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The Magazine of the Arnold Arboretum

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Front and back cover: Urban grasslands are a dominant feature in cities like Boston and New York. At the Green-Wood Cemetery, in Brooklyn, staff and colleagues have implemented a multi-year study, aimed at improving the health, diversity, and ecological function of these herbaceous plant communities. Parallel projects have been underway at the Arnold Arboretum. An urban grassland, pictured near the Arboretum's Hunnewell Building, provides visual contrast from the accessioned collections of trees and shrubs, even in winter. Photo by Michael S. Dosmann.

Inside cover: Ernest Henry Wilson often photographed plants and landscapes while collecting on behalf of the Arnold Arboretum, but he rarely took portraits. This image, created July 1910, shows a man transporting medicinal bark of the hardy rubber tree (*Eucommia ulmoides*) in present-day Chongqing municipality, China. Photo from Arnold Arboretum Archives.

Inside back cover: The Arnold Arboretum's oldest specimen of *Eucommia ulmoides* (accession 14538*A) is an architectural showpiece. Photo by Jonathan Damery.



A Cottage Flora

Cat Meholic

In the fall of 2015, I moved into a small cottage on the back of the Granogue Estate, a sprawling property in northern Delaware. When my parents first visited the estate, I could tell they were nervous. As we drove the mile-long driveway, the road got worse and worse. I tried to understand their apprehension; their daughter would be living alone in the last cottage on a woodland edge. I only had one small dog at the time, a feisty, unintimidating Yorkshire terrier. As we drove past cornfields and open meadows, and descended into the valley, all I saw in my new home was a childhood dream come true. My parents admitted that the old stone house, covered in white plaster, was charming.

A young woodland is located on one side of my cottage, and the Brandywine Creek runs directly behind it. The light reflects off the creek into the house in unusual patterns, and on winter evenings, geese fly to the river, passing so low that I can hear the whispering of their wings. I often think of the *Sand County Almanac* and search for signs of life, as Aldo Leopold described, in every season: the mergansers that appear like clockwork in February, the tracks left from a battle of fox and rabbit in the snow, and the beaks of trillium (*Trillium* spp.) poking up in the spring. I am captivated by my surroundings. These woods have provided me with years of comfort and continuously pique my curiosity. Each copse is unique, but

most contain a mix of old tulip poplars (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and hickories, primarily shagbarks (*Carya ovata*).

The house itself is two stories, built into the hillside. When the house was inhabited by a farmer, his wife, and eight children, the downstairs kitchen was an open structure for the livestock to bed down at night. Today the cottage (or “studio,” as the residents of the estate call it) is stacked with horticulture and botany books. These books are mostly gifts from my mentors, colleagues, and friends, and the bulk came from the lifetime collection of my graduate advisor, John Frett. His collection was so extensive that I turned an open staircase into a makeshift bookshelf to house them. The generous windows overflow with plants. In this ideal setting, I have completed a thesis, adopted two more dogs, started a nonprofit called Women in Horticulture, and begun a checklist for the flora of the property.

—

Irénée du Pont Sr. established the Granogue Estate and relocated his family to the property in 1923, when he was president of the DuPont company. The main house is now the residence of Barbara and Irénée du Pont Jr. Much of the 505-acre property is actively farmed for corn, soy, hay, and dairy production, but large sections of forest and meadow have been preserved. Although the estate is less than a twenty-minute drive from Trader Joe’s, Target, and a shopping mall, the landscape feels like a rural oasis. In these woods and meadows, I have walked my dogs almost every day for four years. While holding two leashes, and with a third dog strapped to my waist, I scribble out notes in a Moleskine notebook tucked in my dog-walking fanny pack, recording the flora that I observe. Although I must be a comical sight to my neighbors, which happen to be mostly cows, this method has been effective. Upon returning home, I add additional details to the notebook, and on rainy days when I am not outside as much, I update my Excel spreadsheet. Over time this exercise has turned into a checklist that is extraordinarily simple. The

list itself records just the scientific name of the plant, and in some cases the date I observed it. What started as a means of learning about the land I lived on quickly morphed into a love of the plant communities that inhabit there. Already this information has had small impacts on land use.

