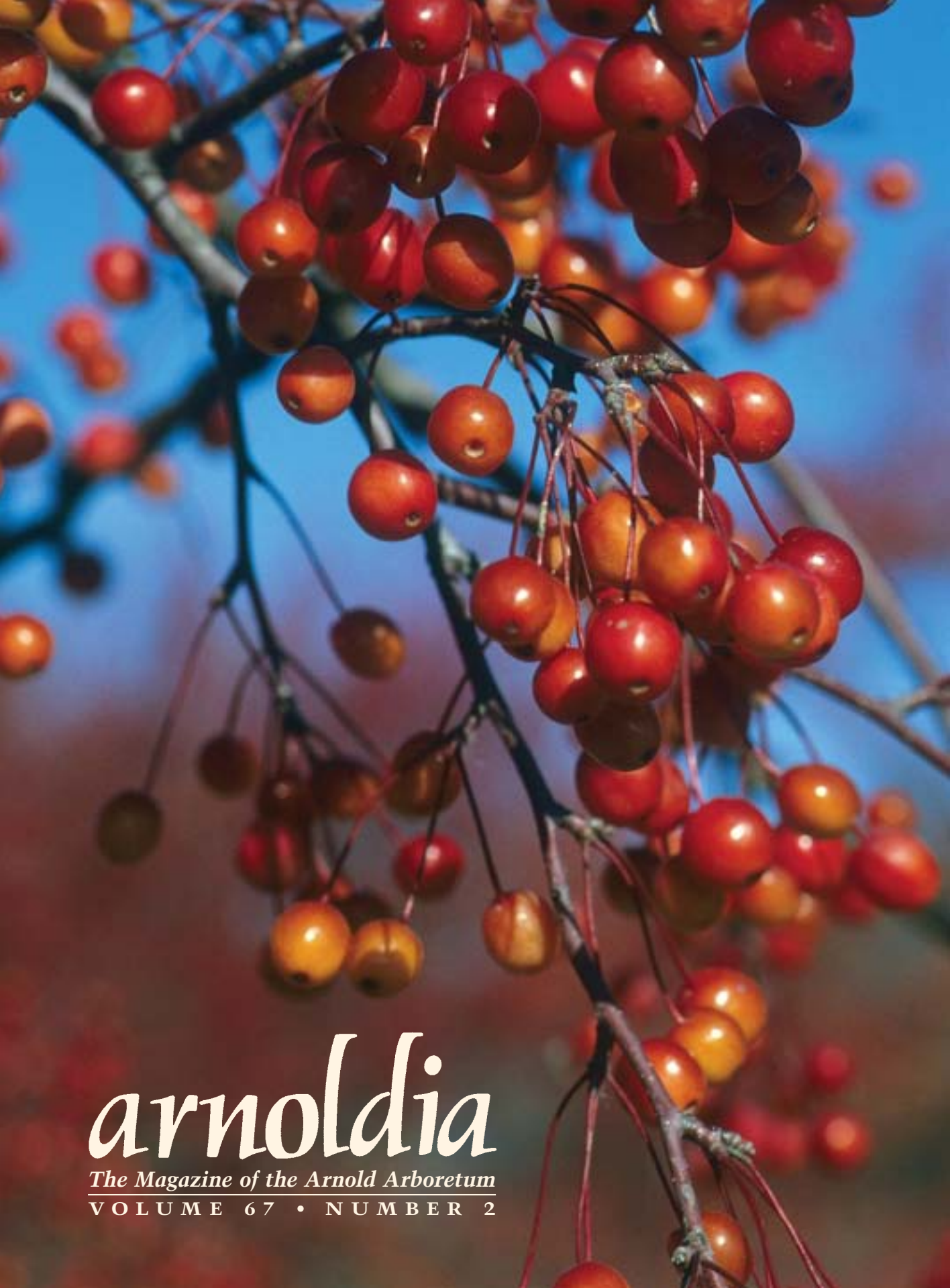

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Back cover: This early 20th century poster prompts Bostonians to visit the crabapple (*Malus*) collection at the Arnold Arboretum via elevated train car. Archives of the Arnold Arboretum.

Crabapples . . . With No Apologies

Jeff Iles

NANCY ROSE

An oldie but a goodie, red-flowered 'Liset' is still a popular crabapple.

One of my favorite older horticulture books is a signed copy of *Ornamental Crabapples* by Arie F. den Boer. Published in 1959 by the American Association of Nurserymen, this little manual was perhaps the first successful attempt at popularizing the various species, varieties, and cultivars of crabapples (those taxa in the genus *Malus* bearing fruits 2 inches in diameter or smaller). I like the book because it provides a unique glimpse back to an era when selections like 'Aldenhamensis', 'Almey', and 'Dorothea' ruled the nursery sales yards. Those cultivars are rarely seen today but others described in the book, including *Malus floribunda*, 'Liset', 'Profusion', and 'Red Jade', *have* prevailed and would be totally appropriate in today's landscapes.

What I really enjoy about the book, though, is the author's unapologetic and matter-of-fact acceptance of crabapples, warts and all. For example, he begins the chapter on insect and disease pests with this blunt statement: "It should not be considered strange or disturbing that apples and crabapples are visited once in a while by some unwelcome guest." You have to admire Mr. den Boer's understated admission

that certain members of the genus *Malus* do have pest issues, but the reality is few landscape plants are problem-free.

Yet for some reason crabapples are subjected to much disrespect by certain detractors, even those who readily accept the premise that most landscape plants aren't perfect. Crabapple naysayers are happy to share their tales of crabapple woe, particularly when they involve susceptibility to foliar diseases ("My Uncle Vito over in Dubuque had a crabapple in his front yard that would defoliate completely every July.") or fruit litter ("You think that's bad… my Aunt Betty had one that would drop loads of rotting, messy fruit all over her patio every summer.") These repeated knocks against crabapples often trace to plantings of once-popular, older crabapple cultivars such as 'Hopa' and 'Radiant'. Originally embraced for their head-turning spring flower extravaganzas, these cultivars are now sadly, and maybe a bit unfairly, remembered only for debilitating disease problems and overly large, non-persistent fruit. Unfortunately, a sufficiently large population of 'Hopa', 'Radiant', and other less-than-stellar cultivars still can be found in present day landscapes, reinforcing the misperception that *all* crabapples defoliate in July and double as fast-food emporiums for every yellow jacket wasp in the neighborhood.

But surely we—whether plant scientists or backyard gardeners—should understand the folly of making blanket statements about a group of plants with upwards of 900 named selections. After all, a family (in the non-taxonomic sense) that large is bound to produce a few bad apples, if you'll excuse the pun.

Why Crabapples Still Rule

The fact is that crabapples remain atop the list of small ornamental trees used in residential and commercial landscapes in USDA hardiness zones 4 through 7 for many very good reasons. Crabapples offer an avalanche of fragrant and colorful spring flowers in white and

JEFF ILES

Select apple-scab-resistant cultivars in order to avoid the heartbreak of mid summer crabapple defoliation.

JEFF ILES

Malus floribunda **sports beautiful pink buds and white flowers.**

JEFF ILES

Crabapples with persistent fruit provide months of color.

NANCY ROSE

The weeping branches of 'Red Jade' laden with bright red fruit.

shades of red ranging from palest pink to deep burgundy. As an added spring attraction, many crabapples display beautifully contrasting colors as the flower evolves from tight bud stage to fully opened flower—for example, deep pink buds opening to white flowers or deep red buds becoming bright pink flowers. Most crabapples have handsome foliage with leaf color ranging from dark green to burgundy. Though generally not noted for fall foliage color, some crabapples including *M. tschonoskii* and 'Satin Cloud' develop eye-catching shades of orange, crimson, and purple, while others flaunt hues of apricot ('Prairie Maid') and golden-yellow ('Amberina' and 'Red Swan'). Providing as spectacular a display as their spring blossoms but much longer lasting, the best crabapples bear bushels of vividly-colored fruit that enliven the fall and winter landscape. Another plus is the broad array of growth habits and mature sizes that makes it possible to choose a crabapple for practically any landscape situation. Finally, when planted on appropriate sites (well-drained soils and full sun) and given modest annual care, crabapples can have a functionally effective life of at least 40 to 50 years, and sometimes much longer.

