election of William Weld as present governor of Massachusetts.

Across Center Street from the Arnold Arboretum (between Allandale Street and the VFW Parkway), visitors can explore for themselves the 31-acre Allandale Woods, a jigsaw puzzle of City of Boston parkland and private land to which conservation restrictions have been applied. The Boston Natural Areas Fund (BNAF) has taken the lead in managing the property, which has a special connection to the Arnold Arboretum in that both were part of the original land grant to Joseph Weld that included much of modern-day Jamaica Plain. Superficially, the Allandale Woods looks like an ordinary oak and maple forest of the metropolitan Boston area, most of it an undulating glacial landscape of ridges and valleys, streams, and rocky outcroppings of Roxbury pudding stone, but records reveal it as a place of considerable historical interest as well.

A careful observer can see remnants of old farm walls, estate boundaries, abandoned

The old springhouse on the grounds of the former Souther estate, which once tapped into Allandale spring. This structure is located on privately owned property adjacent to the publicly held portion of the Allandale Woods. Photo by P. Del Tredici.

apple orchards, and old foundations that clearly indicate former uses of the land. Probably the most exceptional structure in the Allandale Woods is a six-sided wooden springhouse with a conical cap tipped by a large metal ball. This crumbling structure, built in the 1870s, sits over a pipe that taps the Allandale Spring, a famous source of water in the region. Surrounding the springhouse are several ancient, overgrown apple trees.

Early History

The human story of the Allandale Woods begins with the Indians who had camps and lodges in the Saw Mill Brook valley until 1000 B.C. This area was presumably hospitable, with abundant running water and level ground. When the first English settlers arrived in the region, Algonquin Indians lived not far away, near the Neponset River Valley in Quincy, making it easy to imagine Indian hunters and fishermen moving through the primeval Allandale Woods.

The historical record begins on June 5, 1632, when the Reverend Thomas Weld and his brother Joseph arrived in Boston and settled in Roxbury. Joseph Weld became the captain of the Roxbury militia, and fought in the first major Indian war in the New England settlements, the Pequot War of 1637. After defeating the Indians, Weld was one of the commissioners who negotiated the peace treaty; a grateful Governor Winthrop rewarded Captain Weld handsomely with a large estate in the western end of Roxbury called Jamaica End.

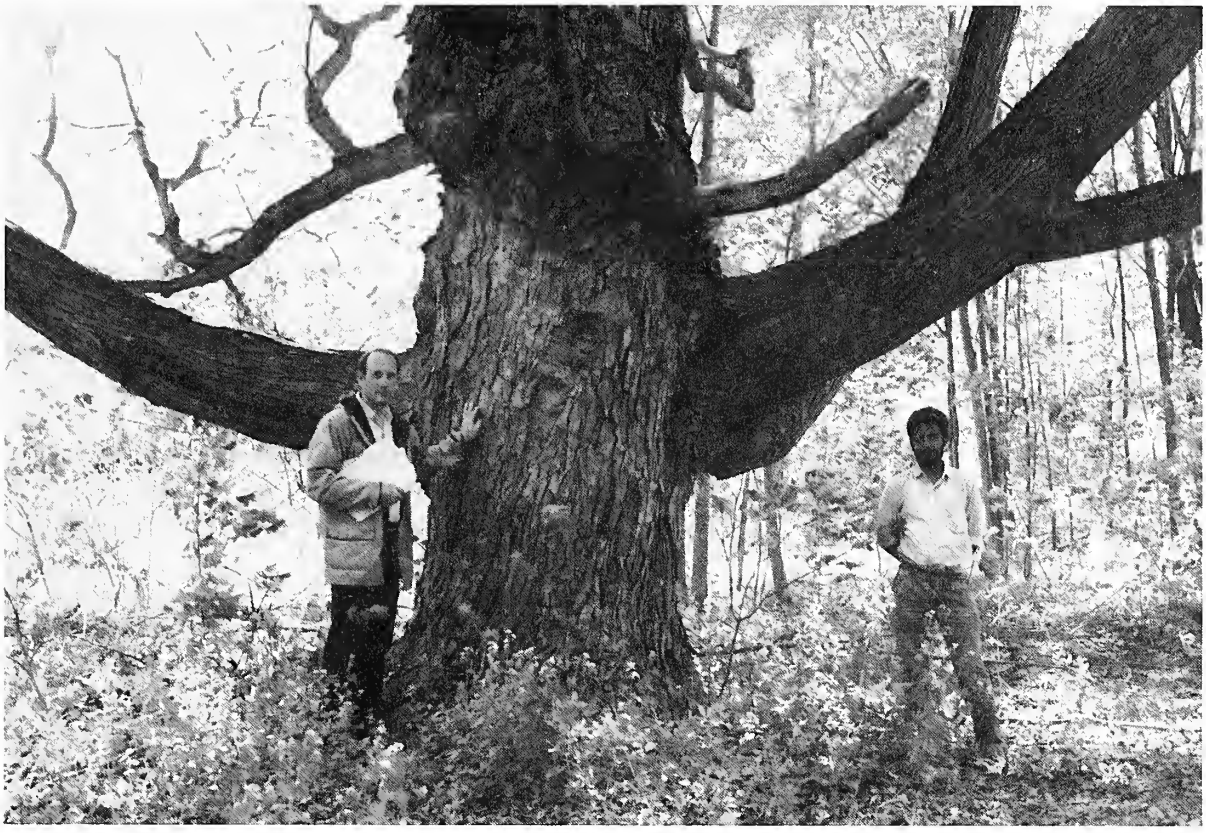
There is evidence to suggest that this estate covered all of the land from the present-day Arboretum to the VFW Parkway and north to the spring along Allandale Street. The property was used as a large farm for growing the crops of the day—rye, corn, squash, pumpkins, apples, beans, tobacco, and hay for feeding livestock. Much of the labor for the huge farm apparently came from Indian and black slaves until Massachusetts outlawed slavery in 1783. The remnants of the field boundaries can still be seen in the low rock walls found throughout the Allandale Woods.