One of my first successes on the property was when a trail-running race agreed to no longer use a path that was carved straight through a population of goldenseal (*Hydrastis canadensis*). When the trail was created, before a March event, I was disheartened that I would not be seeing the glorious little white flowers or finally observing the goldenseal fruit in a wild population. I travel regularly in this section of the woods, so this part of the population was the easiest for me to view while corralling my dogs along the path. I showed the damage to an ecologist friend, and she was also dismayed. Goldenseal is not exceptionally rare in the state, but this population is the largest one we had ever seen in northern Delaware. After several attempts, I succeeded in contacting the race director and did my best to communicate how the path impacted that population of goldenseal. This was after two seasons of the race using the path. Thankfully, the director was amenable to my recommendations, and the population is slowly rebounding from the disturbance.

On another occasion, regular path maintenance was endangering a small group of common moonseed (*Menispermum canadense*). In this case, the damage to the population could not be avoided as this section of the property needs to be accessible by vehicles and a horse-drawn buggy. The woodland edge and the moonseed population had been slowly encroaching for years. To help preserve the genetic diversity of this population, whole plants were given to two botanical gardens: Mt. Cuba Center and Natural Lands’ public garden, Stoneleigh. After path edges were mown back, the moonseed has surprisingly rebounded from its roots.

The estate has also been a great resource for educational exercises. Mt. Cuba Center is located just 7.4 miles from the Granogue Estate and is a regional resource for everything related

Facing page: An unnamed creek on the Granogue Estate flows into the Brandywine Creek.

to native plants. I know the precise distance because I drove to Mt. Cuba every day for years as their plant recorder and assistant curator. Over the years I have had the pleasure of sharing the botanical treasures of Granogue with colleagues and friends, including those at Mt. Cuba. (I must admit, at this stage in my career, the terms “colleague” and “friend” are often synonymous.) Colleagues from Mt. Cuba were impressed by the extent of a large population of showy orchis (*Galearis spectabilis*) at Granogue, and two interns were sent to Granogue to do a population estimate and record associated taxa. Research on native orchids has been at the forefront of Mt. Cuba’s research initiatives, and data from Granogue were included in work by Adrienne Bozic, the orchid fellow at Mt. Cuba, who oversaw the development of an orchid inventory for a large part of Delaware.

I also worked with colleagues at the University of Delaware, where I completed my graduate work, to conduct an exploratory study on the impact an existing riparian buffer has on the water quality of the Brandywine Creek. My cot-

tage is situated across a gravel driveway from a field for dairy cows. I am lucky that this field is used for breeding the next generation of bovines and not full dairy production. In the spring I have wrestled a newborn calf in the snow to tuck it back under the fence with its mother. For two years, however, I watched as cows defecated directly into a water source that drained into the Brandywine. Our analysis found that the small corridor of trees that served as a riparian buffer drastically reduced the amount of pollutants entering the Brandywine, confirming the ecological value of the plant populations that were included on my checklist. I am still hesitant to jump in the water downstream after an extreme rain event, but at least the impacts are much less than I anticipated.

My observations of the flora at Granogue also include comparisons to adjacent sites. The Brandywine Creek State Park is separated from Granogue by Thompsons Bridge Road. When crossing this road, the change in vegetation is apparent even to the most plant-blind of indi-



A view of the Granogue Estate, with the Brandywine Creek State Park in the background and the author's cottage nestled into the tree line.

viduals. Although both sides have almost an identical canopy, the understory is drastically different. The state park has large swathes of Japanese barberry (*Berberis thunbergii*) that create six-foot walls on either side of the path. Porcelain berry (*Ampelopsis brevipedunculata*) covers defoliated trunks, and whole patches of forest have toppled due to stress, pests, and repeated wet summers.