Where Do They All Come From?

There are interesting stories behind the discovery, naming, and introduction of every species, variety, and cultivar of crabapple. From *M. baccata,* gleaned from the wilds of Siberia and named by Linneaus in 1767, to modern cultivars that owe their existence to countless crosses and backcrosses, one has to marvel at the imagination, determination, and luck required to bring a single crabapple selection to the attention of the gardening public. As an illustration, consider the circuitous birthing path for the much admired weeping crabapple 'Red Jade'.

The 'Red Jade' story begins in the early to mid 1800s in northeast Asia with the discovery and introduction of *Malus prunifolia.* The plumleaf crabapple was known for having many forms, and as luck would have it, a weeping form was

JEFF ILES

A Father Fiala introduction, 'Orange Crush' crabapple is gaining popularity.

discovered and given the cultivar name 'Pendula'. Later, *M. prunifolia* 'Pendula' was crossed with *M. floribunda* (Japanese flowering crabapple) with the result being a small, weeping tree eventually dubbed *M. floribunda* 'Exzellenz Thiel'. Selected by Späth Nursery in Germany and introduced to North America by the Arnold Arboretum in 1912, this diminutive, disease-prone crabapple was one of the first weeping ornamental trees used in the United States. In 1935 serendipity stepped in as Dr. George M. Reed of the Brooklyn Botanic Garden either discovered or purposely germinated and grew open-pollinated seedlings from *M. floribunda* 'Exzellenz Thiel'. What initially captured his attention isn't clear, but one of those seedlings developed into a beautiful weeping tree. In 1953 it was given the cultivar name 'Red Jade'; the name remains a bit of a mystery but probably refers to the bright red, ½ inch diameter fruit and the glossy "jade" green foliage, two notable and recognizable features of the cultivar.

Now fast-forward to one of today's rising stars, *M.* 'Orange Crush'. This delightful introduction sports orange-crimson flowers, handfuls of deep maroon fruit, and excellent disease (and Japanese beetle) resistance. But its existence and subsequent rise to fame comes only after a mind-numbing series of crosses, ending finally when Father John Fiala crossed *M.* 'Liset' with *M.* 'Red Swan'. And you can bet *M.* 'Orange Crush' will join the hybridization dance many times before it's put out to pasture.

Selecting the Right Crabapple

Finding a great crabapple for your landscape is pretty easy these days. The vast majority of crabapples now sold in nurseries and garden centers have much improved resistance to disease compared to their predecessors, and also feature highly ornamental fruit that is either small in size, persistent, or relished by our winged friends.

The decision to include one or several crabapples in a landscape planting really hinges on several factors. First and foremost, the tree you choose must fit the site. For example, if you don't have sufficient room for a large tree (stan-

NANCY ROSE

Dense-crowned 'Coralcole' (Coralburst®) crabapple fits in smaller spaces.

dard crabapples typically grow 20 to 25 feet tall and wide), you might consider one of several dwarf selections such as 'Camzam' (Camelot®), 'Cinzam' (Cinderella®), 'Coralcole' (Coralburst®), or 'Lanzam' (Lancelot®). And if you like the somewhat formal look of dwarf forms top-grafted to a standard, then you must investigate the aptly-named 'Lollizam' (Lollipop®) and two *Malus sargentii* selections, 'Select A' (Firebird®) and 'Tina'. If you're looking for an upright-growing selection that will pose minimal problems for pedestrian and vehicular traffic, the increasingly popular 'Adirondack' (selected by Don Egolf at the United States National Arboretum) is the crabapple for you. But if space constraints aren't an issue (parks, golf courses, entryway plantings, large residential lots, etc.) imagine the visual impact of informally arranged drifts (5 to 9, or more) of red-flowering 'Cardinal', red-fruited 'David', or gold-fruited 'Schmidtcutleaf' (Golden Raindrops®).

Next, consider special maintenance issues such as disease susceptibility. In a perfect world, we'd quickly rule out using crabapple

JEFF ILES

White-flowered 'Adirondack' has a tidy upright-vase shape. The crabapple to the right is 'Purple Prince'.

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Clockwise from upper left:
'Camzam' (Camelot®)
'Jewelcole' (Red Jewel™)
'David'
'Donald Wyman'
'Schmidtcutleaf' (Golden Raindrops®)

The "Best" Crabapples (*Malus* spp.)

TAXA	FLOWER	FRUIT	HT/WD	FORM	FOLIAGE
'Adirondack'	white	orange-red (½")	18'/10'	upright (inverted cone)	dark green
Limitations: slow-growing					
'Camzam' (Camelot®)	fuchsia-pink	burgundy (⅜")	10'/8'	rounded/compact	dark green/burgundy
Limitations: not much late-season interest					
'Cardinal'	pinkish-red	deep red (½")	16'/22'	broadly spreading	dark purple-red
Limitations: none known					
'Cinzam' (Cinderella®)	white	gold (¼")	8'/5'	rounded, upright	light green
Limitations: slow-growing					
'David'	white	scarlet (⅜")	15'/20'	rounded	light green
Limitations: alternate bloom; light apple scab noted; fruit mummies persist until spring					
'Donald Wyman'	white	bright red (⅜")	20'/20'	rounded	medium green
Limitations: apple scab noted; fruit mummies persist until spring					
floribunda	pink-white	amber (⅜")	12'/20'	spreading/irregular	medium green
Limitations: unimpressive fall fruit display					
'Schmidtcutleaf' (Golden Raindrops®)	white	golden-yellow (¼")	20'/15'	upright	medium green/deeply cut
Limitations: alternate-year bloom; fire blight has been reported					
'Lanzam' (Lancelot®)	white	gold (⅜")	10'/8'	oval	medium green
Limitations: flowers/fruit borne on interior of the tree which diminishes their ornamental effect					
'Louisa'	rose-pink	amber (⅜")	10'/15'	weeping	dark green/glossy
Limitations: fruit are ornamentally insignificant					
'Orange Crush'	rose-red	red (⅜")	15'/15'	rounded	purplish-green
Limitations: none known					
'Prairie Maid'	deep pink	red (⅜")	15'/15'	rounded	medium green/yellow-apricot fall
Limitations: none known					
'Prairifire'	pinkish-red	dark red (½")	20'/20'	rounded	purple turning reddish-green
Limitations: requires pruning to correct overcrowded branching					
'Purple Prince'	rose-red	maroon (½")	20'/20'	rounded	purple turning bronze-green
Limitations: heavy fruit production may weigh branches down					
'Jewelcole' (Red Jewel™)	white	red (½")	15'/12'	pyramidal	medium green
Limitations: none known					
'JFS-KW5' (Royal Raindrops®)	pinkish-red	red (¼")	20'/15'	upright	purple cutleaf/orange-red in fall
Limitations: none known					

NANCY ROSE

This specimen of 'Bob White' shows just a few spots of apple scab on its leaves.

