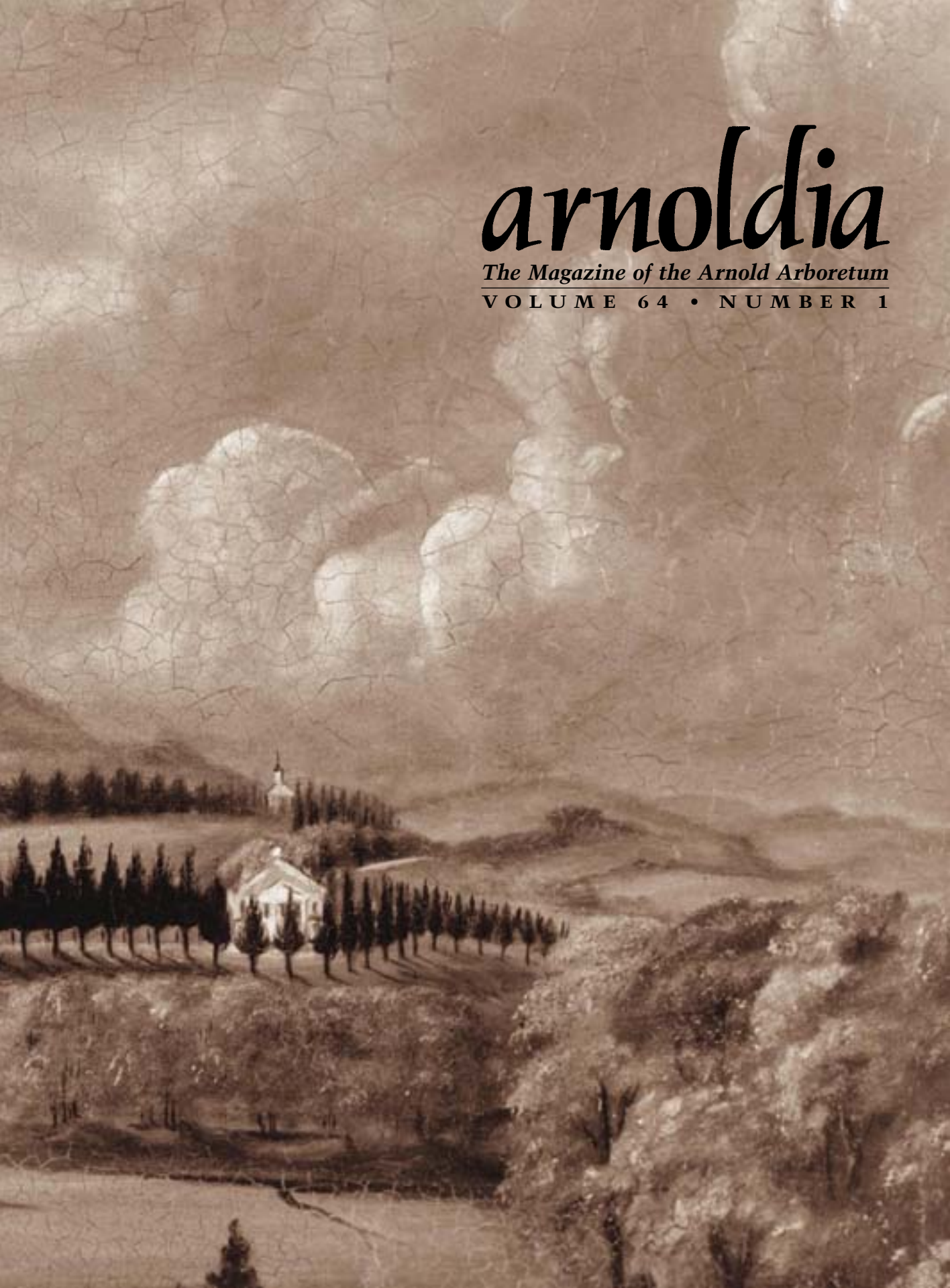

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Outside covers: Seat of Benjamin Bussey, Esq., at Jamaica Plain. Oil on canvas by William Cobb, 1839. This landscape includes the areas of the Arnold Arboretum that have come to be known as Bussey Hill, Hemlock Hill, and the South Street Tract. South Street is plainly visible, and it is easy to see where Sawmill Brook—now Bussey Brook—crosses it. The Bussey mansion appears in the middle ground. Bussey had begun buying up farmsteads in 1805 and continued to do so over the next thirty years. Some of the hedgerows that delineated the separate parcels appear in the painting. On the south slope of the hill, a lilac hedge, still extant today, formed one of these boundaries. This view of the Arboretum from Walk Hill, near the Forest Hills transit station, remains virtually unchanged today. From the Archives of the Arnold Arboretum, Harvard University.

Inside front cover: Clockwise from top left, gray catbird fledgling in a red osier dogwood near Faxon Pond; Baltimore oriole and nest in a cottonwood tree on Peters Hill; orchard oriole fledgling and nest, which is tethered to a crabapple on Peters Hill; young eastern kingbirds; great crested flycatcher in nest on Peters Hill.

Inside back cover: Clockwise from top left, Baltimore oriole in the nest in a red maple near Faxon Pond; young eastern kingbird in a catalpa at the bottom of Bussey Hill Road; eastern kingbird nesting in a Kentucky coffeetree near the ponds on Meadow Road; great horned owl perched in a favored species—white pine—on Bussey Hill not far from the South Street gate; female boblink bearing food, resting on a hawthorn on Peters Hill.

Benjamin Bussey, Woodland Hill, and the Creation of the Arnold Arboretum

Mary Jane Wilson

The Arnold Arboretum was officially established in March 1872, when an indenture was signed by which trustees of a bequest of James Arnold agreed to turn the fund over to Harvard College, provided the college would use it to develop an arboretum on land bequeathed earlier by Benjamin Bussey . . . An intense regard for the land and for agricultural endeavor led Bussey to leave a large portion of his fortune and all of his property in West Roxbury to Harvard College for the creation of an institution for instruction in farming, horticulture, botany, and related fields.
—Ida Hay, *Science in the Pleasure Ground*

The following is adapted from the first full-length life of Bussey, soon to be published in its entirety.

I first met Benjamin Bussey when I opened an old family box labeled "Important Papers—Save." Inside I found more than two hundred documents, primarily letters written in the early 1800s, addressed to a Benjamin Bussey of Boston. It appeared that Bussey was a man of importance in Federalist New England and that here was a story to be told. My research confirmed that, indeed, Bussey was an outstanding New Englander. The letters found in that box have allowed me to piece together Benjamin Bussey's life and encouraged the telling of his story. May history better remember and recognize this extraordinary man who bettered the world in which he lived and whose legacy remains today in a most special way, enhancing the lives of untold others, through the Arnold Arboretum.

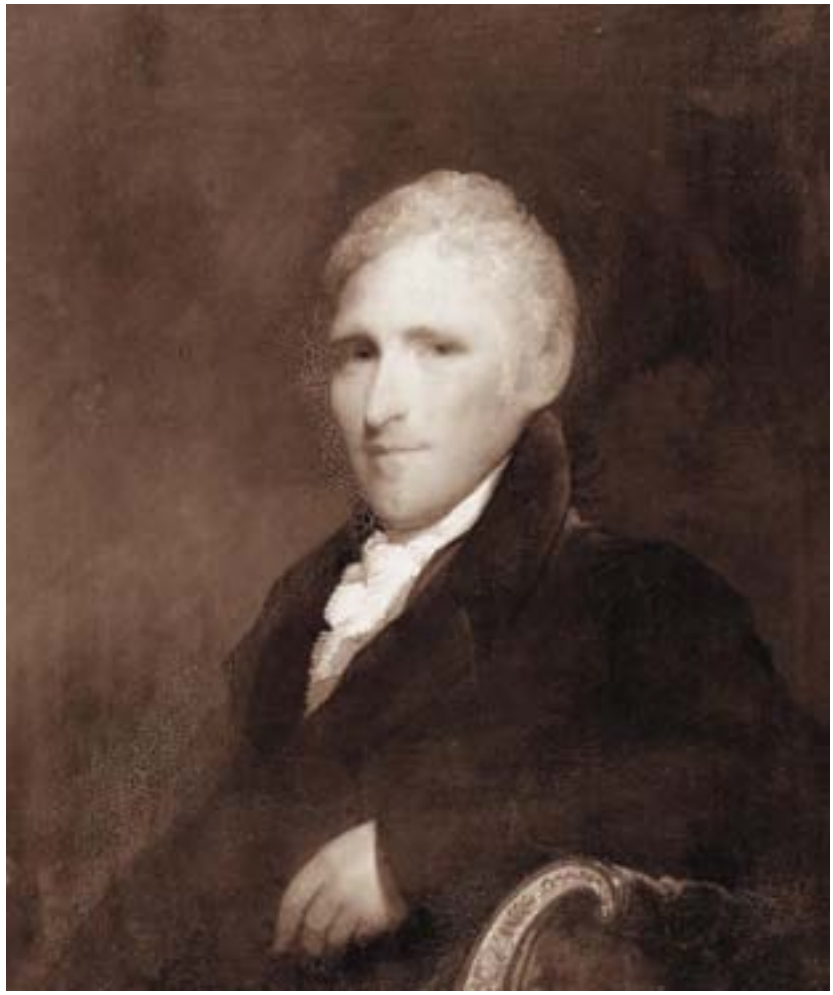
Benjamin Bussey (1757–1842) played an important role in the growth of commerce, manufacturing, and agriculture in New England. After a childhood of frugal living and hard work and a soldier's travails in the American Revolution, he became a merchant, eventually amassing a great fortune from European trade. He was also on the cutting edge of New England's manufacturing industry, with woolen mills in Dedham, Massachusetts, that introduced the water-driven Broad Power Loom to America. Throughout his life he was a benefactor to many individuals as well as to religious and civic organizations.

As a farmer Bussey acquired vast tracts of land from Boston, Massachusetts, to Bangor, Maine. At his country estate, Woodland Hill, he demonstrated his support for the new movement called "scientific farming." His sponsorship of agricultural education, "remarkable in its foresight,"[1] led to his bequest to Harvard College of Woodland Hill for a school of agriculture and horticulture. Harvard honored his bequest in 1869 with the creation of the Bussey Institution.

The years have obscured his name. His mills in Dedham are gone, his properties in Maine in great part absorbed by the city of Bangor. Only traces of his life remain in the landscape: a street bearing the Bussey name in Dedham and a hilltop and a brook named for him at the Arnold Arboretum.