The Granogue side of the road has faced the same stressors, but the understory is more complex, which seems to add resilience to the existing canopy. The understory shrubs and trees include spicebush (*Lindera benzoin*), common witch-hazel (*Hamamelis virginiana*), American bladdernut (*Staphylea trifolia*), hornbeam (*Carpinus caroliniana*), American holly (*Ilex opaca*), flowering dogwood (*Cornus florida*), black cherry (*Prunus serotina*), pinxterbloom azalea (*Rhododendron periclymenoides*), swamp azalea (*Rhododendron viscosum*), smooth blackhaw (*Viburnum prunifolium*), and mountain laurel (*Kalmia latifolia*). The herbaceous layer is a fantastic mix of ferns, spring ephemerals, violets, sedges, and other native flora, including wild ginger (*Asarum canadense*), zigzag goldenrod (*Solidago flexicaulis*), white wood aster (*Eurybia divaricata*), numerous species of trillium (*Trillium* spp.), and yellow jewelweed (*Impatiens pallida*). Although most of these taxa are not considered rare, it is striking to see the contrast in population members between the state park on one side of Thompsons Bridge Road and the estate on the other.

This difference in taxa has captured my curiosity. Both properties were historically logged and then fragmented into farm fields. The hills are steep and rocky along the Brandywine, with the iconic “blue rocks” that our Minor League Baseball team is named after, and these rocky slopes were often too difficult to use for crops but were moderately successful for grazing sheep or goats. Old stone walls, characteristic of New England and the northern Mid-Atlantic, cut through sections of the existing forest, acknowledging this past. Despite these similarities, certain site characteristics provide at least a partial explanation for the floristic differences between the properties:

The state park has increased human usage, and the estate, meanwhile, has increased deer hunting, lowering herbivory pressure. Locals have also suggested that the presence of cows on the estate deters deer, which seems to be true, at least anecdotally.

As stewards of your own properties or those publicly shared—neighborhood parks and even urban wilds—it is important to understand your land as thoroughly as possible, and part of this is to understand the plant and animal communities that are present. I’m reminded of a quote from Aldo Leopold: “We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.” From the time we are born, we learn to “love and respect” our human communities, but we must teach ourselves to do the same for our natural communities that surround us. As an observer of plant communities, I have seen how sharing the knowledge of these communities changes the way in which humans treat them. A checklist provides the basis for assessments of biological productivity, ecosystem classifications, conservation decisions, and documentation of spatial or temporal changes over time. Without a basic checklist none of this would be possible.

Every effort towards a better understanding of our natural world counts. Without someone observing and documenting the plants at Granogue, projects involving the path modifications and subsequent off-site plant preservation would not have been possible. Even these small projects have had a positive impact beyond the Granogue boundaries. I might seem naïve or romantic, but I firmly believe if more nature enthusiasts observed their surroundings more closely and acted on what they were seeing, the impacts would be magnified in meaningful ways. I hope that the trend of encouraging citizen scientists continues to expand until we roll our eyes at how everyone now calls themselves a citizen scientist. What better citizen could we hope for?

Cat Meholic is the curatorial horticulturist at Ambler Arboretum of Temple University.

Beyond the Trees: An Herbaceous Shift at the Arnold Arboretum

Brendan Keegan

While walking down Oak Path last October, I was drawn to a glint of yellow among the dappled shades of green. I carefully stepped through the tall grasses and clumps of wood aster (*Eurybia divaricata*), and found, to my surprise, a blue-stemmed goldenrod (*Solidago caesia*) in bloom. A few bumblebees busily gathered pollen in the afternoon light, hanging on the plant's characteristically staggered flowers that ascend like golden rungs on a ladder.

Although blue-stemmed goldenrod is a common native plant, I had never seen one growing in the middle of the oak collection. Despite providing ideal habitat, with the high canopy allowing ample sun, the collection is typically mowed, which kills young perennials long before their autumn blooms. In 2019, however, much of the oak collection was purposefully left fallow to encourage the growth of herbaceous species. The lack of mowing resulted in an abundance of common violets (*Viola sororia*) in the spring followed by blue and white asters (*Symphyotrichum* and *Eurybia*), several species of goldenrod (*Solidago*), and, presumably, some very pleased bumblebees in the fall.