NANCY ROSE

If only Aunt Betty had planted her 'Dolgo' crabapple (shown here) out in the yard instead of next to the patio she wouldn't have a crabapple mess underfoot.

selections with poor resistance to fungal pathogens *Venturia inaequalis* (apple scab) or *Botryosphaeria obtusa* (frogeye leaf spot) responsible for premature defoliation, and would never entertain the addition of a crabapple susceptible to the bacterium *Erwinia amylovora* (fire blight). The fungal prankster responsible for apple scab (actually, there are several races of *V. inaequalis*) has been especially frustrating for crabapple lovers because resistance to scab apparently is not a forever kind of thing (or, is not a permanent and binding contract between pathogen and host). In fact, all it takes is one lucky "super" ascospore infecting a previously resistant crabapple host to begin the process of resistance breakdown in that host. Notable examples of resistance breakdown and the subsequent development of scab have occurred on *Malus* 'Prairifire', 'Bob White', 'Jewelcole' (Red Jewel™), and *floribunda*. But sometimes positive attributes outweigh the negative, and therefore I'm willing to look the other way when 'Indian Magic' jettisons most of its scab-flecked leaves in late summer, only to reveal one of the most visually stunning fruit displays in all of *Malus*-dom (see front cover).

When the topic of fruit size and persistence comes up, crabapple detractors frequently trot out the poster child for obnoxious fruiting behavior, *Malus* 'Dolgo' (ignoring the fact that its large crimson fruits are great for making tasty preserves). But it would be disingenuous to paint all crabapples with the same brush. For example, crabapple selections like 'Jewelcole' (Red Jewel™) and 'Donald Wyman' produce bright red, extremely persistent fruit that eventually fall from the tree, but only after they've dried and shriveled to one-half their original size. Others like 'Snowdrift' and 'Bob White' drop very little fruit thanks to the work of opportunistic and grateful birds. And on those sites where fruit production of any kind is forbidden, fruitless selections 'Spring Snow' and newcomer 'Jarmin' (Marilee®) are viable options.

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The bright red fruit of 'Donald Wyman' last through the winter.

NANCY ROSE

The bite-sized orange fruit of 'Snowdrift' attract birds.

NANCY ROSE

The form of weeping crabapple 'Red Jade' outlined in snow.

JEFF ILES

The pinkish-red flowers of 'Prairifire' crabapple.

What about weeping crabapples? Real or imagined, several barriers stand in the way of using weeping trees in the landscape. For starters, consider the word "weeping." Who wants a sad landscape? Secondly, trees like weeping willow and weeping mulberry have, albeit unfairly, caused many weekend gardeners to be wary of any plant with cascading branches. Finally, and perhaps most importantly, weeping trees can be very difficult to integrate into the landscape. They vie for attention when used in groupings and look awkward and forlorn if used as a solitary specimen in the middle of a large lawn. And sticking one smack dab in the center of that unnatural-looking berm in your front yard isn't the answer either. But when classy, weeping crabapples like 'Louisa' and 'Huber' (Royal Fountain®) come along, we are obliged to find them a prime location in the landscape where they can be viewed and appreciated at any time of day and throughout the year, especially during the winter months. Positioning a weeper at the corner of a home, near a water feature, atop a terrace, or at the end of a shrub border will gain approving looks from visitors and neighbors alike.

Finally, consider a crabapple's ability to stop you in your tracks as you stroll through the landscape. If you've ever seen 'Prairifire' awash in bright pinkish-red flowers, 'Doubloons' sporting a bumper crop of golden-yellow fruit, the handsome purple cutleaf foliage of 'JFS-KW5' (Royal Raindrops®), or the memorable silhouette of weeping 'Red Jade' encased in a glittering mantle of ice, well, you know what I mean.

Still, there are some who can't be convinced crabapples are anything but disease-prone, messy trees. And in all honesty, this anti-crabapple mindset is probably a good thing. I mean, what kind of crazy world would it be if everyone began planting crabapples? See you at the garden center.

NANCY ROSE

Delicate pink flowers flow along the weeping branches of 'Louisa'.

Resources

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Malus at the Arnold Arboretum: An Ongoing Legacy

Michael S. Dosmann

NANCY ROSE

***Malus* in bloom on Peters Hill, the Arnold Arboretum, May 2008.**

In his book *Flowering Crabapples: The Genus* Malus, the late Father John Fiala (1994) states that "no horticultural institution did as much for introducing and discovering new species, varieties, or special clones [of *Malus*] as did the Arnold Arboretum." Those are humbling words coming from such an authority as Father John. As I considered his accolade, I asked myself: What were the drivers that made this all possible?

No doubt there were a number of factors involved in making the Arnold Arboretum "the 'mother arboretum' for flowering crabapples" (Fiala 1994). Timing played a critical role in the initial development of the crabapple collection as well as its ongoing use and development. The Arboretum's founding in 1872 and early rapid expansion of collections coincided with vigorous plant exploration efforts around the world. With respect to *Malus,* countless taxa new to science were collected from the wild and described, while many others new to North America were introduced from cultivation elsewhere (primarily Europe). Additional introductions of taxa from varying parts of their native ranges ensured that a high degree of genetic variation was present.

Simply having a diverse and sizeable collection of crabapples does not necessarily make it significant, however. The collection's active use in science throughout its existence put it on the map. Early on, the *Malus* collection was notably used in the study of taxonomy—the description of new species and their classification. This was followed by the collection's incorporation into better understanding genetics and cytology, as well as physiology. The collection proved to be of value to applied horticulture as well. Following World War II, as the demand for greater diversity of high-quality landscape plants increased, the products of these plant-breeding efforts (novel hybrids and cultivars) were grown and evaluated at the Arboretum.

Development and scientific use of the collection was made possible by a number of prominent Arboretum personalities. Charles S.

ARNOLD ARBORETUM ARCHIVES

Famed plant explorer Joseph F. Rock made this image of *Malus transitoria* on an expedition in Kansu (Gansu) province, China, on October 21, 1926.

Sargent, first director of the Arboretum, knew the research value of a well-documented collection and ensured that the initial development of the Arboretum, including its growing repository of apples and crabapples, would get off on the right foot. He also recognized that Rosaceae was indeed too large a family to occupy its allotted space—the hillside currently known as State Lab Slope near the Forest Hills Gate—which was dictated by the Arboretum's design based on the Bentham and Hooker sequence of plant families. And so, at the end of the nineteenth century, he designated large expanses on Peters Hill for the cultivation of *Pyrus,* his beloved *Crataegus,* and of course *Malus.* The expansion provided much relief, as numerous new species, hybrids, and cultivars were rapidly being introduced and needed space. Sargent himself collected and introduced new *Malus,* including the low-growing *M. sargentii* and the lesser-known but highly ornamental *M. tschonoskii,* both from his 1892 trip to Japan. Amazingly, the original specimens of these two species, now nearly 120 years old, still grow near the Bradley Rosaceous Collection and represent the Arboretum's oldest *Malus* accessions.

Ernest H. Wilson also played the role of explorer and introducer. *Plantae Wilsonianae* credits Wilson with collecting from some 16 *Malus* species during his travels in China, several of which were taxa new to science. Perhaps the best of these is *Malus hupehensis,* the picturesque small tree with a vase-shaped habit that Wilson made numerous collections of during both his Veitch and Arboretum expeditions. In describing its merits, Wilson (in Sargent 1913–1917) notes that "it is very beautiful in spring when covered with light pink flowers, and resembles at this time a flowering cherry rather than an apple tree; the effect of the flowers is heightened by the purple calyx and the purplish tints of the unfolding leaves."

Alfred Rehder, Arboretum taxonomist, may not have collected and introduced material from the wild, but he certainly applied his shrewd skills of observation and classification in describing and naming scores of the new *Malus*

ARNOLD ARBORETUM ARCHIVES

***Malus floribunda* on Peters Hill, photo by Ralph W. Curtis, May 10, 1922.**

MICHAEL DOSMANN

The lovely pink flowers of *Malus hupehensis*.

MICHAEL DOSMANN

One of the original *Malus* 'Mary Potter' (181-52-B), planted in 1952.

species and countless infraspecific taxa and hybrids. Hybrids within *Malus* are quite common, and as the Arboretum's collection grew and diversified, genes began to mix, hybrids arose, and more discoveries were made.