The land remained in the Weld family until 1806. During that year Colonel Eleazer Weld, great-great-grandson of Captain Joseph, sold off a large portion of his estate to pay debts he may have incurred while supporting the Revolutionary Army. What was to become the most famous hundred acres went to Benjamin Bussey, a wealthy silversmith and owner of a woollen mill. Bussey's estate is today part of the Arnold Arboretum.

The rest of the land—along the future VFW Parkway and what is now the Allandale Woods—became the estate of Thomas B. Williams. On a site near the rear of the present-day Church of the Annunciation, Williams built a farm that operated for most of the nineteenth century. In 1864, Williams sold twenty acres of his land facing Allandale Street to Henry W. Wellington, and twenty years later, the land was purchased by Maria Souther, probably also a Wellington. The Souther estate consisted of a grand two-and-one-half-story house set on a curving terrace. Below the house was a sixty-foot-long greenhouse and a meandering stream, with the springhouse built at its source and with a pond downstream. Maria Souther's daughter, Marguerite, lived here until 1968 when the house, greenhouse, and spring were sold to the Faulkner Hospital.

Numerous remnants of the Souther estate can still be seen in the Allandale Woods, such as the curving drive with its enormous oaks and sugar maples. Unkempt crabapples, ornamental cherries, and butternut trees persist near the building site. The huge, overgrown apple trees along the stream survive but do not fruit under the shade of nearby trees. The six-sided springhouse, with its conical roof, remains elegant even as it falls into ruin. The meadow below the old estate is still beautiful with black-eyed Susans, crown vetch, and other wildflowers. Yet the vigorous growth of poplars, aspens, and other trees in the meadow suggests that the area will soon again become a woodland.

The remainder of the Williams farm was purchased by the City of Boston in December 1894 to build a parkway that would connect



One of two enormous sugar maples that line what was once the drive leading to the Souther estate, now privately owned. Photo by P. Del Tredici.

the Arnold Arboretum and Franklin Park to the Stony Brook Reservation. The landscape architectural firm of Olmsted, Olmsted and Eliot furnished detailed plans in 1896, but the Veterans of Foreign Wars (VFW) Parkway was not completed until 1936. A great stone and cement wall was built at some point to separate these city lands from the private lands to the north. When this wall was built and who built it has yet to be discovered. It is about eighteen inches wide and about three feet high, and runs up and down the steep landscape.

Between 1891 and 1905, Allandale Woods became part of a second extensive Weld estate, that of Mary (Weld) Pratt who married Edward Brandegee, a wealthy clothing manufacturer, in 1902. Her 195-acre estate extended as far as Newton Street opposite the Brookline Country Club and included a 79-room, neo-Georgian house and Italian gardens on the north side of the Allandale Woods. Broken slabs of marble, pieces of Romanesque statuary, and rusty mowing machines can still be seen in the tumbledown garden sheds. Nearby are covered stalls that were once used for keeping domestic animals.