Unlike the accessioned trees (each lovingly labeled, monitored, and cared for), the wild populations of herbaceous plants, such as the blue-stemmed goldenrod, often exist in anonymity. A new appreciation for the herbaceous understory's benefits to the woody collection and to the urban ecosystem, however, is redefining the Arboretum's approach to these plants. The horticulture team has, among other things, begun leaving areas fallow to encourage spontaneous populations. Staff have also begun collecting and propagating herbaceous plants for landscape renovations, and these plants have been introduced as ground cover in the formal collections. An herbaceous shift is underway.

A Naturalistic Legacy

Although the Arnold Arboretum is famous for its history of plant exploration and its collection of temperate woody species gathered from around the world, it is perhaps less well known that the landscape itself was originally intended as an homage to New England. Both Frederick Law Olmsted, the landscape architect who designed the Arboretum, and Charles Sprague Sargent, the Arboretum's founding director, guided this aesthetic, drawing on shared horticultural principles and a desire to mimic the region's natural ecosystems. Although the resulting naturalistic aesthetic is taken for granted these days, it is easy to overlook how innovative and even radical the Arboretum's landscape was considered at the time.

By the late 1800s, city planners across the United States were beginning to think about the importance of green space for the public. The industrial revolution had brought the masses into the urban core, where there was little escape from toil in factories. Wealthy homeowners, on the other hand, developed their gardens in the fashion of the day, filling greenhouses with imported tropical plants and their yards with various exotic specimens. In many cities, newly built public parks reflected the taste of the wealthy, with formal gardens and annual beds taking pride of place.

Olmsted's vision for the Arboretum, and for the larger parkway of which the Arboretum is one part, could not have been more different. He planned for the winding roads to be bordered by layers of natural-looking shrubs and trees in order to invoke feelings of rural country lanes. Olmsted preferred woods and natural areas, interspersed with sweeping lawns that were designed to be maintained by cows and sheep. This preference, however, didn't preclude the use of non-native plants. Olmsted outlined this

Facing page: Kent Field provides a colorful showcase of herbaceous-layer restoration and management at the Arnold Arboretum.

ALL PHOTOS BY JONATHAN DAMERY UNLESS NOTED





Local photographer Thomas Marr captured the herbaceous diversity along Bussey Brook in 1908.

idea in an 1888 letter to the editor, in *Garden and Forest*, a publication established and overseen by Sargent: “May we not (as artists) think that there are places with us in which a landscape composition might be given a touch of grace, delicacy and fineness by the blending into a body of low, native tree foliage that of the Tamarisk or the Oleaster ... ?”

Fortunately, Olmsted had a more than willing partner in Sargent. Known for his passion for woody plant collection and discovery, Sargent formed the cast in which the Arboretum was molded. Many of the horticultural decisions he employed at the Arboretum could also be seen at his Brookline estate, Holm Lea. Although Sargent rarely opened Holm Lea to visitors, those granted access marveled at his natural-

istic integration of native and non-native trees, shrubs, and herbaceous plants. Wilhem Miller, a writer for *Country Life*, praised the estate, in 1903, as an example of “‘natural’ landscape-gardening.” Miller observed that “while there are few places that are more cosmopolitan—so far as kinds of plants are concerned—the visitor will search in vain for anything that sounds a discordant note.” Similarly, Nathaniel Greene, a journalist writing for the *New England Magazine*, in 1908, observed that “Professor Sargent wants nothing on his place that is not harmonious with a New England landscape.”

The combination of Olmsted’s landscape philosophy and Sargent’s horticultural decisions resulted in an Arboretum that combines plants in a naturalistic way. Greene noted that this

combination, as demonstrated at Holm Lea, differed from the approach used in parks in other cities, which “tend to look alike, because they use chiefly tender bedding-plants, which are costly, ephemeral, loud, garish.” A fitting, albeit melancholic, example of Sargent’s lasting sympathies towards naturalistic plantings was the location of his memorial service held on June 9, 1927. Rather than celebrating his legacy near the Hunnewell Building where he spent much time, or under one of the species named in his honor, the event was held in one of his favorite locations along Bussey Brook “where white oaks, a white pine, and a white beech, all native to American soil, overhung the temporary platform.”