Perhaps the most ardent scientific user of this botanical petri dish was Karl Sax, former Arboretum director and research scientist at the Bussey Institute. Through the course of much of his Arboretum career, he integrated the Arboretum's *Malus* collection into a wide array of studies ranging from polyploidy and apomixis (Sax 1959) to plant physiology (Sax 1957). A byproduct of his many cytology and breeding experiments was an abundance of hybrids, from which Sax was able to evaluate and select a number of crabapple cultivars (Sax 1955). Four prominent ones are 'Blanche Ames', 'Henrietta Crosby', 'Henry F. du Pont', and 'Mary Potter'. The latter is perhaps his finest introduction and a personal favorite of mine. 'Mary Potter'—a cross between *M. sargentii* 'Rosea' and *M.* x *atrosanguinea*—is low-growing yet spreading, producing an abundance of single white flowers in the spring and bright red fruit in the autumn. Making the story all the more interesting is that it was named after the daughter of C. S. Sargent, and has the Sargent crabapple as a parent.

ARNOLD ARBORETUM ARCHIVES

In this 1959 photo by Heman Howard, Karl Sax is seen with a grafted dwarf apple tree, one of his many research interests at the Arboretum.

A *Malus* Mystery

Old, robust collections like the Arnold's are always full of new surprises. An interesting story concerns two unusual trees growing on Peters Hill, AA 691-52-A and B. While a Putnam Fellow in the spring of 2001, I became enamored by their wide-spreading, low-branching form; 691-52-B, the slightly larger of the two, stands 18 feet (5.5 meters) tall and 33 feet (10.1 meters) wide. The leaves and flowers are borne in dense, tight clusters throughout the canopy, giving the two specimens an unusual cloud-like appearance. The flower buds are magenta at first, and then transition into light pink before they open into creamy white blooms. The tag read simply "*Malus* sp." so I figured the trail was cold and that nothing more could be found about these plants.

However, hidden away in the records was the note: Sax 7841. "Sax Numbers," as these were known, were remnants of Karl Sax's own accessioning system at the Bussey Institute and referenced his research plants or crosses (this one being the 78th plant or cross of 1941). But unfortunately, no additional documentation had ever been found that explained the numbers further, such as source of material, what the parentage had been if it was a cross, or what the understock or scions may have been in one of his experiments. Another seeming dead end, I gave up on pursuit of this additional information.

NANCY ROSE

The mystery crabapple: *Malus* 691-52-A.

Nearly a year later, though, while rummaging through the archives, I stumbled upon an unknown notebook of Sax's that turned out to be his master list of hybrids and experimental units. With this fortunate find, I was able to identify not only these two plants but also a great number of other hybrid *Malus, Forsythia, Prunus* and other genera. It turned out that the duo in question were hybrids that Sax had made between *M. lancifolia* and *M. sylvestris.* Although I do not know if it was his original intent when making the cross, he used these hybrids in a rootstock experiment, possibly to examine any potential dwarfing effects rootstocks can have upon the scion above. Two seedlings of Sax 7841 were the ungrafted individuals I was struck by (691-52-A and B), while 780-52-A and D, located westward and up the hill a bit, were grafted plants that had Sax 7841 as the understock and an unknown wild apple as the scion (his notebook did not provide that detail, alas). Although Sax's cross yielded an unusual plant with ornamental habit, it would be premature to introduce it as a cultivar without further evaluation. And so, in 2007, Arboretum propagator Jack Alexander grafted budwood from both plants of 691-52 onto numerous seedlings of *Malus* 'Antonovka'. Soon these trees will be planted and further evaluated for potential selection and introduction.

While Sax may have been the creator of many of the cultivars, it was Arboretum horticulturist Donald Wyman who was their biggest promoter. He lauded their merits throughout the pages of *Arnoldia* and in his books, and advocated for their use in his lectures and correspondence. And, like Sargent before him, Wyman tapped his extensive global horticultural network to distribute Arboretum selections as well as acquire new taxa to grow and evaluate. In honor of Wyman's dedication to crabapples, the Arboretum introduced *Malus* 'Donald Wyman' in 1970 to honor him in his retirement. A fantastic selection, it is appreciated for its abundant white flowers in the spring, relatively high disease resistance, and very long-lasting display of brilliant red fruit from autumn through winter. Interestingly, this tree was actually a spontaneous seedling that was first recorded growing on Peters Hill on March 20, 1950. Due to its aesthetic appeal, it was later accessioned and then selected and introduced as the cultivar known today; the original tree still stands. It is ironic that, despite the great efforts of breeding and selection made over the years, the Arboretum's most important crabapple introduction to date must be chalked up purely to serendipity.

MICHAEL DOSMANN

MICHAEL DOSMANN

The original specimen of 'Donald Wyman' (seen here in spring bloom and fall fruit) still stands on Peters Hill.

Although the period from Sargent to Wyman may have been known as the "Golden Era for Crabapples" at the Arboretum, work in the collection did not end when Wyman retired. As the Arboretum shifted the focus of its collections policy towards acquisitions of known wild origin in the 1970s and 1980s, novel germplasm from Asia again crossed the threshold. For example, the 1980 Sino-American Botanical Expedition yielded several fascinating collections, including an unusual southern provenance of *M. baccata,* the Siberian crab, found in Hubei province. In addition to its unusual collection site, this collection (SABE #1298) produces flowers and fruits borne on particularly long pedicels (Spongberg 1991). An amazing trio of this accession, AA 1843-80-D, H, and I, each with outstanding spiral-grained bark,

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This trio of *Malus baccata* display their distinctive spiral-grained bark in the Arboretum's Bradley Rosaceous Collection.

can be found in the Bradley Rosaceous Collection. Other collections of *M. hupehensis* and *M. halliana* were made on this momentous expedition as well, significantly increasing the genetic diversity of these species in cultivation. The Arboretum collection continues to undergo development. Recently, we have acquired a number of wild-collected *M. sieversii,* the progenitor of the cultivated apple found growing in Kazakhstan and neighboring countries.

With respect to the enhancement of fruiting genotypes, the Arboretum's collection played a noteworthy role, even if it was indirect. Apple scab is a serious fungal disease that damages not just the leaves of trees but also fruits, causing serious economic losses in apple orchards. Resistance can be conferred by the presence of the V_f gene, whose original source came from *Malus floribunda* selection 821 growing at the University of Illinois. This clone, the most frequently used source for scab resistance in the world (Koller et al. 1994), arose from seed sent from the Arboretum in 1908 to C. S. Crandall, a geneticist at the University of Illinois who was studying inheritance patterns in *Malus.* However, it was not until the 1940s that the initial crosses were evaluated for disease resistance, and it has only been in the last 30 years that high-yielding cultivars have been introduced through the PRI (Purdue-Rutgers-Illinois) Apple Breeding Program, the most important just in the last few years (Janick 2006). I like this story for a number of reasons. It demonstrates how important it is for the Arboretum to distribute material (plants, seeds, cuttings, tissue, etc.) to researchers to enable their work. It also illustrates the importance of prudence and patience when working with trees—in this case, it has taken nearly 100 years since the original shipment from the Arboretum for the most meaningful dividends in research (in this case superior apple cultivars through one breeding program) to be realized.

Currently, the Arboretum's living collection of *Malus* comprises 455 accessioned plants (about 3% of the total collection), representing 173 unique taxa, 104 of which are cultivars. Development is constant: old lineages of high value are maintained through vegetative propagation, discretionary accessions are disposed of, and new germplasm is obtained. Recent and future renovations on Peters Hill and the Bradley Rosaceous Collection provide wonderful opportunities to grow novel material of both wild and cultivated origin. At the species level, the goal is to possess two to three wild provenances; for cultivars, we will continue to trial new introductions of ornamental selections and will also begin to feature several selections of eating apples. And, of course, the collection will continue to hold many old and historically important selections, including those introduced by the Arboretum.