Vegetation

After three centuries of use both for farming and for the cutting of firewood, the Allandale Woods today is a young forest with mostly small trees that have colonized the area. The dominant vegetation along the sides and tops of the ridges consists of oak trees (including the white, black, red, chestnut, and scarlet species) with an understory of blueberry and huckleberry bushes. White pines are surpris-

The long boundary wall that runs through part of the Allandale Woods. Photo by P. Del Tredici.

ingly rare, only occurring as a few scattered trees near the old garden sheds. Openings in the forest contain small trees of black cherry, trembling aspen, sassafras, gray birch, and sweet cherry. Common herbs include wild lily-of-the-valley and sarsaparilla. These ridge tops have thin, dry soil, which makes them prone to fire, such as the one that burned a section of the woods in 1988.

On slopes that are damper and more protected, hickories, hemlocks, and beeches become more common, with numerous sprouts of American chestnut, patches of the maple-leaved viburnum, and scattered clumps of ghostly white Indian pipes. On these lower, damper slopes the forest is composed primarily of red maples and black birch, with scattered ash, sugar maple, mockernut hickory, pignut hickory, and shagbark hickory. In many of these areas, particularly when disturbed by dumping, there is a dense understory of alder buckthorn and common buckthorn, multiflora rose, gooseberry, and a truly prolific growth of poison ivy that covers the ground and grows up tree trunks. On the edge of some of the most disturbed wet ground are large eastern cottonwoods, Asian cork trees, and castor aralias, the last two most likely started from seeds carried by birds from the nearby Arnold Arboretum.

In the center of these disturbed areas of dumping and old quarrying, one finds a tangle of vines, such as wild grape, bindweed, Virginia creeper, catbriars, oriental bittersweet, and brambles. The wildflowers found in the Allandale Woods are almost exclusively weedy species characteristic of disturbed ground (butter-and-eggs, Canada hawkweed, goldenrods, asters, yarrow, and garlic mustard). Some of these are either escaped or persisting ornamentals, such as lily-of-the-valley and dame's rocket. Presumably because of the heavy human impact, only a few native woodland herbs are now found in the Allandale Woods including bastard toadflax, wild geranium, Indian pipes, sarsaparilla, dogbane, false indigo bush, yellow gerardia, cow wheat, Solomon's seal, wild lily-of-the-valley, and false Solomon's seal.

An Ecological Experiment

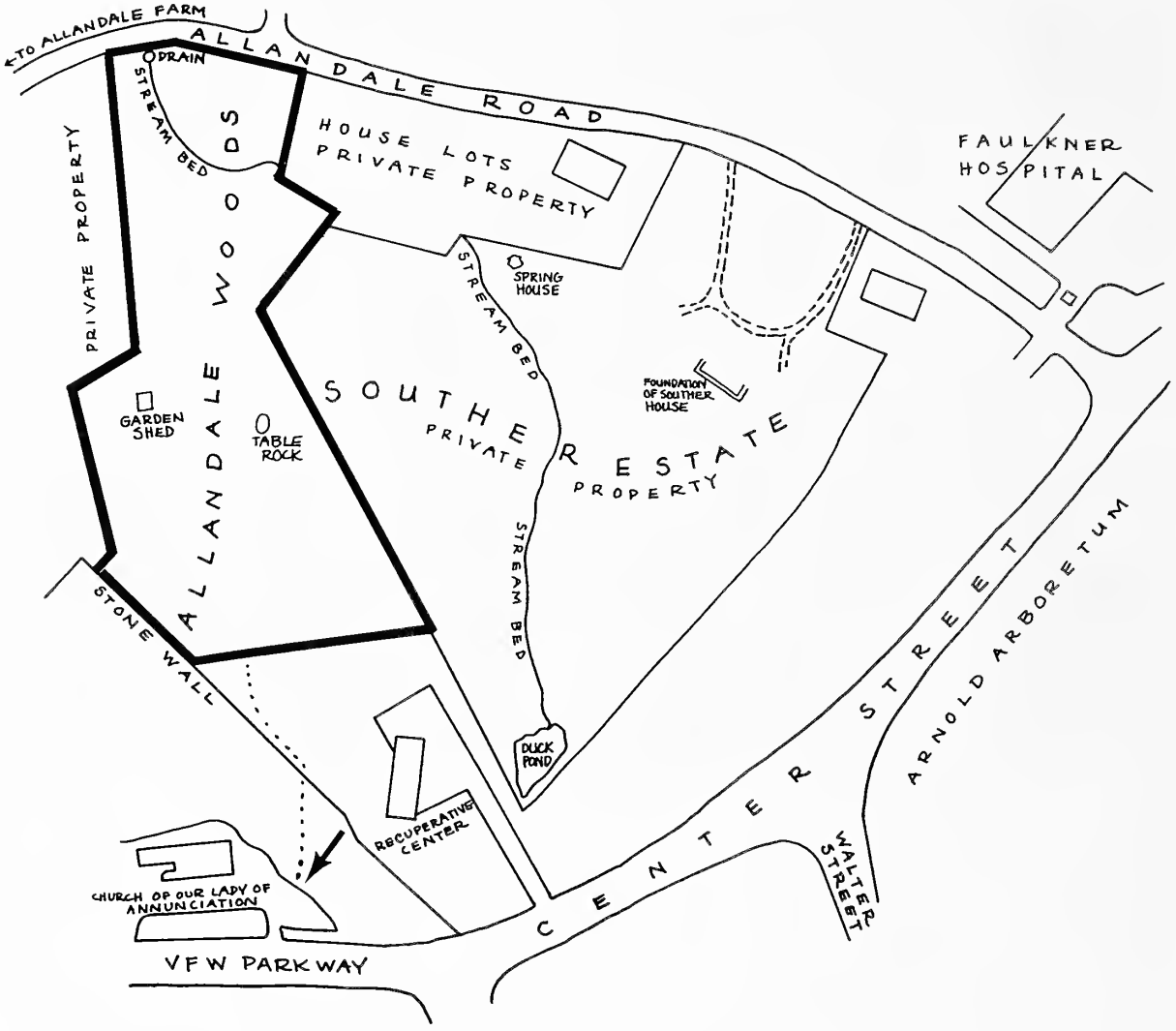
Many common perennial wildflowers do not occur in the Allandale Woods even though they are common in conservation areas only a few miles away. Apparently during the period of intensive farming, many species were eliminated from the landscape and have been unable to return to the site via natural seed dispersal. In the fall of 1989, the BNAF decided to introduce a number of common perennial species into the Allandale Woods in an attempt to increase the number of native wildflower species present and to test alternative techniques for species introductions.