Bussey had accumulated a great fortune by the early 1800s. Around the same time, a combination of embargos, falling markets, and failing enterprises made the shipping business

less attractive, and he retired from the merchant life. Five Summer Street in Boston had been his home since 1798. The property included a mansion with grounds and gardens and a carriage house for the family's horses and vehicles. In 1806 he purchased the farm of Eleazer Weld, located in what was then known as West Roxbury, now the Jamaica Plain/Forest Hills section of Boston, an area popular for country seats and summer relaxation. Several of Bussey's friends had already established country estates. Joseph Barrell built Pleasant Hill in Charlestown in 1791; Theodore Lyman, The Vale in 1793 in Waltham; and John Codman renovated the Russell estate in Lincoln in 1797. These gentlemen farmers used new experimental methods to develop their lands. In 1792, twenty-one lawyers, doctors, politicians, and merchants chartered the Massachusetts Society for Promoting Agriculture (MSPA). The Society acquired and disbursed information on crop rotation, reforestation, and the use of cattle to provide natural fertilizer. Bussey joined the Society in 1803.

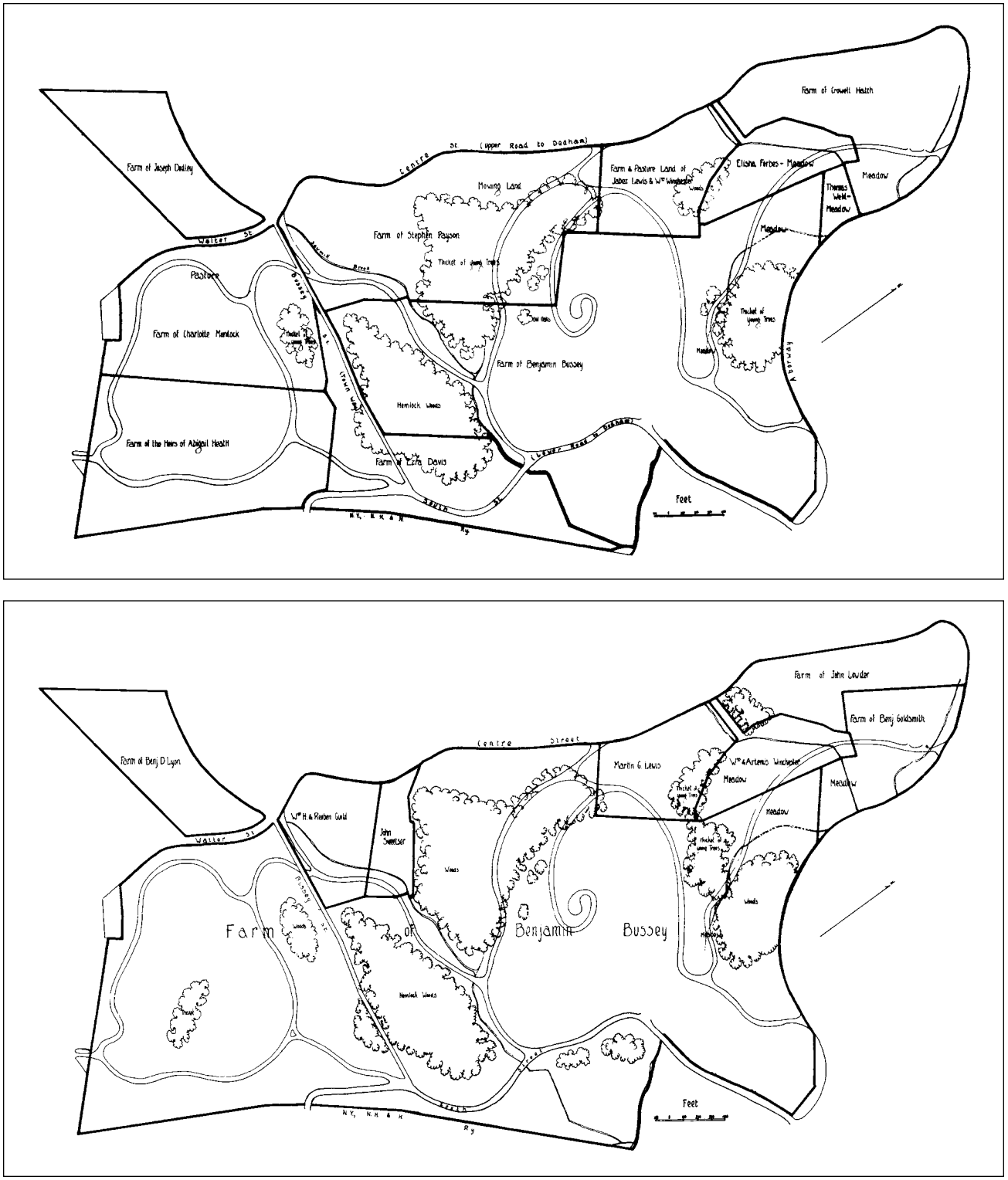


COURTESY OF THE HARVARD UNIVERSITY PORTRAIT COLLECTION, HARVARD UNIVERSITY ART MUSEUMS. BEQUEST OF BENJAMIN BUSSEY, 1894

In 1808 Bussey made arrangements with the famed portraitist Gilbert Stuart to paint the family's portraits. Bussey's own was the last to be finished. Reporting on its progress after a visit to Stuart's studio, daughter Eliza wrote to her mother, who was with Benjamin in Bangor, "It is the very image of himself and the pleasure I have in viewing it lessens the pain of our separation for I feel as tho' in his presence when I look at the portrait."

At this point in his life Bussey was virtually free to devote his time to managing his investments and his real estate. His son and daughter were grown and on their own: Benjamin III had graduated from Harvard and Eliza had married. Developing his estate was now the major focus of his life, becoming both an experiment in developing his interest in scientific farming and an outlet for the attachment to the land that had formed in his childhood and progressed to ornamental gardening at the Summer Street residence. The spacious meadows, hills, and brooks, and the excellence and variety of the Jamaica Plain landscape spoke to his agrarian nature. Woodland Hill would eventually grow to encompass more than three hundred acres.

Bussey immediately assumed management of the farm operations. Farmhands were hired and a woman, Anna Sherman, was employed to watch over the farmhouse needs. The land was plowed and planted with new products such as Liberian wheat, and outbuildings were erected, including a barn to house the livestock, cattle, swine, and the newly introduced merino sheep. He also targeted reforestation for an important role in his farming activities. Except for one stand of trees (later known as Hemlock Hill)



Maps of land that now comprises the Arnold Arboretum. Benjamin Bussey greatly expanded his holdings between 1810 (above) and 1840 (below).

COURTESY OF MRS. GEORGE SKINNER. ARCHIVES OF THE ARNOLD ARBORETUM

The mansion on Bussey Hill photographed in the 1930s.

and a hillside oak that had escaped cutting, the land was treeless, having been cleared to supply the city with firewood, to raise hay, and to graze animals. Shortly after the purchase of the farm Bussey established the first of his woodlots, and by 1810 several areas of young woods were growing. He added numerous species of trees and shrubs to the estate, including European larch, catalpa, honey locust, and silver fir.

Bussey chose to site his mansion on the south side of Weld Hill (now known as Bussey Hill), a commanding location that overlooked the great variety in his landscape: woods, brooks, fields, and meadows. While supervising the farm operations, he watched his new home rise. If he was away, his daughter Eliza and her husband Charles followed the progress of the building. In July of 1816, when Bussey and his wife Judith were enjoying a visit to Saratoga Springs, Eliza sent word that the new house was beginning to look finished, with windows set in the upper stories and the tops of the piazzas shingled.[2] Charles reported a few days later on both farm and house.

> [T]he hay of all sorts and the barley are now under cover . . . and the fields are seldom so verdant as the rain Sunday was a constant pour. Joe came very near losing his chickens, many apparently dead after the flood. We brought them into the house and by the application of flannel and by the children's hands all but three were restored to their anxious mothers. The work at the new house proceeds with regularity. About two thirds of the plastering is Finished . . . that in the attic and in the entry leading to it has many small cracks in it owing to its drying too fast, occasioned by its proximity to the roof . . . I have cut the dead limbs from the trees in the woods near the walk and the stone wall is finished to the bottom of the summer house. I have also taken the dead wood from the honeysuckles. We have had some days past the company of Miss Ely and her sister from Hartford . . . have taken tea with Aunt Lowder and have had Mr. and Mrs. Parsons with us at dinner yesterday.[3]

The finished mansion was a model of stately neoclassical elegance. It was approached by a gravel carriage road lined with gutters of granite sea pebbles and bordered with white pines

and horsechestnuts. At the top of the steep incline the road ended in a turnaround at the mansion entrance, where granite steps led to a front porch floored with white marble tiles. The interior of the house reflected the popularity of French decor at the time. The dining room wallpaper was of Paris views and monuments. The drawing room and parlor floors were covered with Brussels carpets. Damask draperies hung at the windows and throughout the house were costly French furnishings, such as the settee and set of chairs with needlework upholstery that Bussey had acquired at the close of the French Revolution.

Other accoutrements were added over the years. In 1818 Bussey purchased a copy of the Declaration of Independence for ten dollars, and in 1832, five copies of old masters painted by Rembrandt Peale. Peale sent a note with them expressing his gratitude "that five of his best copies of the masters would reside together in Bussey's hospitable mansion where they would be appreciated properly."[4]

Plantings around the mansion included a wide-spreading American elm, a weeping beech, and a black oak that in time would offer cooling shade. Nearby were cherry and mulberry trees. A few yards from the house, a crescent-shaped pond was fed by an underground reservoir that piped water down to the house. Stone steps and a cobblestone path wound up the hill behind the house, bordered with lilacs and white pines that screened the distant working farm. Myrtle and lilies-of-the-valley covered the ground beneath the trees. At the crest of the hill was the stone-based summerhouse where Bussey and his friends viewed the distant Great Blue Hill and the town of Boston. Looking upward observers could see the heavens, and looking downward on a clear night, the stars were reflected in the crescent pool. The summerhouse later became an observatory.

Friends and neighbors came to Woodland Hill to stroll through the ornamental plantings or to climb the hill to the summerhouse, passing by the sweet-smelling lilacs. Some came for tea, others for dinner. The mansion's spacious rooms and many chairs (the west drawing room alone held forty-two) allowed the Busseys to entertain large groups. French china, silver pitchers, and crystal goblets made for elegant serving. Much of the food grew on Bussey's land: the cherries came from the orchards, the rhubarb from the garden, and his livestock provided the popular roasted veal and calves-head soup.

His neighbors included Enoch Bartlett of Bartlett pear fame; John Warren, a distinguished physician, known for his Roxbury russet apple; and Joseph Story, associate justice of the United States Supreme Court and a Harvard law professor. One frequent visitor, Dr. Thomas Gray, minister of the Third Parish in Roxbury, often came for dinner following the Sunday worship service. The short distance between the church and Woodland Hill made it very convenient for Gray to visit Bussey as well as for Bussey to attend the meetinghouse.