The Spontaneous Flora

While Olmsted designed the Arboretum’s bucolic setting and Sargent filled it with plants from around the world, the responsibility of documenting the landscape’s herbaceous species fell to staff working on the grounds. In the early years, this role was filled by Ernest Jesse Palmer, a self-taught botanist from southwestern Missouri. Palmer came to the attention of Sargent around 1901 after he mailed Sargent fruits from several species of hawthorn (*Crataegus*), a group of plants that Sargent was beginning to research intensely. The pair corresponded for decades, with Palmer regularly collecting plant material for the Arboretum, before he finally accepted a position as a botanical collector and moved to Boston in 1921.

Palmer soon began to inventory and study the spontaneous herbaceous flora at the Arboretum. Fortunately, he assiduously documented his observations, with the vast majority of the 2,235 spontaneous plant vouchers in the Arboretum’s herbarium attributed to his name. He compiled his findings in an article titled “The Spontaneous Flora of the Arnold Arboretum,” first published in a 1930 issue of the *Journal of the Arnold Arboretum*. Palmer’s “Spontaneous Flora” remains a valuable benchmark for studying the diversity of wild plants in the Arboretum landscape, and the wider region.

Unsurprisingly, the current wild plant composition is much different than Palmer’s records describe. In his day, there was greater overall herbaceous plant diversity. Palmer noted “bits of

open meadow” between the young trees in many of the collections, “where the grass and other undergrowth is cut at infrequent intervals.” Many plants flourished among what were then saplings in the hawthorn collection, including nine species of aster and goldenrod. Included among them were the “pretty violet rays and yellows discs” of the flax-leaved aster (now classified as *Ionactis linariifolia*), which were “especially abundant and showy.” These days, flax-leaved aster is a rare sight among the hawthorns.

Other parts of the Arboretum, however, seem unchanged. Palmer observed, in the 1920s, that “Elderberry ... Joe Pye Weed ... Poison Hemlock ... New England Aster ... and New York Aster are most conspicuous” along the steep banks of Bussey Brook, a spot where they continue to thrive. Somewhat amusingly, he also noted that the “curious little parasitic Love-vine or Dodder twines its amber evanescent stems about some of [these] upright herbs.” Despite periodic assault by a century’s worth of horticulturists intent on its removal, a healthy population of dodder (*Cuscuta gronovii*) persists in that exact location to this day.

Palmer’s wild plant baseline also proved invaluable for follow-up surveys documenting the change of spontaneous species through time. At least nine species from his 1930 publication no longer grow in the Arboretum, and four of those are now endangered in Massachusetts. Of the six species of orchid that once grew in the landscape, only pink lady slipper (*Cypripedium acaule*) has been recently documented. Ten additional herbaceous species are on the state watch list, and their status in the Arboretum is undetermined. Ironically, Palmer, who worked without the benefit of historical documentation to guide his observations, lamented that many plants which “might have been found ... [are] now gone forever from the Arboretum” as a result of physical alterations ongoing in his day.

Cultural preferences likely played a role in changing species abundance. Lawns were increasingly viewed as more favorable than unkempt meadows, and they allowed greater mobility throughout the collection. Although horse-drawn sickle mowers were the tool of choice by the early 1900s (and were used by Sargent’s land managers at Holm Lea), frequent mowing would not occur until the Arboretum



Jerusalem artichoke (*Helianthus tuberosus*) and blue-stemmed goldenrod (*Solidago caesia*) attract summer pollinators.

acquired gas-powered machinery in the midst of labor shortages during World War II: a tractor, with an attachment for hay cutting, in 1945, and two lawn mowers in 1946.