The first part of the project involved collecting wild adult plants of foam flower (*Tiarella*

A distinctive outcrop of Roxbury pudding stone capped with a glacial erratic, known as Table Rock. Photo by P. Del Tredici.

cordifolia), partridgeberry (*Mitchella repens*), Christmas fern (*Polystichum acrostichoides*), wood lily (*Clintonia borealis*), Jack-in-the-pulpit (*Arisaema triphyllum*), Indian cucumber root (*Medeola virginiana*), shining club moss (*Lycopodium lucidulum*), wood sorrel (*Oxalis montana*), and wintergreen (*Gaultheria procumbens*) from woods in Newton, Massachusetts, and Sunapee, New Hampshire. With the exception of Jack-in-the-pulpit, which is rare in Allandale Woods, none of these species apparently grows here even though the site looks suitable for all eight species. These plants were transplanted onto what appeared to be suitable sites along the path running from so-called Table Rock down along an old rock wall into a wooded dell. The transplants were checked in the spring and late summer of 1990 and again in the spring of 1991. Based on these limited observations, it is apparent that all species, with the possible exception of Indian cucumber root, have survived transplantation. The Jack-in-the-pulpit, foam flower, and wood lily all flowered in 1991.

While the success of the adult transplants demonstrates that the Allandale Woods is suitable for the growth of native species that do not occur there naturally, the experiment does not say anything about the process of their establishment from seed. In an attempt to investigate this crucial phase of their life cycle, the seeds of ten additional species were obtained from the New England Wildflower Society and introduced into the Allandale Woods at specific marked points during the



Allandale Woods and the surrounding area. The main public trail begins behind the ornate Church of Our Lady of the Annunciation (arrow) and turns through the oak woodland to the distinctive outcrop and flat boulder known as Table Rock.

fall of 1989. None of the species selected occurred in the woods, yet there were many sites that looked as if they were at least potentially suitable for the species. The purpose of using seeds was to simulate the natural process of establishment of new plant populations through seed dispersal by animals or wind.

Species that grow in four different types of habitats were selected for the experiment. Seeds of the first group were planted in open, disturbed ground and included butterfly weed (*Asclepias tuberosa*) and coneflower (*Rudbeckia* sp.). The second group, planted in lightly shaded, open forest, included columbine (*Aquilegia canadensis*), harebell (*Cam-*

panula rotundifolia), and wild pink (*Silene caroliniana*). The third group, planted in shaded forest with rich soil, consisted of wild ginger (*Asarum canadense*), golden alexander (*Zizia aurea*) and painted trillium (*Trillium undulatum*). The fourth group, planted along wet stream banks, included cardinal flower (*Lobelia cardinalis*) and cow parsnip (*Heracleum sphondylium*).