Relatives and their families also spent many hours at Woodland Hill. They came, mostly from Boston, either by personal coach or by the public stage that had begun hourly service to Roxbury for twelve-and-a-half cents per passage. Eliza and Charles, living at 7 Summer Street, Boston, brought their daughters Judith, Eleanor, Eliza, and Maria to play in the woods and meadows.

Bussey participated in local activities and hosted visiting dignitaries when they came to town. In 1824, when the Revolutionary War hero Lafayette visited Roxbury, he joined the prominent politician H. A. S. Dearborn and Governor William Eustis in paying homage to this well-loved personage. Later, when President Andrew Jackson came to Boston, he joined in another grand procession: Vice President Martin Van Buren rode in Bussey's yellow coach drawn by a team of "six horses, richly caparisoned, and attended by liveried servants."[5]

In his seventies, Bussey placed the farming operations under the direction of his grandson-in-law, Francis Head. Comfortably settled in their mansion, the Busseys enjoyed their Peale paintings along with Gilbert Stuart's portraits of the family, the busts of John Adams, General Henry Jackson, George Washington, and one of Benjamin himself. Outdoor sculptures, Ital-

PHOTOGRAPH BY KENNETH R. ROBERTSON. ARCHIVES OF THE ARNOLD ARBORETUM

Benjamin Bussey planted this American elm (Ulmus americana) *in front of his mansion, where it remained for a century and a half, until the mid 1970s, when it became one of the last of its kind in the Arnold Arboretum to succumb to Dutch elm disease.*

ian marble statues and vases, were set along the carriage turnaround and at the mansion's entrance.

The orchards produced acceptable apricots and juicy plums and massard cherries that Bussey said were "for the birds because they took their full share." He added to the beauty of the rhododendrons, tulip trees, and lilacs with trails that wound through the woods, rude bridges that crossed Bussey Brook, and gold and siver fish that swam in a willow-bordered pond.[6] He continued building a fence of giant ashlars to encompass the entire estate. Some stones were two to three feet in length.

By 1841, when Woodland Hill had reached a pleasing maturity and had grown in size through the purchase of several additional farms, Bussey opened the gates to the public so that others

might share in the beauty of the land. In May of that year, the final codicil of his will was signed. After generously providing for his family, for three good friends, and for the Boston Female Asylum, Bussey set forth a plan to benefit his fellow man through Harvard University.

First, he directed a large portion of his estate to Harvard's schools of law and theology, the two branches of education he considered most important in advancing "the prosperity and happiness of our common country." Second, he provided for a school of agriculture and horticulture. Following the deaths of any heirs and their families, Woodland Hill and his Boston real estate were to be conveyed to the President and Fellows of Harvard College. He ordered the trustees to retain the estate and with the monies and other properties he conveyed to them to establish "a course of instruction in practical agriculture, ornamental gardening, botany, and other branches of natural science . . . to be called the Bussey Institution . . ."[7] One-half of the income from his estates and property was to be used to support the institution; the other half was for the endowment of professorships or scholarships in the law and divinity schools.

On the evening of January 13, 1842, Benjamin Bussey Esq. died at his seat in Jamaica Plain, aged eighty-five years, a distinguished merchant of Boston, manufacturer of Dedham, benefactor of New England, and master of Woodland Hill.

The deed for the Woodland Hill estate was conveyed to Harvard College by the trustees of the Bussey estate on August 28, 1861. The Bussey Institution's School of Agriculture offered a

ARCHIVES OF THE ARNOLD ARBORETUM

This Gothic Revival building housed the Bussey Institution of Harvard University beginning in 1871, as directed by Bussey's will. It was demolished after a destructive fire in 1971.

three-year program in farming, horticulture, agricultural chemistry, economic zoology, and entomology. Students were taken into the fields as an introduction to practical farming and later to the Arboretum to study and collect plant specimens. The enrollment was small and decreased even more after land-grant colleges were established. In 1908 the Bussey was reorganized as a research institution with graduate instruction only, and in 1936 its activities were integrated with the biology laboratories of Harvard and the Institution itself was closed.

In the 1870s, just after the Bussey Institution's inception, a portion of Woodland Hill was incorporated by Harvard as part of a new venture, the creation of an arboretum. The nation's first public arboretum was named, not for Bussey but for James Arnold, the New Bedford merchant who donated the funds for its development. Although Bussey's connection to the land was obscured, the Arnold Arboretum offered in great measure what he had desired—education and recreation to untold numbers of citizens who daily walk the grounds and know its beauty. Benjamin Bussey's name lives on through the remaining professorships endowed by his will, through the learning passed on by the hundreds of students of the Bussey Institution, and through the work of Harvard's Biological Laboratories.

RÁCZ & DEBRECZY. ARCHIVES OF THE ARNOLD ARBORETUM

Remnants of Bussey's outbuildings stood on Bussey Hill into the 1990s.

Endnotes

[1] "The Bussey Institution 1871–1929," William Morton Wheeler, in *The Development of Harvard University Since the Inauguration of President Eliot 1869–1929,* ed. Samuel Eliot Morison (Cambridge: Harvard University Press, 1930), p. 508.

[2] Bussey letter, Jul. 1816, Bussey Papers, Dedham Historical Society.

[3] Letters #46, Aug. 2, 1813, and #45, Aug. 13, 1816, Bussey Collection, William L. Clements Library, University of Michigan, Ann Arbor.

[4] Peale letter to Bussey, Nov. 3, 1832, Special Collections, Getty Center Institution for History of Art and the Humanities, Los Angeles, California.

[5] *Annals and Reminiscences of Jamaica Plain,* Harriet Manning Whitcomb (Cambridge, MA: Riverside Press, 1897), p. 54.

[6] Ibid., p. 53.

[7] Will of Benjamin Bussey, Norfolk County, Massachusetts, Probate Court.

Mary Jane Wilson is a Michigan native with a lifelong interest in Michigan history. Her local and state involvement includes the establishment of the Friends of the Capitol, Inc., and the Docent Guild of the Michigan Historical Center. Her writings include *"The Watch of the Capitol," "Lansing, A Look to the Past,"* and *"The Junior League of Lansing 1948–2003."*

THE FOUNDING OF THE TREE MUSEUM IN BUSSEY PARK

Jamaica Plain, Boston, Mass

Commonly Known as The Arnold Arboretum

From an Address Delivered Before The Garden Club of Alameda County
*June 11, 1922**

By Mrs. Edward Gilchrist Low

In 1842 Benjamin Bussey died at his country estate, Woodland Hill, leaving most of his property to Harvard College. His town house of Colonial type, with large gardens and stables in Summer Street, in the very centre of the city of Boston, was sold and the proceeds given to Harvard College. His widow was to continue to live at their country estate, Woodland Hill, Jamaica Plain. In 1849 the widow died. Then a grand-daughter came into possession, having life tenure of the place. Eventually the greater part of the property was to be used for a School or College, where agriculture, botany and all scientific studies pertaining thereto should be established at Woodland Hill.

This place had upon it a Mansion House, four cottages, stables, farm, barns and outbuildings. There were 360 acres. In 1815 the place had been laid out by an architect, who evidently had great artistic taste. To approach the house from the street there was a fine avenue, fairly steep in ascent, bordered on either side by white pines and horse chestnuts, and on the west side of these were cherry and mulberry trees.

The view from the Mansion House was very pleasing. To the south on the horizon line stretched the Blue Hills in Milton; in the immediate foreground was an oval of grass, decorated with marble statues and marble vases on which were carved masks; these came from Italy. Behind the house there were stone steps leading to a path winding round a hill for three quarters of a mile; it was bordered by trees—pines, beeches, wild cherry, Cercis canadensis, yellow laburnum, syringas and lilacs, and under these were many flowering plants—lilies-of-the-valley, periwinkle, Lilium flavum and others.

On the summit of the hill was an octagonal room called the Observatory, for the extended view which spread out before one's eyes—to the south the Blue Hills, the Hemlock Hill, the undulating country, pasture land, and to the east the State House and Boston Harbor. Near the house were herbaceous borders interspersed with shrubs—Magnolia, Umbrella tripetala, weeping cherry, a fine tulip tree, Liriodendron tulipifera, Narcissus poeticus, tulips, crocuses, Stars of Bethlehem, Cinnamon roses, etc.

There were vegetable and fruit gardens and a cold glass house, where large plants oleanders and other kinds, used to decorate the piazza, were wintered. The woods

ARCHIVES OF THE ARNOLD ARBORETUM

"Bussey's Woods," now known as Hemlock Hill, became a favorite site for recreation among nineteenth-century Bostonians. Century Magazine *published this view in 1892.*

were filled with wild flowers. There were picturesque stone bridges with round arches, under which the brook babbled. This was fed by a living spring, whose fresh water ran through a fish pond, where gold fish swam about, then by a narrow marble trough, down a small bank; soon it leaped over rocks and stones until, checked in its swift course by the meadowland, it meandered slowly to join the larger streams far away. There was a legend that the Indians in the early part of the eighteenth century came from afar to drink of this water, and it was always called The Indian Spring.

There were pleasure grounds, fish ponds, orchards and the wondrous Hemlock Hill, designated by Sir Joseph Hooker of Kew Gardens, England, the finest in the world.

This is a description of Woodland Hill, now known in the archives at the City Hall, Boston, as Bussey Park, in 1842, at the time of Benjamin Bussey's death.

* The typescript in its entirety is in the Archives of the Arnold Arboretum. In 1901 Mrs. Low, a great-granddaughter of Benjamin and Judith Bussey, established on her land in Groton, Massachusetts, "a college where instruction [was] given to women in Landscape Gardening, Elementary Architecture, Horticulture, Botany and allied subjects."

A Century of Breeding Bird Data—Changes Over Time at the Arnold Arboretum

Robert G. Mayer

The area that is now home to the Arnold Arboretum attracted resident and migrating birds long before it was officially established in 1872. Birds beget birders, who in turn keep records of the species that visit and nest in a given location. By 1895, when the first known report of breeding populations was compiled, the Arboretum encompassed all but fifteen of its current 265 acres. While the landscape has not changed much over the intervening century, the living collections—now comprising over 4,500 woody plant taxa—have changed dramatically. Habitats within the Arboretum's boundaries include marshland, deciduous woods, coniferous areas, streams, and three manmade ponds surrounded by lawns, providing hospitable sites for many diverse species of birds to raise their young. Lists drawn up by regular birders show that while the number of nesting species at the Arboretum has remained quite stable since 1895, many changes have occurred in the lists' components. In this article I review those changes and speculate on their causes, as well as on prospects for the future.

ROBERT G. MAYER

Yellow warbler sitting on nest in a mockorange on Bussey Hill Road.