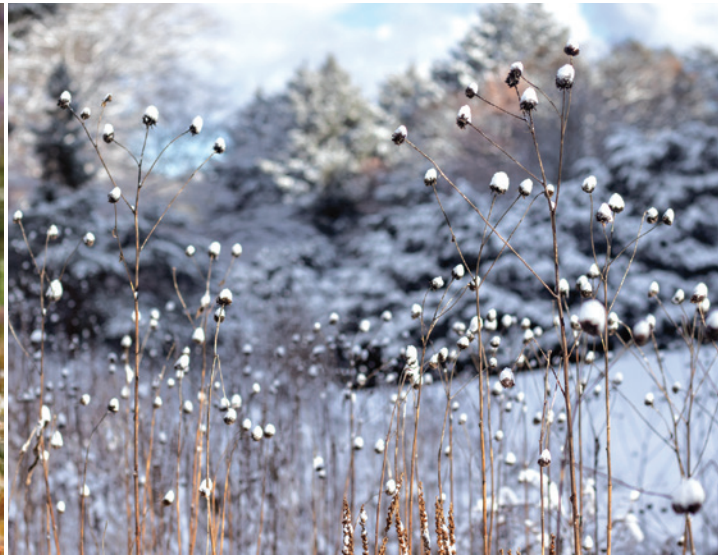
Mowing also provided a cost-effective and reliable tool for keeping down unwanted vegetation, which became especially important as invasive plant populations increased. The asters and goldenrods that Palmer described on Peter's Hill were soon jostled by Oriental bittersweet (*Celastrus orbiculatus*) and black swallowwort (*Cynanchum louiseae*), just two of many invasive species that harm the valuable woody specimens they grow among and on. While frequent mowing can mitigate these problems, it also kills the native grasses and forbs that once beautified the collections, depressing overall biodiversity. Mowing has also resulted in mechanical damage to accessioned plants and contributed to soil compaction collection-wide.

Although no comprehensive bulletin of spontaneous plants has been published since Palmer's last edition of "Spontaneous Flora," in 1945, staff and researchers continue to assess the status of herbaceous plants and other spontaneous species. Peter Green updated Palmer's list, in 1962, when he published "Herbaceous Aliens in the Arnold Arboretum" in *Arnoldia*. Leslie Mehrhoff, the herbarium curator at the University of Connecticut, reviewed and updated Palmer's baseline while documenting changes in invasive plant populations beginning in 2008. Mehrhoff intended to publish a

comprehensive update to Palmer's list, but the project ceased after his death in 2011. Around that time, Walter Kittredge, of the Harvard University Herbaria, completed a multi-year taxonomic project, verifying the identifications for the well-over two thousand herbarium specimens that constitute the Arboretum's spontaneous flora collection. These individuals have kept institutional knowledge alive by channeling Palmer's surveying efforts, allowing the Arboretum to keep track of changes to herbaceous species composition through the years.

Shaping the Herbaceous Layer

In 2017, new strategies for increasing the ecological value of the landscape began reshaping the herbaceous flora once again. These changes started when Andrew Gapinski, the Arboretum's head of horticulture, organized the first official Herbaceous Committee. The group, of which I was a founding member, was initially concerned with identifying areas in the landscape where mowing pressures could be reduced or eliminated, in an effort to limit mechanical and compaction-related damage to accessioned plants. Compacted soils had compounded after decades of running heavy, gas-powered equipment directly around and beneath the plants. A healthy herbaceous layer would allow for staff to leave "no-mow" zones, mitigating future compaction and reducing fossil fuel inputs. The committee also anticipated that, as shorter-lived herbaceous species come and go, their



Herbaceous plants provide visual texture throughout the seasons.

decomposing roots would help to break up and enrich the compacted soil.

The committee discussed ways to increase the herbaceous diversity and how these collections could subsequently be managed by horticultural and curatorial staff. Irina Kadis, former Arboretum curatorial assistant and native plant expert, was central to this effort. Her knowledge and cross-checking of Palmer's observations informed the committee's reintroductions. The committee also relied on her personal knowledge of natural lands to determine from where to source the plants.

In order to maximize the ecological benefits, as well as to mimic the naturalistic setting which Palmer described, the committee agreed to only introduce plants native to Massachusetts. These plants would, ideally, be sourced or collected from wild populations, allowing the Arboretum to document provenance and conserve local ecotypes. This means that, for a widespread species like red columbine (*Aquilegia canadensis*), which has a native distribution stretching from the East Coast to the eastern Great Plains, the Arboretum would only acquire locally sourced wild material, to protect our regional genetic diversity.