A cursory check of the sites in the late summer of 1990 and the spring of 1991 did not reveal any seedlings of any of these species. These failures suggest that the successful establishment of new populations from seed is probably a rare event, with many apparently suitable sites for a species actually being unsuitable for unknown reasons. Another possibility is that under field conditions the seeds may have to undergo a long period of dormancy before they will germinate. Under laboratory conditions there appears to be considerable variability among these species in their seed dormancy requirements. Seeds of butterfly weed germinated vigorously after three months of cold stratification, golden alexander seed required two three-month episodes of stratification, and painted trillium seeds did not germinate at all after two periods of stratification.

Our experience in finding adult transplants far more effective than seed in establishing new populations is in agreement with the conclusions reached by numerous other workers who have tried to recreate wildflower meadows and prairie communities. Simply placing seeds in a new environment is generally not enough to achieve successful plant establishment.

These sites in the Allandale Woods will continue to be monitored in the years ahead for the appearance of seedlings from the experimental seed introductions and for the persistence of the adult transplants. The results will help to determine which technique is the most effective for increasing the biological diversity of a young, disturbed conservation area, with the ultimate goal of partially restoring the original species composition.

During the last three-and-a-half centuries, the land has been the scene of key events both in New England history and in the history of the Weld family, with a cast of characters including Puritans, soldiers, farmers, slaves, Revolutionary War patriots, merchant princes, and, most recently, estate owners and dowagers who have built homes fit for royalty. An appreciation of this history can add to the enjoyment of a stroll through the Allandale Woods—far from the sounds of the modern world.

Acknowledgments

As it exists today, Allandale Woods consists of thirty-one acres of publicly owned or publicly accessible conservation land. The Boston Natural Areas Fund, a nonprofit organization dedicated to the preservation of urban green space, and the Boston Conservation Commission have worked together for the past twelve years to protect Allandale Woods through the outright purchase of land, with public and private funds, and through the procurement of conservation restrictions.

The material presented in this article is the result of a project sponsored by BNAF, with funding from the Boston Parks and Recreation Department, to protect and enhance the city-owned Allandale Woods.

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BOOKS

Nan Blake Sinton

The City Garden's Handbook: From Balcony to Backyard by Linda Yang. Random House, 1990. 316 pages. 150 color photographs. 70 line drawings. Hardcover. $26.95.

Copies signed by the author are available from the Arnold Arboretum Book Shop.

Owning *The City Gardener's Handbook* by *New York Times* garden writer and columnist Linda Yang is like living next door to the most resourceful plant enthusiast in town, who also happens to write with grace and style. Based on years of hands-on gardening experience, she has developed the confidence to look at an inhospitable area of concrete, shade, and pollution and immediately start planning its transformation into a garden space.

This is not a coffee-table book, but a practical, comprehensive guide to gardening in small and difficult situations. The numerous photographs, grouped in "blocks" for easy reference, are proof of the city resident's ability to create gardens in unimaginable spaces. Linked to garden plans or accompanied by plant lists, the pictures show the garden in all seasons and illustrate the creative use of fences, trellises, furniture, and containers.

Linda Yang's advice is useful to both novice and experienced gardeners. Her detailed chapter headings provide a ready trail of informative markers through the complicated process of creating a garden from scratch. The thirteen chapters include: starting off; assessment of problems of wind, pollutants, and soil conditions; selecting, locating, planting, and caring for appropriate plants; and understanding the ways of uninvited garden visitors—insects, diseases, and resident squirrels.

This is a book of answers—from a source list of mail-order suppliers of plants, tools, garden furniture, and accessories, to an almanac of seasonal tasks and reminders. The reader will also find useful guides, such as the "Chart of Reduced Fertilizer Quantities," which scales down applications to container and small yard proportions, and specialty plant lists covering such categories as plants for gardens with less than five hours of autumn sun, plants for medium-tall hedges, and weeping trees as accent plants on balconies.

Fifteen years ago, Linda Yang wrote *The Terrace Gardener's Handbook*, which contained many excellent suggestions on gardening in containers. In *The City Gardener's Handbook*, the information on containers is once again comprehensive, accurate, and inspiring. From anchoring a window box to planting birches in wooden tubs, the emphasis is on both how and what to plant, coupled with their integration into a cohesive design.

This is a book destined to bear the true mark of the gardener's companion—muddy thumb prints on every well-read page. With Linda Yang's assistance, city gardeners will be well equipped to create their own green spaces. Not trendy, not just decorative, this book is simply invaluable.