The Listers

In 1895, *Garden and Forest* published a short article in which Charles E. Faxon documented his bird sightings in the Arboretum over a period of several years.[1] According to the article, fifty species of birds were then nesting in the Arboretum. Sixteen years later, Faxon added another five species to the list.[2]

For the better part of his career at the Arnold Arboretum (1882–1918), Faxon was in charge of the library and herbarium, but it is as a botanical illustrator that he has been remembered. His publication list approaches two thousand drawings. In a review of Charles S. Sargent's *Silva of North America,* where many of these drawings were published, naturalist John Muir declared him "the foremost botanical artist in America."[3]

Like that of many other scientists of his era, Faxon's interest in natural science was broad; he was an enthusiastic birder as well as a botanist. Recognizing the importance of the Arboretum as a birding site, he set about to "put on record a statement of the present bird population of the place" so that future observers "[could] see how many of the present feathered tenants will remain."[4] Faxon is memorialized at the Arboretum by the name of one of the three manmade ponds near the Bradley Collection of Rosaceous Plants.

Miriam E. Dickey, for many years head of the education department of the Boston Children's Museum, led bird walks in the Arboretum

nearly every Saturday for 35 years, from 1939 through 1976. In 1976 she reported in an article for *Bird Observer of New England*[5] that she and her group of regular birders had seen nearly 150 species of birds at the Arboretum, of which 45 "[had] been seen on a nest with eggs or young." Many of the observers were children from the summer day camp that Dickey ran for nearly thirty summers. Her efforts to educate children about natural science also included teaching in the Boston Public Schools and in a Massachusetts Audubon Society program for inner-city children. She remained active in both birding and teaching until her retirement in 1997 at the age of ninety and in 1998 was inducted into the Massachusetts Hall of Fame for Science Educators.

In 1971 *Arnoldia* published a report about birds nesting at the Arboretum written by Richard E. Weaver. Weaver, who played a key role in shaping the Arboretum's grounds during his thirteen-year tenure as horticultural taxonomist and assistant curator,[6] included in his article not only his own observations but a list drawn from Faxon's and Dickey's observations as well. His list totals 44 species.[7]

And finally, the last report in this overview was compiled by the writer. I have been birding at the Arnold Arboretum almost weekly for nearly five years. With the contributions of several other experienced birders, I have documented forty-six confirmed breeders and another five probable breeders during that period.[8] The combined list from these four reports is presented in the table that appears on page 14.

The Losses

As the list shows, the number of breeding species at the Arboretum has decreased somewhat over the century. Twenty-seven species that were recorded by previous observers are most likely no longer nesting on the property. Two game birds, bobwhite and ruffed grouse, may have been extirpated early on by hunting or by habitat loss; another, ring-necked pheasant, was last seen in 2000. The spotted sandpiper, black- and yellow-billed cuckoos, least flycatcher, barn swallow, and eastern bluebird have not nested there since the middle of the twentieth century, probably owing to the loss of suitable habitat and nesting sites and to a reduction in the overall population of some of these species. Seven warbler species, as well as yellow-throated vireo and veery, have stopped nesting in the Arboretum. Some of these species have experienced significant population decreases throughout Massachusetts, while others may no longer be able to find hospitable nesting sites in the increasingly urban habitat. Ground nesting species, such as bobolink and field sparrow, have lost habitat since the Arboretum staff began cutting the grass shorter at the beginning of the twentieth century; increasing numbers of dogs and walkers in the meadows may also have discouraged nesting. That bobolinks have recently begun breeding again on Peters Hill, discussed below, indicates that these trends can be reversed.

The Gains

On the positive side, seven species that did not appear on previous lists have been documented as confirmed or probable breeders at

ROBERT G. MAYER

Yellow warbler nestlings surrounded by mockorange.

List of Breeding Birds by Reporter

Species	Faxon	Dickey	Weaver	Mayer	Species	Faxon	Dickey	Weaver	Mayer
Green Heron				X	Cedar Waxwing	X	X		
Mallard		X	X	X	European Starling		X	X	X
American Black Duck		X	X		Yellow-throated Vireo	X			
Wood Duck		X			Warbling Vireo	X	X	X	X
Cooper's Hawk				X	Red-eyed Vireo	X	X	X	X
Red-tailed Hawk			X*	X	Blue-winged Warbler				X
American Kestrel			X*		Golden-winged Warbler	X			
Ring-necked Pheasant	X	X	X		Brewster's Warbler	X			
Ruffed Grouse	X				Yellow Warbler	X	X	X	X
Northern Bobwhite	X				Chestnut-sided Warbler	X			
Spotted Sandpiper	X				Black-throated Green Warbler	X	X		X*
Rock Pigeon		X	X	X	Pine Warbler				X*
Mourning Dove		X	X	X	Prairie Warbler	X	X		
Yellow-billed Cuckoo	X				Black-and-white Warbler	X			
Black-billed Cuckoo	X				American Redstart	X			
Eastern Screech-Owl	X	X		X	Ovenbird	X	X	X	X*
Great Horned Owl			X*	X	Common Yellowthroat	X	X	X	X
Chimney Swift	X	X	X	X*	Yellow-breasted Chat	X			
Ruby-throated Hummingbird	X				Scarlet Tanager	X	X	X	
Downy Woodpecker	X	X	X	X	Northern Cardinal		X	X	X
Northern Flicker	X	X	X	X	Rose-breasted Grosbeak	X	X	X*	X*
Eastern Wood-Pewee	X			X*	Indigo Bunting	X	X	X	X
Least Flycatcher	X				Rufous-sided Towhee	X	X	X	X
Eastern Phoebe	X	X	X	X	Chipping Sparrow	X	X	X	X
Great Crested Flycatcher		X	X*	X	Field Sparrow	X			
Eastern Kingbird	X	X	X	X	Vesper Sparrow	X			
Barn Swallow	X				Song Sparrow	X	X	X	X
Blue Jay	X	X	X	X	Bobolink	X			X
American Crow	X	X	X	X	Red-winged Blackbird	X	X	X	X
Black-capped Chickadee	X	X	X	X	Common Grackle		X	X	X
Tufted Titmouse				X	Brown-headed Cowbird	X	X	X	X
White-breasted Nuthatch		X	X	X	Orchard Oriole				X
Carolina Wren	X			X	Baltimore Oriole	X	X	X	X
House Wren		X	X*	X	Purple Finch	X		X	
Eastern Bluebird	X				House Finch				X
Veery	X				American Goldfinch	X	X	X	X
Wood Thrush	X	X	X	X	House Sparrow		X	X	X
American Robin	X	X	X	X					
Gray Catbird	X	X	X	X		55	45	44	51
Northern Mockingbird		X	X	X					
Brown Thrasher	X	X	X	X	* = probable breeder				

the Arboretum in recent years. Nesting green herons have been seen several times near the ponds, most recently in 2003. A pair of Cooper's hawks was seen together in the Hemlock Hill area throughout the summer of 2004, and later with a juvenile. Some birders speculate that the woolly adelgid infestation may have indirectly encouraged the hawks to breed at the Arboretum by decreasing the density of the hemlock stand; the species' overall population increase in Massachusetts may also account for this new record. Tufted titmouse, another recent addition to the list, has become a common nester in the state as it extends its range northward.

In 2003 a pair of blue-winged warblers nested in a shrub in the Bradley Garden, but we don't know whether their young fledged and they have not been found nesting again. Pine warbler has shown a trend toward nesting in both coastal and interior areas of Massachusetts; in the Arboretum they are probable nesters in the conifer collection as well as in the pines on Peters Hill. An orchard oriole nest was discovered in June 2004 in a stewartia next to the wet meadow near the main entrance. The same pair of birds, or another pair, returned in 2005 to nest in a katsura less than 15 feet away. Orchard orioles had been sighted in late May several years earlier, suggesting that nesting may have occurred even before 2004. Finally, house finches have replaced purple finches as nesters in the Bradley Collection, as they have throughout much of the eastern United States.

Other species now missing although present on previous lists may simply have been overlooked in the surveys of the last five years. In this category are cedar waxwing and scarlet tanager, both of them likely species for breeding in the Arboretum. Red-bellied woodpecker, known to nest in nearby Franklin Park, and willow flycatcher, which is heard increasingly late into the spring, especially in the new Stony Brook Marsh section of the Arboretum, are both good candidates for turning up in surveys within the next decade.

An Exciting Case History: Bobolinks

In late May of 2005, a flock of forty or more migrant bobolinks was seen on the grassy slopes of Peters Hill, considerably more than usual for that area. Hoping to encourage the birds to nest, the Arboretum staff stopped mowing in that area and posted signs urging dog walkers to avoid the tall grass and keep their dogs leashed. The effort was rewarded: by mid June at least one pair of bobolinks had nested near the top of the hill. The pair was later observed bringing food to hatchlings and there was evidence that young birds had crawled out of the nest, but no confirmed sightings of fledglings were reported, perhaps because the intense heat wave in late June led to the hatchlings' demise. Nonetheless there is hope that continued protection and delayed mowing will attract more nesters next year and that bobolink breeding will be firmly reestablished in the Arboretum after more than a century.

Endnotes

[1] C. E. Faxon, "Birds of the Arnold Arboretum," *Garden and Forest* (July 1895) 8(387): 292–93.

[2] — — — "Birds in the Arboretum," *A Guide to the Arnold Arboretum,* 1911: 31–33.

[3] John Muir, "Sargent's Silva," *Atlantic Monthly,* July 1903.

[4] Faxon, "Birds of the Arnold Arboretum."

[5] Miriam E. Dickey, "The Arnold Arboretum as a Birding Area," *Bird Observer of Eastern Massachusetts* (Jan-Feb 1976) 4(1): 4–7.

[6] R. E. Weaver, "Birds in the Arnold Arboretum," *Arnoldia* (Nov 1971) 31(6): 349–365.

[7] Papers of Richard E. Weaver, Jr., 1970–1983, Archives of the Arnold Arboretum, Jamaica Plain.

[8] Using the definition of "probable" applied in the *Massachusetts Breeding Bird Atlas,* which includes (1) singing male present or mating calls heard on more than one date in same place; (2) a bird or pair of birds apparently holding territory or visiting probable nest site; (3) courtship and display or aggressive behavior or anxiety calls from adults, suggesting probable presence of nest or young nearby; (4) nest building by some wren and woodpecker males, birds known to build multiple nests in a flurry of eager optimism, which is sometimes entirely unwarranted.

Robert Mayer has been birding, photographing, and volunteering as a docent and field study guide for five years at the Arnold Arboretum.