Acquiring wild seed poses a significant hurdle and is an ambitious jump for an institution focused on woody plants. However, there is ample precedent for building the collections with plants from New England. In the 1870s, the Arboretum propagator, Jackson Dawson, used a horse and buggy to collect native shrubs and

trees to fill the young Arboretum's nurseries. Dawson continued to make local collections throughout his more than forty-year career, but recent local efforts are the first to strategically add to the Arboretum's herbaceous understory. I helped organize collaborations with the Native Plant Trust, the Trustees of Reservations, and the Massachusetts Audubon Society, allowing staff to purchase or collect seed from beautiful natural areas close to home.

These revised management strategies have resulted in prominent no-mow zones on Peters Hill and in the conifer, oak, birch, linden, and maple collections. The meadows on the face of Peters Hill are particularly notable. Although cool-season grasses comprise the majority of the spontaneous vegetation, large stands of common milkweed (*Asclepias syriaca*) and goldenrod are emerging. In addition, over two thousand butterfly milkweed (*A. tuberosa*) plants dot the hillside, propagated in the Dana Greenhouse from seeds collected on Martha's Vineyard and donated by the Polly Hill Arboretum. The meadow also provides habitat for a variety of insects, birds, and mammals. A pair of eastern bluebirds, spotted in the spring of 2019, were the first to successfully nest in the Arboretum's collection since 2006.

In the Kent Field meadow, down the road from Sargent's chosen memorial site, masses of introduced mountain mint (*Pycnanthemum muticum*), common boneset (*Eupatorium perfoliatum*), butterfly milkweed (*Asclepias*



Jim Papargiris, the Arboretum working foreperson, plants butterfly milkweed (*Asclepias tuberosa*) during a staff workday in 2018.

tuberosa), little bluestem (*Schizachyrium scoparium*), great blue lobelia (*Lobelia siphilitica*) and golden Alexanders (*Zizia aurea*) provide food and shelter for wildlife throughout the seasons. In late summer, monarch butterfly caterpillars carefully munch on the milkweed, while a variety of butterflies and bumblebees cover the stands of mountain mint and purplestemmed aster (*Symphyotrichum puniceum*). In the evening, Kent Field is a prime spot to observe bats darting for insects, while great horned owls use the towering conifers to watch for unwary voles and mice.

In addition to revitalizing meadows, the Arboretum is also actively collecting and purchasing herbaceous plants in response to other forms of landscape change. In 2018, a considerable number of beeches (*Fagus*) were removed from the Arboretum's collection, due to an outbreak of beech bark disease. This caused

a massive shift in the growing conditions for the herbaceous layer, which went from deep shade to full sun essentially overnight. Expansive areas were laid open and bare. The following year, I coordinated the purchase of several thousand plugs of wild-sourced foxglove beard-tongue (*Penstemon digitalis*), New York aster (*Symphyotrichum novi-belgii*), and other herbaceous species from the Native Plant Trust. Horticulturist Scott Phillips and I developed a plan to use these native plants for landscape restoration in the collection.

Although most of the herbaceous plantings have occurred in naturalistic portions of the Arboretum landscape, the efforts have also filtered into the formally designed collections. Phillips led the acquisition of herbaceous species to fill mulch beds in the Bradley Rosaceous Collection. This project fulfills the original vision of the Bradley redesign, which began in



The Peters Hill meadow provides habitat for nesting birds.

2007. The herbaceous plants, primarily native members of the rose family (Rosaceae), fill in the open expanses of mulched beds, complement accessions, mitigate weed problems, and reduce the future needs for herbicide applications. Above all else, the new plants are beautiful and highlight ways that green groundcovers can be simultaneously functional, attractive, and consistent with the overall vision of the collection.

Constant Change

Temperate woody plants will always be the cornerstone of the Arboretum's mission, but recent projects with herbaceous plants will hopefully continue to spread through the collection. These projects will be crucial for the Arboretum's efforts to develop a more resilient landscape, protecting our valuable woody plants while enhancing the ecological function of our

urban habitat. Beyond that, these herbaceous plantings fit well with the intent of both Olmsted and Sargent, whose original designs stressed the importance of a naturalistic landscape.