NANCY ROSE

***Malus* 'Dorothea'.**

Crabapple Cultivars Introduced by the Arnold Arboretum

'Barbara Ann'

'Dorothea'

'Henrietta Crosby'

'Henry F. Dupont'

'Katherine'

'Pink Pearl'

'Blanche Ames'

'Bob White'

'Donald Wyman'

'Mary Potter'

'Prince Georges'

***M. baccata* 'Columnaris'**

***M. baccata* 'Jackii'**

***M. ioensis* 'Palmeri'**

***M.* x *robusta* 'Erecta'**

***M. sargentii* 'Rosea'**

***M.* x *zumi* 'Calocarpa'**

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In the Footsteps of Father David

Cédric Basset

Armand David (1826–1900), famously known as "Father David," is well known by those passionate about plants. Indeed, many plants carry his name, such as *Davidia* and *Acer davidii.* Though best known for his plant discoveries, one cannot mention this great figure without also mentioning the famous giant panda that he discovered in 1869 near Baoxing (previously Moupin) in the Sichuan province of China.

During our expedition to Sichuan in May, 2007, we followed the same paths that Father Armand David took during the second half of the nineteenth century. These regions—with their extraordinarily rich flora and fauna—are fortunately still preserved, no doubt in part because they remain very difficult to access.

A Few Notes from Father David

Upon arriving in Moupin, Armand David wrote: *"The land of steep mountains is, despite the loggers and farmers, abundantly forested with fir trees and cedars up to 3,000 m… The lanceolate pine and the narrow-leaved pine, as well as the alder of Setchuan, thrive up to 2,000 m. The rhododendrons are particularly abundant."* It

ALL PHOTOGRAPHS ARE BY THE AUTHOR

This flowering *Rhododendron* was part of the extreme botanical richness we admired in the narrow valley of Pujigou, located south of the nature reserve of Fengtong.

should be noted that there are no cedars (*Cedrus*) in this region; Father David probably uses this term to designate other conifers with a similar horizontally spreading form. The lanceolate pine is certainly his designation for *Cunninghamia lanceolata*.

At that time, Moupin (now known as Baoxing) was still part of Tibet. And Armand David wrote: *"Long closed to the Chinese, the principality now tolerates their growing number."* That was a different era, indeed.

On March 23, 1869, having just discovered the giant panda (*Ailuropoda melanoleuca*) he writes: *"The young bear is entirely white, except for his four limbs, his ears, and the area around his eyes which are a deep black. Thus, we have here a new species of Ursidae that is very remarkable not only because of its color but also because of the hairiness under its paws."*

Later, he writes concerning his botanizing: *"The large rhododendrons are flowering, and I can already distinguish at least seven distinct species. I also found, in the middle of a wet forest, a magnificent magnolia with large purplish flowers and with no leaves yet."* This may be *Magnolia liliiflora*, naturally present in this region.

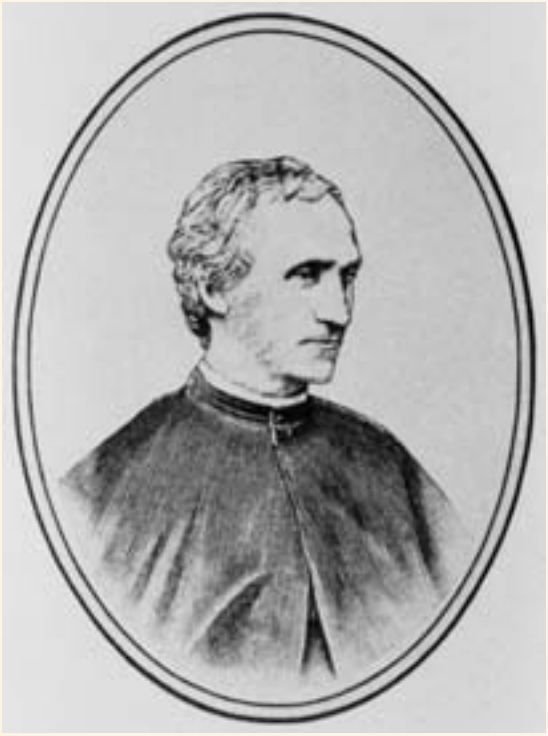
Cunninghamia lanceolata **is a large conifer in the cypress family (Cupressaceae) that can reach 50 meters (164 feet) in height. It is present in the landscape of the Chinese provinces explored by Father Armand David.**

Baoxing, Town of the Panda

Nowadays, the little town of Baoxing pays homage to Father David with a statue of him and with another that celebrates his discovery of the panda. The balustrades along the river are engraved with representations of the numerous species of plants and animals that he discovered during his sojourn in the region.

According to numerous local officials, Armand David's discovery over 130 years ago confers on Baoxing the status of "cradle of the giant panda." And yet, Baoxing remains infrequently visited by tourists. Westerners are rare, since the town is located on a road little used by tourists. The roads that connect Chengdu to Tibet through Kangding and Litang, or through Wolong, pass to the south and north of Baoxing, respectively, while the north–south road that connects Rilong to Ya'an through Baoxing is poorly travelled.

There are several explanations for this lack of tourist traffic. The road linking Rilong to Ya'an is not always in a good state. It is long and winding, and the lack of bus service forces one to use a taxi. There are few possible stops along the road. Our stop in the small town of Yanjingping was an adventure: no real hotel, only one very dirty house, and one building



ARNOLD ARBORETUM ARCHIVES

An Extraordinary Discoverer of Life

Armand David was born September 7, 1826, in the village of Espelette in southwestern France. On November 4, 1848, he joined the Lazarist order in Paris where he studied for several years. He then traveled to Italy to study medicine, zoology, and botany. On July 5, 1862, he arrived in Peking where he lived for the following twelve years. During those years, he carried out three expeditions to western China. After falling sick during the third expedition, he returned to France in 1874. During his life in China, he visited Inner Mongolia, Shanghai, the Sichuan provinces, and Hubei and Jiangxi, combining his missionary work with his scientific research. From March 1, 1869, until 1872, he worked in Moupin (now known as Baoxing) in Sichuan. During his travels in China, Armand David collected 13,000 specimens including 189 new plant and animal species, among these the handkerchief (or dove) tree (*Davidia involucrata*), the butterfly bush (*Buddleja davidii*), *Lilium davidii, Populus davidiana,* as well as thirteen species of rhododendrons, three magnolias, four firs, and four oaks.

where we found a room with no bathroom facilities. In the only restaurant in town, we involuntarily attracted a crowd and became, for the duration of our dinner, the main attraction. Baoxing, on the contrary, turned out to be a quiet small town, ideal for an enjoyable stop. There we stayed in a comfortable hotel where the rooms were very clean.

The Forgotten Valley and Pujigou

Baoxing is located to the south of the nature reserve of Fengtong. This reserve covers 40,000 hectares (98,842 acres), with 13 percent of the area serving as habitat for the panda. The town proudly advertises the region and its natural marvels—virgin forests, waterfalls, forests of *Osmanthus,* panoramas—but public transportation, as often in China, is non-existent. One must hire a vehicle and driver (fairly easily done at the train station) and communicate to the driver that he must wait all day or return to a meeting point after several days. Otherwise, in the small villages, one would not be sure of finding a vehicle available for returning to town.

We decided to enter the nature reserve by an alternative route, by taking the road that leaves from the northwest of Baoxing and winds to its final destination, the village of Pujigou. The road, paved at its start, rapidly gave way to a narrow dirt path where we had perilous crossings with the trucks from a nearby quarry. To our surprise, after two and a half hours of driving, our driver stopped before a dilapidated wooden bridge and told us that we had to continue on foot.