The (un)Natural and Cultural History of Korean Goldenrain Tree

Michael S. Dosmann, Thomas H. Whitlow, and Kang Ho-Duck

The midsummer floral and autumnal fruit displays of goldenrain tree, *Koelreuteria paniculata,* have caught the eye of Western botanists and gardeners alike since 1747, when Pierre d'Incarville, a Jesuit priest, introduced the species to Europe from northern China. By 1763, this charming tree was being grown in the Jardin du Roi in Paris, and in 1809 it made its first known appearance in the United States when Thomas Jefferson received a shipment of seeds from Madame de Tessé, a French aristocrat and fellow botany lover with whom he often traded plants. It has since become a popular garden ornamental and is much appreciated for its tolerance of urban conditions.

Goldenrain tree's Chinese distribution lies in the eastern half of temperate China, extending from Sichuan Province northeast to Liaoning Province, where it is frequently found growing in dry streambeds and valleys. About a dozen separate populations have been discovered on

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Goldenrain trees in bloom above their namesake restaurant—Mogamchoonamu—in Balsan 1-Ri, a fishing village near Pohang on the eastern coast of the Korean peninsula.

the Korean peninsula as well as in Honshu, Japan. Several theories about the origin of these populations have been proposed. The close proximity of most populations to the Yellow Sea suggests a likely route for Chinese propagules dispersed by water, man, or some combination of the two. In his 1976 monograph of the genus, Frederick Meyer of the U.S. National Arboretum states convincingly that the species' appearance outside of China was due solely to man.[1] The species was not encountered during Japanese botanist Takenoshin Nakai's thorough survey of the Korean peninsula (1915–1936).[2] However, we cannot assume they were not present at the time, as the small, isolated populations could easily have been overlooked. Contrary to the view that the species was introduced from China, the recent discovery of several inland populations has led to speculation by some that it was once naturally widespread throughout the Korean peninsula and that only a few remnant populations remain.[3]

Red dots mark the five Koelreuteria paniculata *populations the authors visited in South Korea. Locations, counterclockwise from top left: Anheung, Anmyondo, Wando, Pohang, and Woraksan.*

The cultural significance of goldenrain tree in Asia lends support to the argument for human-mediated origins. Chow noted that in China it was common around temples, palaces, and gardens and was used to mark the tombs of important officials.[4] Likewise in Japan, the use of goldenrain tree is linked to religious practices. An early researcher posited that it may have first appeared in a Buddhist monastery in Kyoto around 1220 AD, grown from seeds brought from China.[5] Ohwi, a prominent Japanese botanist of the twentieth century, also believed in the Buddhist connection, pointing out that the species had naturalized near temples along the shoreline.[6] (Buddhism arrived in Japan in the mid sixth century, most likely by way of Korea, where it can be traced back to the mid-to-late fourth century.) In Korea, the species has been preserved in local forests by villagers for use in shelterbelt plantings to protect homesteads from salt spray.[7]

Their origin is not the only aspect of the Japanese and Korean populations that has puzzled botanists. Their ability to survive the stressful conditions at the ocean's edge has also been of interest. In 1979 the Morris Arboretum's Paul Meyer collected from trees in Paengnipo (also known as Panjikol) on the west coast of South Korea. He described the population as "a dense scrubby thicket with few plants reaching more than two meters, the plants growing on sand dunes, just above the high tide level."[8] He depicted the site as "exposed to periods of sea water inundation, wind, drought and salt spray." Their unusual character also prompted collection by Arnold Arboretum botanists Richard Weaver and Stephen Spongberg in 1977.[9]

Recent studies of Korean populations, most of which now have government protection because of their biological and cultural significance, have found high genetic differences among populations but low levels of genetic diversity within them, suggesting local inbreeding and little gene flow between populations.[10] To date, however, the comprehensive phylogenetic study that would be required to establish the relationships of all the Korean populations—as well as those of China and Japan—has not been undertaken.

The first sighting of goldenrain trees was outside several marina buildings on the island of Anheung.

The Urban Horticulture Institute (UHI) at Cornell University has been studying the goldenrain tree for several years, in particular because of its tolerance of the stresses of urban landscapes. The UHI staff has assembled a diverse germplasm repository of living plants from Asia as well as from Western gardens, and has been conducting experiments in the field, greenhouse, and laboratory to better understand the species' natural variation and its physiological response to varying environments. Asia's coastal populations have been targeted to test hypotheses related to microevolution and adaptation to salt spray. However, results of *ex situ* experiments, no matter how compelling, are best viewed in light of the plant's natural habitat. Therefore, during the summer of 2004 the three authors visited five populations of goldenrain tree in South Korea, one inland and four along the coast. In addition to describing the sites and the condition of the trees, we collected tissue for future molecular analyses, measured photosynthesis to assess plant performance using a portable gas-exchange system (LiCor 6400), and, when possible, interviewed local people.

Anheung

Michael and Tom arrived in South Korea on the evening of June 14, 2004, and met Kang the following morning. During the ninety-minute drive to Seoul, we discussed woody plants of mutual interest—in particular, mogamchoon-amu (the goldenrain tree). Once at Dongguk University, we toured Kang's laboratory, readied our expedition supplies, and met his graduate

students, including Kim Tae-Young, who joined us on our trip.

The next morning, we left for the province of Chungchan Namdo, west-southwest of Seoul. In the small town of Mollipo[11] we joined Chang Kyon-Wan, chief of the western branch of the Korea Forest Research Institute (KFRI). We had intended to visit the nearby population at Paengnipo but learned that it had recently been destroyed for resort construction. (Government protection is at times more theoretical than real.) Mr. Chang recommended that we instead visit another population in the region, near the island fishing village of Anheung. None of us had heard of this population, but we eagerly hopped in our car and headed south, following Mr. Chang to our destination. Upon arrival, our guide provided us with a general lay of the land, told us where to find our target species, and then had to depart. A view with binoculars of a distant wooded hill revealed trees with pinnately compound leaves. But after rushing over we identified it as *Platycarya strobilacea,* of the walnut family, a common species in the region. This was only after discovering its strobiles, peculiar dried, five-centimeter (cm)-long, cone-like fruits. We also saw a great deal of *Pinus densiflora* (Japanese red pine) and of shrubs such as *Rhus chinensis* (Chinese sumac) and an Asian species of spicebush, *Lindera obtusiloba*—but no goldenrain trees.

A bit disgruntled, we made our way along a bumpy dirt road to the very tip of the island where we had our first sighting: two multistemmed trees growing among fishnets, traps, and a rubbish heap outside a boat rental business. They stood 4 to 5 meters (m) tall and had a dense canopy of conspicuously cupped leaves, a response to salt-spray stress. With rising spirits we followed the road a kilometer (km) up and over a final hill, past a copse of *Pinus densiflora* to the ocean's edge, where we found the actual population. We had no trouble identifying the species, for not only were the trees protected by a chainlink fence 1.5 m high, but little yellow signs labeled *"Koelreuteria paniculata"* hung from nearly every tree. Such is the nature of plant exploration in the twenty-first century.

Despite being protected, the population had not been mentioned in any previous reports, so it was important that we census the site in the few hours remaining before dusk. The trees were growing 8 to 10 m from the harbor's edge, covering about half a hectare (ha). Goldenrain tree was the dominant species, with a few small *Platycarya strobilacea, Rhus chinensis, Elaeagnus macrophylla,* harlequin glorybower *(Clerodendrum trichotomum),* and the viney *Hedera rhombea* mixed in. We counted 25 adult goldenrain trees ranging from 3 to 4 m in height but no juveniles despite evidence of fruiting the previous year. There were both single- and multistemmed trees; most were growing upright although on the stand's windward edge we found a few prostrate individuals. To describe the trees as vigorous would be an overstatement: There was widespread evidence of salt injury on the leaves, including leaf-rolling (cupping) and surface puckering. Over time, leaves exposed to salt can become chlorotic (yellowed) or even die, and we saw both. We also found misshapen branches that had shortened internodes (spaces between leaves), resulting in leaves growing abnormally close together. This, when accompanied by a windswept form, is the syndrome referred to as elfinwood, which is akin to the krumholz commonly seen in conifers at high altitudes.

At this site as elsewhere, we recorded height and stem diameter and attempted to estimate the age of the trees through increment coring. The largest diameter at breast height (dbh) was 34.5 cm and we ascertained that this stem was 72 years old. Quite a few of the multistemmed trees were noticeably larger at the base; coring one tree's base and largest stem yielded 84 and 38 annual rings, respectively. Most of the trees were similar in size and habit, suggesting an even-aged stand that may have had most of its stems cleared several decades ago. The substrate, unexpectedly, consisted mainly of cobblestones, perhaps ship bilge or dredge spoil from the nearby harbor.

The next morning we made our way to the nearby Chollipo Arboretum. This famous plant collection, situated among the coves at the ocean's edge, was founded by the late Carl Ferris Miller in the early 1970s and is at the top of the must-see list for any connoisseur of woody plants.[12] Chong Mun-Yong, the hor-

ticultural director, gave us a warm welcome and a complete tour, despite the torrential rain that marked the beginning of the monsoon season. The collections of magnolias and hollies were impressive, and the heady aroma from the blooming chinaberry *(Melia azederach)* was nearly overpowering. We also saw a number of goldenrain trees that had been collected from the now extirpated Paengnipo site; had it not been for Mr. Miller's efforts, it is doubtful that germplasm from this population would still exist. At the end of our visit, when Mr. Chong invited us to sign the institution's visitors' book, Michael and Tom laughed at how small the botanical world was—just two days before, the Arnold Arboretum's Peter Del Tredici had signed the book during his visit.

Anmyondo

Our next destination was a site near the seaside resorts of Bangpo Beach and Bangpo Harbor, on the western edge of Anmyondo, an island in the Yellow Sea to the south of the Taean Peninsula. After arriving on the afternoon of June 16 and dropping our things at the hotel, we decided to explore the area while there was still daylight. To aid in our search for the goldenrain trees, we had brought photographs taken by Paul Meyer during his 1984 visit. They showed a remote population of several hundred windswept trees at the ocean's edge, with a steep hill in the background.

Not five minutes after we set off on foot along the high-tide line from Bangpo Beach south toward Bangpo Harbor, we were surprised to stumble upon a cluster of scrubby *Koelreuteria paniculata* scattered across the base of a hill—but it was clearly not the population shown in Meyer's photos. This group consisted of about 20 small trees, all less than 2 m tall. Leaf injury from salt spray was more severe than at Anheung, but it was largely confined to the outermost leaves, and a recent second flush had produced substantial new growth. We found a motley assortment of other species growing here, including the vines *Pueraria lobata* (kudzu, the "vine that ate the South"), *Lonicera japonica* (Japanese honeysuckle), and shrubs such as *Ligustrum obtusifolium* (border privet), *Eleaegnus macrophylla,* and a shrubby member of the linden family, *Grewia biloba* var. *parviflora.* While all showed some salt damage, their growth seemed only marginally compromised. The most common symptom among these species, in addition to leaf yellowing, was succulence: many leaves become thicker when exposed to salt spray. (The *Grewia* were particularly resilient.) The substrate along the tidal marks was the same as at Anheung: large cobblestones. These stones had clearly washed ashore from the ocean, prompting us to reconsider our earlier hypothesis that the Anheung population was growing on dredge spoil or ballast rather than on naturally deposited stones.

Farther down the beach, we got our first view of Bangpo Harbor and our original target population. The site looked very different from the 1984 photos. The beach and high-tide mark, just a few meters from the population's edge in 1984, were now 75 to 100 meters away. Between the trees and the sea, parking lots, boardwalks, hotels, and restaurants had been built to accommodate the flourishing tourist and fishing industries. The goldenrain trees, covering nearly a hectare (1.47 acres), were surrounded by a formidable 1.5-m-tall wrought-iron fence painted grass green. Two large interpretive signs, in both Korean and English, described the species and the population's designation in 1962 as a monument (number 138). We laughed at our achievement in finding such an isolated population; a glowing neon sign would not have made it more obvious.

Unlike the Anheung population, this one was actively managed by local authorities. All understory vegetation had been removed and many of the trees were propped up with metal braces and cables to force upright growth. All of this had been done since 1984, when few trees were taller than 3 m; they now generally ranged between 5 and 7 m in height. Their growth and increased vigor probably resulted from the decline of salt spray over the past two decades: a breakwater now lessens the intensity of wave action, the waves themselves are farther away, and in some parts of the site, buildings now block spray completely.

We were assisted over the next few days by Kang's colleague Woo Su-Young, a professor in the Department of Environmental Horticul-

PAUL MEYER

The western edge of the Bangpo Harbor goldenrain tree population on Anmyondo as it appeared in 1984, above, and in 2004, below.

ture, University of Seoul. We had intended to measure foliar salt deposition, but recent rains had washed all the salt from the leaves. However, especially on the farthest windward canopy edges, leaf damage from earlier exposure was substantial, mostly limited to cupping/rolling and puckered (bullate) surfaces, which allowed us to assess the stress. Some leaves had been killed, but in many of these cases new growth was emerging from buds lower on the branch. We also found that looks can be deceiving, as gas-exchange measurements on mature leaves—even those with significant injury—had moderate to high photosynthetic rates.

Stem size was fairly uniform throughout, though the trees on the farthest windward edge were smaller. The stand's basal area, which is an estimate of the total cross-sectional area of all trees in the stand (here only goldenrain tree), was 14.2 m^2/ha. While we do not know what the basal area had been in previous years, we could compare dbh values. Mean dbh was nearly twice that reported by Lee *et al.* in 1997, supporting our view that the trees had grown significantly as the amount of salt spray had declined recently. Most of the trees had multiple stems that separated 20 to 30 cm above the base, and the mean basal diameter was 21.8 cm. We tried to age individuals by coring stems and bases but found internal rot in most trees beyond 25 to 30 annual rings. Despite finding copious seeds from the previous year, we found no evidence of seedling recruitment, which could be the result of poor germination and/or the removal of juveniles during clearing. This failure of seedlings to regenerate, particularly if over a prolonged period of time, constrains a population's ability to survive.

Despite this lack of sexual reproduction, we found conclusive evidence of clonal regeneration. One rainy afternoon, as we cored the base of a multistemmed tree, we removed a bit of soil from around the base and saw what appeared to be a horizontal stem leading away from it. With trowels, penknives, and fingers, we carefully excavated the sandy loam from the stem and at its end, 1.2 m away from the trunk, we found another, slightly smaller tree. Curious to explore the network further, we excavated the opposite side of the original tree and found another lateral stem, this one leading to a prostrate individual. Two other trees within 2 m of the original stem also turned out to be vegetative clones. In response to disturbance and other stressors, many temperate trees form basal sprouts.[13] To our knowledge, this is the first documented observation of stem or root suckering in *Koelreuteria paniculata.* In light of the stand's poor sexual reproduction, clonal reproduction would seem to play a critical role in its persistence and might also explain the low levels of within-population genetic diversity reported in earlier studies of coastal populations.

At the population on Anmyondo, we discovered that goldenrain tree can vegetatively reproduce from stem and root suckers.

Soil cores taken near the central stem showed a marked difference between the windward and leeward sides of the clump. The leeward side was topped by an organic layer at least 6 to 8 cm thick, whereas the windward side had a very shallow organic layer, typically of less than 2 cm. This kind of soil profile is similar to that of dune-forming

species whose networks of roots and stems capture organic matter, often their own fallen leaves. Nearer the ocean's edge of the stand, we found that soil had lower organic matter and was coarser, in many cases comprising stones similar to those we had observed at other sites.

We had wonderful meals at the Marine Motel, just a stone's throw from the goldenrain tree population. One evening, after sampling a fruity North Korean alcohol made from bilberry *(Vaccinium uliginosum),* we interviewed the proprietress, Mrs. Choi. Her family had lived at Bangpo Harbor for many generations, and she considered herself the trees' caretaker, much to the chagrin of the local authorities. She told us that the population had been there for as long as her family could recall, at least 150 years. When her grandfather was a boy, it had been much larger and was managed by the family as a windbreak to protect the homestead and garden from salt spray. She was quick to point out that it was not until the population was designated a cultural landmark in the 1960s that it shrank in size and became a monoculture. We asked about the goldenrain trees' origin, but she had no answer beyond the traditional local explanation—that the trees came from China—and had no idea of whether they had been deliberately planted or had grown from seed that floated across the sea.

A large flowering goldenrain tree growing near the fishing hamlet of Kalmun-ri, Wando. During our visit, only about half of the population had been protected by a fence; the remaining areas were used by local fisherman to store floats and nets.

Wando

The island of Wando is positioned off the south-southwest edge of the Korean peninsula and is home to an array of warm-temperate woody species such as *Camellia japonica, Actinodaphne lancifolia,* an evergreen member of the laurel family, and *Cinnamomum japonicum,* sometimes called the Japanese camphor tree. On the morning of June 21 we met Oh Chan-Jin of the Wando Arboretum, which has been coordinating goldenrain tree preservation efforts at a site near Kalmun-ri. He described the population there as the healthiest he had seen in Korea, attributing the trees' vigor to the microclimate of the site: it is on the island's northwest side, separated from the mainland by only 2.5 km and therefore protected from harsh winds off the ocean. The population came under government protection as recently as 2002 (monument number 428), and at the time of our visit only half of the area had been fenced in.

After our chat with Mr. Oh, we drove the short distance to the hamlet of Kalmun-ri, where the woods spanned several hectares along nearly a kilometer of shoreline, with most of the *Koelreuteria* in a strip running about half that distance. At the high-tide mark, a 1.5-m-high stone retaining wall had been erected along much of the site's length. Jutting from the wall was a 50-m quay, to which several boats were moored and where local fishermen unloaded their daily catches.

There was much greater species diversity here than at the previous sites, which were essentially monocultures. Bigleaf dogwoods *(Cornus macrophylla)* were in full bloom, the largest any of us had seen (several over 50 cm in dbh and

Summary of Populations Visited and Primary Sampling Data

Location and description	Latitude (N)	Longitude (E)	Number of individuals	Average dbh (cm)	Largest dbh (cm)	Oldest stem	Average height (m)
Anheung, protected population near harbor	36° 40.922'	126° 07.190'	25	12.8	34.5	86	3.5
Anmyondo, small feral population near Bangpo Beach	36° 30.423'	126° 20.0'	15 to 20	—	—	—	1.5
Anmyondo, protected population at Bangpo Harbor	36° 30.275'	126° 20.124'	ca. 375	12.4	20.6	36[a]	6
Wando, protected population at Kalmun-ri	34° 21.864′	126° 38.507'	ca. 800	18.7	46.7	53[a]	8
Pohang, westernmost edge of population near Mason-Ri	36° 0.824'	129° 28.723'	—[b]	11.5	18.4	29[a]	6
Pohang, site near Balsan 1-Ri	36° 1.614'	129° 30.157'	—[b]	19.6	32.4	45[a]	10
Pohang, easternmost edge of population near Tae Bo 1-Ri	36° 4.543'	129° 32.721'	—[b]	8.6	14.6	—	2.5
Worakson, population near Podogam hermitage	36° 54.026'	128° 5.405'	36	13.2	24.3	27[a]	8.5
Worakson, population on Joonbong Valley Ridge	36° 53.431'	128° 5.316'	20 to 25[c]	11.8	12.8	21	5
Worakson, population in Joonbong Valley	36° 53.360'	128° 5.314'	300<	20.3	35.5	—	8.5

[a] rotting of internal core limited age estimation
[b] continuous population comprising 1000s of trees
[c] mostly juveniles

10 m tall), their scaly, alligator-like bark and canopies of creamy white flowers prominent everywhere. *Acer pseudosieboldianum* (Korean maple) were also very large, one measuring 44 cm in diameter. Also present in large numbers were Korean plum yew *(Cephalotaxus koreana),* Chinese quince *(Pseudocydonia sinensis),* and Chinese hackberry *(Celtis sinensis).* The multi-stemmed Korean hornbeam *(Carpinus coreana* var. *major)* were particularly striking with their glossy, fluted, muscular bark frequently covered with moss and lichen. (This species has significant ornamental potential but is rarely seen in cultivation.) The understory in these woods was also rich, with an assortment of species including *Cinnamomum japonicum, Eleaegnus macrophylla, Grewia biloba* var. *parviflora,* and juveniles of *Cudrania tricuspidata,* a relative of the North American osage orange.

We concentrated most of our sampling efforts in a part of the fenced section that had not been cleared or otherwise recently disturbed. Mean basal area values for two parallel transects, 5 and 20 m from the beach, were 28.7 and 21.8 m^2/ha, respectively. These values, when compared to those from the Anmyondo site, illustrate the greater volume in the Wando stand. The dominance of *Koelreuteria* in the shoreline transect was easily apparent: this species' mean basal area was 15.5 m^2/ha at the edge and 1.7 m^2/ha deeper into the stand. Compared to other tree species present, goldenrain tree was the greatest in relative density (42 percent) and frequency (27 percent). Overall, the goldenrain trees here were larger than those at previous sites, some exceeding 10 m in height. Once again, we saw evidence of clonal regeneration, but we also found considerable seedling regeneration. As

at the other sites, recent rains prevented us from quantifying salt deposition on leaves, but even on robust trees we found clear evidence of salt-spray injury, mostly cupping with a minor amount of necrosis and defoliation. As might be expected, the damage was most evident where exposure was greatest, on the outer edge of the canopy and on trees nearest the ocean. Surprisingly, even the injured leaves showed moderate-to-high photosynthetic rates.

An interpretive sign near the entrance to the site described in both Korean and English the special nature of *Koelreuteria paniculata,* noting that their seeds had once been used to make rosaries. Our queries of local residents produced answers similar to those of Mrs. Choi in Anmyondo: the stand had been there for generations, likely planted as a windbreak centuries ago.