He told us that Pujigou was located about an hour's walk further. We took five hours, since we walked very slowly at first, our botanical passion ignited as we marveled at discovering an interesting plant with each step. The flora in this infrequently traveled area offers a rare diversity, the very acidic soil being favorable to the growth of many plants of the Ericaceae and the climate allowing amazing sub-tropical species to flourish.

We arrived at an old, abandoned building in the middle of the forest where two men and one woman lived without electricity. The reception was icy at this abandoned and empty inn. We were in Pujigou. It is not really a village, but rather the remains of what must have previously been a remote mountain refuge. Deciding to flee this place, we turned around and went on to find a village where we were hosted by a local resident.

The Fengtong Reserve

In all of our previous trips to China we had never found such a wild valley as at the Fengtong Reserve. Unlike more accessible nature reserves such as Wolong, here at Fengtong there was no road, no cars or buses, only a small path. The valley is narrow, with steep slopes covered with dense vegetation that benefits from the very humid air. From a botanical perspective, it is a real treat.

Davidia involucrata **(center) bloomed among the dense vegetation in this narrow valley in the Fengtong Reserve.**

The orchid *Calanthe tricarinata* grows about 30 centimeters (about 12 inches) tall. It enjoys semi-shaded areas and a humid climate.

The superb striped bells of *Enkianthus deflexus.*

All along the trail, magnificent handkerchief trees (the famous *Davidia involucrata,* dedicated to Father David) in full bloom hung over us. The edge of the path was full of flowering *Disporum bodinieri* (a member of Convallariaceae) and a somewhat rare *Paris, Paris fargesii.* In the nooks of dead tree trunks and on rocks, beautiful orchids—*Calanthe tricarinata* and *Pleione limprichtii*—bloomed abundantly. Above our heads we saw two beautiful shrubs, *Dipelta yunnanensis* of the honeysuckle family (Caprifoliaceae) and *Enkianthus deflexus* of the family of the rhododendrons (Ericaceae). The giant dogwoods (*Cornus controversa*) spread their tiered silhouettes above the shrubs.

***Cornus controversa* displays its elegant horizontal branching habit.**

Some Rare Finds

One great surprise was finding dozens of plants of one of the most spectacular hornbeams, *Carpinus fangiana.* I had wanted to see it for a long time and had already searched for it, notably at Mount Emei (Emei Shan). This tree is surprising for its large leaves (longer than 20 centimeters [7.9 inches]) and catkins that can reach 50 centimeters (19.7 inches) long.

Several species of viburnum (among these *Viburnum brevitubum*) carried their long, white tubular inflorescences in the manner of the viburnum of China, *Viburnum chingii.* We met more frequently another little shrub with lots of flowers: *Deutzia glomeruliflora.*

In this gorgeous reserve, another seasonal spectacle was provided by climbing plants of the Lardizabalaceae: *Holboellia* and *Akebia.* Certain stems, several meters tall, were covered with flowers exuding a sublime scent. A few plants of *Akebia trifoliata* revealed flowers that were almost black. A little higher, *Sinofranchetia chinensis,* belonging to the same family, was reaching even farther up into the trees.

The trail, although inaccessible to cars, was very good for walking. Certain signs showed that it was previously accessible to vehicles. The reserve is home to the giant pandas, and large stands of bamboo of the genus *Drepanostachyum* bordered the trail. We also saw a beautiful, large *Yushania* on which climbed *Codonopsis tangshen* (in Campanulaceae), not in flower.

Remembering Father David

At the forest's edge and along paths on shady rocks, several species reminded us of Father David:

- *Epimedium davidii,* a small epimedium (Berberidaceae) with beautiful four-pronged yellow flowers.
- *Acer davidii,* David's maple (Sapindaceae), with its bark finely striped with white.
- *Corydalis davidii* (Fumariaceae) with its pretty yellow flowers. Much rarer is the impressive *Corydalis anthriscifolia,* a large plant with long purple inflorescences of which we saw only one specimen.

In another small, narrow valley, we observed large arisaemas in flower with enormous leaves

The superb *Carpinus fangiana* growing in the dense forests of Pujigou.

***Viburnum brevitubum* growing in the cracks of rocks in the Fengtong Reserve.**

composed of three leaflets. This was *Arisaema dilatatum,* a little-known species distributed from western Sichuan to Bhutan.

We also were very surprised by the diversity of maple species in this valley. We admired the very rare *Acer sutchuenense,* a small tree of 5 to 8 meters (16.4 to 26.2 feet) high with trifoliate, denticulate leaves.

The Big Surprise

The exploration of this fantastic valley ended in an exciting discovery—finding plants of the famous and rare hellebore of Tibet (*Helleborus thibetanus*). This species (in Ranunculaceae) lives in isolation, as the next closest hellebore species grow more than 5,000 kilometers (3,100 miles) to the west. This hellebore is doubtless the most delicate of its type, with sepals much

***Holboellia* sp., a perennial vine with strongly perfumed flowers.**

Yet another plant named in honor of Father David, the lovely *Epimedium davidii.*

more finely-textured than the other species. Its flowers vary from pinkish-white to dark pink, often with darker pink veins.

Helleborus thibetanus was described by Franchet in 1885 from specimens collected in

1869 by Armand David at Baoxing in Sichuan. The same year, Beresowski collected specimens in the province of Gansu that were described by Maximowicz in 1890 under the name *Helleborus chinensis,* a name now synonymized under *H. thibetanus.*

Tibetan hellebore's introduction to Europe is relatively recent. In 1991, seeds were sent from China by Professor Kao Pao-chung of the Chengdu Institute of Botany. They had been collected from Sichuan, near Baoxing, on Dengchigow mountain at an elevation of 2,300 meters (7,500 feet).

Among the long list of other species that we observed, we should mention *Cotoneaster moupinensis,* several superb dark *Cardamine* along the creeks, several *Clematis,* several *Euonymus,* a beautiful *Magnolia* that was not flowering, several honeysuckles (*Lonicera*), one *Sorbus* with simple leaves, and several plums (*Prunus* spp.).

The very strange-looking *Arisaema dilatatum*.

The rare *Helleborus thibetanus* bears delicately veined pink flowers.

A Good Inspiration

Father David chose well in coming to this mountainous region. The diversity of its flora and fauna is fascinating and important. Efforts to protect the panda and the creation of reserves have allowed the preservation of very species-rich valleys. To travel in this area, one must temporarily do without some comforts, but it is truly worth it, especially since Baoxing has several good hotels.

This region is representative of western Sichuan on the road to Tibet. In addition to Baoxing, one should stop in Kangding, Ganjia Caoyuan, Garze, or also at Mugue Lake to discover fabulous landscapes and a very diverse natural world.

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Translated from French by Elizabeth H. Zacharias, Ph.D., and Ian C. Bourg, Ph.D.

BOOK EXCERPT:

Between Earth and Sky: Our Intimate Connections to Trees

Nalini M. Nadkarni. University of California Press, Berkeley and Los Angles, California. 2008. 322 pages. ISBN 978-0-520-24856-4

Editor's Note: **Dr. Nalini Nadkarni is a noted expert on the ecology of forest canopies in both tropical and temperate regions. Her innovative research has led to greater understanding of forest canopy ecology and forest ecosystem ecology. In this book, Nadkarni steps back from pure science and instead explores the profound connections between humans and trees. The book's structure is based on a creative modification of psychologist Abraham Maslow's pyramidal hierarchy of human needs. Here, the pyramid represents levels showing how human needs are met by trees, from the basic levels of physical needs like food and shelter, mid levels including imagination, language, and connections to time, and ultimately to the apical levels of spirituality and mindfulness. The following are brief excerpts from three chapters.**

GOODS AND SERVICES

Although humans now rely on ships and airplanes made of metal for long-distance transport, trees still figure into the regional and local transportation of our commodities. In 2000, for example, well over half of the $1.7 trillion worth of goods that entered and left the United States used some form of solid-wood packing material, such as pallets and crates. In 2001, an estimated two billion pallets were in use in the United States—six for every American. Over half of these are designed to make just one trip, and pallets as a whole average just 1.7 trips. Only about 10 percent are recycled, ground up and used as landscaping mulch, animal bedding, or core material for particle board. The wood in the pallets that are discarded each year is enough to frame 300,000 average-sized houses. Each year, too, 500 million more pallets are made, consuming trees on the equivalent of 18,000 acres.