Pohang

On June 23, we left Wando driving east along the peninsula's southern coast, then north to the industrial city of Pohang, on the east coast. It was just beyond the city, at the edge of Yongil Bay and facing the open ocean, that we found the next population. We knew very little about this site and no local authorities were scheduled to meet and guide us. Instead, we relied on a set of GPS coordinates. After a few wrong turns we found ourselves on a narrow, twisting road that wound through small fishing villages along the rocky coastline. About 3 km from our target coordinates, we saw the first *Koelreuteria,* in dramatic full flower. The trees dotted the landscape for a stretch of about 10 km, between the village of Mason-Ri eastward to Tae Bo 1-Ri. In some areas, steep hillsides were blanketed with large, healthy trees in full

From left, Kim-Tae Young, Ho-Duck Kang, and Michael Dosmann conduct a vegetation survey on Wando. Kang is measuring the diameter at breast height of a Cornus macrophylla.

Goldenrain trees in full flower growing above the ocean near Mason-Ri, outside Pohang on the east coast of the Korean peninsula.

flower; in others the trees were stunted, flowerless, and almost completely defoliated. We were surprised to see a number of recent roadside plantings, not just single rows, but groves of trees planted by the dozen. We hoped that the trees had come from a local source so that the local wild population would not be threatened by genetic contamination.

A wet, gusty typhoon limited our activities over the next few days. The gas-exchange system does not work well in a downpour, and the steep and rocky slopes would have been difficult to traverse even in the driest of weather. We spent most of our time delimiting the boundaries of the population and taking samples for future genetic analysis. Trees at this site grew both on the shore—or, rather, on the cliffs above it—as well as up to a kilometer inland, in valleys protected from the marine environment. In these valleys we found many trees exceeding 12 m in height and 30 cm in dbh—by far the largest we had seen so far and all in full bloom. By contrast, near Tae Bo 1-Ri, where the ocean spray was greatest, we found fewer than 20 windswept trees, all stunted, none more than 3 m tall and 15 cm in dbh, and all lacking flowers as well as most of their leaves—good examples of elfinwood.

In Balsan 1-Ri, one of the fishing villages that lay along the road beneath the steep slopes, we stopped at a restaurant named Mogamchoon-amu, after the goldenrain tree. Beaming with pride at our interest in the trees, the owner told us the same thing we had heard elsewhere: she did not know their origin but it was common knowledge that they had been there longer than anybody could remember.

Although some trees were being lost as hillsides crumbled under the pressure of increased development, the Pohang population was large

and thriving compared to those we had previously visited and appeared to be confronting fewer threats from either nature or humans. Whereas elsewhere the trees grew in small patches at the very edge of the beach, here they spread from shoreline to inland valleys. Another difference was that many of the trees here grew atop crags and rocky outcroppings, high above the surf where they were not likely to have been planted to protect homes and gardens. In fact, as we gazed at these trees, glowing golden even in the rain and mist, we wondered if they had been planted at all.

Woraksan

With its mixture of coastal and inland environs, Pohang was a perfect transition to our final destination: Woraksan, the 1,093-m-high mountain located in central South Korea. On June 25, as we headed west through spectacularly beautiful mountains, the fishing villages soon gave way to agriculture. Woraksan ("Moon Crags Mountain") lies within a national park that encompasses temples, stone Buddha statues, and a fortress dating from at least the seventh century.

Koelreuteria grows in two areas on the mountain, one near the Buddhist hermitage of Podogam and the other in Joonbong Valley, several kilometers away. Getting to Podogam required a treacherous drive up a rugged road followed by a hike up the steep trail that leads to the mountain's peak. The hermitage, perched on one of the mountain's western ridges at about 400 m, comprised a temple, two lodges for visitors, and several small outbuildings. The site's rich history includes an account from the Unified Shilla Dynasty (668 to 918 AD) of an exiled emperor's son who took refuge in the adjacent Wang Li Cavern.

We found 36 mature trees here, mostly along the crest of the ridge. Like the trees on Yongil Bay, they grew on steep, rugged terrain, with many sprouting from cracks in the cliffs and between large rocks. They were smaller in girth than the trees at Pohang and Wando yet far more upright, likely the combined result of competition for light and absence of salt spray and wind. A precipice above the upper canopy of one of the larger trees allowed us to measure its photosynthetic rates. From this perch we got not just vertigo but also a good view of the early flowering in the trees below; we estimated that they were about a week behind those in Pohang.

The flora at this site included many species we had not seen on the coasts. We counted many Amur maples *(Acer tataricum* ssp. *ginnala),* kousa dogwoods, and a few large, flowering *Tetradium danielli* (a close relative of the Amur cork tree, *Phellodendron amurense*) and *Ailanthus altissima* (tree of heaven). The rich shrub layer contained such familiar garden taxa as Korean boxwood, spireas, *Euonymous alatus* (burning bush), and *Philadelphus* (mockorange). There were also vines such as *Parthenocissus tricuspidata* (Boston ivy), *Akebia quinata,* and the ever-present kudzu.

In the hot afternoon sun, we took a break from measurements and enjoyed a cold watermelon with the monk, Sung Kwan. He began our discussion with a synopsis of the web of all living things: plants, insects, a nearby family of black-and-white rabbits, ourselves. We hoped that our questions about goldenrain trees would elicit local legends, but instead he matter-of-factly told us that they were obviously natural elements of the mountain. When we probed further, he said that he found the trees unattractive and of so little value that he could see no reason anybody would have introduced them. He was also certain that the seeds were far too small to make Buddhist rosaries, contrary to what we had read earlier. Certainly not the responses we had anticipated.

After our chat, he led us down the path through the *Koelreuteria* grove to the Wang Li Cavern, the site of a Buddhist shrine and a spring. Directly in front of the cavern was a pool of water spanned by a rustic wooden bridge and surrounded by a dense colony of *Artemisia vulgaris* (mugwort). On the right side of the cave's mouth stood a *Taxus cuspidata* (Japanese yew) and on the left, a goldenrain tree. Suspended from a branch of the latter was a small brass bell that jingled in the breeze, adding to the atmosphere created by the spectacular valley view and the strong smell of camphor from the mugwort. The human footprint on this mountain stretches at least back to the Goryeo

Dynasty (57 BC to 668 AD), when the nearby Dongmun fortress was built, and contrary to the monk's assertion we were quite sure that at some time in that long history *Koelreuteria* was introduced at Woraksan.

We spent the next day, our last on the mountain, investigating a population of goldenrain trees in the nearby Joonbong Valley. In an earlier report[14] Son numbered this population in the hundreds, but after an arduous hike we found only about 25 individuals in an isolated patch on a ridge at 395 m. Most were juveniles; only a few of the larger trees had flowers. Certain that this could not be the population mentioned by Son, we spent several more hours exploring the area but failed to find more *Koelreuteria,* and we headed back down the mountain at dusk.

Before leaving for Seoul the next morning (June 28), we returned to the valley for a quick examination of a streambed to the south of the ridge where we had found the small population the day before. Almost immediately, we found hundreds of *Koelreuteria* lining the very edges of the rocky waterway. Many were exceptionally large, a few exceeding 15 m in height and 35 cm in dbh. Nearly all were multistemmed, and again we saw evidence of basal sprouting following disturbance, in this case subsidence of the unstable banks. In fact, we saw very large trees, some still alive, that had been uprooted and washed downstream. Water, wind, and gravity are known dispersal agents for the marble-like goldenrain tree seeds; here we saw that entire trees, not just seeds, could be dispersed by flowing water. Although we

Tom Whitlow uses the LiCor 6400 to measure photosynthesis on a tree growing near the Buddhist hermitage at Podogam on Woraksan. The real-time photosynthetic rate (expressed as the rate of CO_2) is determined after inserting a leaf in the unit's cuvette, seen attached to a tripod on the righthand side of the image.

never determined the entire size of this population, we were confident that it continued for a considerable distance toward the crest of Woraksan.

On June 30, we visited the Korea National Arboretum, about an hour's drive north of Seoul. After a wonderful tour of the grounds, we met with several KFRI research scientists who were familiar with *Koelreuteria paniculata*. We were surprised to learn from Kim Sung-Sik that two bird species, the brown-eared bulbul *(Hypsipetes amaurotis)* and the rufus turtledove *(Streptopelia orientalis)*, have occasionally been observed foraging in the Arboretum's goldenrain trees. Rather than eat the seeds, the birds usually drop them short distances away. None of the literature on goldenrain tree mentions seed dispersal by birds, but this behavior could explain the presence of populations on the high cliffs of Pohang and on the isolated ridge at Woraksan, making birds yet another dispersal vector in addition to wind, water, gravity, and people.

A goldenrain tree stood at the mouth of the Wang Li Cavern, near Podogam, the Buddhist hermitage on Woraksan.

Our first goal when we embarked on this tour had been to study the Korean goldenrain trees in their natural (or unnatural) environs. We were expecting to find uncultivated populations regenerating on their own and blending with other natural elements of the landscape. At two locations, Pohang and Woraksan, this is exactly what we found. We were not expecting the heavy human influences we found at Anheung, Anmyondo, and Wando, however, where the populations resembled plantations not long out of management. Nevertheless, we concluded that all the sites we visited reflected the essential nature of *Koelreuteria* in Korea: all are components of cultural landscapes that are intertwined with local traditions ranging from Buddhism to coastal homesteading. And we believe that each population, whatever its origin, now represents a unique cultural landrace that should be preserved, just as we preserve landraces of crop plants.

The second reason for our trip was to learn how goldenrain tree responds to a coastal environment where it must cope with the stresses of salt-spray and other disturbances. The intense monsoon rains we encountered on many days actually provided valuable insights in this regard. As tender leaves emerge in spring, they become stressed from the constant salt spray. This progresses from chlorosis and cupping to death in severe cases, particularly in leaves at the windward edges of the canopy. When these early leaves are damaged, as we observed during our visit, a second set of buds below them is released from dormancy and a new flush occurs with the onset of the monsoon season, producing leaves that are likely to last through the rest of the summer. Although salt is no doubt deposited on the new leaves, the frequent rains rinse much of it away, a process likely facilitated by the curling of the leaves. And, we learned that despite visible signs of salt injury, leaves could still photosynthesize at moderate to high rates. Stem- and root-suckering, a strategy for mitigating the effects of stress and disturbance, help the trees survive

in these sites and may explain the low levels of within-population genetic variation reported in earlier studies. The combination of all these factors may be the source of the species' survivability at these coastal sites.

Regardless of how *Koelreuteria paniculata* arrived on the Korean peninsula, the trees are entrenched in local custom and deserve to be preserved for generations to come, for their cultural as well as scientific significance. The South Korean government's protection of most of these populations is commendable, but the lack of appropriate management threatens the trees' long-term survival. For example, clearing the understory at Anmyondo has limited potential regeneration, both seedling and clonal, and the roadside trees planted near Pohang could contaminate the local gene pool if they are not derived from local source. We strongly recommend a centralized management plan that includes long-term demographic monitoring and evaluation, less intrusive maintenance measures, and preservation of germplasm in *ex situ* repositories.

Endnotes

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Che: Chewy Dollops of Maroon Sweetness

Lee Reich

Among the attractive qualities of *Cudrania tricuspidata,* the fruit—for me—is the main draw. In fact, I wish that I had become better acquainted with che, one of the plant's common names, soon after our introduction. That first meeting was in 1979 at the home of renowned fruit breeder George M. Darrow, then ninety years old and retired from the U.S. Department of Agriculture. His dooryard che, unfortunately, had no fruits ripe for sampling. In the years that followed, I occasionally happened upon the plant on the printed page where I found lukewarm descriptions of the fruit's flavor—"mild watermelon," for example. Almost twenty years after our introduction I decided, finally, to plant a che and evaluate the fruit for myself; a year later I tasted my first fruit. It was very good and nothing like a "mild watermelon."

Were you to meld all the characteristics of a fresh fig and a mulberry—both, incidentally, relatives of che—you would end up with some-

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Che's aggregate fruits combine the flavors of fresh figs and mulberries: neither quite as rich as a fig nor quite as sweet as a mulberry.

thing very close to a che fruit. To wit, che is an inch to an inch-and-a-half across, round, and a dull maroon with a rich red interior, a slightly chewy texture, and a few edible seeds. The flavor is most definitely fresh fig plus mulberry although neither quite as rich as the fig nor quite as sweet as the mulberry.

Che, like mulberry and fig, is an aggregate fruit, the individual fruitlets more or less coalesced. The surface texture most closely resembles that of yet another relative, the osage orange *(Maclura pomifera),* whose four-inch-diameter, green-skinned orbs are completely inedible. Deliberate hybrids—with the euphonious and likewise hybrid name *Macludrania hybrida*—have been created between osage orange and che, the first in France in the latter half of the nineteenth century. The goals for creating such hybrids were not specified—perhaps a baseball-sized che fruit?—but the original ones, using che as the male parent, most closely resembled their father in plant form. Hybrids derived from those French plants were planted at the U.S. National Arboretum in 1960 and were said to look like thornless osage orange trees. Their hybrid origin has since been questioned and, in any case, little mention has been made of their fruits.

Che fruit itself is rarely mentioned, even in writings from China where che is native. The plants have been valued by the Chinese for their leaves, as feed for silkworms. Although the silk produced from them was said to produce lute strings with a particularly clear sound, their leaves were used only to supplement mulberry leaves as feed, perhaps because thorny stems make picking them more difficult.

It was in the latter half of the nineteenth century that che first made its way to the Western world. It has been grown in France since 1862 and in England since 1872 with no mention made of its fruit production or use. It first arrived in America in 1909 among a few thousand other cuttings and live plants sent over from China by E. H. Wilson. By 1912, a tree at P. J. Berckman's Nursery in Augusta, Georgia—presumably derived from that introduction—was twelve feet high and bearing a bushel and a half of fruit. The following year another shipment arrived from China, sixteen rooted plants sent over by the U.S. Department of Agriculture's plant explorer Frank N. Meyer for testing in drier regions as a hedge plant for gardens and a living fence for farms and, in less arid regions, for bank stabilization.

Today, che remains relatively unknown as a fruit or a plant, despite the plant's early and reliable fruit production, its resistance to pests, and its probable (judging by the closely related osage orange) wide adaptability. It even lacks a widely accepted common name, having been also called cudrang, mandarin melonberry, silkworm thorn, and—derivation unknown—storehousebush in English, and in China, *tcho sang* (wild mulberry), *tsa, tse-tsang* (thorny mulberry), *cha-shu, poh-hsi, shih, nu-che,* and, of course, *che.* Yet, given the quality and productivity of even unselected seedlings, che is surely an uncommon fruit worthy of attention, especially if some of that attention were directed to selecting or breeding plants that were thornless, bore well without pollination, and ripened earlier.

The Plant

Cudrania triloba has been variously described as a large shrub or a small tree usually growing to a height of about twenty feet, occasionally soaring to sixty feet. Some suckers are produced at the base of the plant and, with age, the tree develops a spreading, flattened top and a bark that ripples with deep furrows. A sprawling, almost vine-like habit has been ascribed to some of the shrubbier sorts. But many kinds of plants change morphologically (beyond attaining the capacity to flower) as they transition from juvenility to maturity. As examples, citrus lose their thorns and English ivy changes from a vine to a woody shrub. Vining behavior and increased thorniness could merely be descriptions of juvenile che plants.

Che's thorns are an unresolved issue. Although the plant is typically thorny, branches higher up in older plants frequently are thornless. Dr. Darrow propagated two plants from thornless branches and, while one of the two remained thornless, the other eventually grew thorny new shoots. The question arises, then, whether we have here a chimera—a plant made up of two kinds of genetically dissimilar cells,

ARCHIVES OF THE ARNOLD ARBORETUM

E. H. Wilson photographed these two Cudrania tricuspidata *in August 1918 in Japan, where they had been planted roadside. He noted that they were forty feet in height and in girth of trunks, four and seven feet.*

ARCHIVES OF THE ARNOLD ARBORETUM

Frank N. Meyer's photograph of this very interesting trunk is dated January 1914. His legend reads, "Cudrania triloba. Village of Yo tze ko, south of Sianfu, Shensi China. The peculiar looking trunk of a Chinese osage-orange called 'Teho che shu.' The leaves are occasionally used for feeding silkworms. Locally the small red fruits are considered unwholesome."

in which new plants propagated from one set of cells may be thornless and from the other set thorny—or perhaps it is merely a question of juvenility versus maturity, with juvenile stems, as in citrus, being the thorny ones. In that case, plants propagated from vigorous stems near the base of a seedling tree will be juvenile and thorny while those propagated from stems higher in the tree will be mature and thornless. Cytological studies and observation of seedling plants as they mature would resolve this issue.

The shape—or, I should say, shapes—of che's leaves are similarly variable. In 1877, a Dr. Hance, who had assigned to che the botanical name *Cudrania triloba,* wrote that it was "an unfortunate specific name, as the foliage seems highly variable." The plant's specific name was later changed to *tricuspidata* although the leaves are sometimes entire or indistinctly lobed and sometimes three-lobed. Increased lobing of leaves, incidentally, is another characteristic of plant juvenility that might be lost with maturity, another change exemplified in maturing English ivy plants. Che leaves remain healthy and green throughout the growing season, then drop without fanfare.

Che flowers are as hard to pin down morphologically as are the leaves. Mostly, plants are either male or female (dioecious), but male trees frequently bear some fruits (which only follow female flowers) and female trees frequently yield good crops without male pollinators. Like some varieties of persimmon, male or female che plants might bear a few flowers, perhaps whole branches, of flowers of the opposite sex. This explanation seems more likely than parthenocarpy because ripened fruits typically have a few seeds in them, which indicates that pollination did occur—unless che is among the few plants capable of producing seeds solely from mother plant tissue, without pollination (i.e., it is apomictic). The waters are further muddied by a possible link between thorniness and gender; Dr. Darrow observed that, on one plant at least, thorny stems acted like males: they were fruitless but their presence made female stems fecund. Gender questions could be answered with close observation and controlled pollinations.

Che flowers—small, yellowish-green in rounded heads—are reliably borne, either singly or in small groups, in the axils of leaves on growing shoots. Fruiting is equally reliable because the flowers open late, about the time that mulberry fruits are just starting to ripen. Plant a che tree and it will not have you waiting long for those first flowers or fruits; my plant—a clone—yielded both the year after planting.

Cultivation

The etymological meaning of "che" is "stony ground," indicating its natural habitat. Just because it tolerates drought and poor soil does not mean that it would thrive best and yield the most luscious fruits on such ground. I give my che the same good soil—well cultivated, moderately fertile, and humus-rich—enjoyed by my other fruits. Good drainage is important.

Che is said to prefer a warm soil. This requirement probably has basis, especially if a warm soil infers also a warm site, because in northern regions such a site would be needed to ripen the relatively late ripening fruits. The plant itself is hardy to USDA zone 5 or 6 and also grows well into subtropical regions, although individual clones might better tolerate either end of this climate spectrum.

Che is a plant that performs well with little or no regular pruning. Prune the young plant so that each of its main branches has plenty of room, then, when the plant matures, do nothing more than cut off any dead, broken, or out of place branches that you might find. Drastic shortening of any branches that become decrepit will stimulate vigorous, new shoot growth on which flowers and fruits are borne.

You may want to prune the tree more heavily if you are feeling regal, in order to extract a reddish yellow dye from the pruned stems. The Chinese used so-called "che yellow" for coloring imperial garments.

Propagation

Che is easy to propagate by any one of a number of methods. Seeds germinate readily if sown immediately upon removal from the fruit, or, if stored, after a period of cool, moist stratification. Be forewarned, though: seedlings may take up to a decade to bear fruit.

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The leaves on these branches of Cudrania tricuspidata *appear to have lost their juvenile variability.*

As previously mentioned, cloned plants bear at a very young age. Take semi-hardwood cuttings after midsummer, ideally treating them with rooting hormone and then putting them under mist. Root cuttings are another method of clonal propagation.

Che takes well to all sorts of grafting techniques. Grafting seedlings onto mature plants is one way to shorten the juvenility period and so more quickly evaluate their fruits. Create more robust and tree-like specimens by grafting che on osage orange rootstock.

Harvest and Use

Although che fruits ripen late in the growing season, be patient with their harvest because they are tasteless until softened and dead ripe. Do not expect the fruits to drop into your hands at that time; each che has to be plucked individually (a case for parthenocarpy). Likewise, do not expect to pick the fruits all at once, because they have a long ripening season, a month or more. Here in New York (zone 5), my che fruits begin ripening about the middle of October, about the same time as has been reported from the mountains of Virginia and a couple of weeks after times reported from near Washington, DC. Reports of first ripening in November in California and August in Georgia possibly highlight different ripening seasons for different clones.

Che bears heavily—Darrow reported hundreds of pounds on a mature female tree. What fruits you cannot eat at one sitting will keep for several days under refrigeration. Still more than you can eat? Blend the fruits, then strain out the seeds for a delicious nectar.

Formerly a fruit researcher for the United States Department of Agriculture and Cornell University, Lee Reich, PhD, is currently a garden writer and consultant (www.leereich.com). Che is one of the fruits featured in his book *Uncommon Fruits for Every Garden* (Timber Press, 2004).