Our global reliance on pallets also introduces nonnative pests. One is the Asian longhorned beetle, an "exotic" pest that has threatened North American hardwood trees such as maple, elm, birch, poplar, and willow since 1996. The clue that these large beetles arrived in "Trojan pallets" was that outbreaks were concentrated near warehouses in New York, New Jersey, and Chicago, which contain pallets from China and Korea, where the beetles are native. Since then, infested pallets have been intercepted by vigilant entomologists in many North American cities, and so far, serious outbreaks have been contained. Europe, meanwhile, is suffering from an invasion of the pinewood nematode, thanks to products received from the United States, China, and Japan. Because of such threats, many export companies have begun to use metal or plastic pallets. These in turn create other problems, as those materials are not as easily recycled.

PLAY AND IMAGINATION DREAMING ALOFT

To many climbers, the ultimate experience is spending a night high in the treetops. There is something about sleeping in the forest—whether on the ground or in the trees—that brings us as close as we can get to nature.

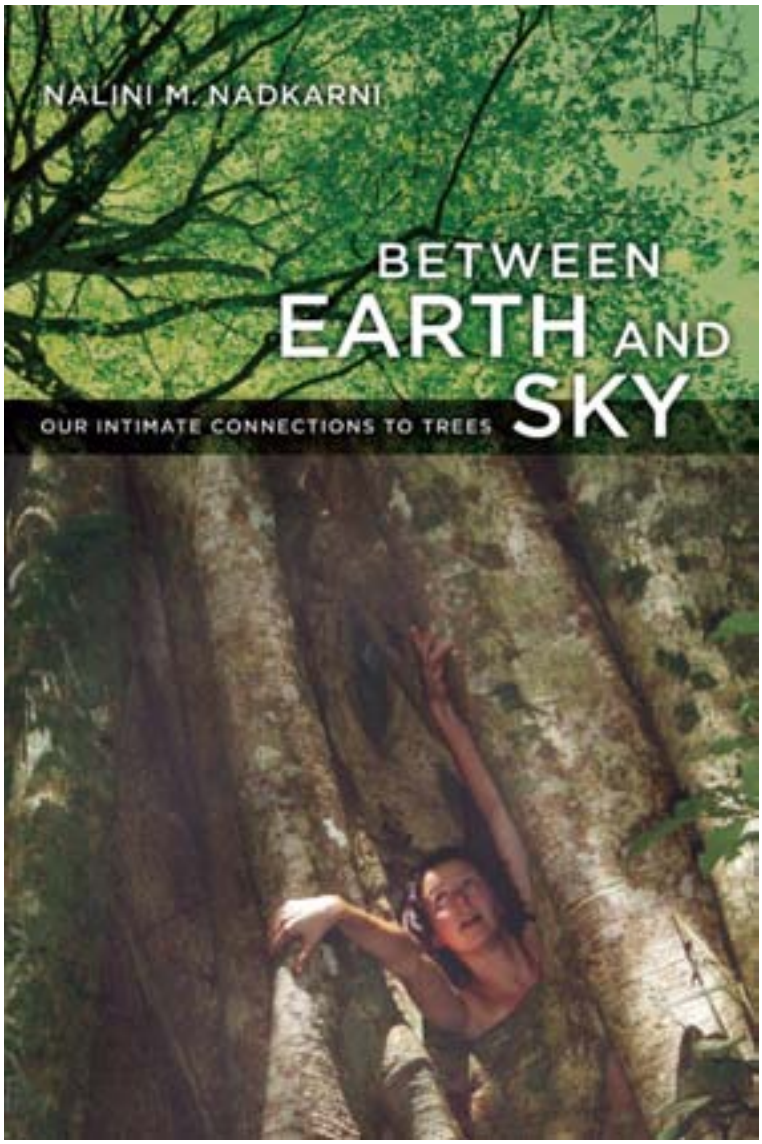
My first overnight experience suspended in a hammock between branches of a giant tropical rainforest tree remains vivid in my memory even thirty years later. I climbed into the canopy as the sun set, the darkening understory giving way to the lighter environment of the canopy—though that, too, gradually became part of the jungle night. Bird songs gradually yielded to the buzzing, whirring, creaking calls of insects, which grew louder both below and above me, a sort of stereo effect I had never heard before. I curled up on my hanging cot, water bottle and a bag of snacks tied to an auxiliary cord, my harness and rope giving me a sense of security as the spookiness of being two hundred feet above the ground crept into me. At some point during the night, an anteater rambled over to my perch, in pursuit not of a dormant human but rather of the steady stream of leaf-cutter ants that were harvesting chunks of leaves from the trees and walking them along the branch highways down to their underground nests. On seeing me, the collie-sized mammal seemed as startled as I had been. But we looked at each other for a long moment without fear, two arboreal animals in a high place on a dark night.

Since that time, I have spent many nights aloft. What has surprised me is not the "otherness" of the canopy night compared to where we ground-bound humans normally sleep, but rather how homey and comfortable it seems up there with darkness stretching out in three dimensions. We were raised with the classic lullaby, "Rock-a-bye baby in the treetops," with its inevitable and sobering conclusion: "and down will come baby, cradle and all." And there are noxious insects and poisonous reptiles somewhere up there. But during those nights I spent on my canopy cot, swaying slightly in the wind one hundred feet above the ground, I couldn't have felt safer and more ready for sleep, lulled by my nocturnal companions above, below, and around me.

CONNECTIONS TO TIME

Trees express time with a precision and beauty that are unmatched in nature. Changes in their foliage mark the passage of Earth's seasons, while the incremental growth in their rings mark Earth's years. Nothing more effectively indicates seasonal transitions than the tender green of the emerging buds of spring, the rich, deep greens of summer, the multicolored leaves of autumn, or the delicate filigree of snow on tiny twigs after a winter storm. We are inspired by trees' relationships to time: the great age they can attain and the fierce disturbances they can endure. When we walk along the winding paths of a cemetery, we pass beneath the trees that have dwelt there far longer than their interred neighbors, giving us a comforting sense of continuity.

Measuring the age of trees in tropical forests has been a perennial problem for ecologists. Because in many places favorable growth conditions occur year-round, many trees in the tropics are constantly growing and so have no rings at all. Even trees that do undergo seasonal growth, such as those in habitats where rainfall is concentrated into a few months of the year, have unreliable rings because they can jump into a growth mode in response to even small inputs of out-of-season rainfall. The tropical dendro-



chronologist, therefore, must turn to other methods to determine a tree's age.

One surprisingly useful tool for tree dating emerged through the development of atomic weaponry. During the early era of nuclear testing, atomic devices were detonated in the atmosphere. The radioisotopes ejected from these explosions spread worldwide, forming a thin, weakly radioactive blanket over the earth. Some of these radioisotopes mimic naturally occurring elements so closely that many plants and animals cannot distinguish them. Trees take them up and incorporate them into their cells, along with their regular nutrients. Radioactive strontium, for example, mimics calcium, a nutrient that plants use to build new cell walls, much as animals use calcium to build bones. In 1954, trace amounts of radioactive strontium generated from bomb tests wafted through the air, dissolved in rain, entered the water cycle, were absorbed by roots, and then were incorporated into the living tissues of trees. This resulted in a short-lived but distinctive radioactive signal that has been held in the tissues of all of the trees living in the world at that time. Now, half a century later, scientists extract pieces of wood from tropical trees and note where in the cross-section of the trunk the "1954 bookmark" of radiation occurred. This allows scientists to measure how much each tree has grown since that time. Although the results cannot be extrapolated to determine how old a tree is, they do provide the dendrochronologist with an exciting tool to compare the rates of growth (from 1954 to the present) of individual trees and different species of trees that lack reliable rings. By revealing relative growth rates, this approach gives scientists a better understanding of population dynamics within forests.

Autumn's Harbinger: *Acer rubrum* 'Schlesingeri'

Michael S. Dosmann

Autumn is my favorite time of year, and during the dog days of late summer I particularly look forward to the cooler, crisper, colorful months to come. That's why I am delighted when, on some sultry August afternoon, I notice that our *Acer rubrum* 'Schlesingeri' has begun to express the first hints of leaf color at the Arboretum. In most years, the green foliage of this early-coloring red maple shades to bronze by mid August, and by early September the entire canopy is ablaze in carmine red. The colorful display usually holds into October.

The precocious and stunning autumn coloration of this selection first caught the eye of Arboretum director Charles S. Sargent in the late 1800s. The original tree grew at the home of Sargent's neighbor, Mr. Barthold Schlesinger, in Brookline, Massachusetts. On February 13, 1888, budwood from this tree arrived at the Arboretum and, upon grafting, became accession 3256-A. It was planted along Meadow Road across from the Hunnewell Building, where it remains to this day.

Curiously, this cultivar's introduction to the ornamental scene occurred not in North America but in Europe. Sargent had shared it with the world-famous Späth Nursery in Berlin, which first made it commercially available in their 1896–1897 catalog. During World War II, the nursery dissolved, no doubt limiting the supply of this sought-after clone. In 1951, the Arboretum distributed plants to some 25 cooperating nurseries as a means of promoting the cultivar and increasing supply. In his description of the tree and this distribution program, Donald Wyman (1956) noted the efforts made to learn if the precocious fall color trait was truly genotypic or just a function of environment: "… scions from this variety were grafted on seedling red maples, but both the scion and the understock were allowed to grow. In the fall, it was clearly evident that the variety *schlesingeri* ['Schlesingeri'] would produce autumn color several weeks before the seedling understock on which it was growing, regardless of where it was planted."

Unfortunately this cultivar is now often misidentified, so the *Acer rubrum* 'Schlesingeri' that you purchase at the local nursery may not be true-to-type. This has even happened at the Arboretum. In the early 1980s, three trees labeled as 'Schlesingeri' were donated by a large, reputable, national nursery. But in 1989, Arboretum horticulturist Gary Koller noted that they "do not match 3256-A … identification (of) this cultivar is questionable." Further observations proved Koller correct and these trees were duly removed. Michael Dirr, in his *Manual of Woody Landscape Plants,* also noted that "some of the material in today's market does not appear similar to the Arnold Arboretum's fine specimen." And an interesting study on red maple cultivar coloration (Sibley et al. 1995) yields further evidence: although the trees of 'Schlesingeri' examined in the study were obtained from a reputable nursery, they developed the wrong leaf color (orange) far too late (no earlier than the 5th of October) to be true 'Schlesingeri'.

Over 120 years later, this old sentry remains in its original location. It stands 65 feet (19.8 meters) tall with a crown spread of about 60 feet (18.3 meters), and its trunk diameter (below the lowest branch) is 44.6 inches (113.3 centimeters). Red maples generally reach maturity at around 75 years of age, so it is no surprise that this individual is in decline. Recent efforts to maintain this important lineage by rooting cuttings have been a success: accession 408-91-A grows next to Faxon Pond, and scores of new cuttings are now rooting in the greenhouse. One of these new plants will eventually replace the original tree, while others will be distributed to commercial nurseries so that they, too, will have the real cultivar again.

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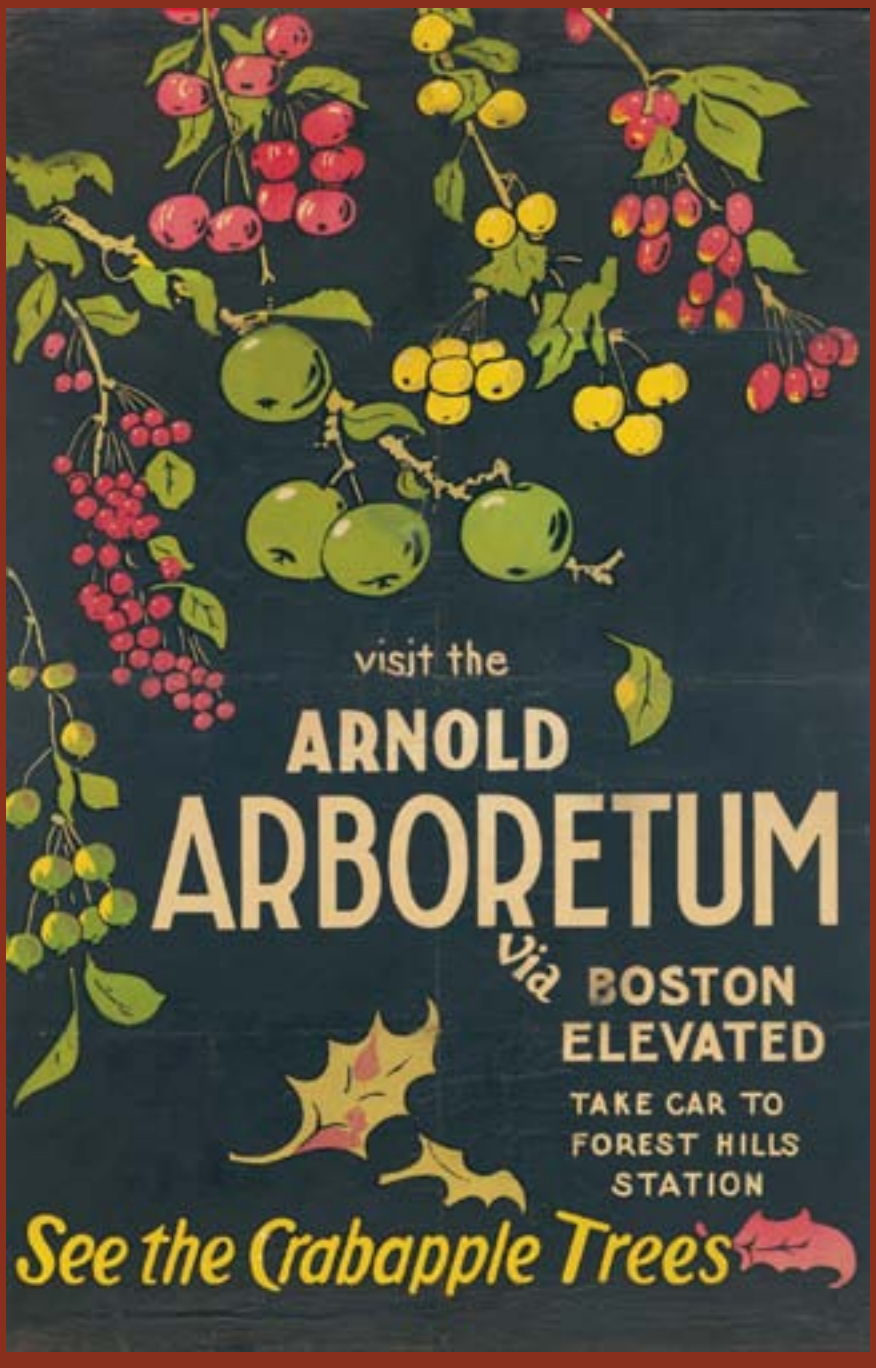
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