Looking to the past verifies that the only constant with plants in the Arboretum's landscape is change. As Palmer observed, herbaceous populations and entire species will continue to come and go, following the ebbs and flows of management, culture, and climatic changes. If the trend continues, perhaps herbaceous accessions will eventually lose their anonymity and become as beloved to visitors as the towering trees. In the meantime, you can be sure that at least one Arboretum demographic will enjoy them—bumblebees searching for just a few more blue-stemmed goldenrod flowers on a warm autumn afternoon.

Brendan Keegan is a gardener at the Arnold Arboretum.



A Lily from the Valley

Michael S. Dosmann

This story is of a flower and the man who ventured to the other side of the world, away from family and modern convenience, to collect it. The plant was not just an object of desire but one of such value that it would underwrite the most significant collecting expeditions of the day. Yet, its beauty almost betrayed the collector, nearly taking his reputation and his life. It is also a story of their redemption: the story of Ernest Henry Wilson and the regal lily (*Lilium regale*).

When I first glimpsed regal lilies in the wild, in 2014, I was in northern Sichuan Province, China, to retell Wilson's story for CCTV's documentary, *Chinese Wilson*. I recall how gusts filled the air with sand, as well as a bright aroma from lilies, prompting me to simultaneously squint and sniff deeply. Ensembles of the glistening, trumpet-like blossoms dotted the gray cliffs above the Min River. The blooms were sometimes a half-dozen to a stalk, predominantly a clear white, with a purplish blush on the outside and yellow throats within.

I admired them from a vantage point on the narrow, rocky trail below. Most stems reached straight up to the sky, while others dangled out from the cliffs at near-ninety-degree angles. I was baffled by how they could defy gravity like that, with so little soil to cling to amidst the ever-blowing wind.

Because of my plant collecting experience in China for the Arnold Arboretum, following in Wilson's footsteps, I had been asked to guide viewers for the documentary. The third and final episode highlighted Wilson's collection of *Lilium regale* and a rockslide that nearly ended his life not far from where we filmed that day. The episode was rounded out with narrations of Wilson's own descriptions of events. That part was easy. Wilson retold the story often, in numerous books and articles, with a dramatic flair that would have prompted Mark Twain's praise. Most accounts started with a rehearsed rhetorical question, as it did in "Price of the Regal Lily," published in *Country Gentlemen* in October 1925: "How many people know the



The author (facing page) is photographed for a documentary that recounted Ernest Henry Wilson's harrowing collection of the regal lily (*Lilium regale*). The filmmakers orchestrated a reenactment of the mule train that was important to Wilson's retellings of the story.

size of a mule's hoof?" He then would respond, "Frankly I do not know with mathematical exactness, but as I lay on the ground and more than forty of these animals stepped over my prostrate form the hoof seemed enormous, blotting out my view of the heavens." How is that for an opening line? The explorer went on to richly describe the dusty "rude land" south of Songpan where his "royal lady" grew: "That such a rare jewel should have its home in so remote and arid a region of the world seemed like a joke on Nature's part."

The disaster occurred on September 4, 1910, while Wilson was on his fourth expedition to China. "Dysentery in a mild form" had prompted him to ride in the sedan chair, yet he noted that "song was in [their] hearts" for they were near Wenchuan and just north of Sichuan's capital, Chengdu, where good food and accommodation awaited. When the landslide struck, his chair was tossed to the river several hundred feet below. Errant boulders left the team scattered, and Wilson's right leg shattered in two places. Luckily, he never lost consciousness, and he instructed his team to use the camera tripod to splint his leg. It was then that

the mule train approached. Because the path between the cliff face and the roaring torrents below was too skinny for them to turn around, the only choice was for Wilson to remain on the ground and watch as each and every mule stepped over.

What followed was a hastened and painful three-day journey to Chengdu, with Wilson carried on an improvised stretcher constructed from the remnants of his chair. Doctors at the Friends Foreign Mission set his leg as best they could, but the possibility of amputation persisted for weeks due to nagging infection. In the end, however, his leg—now nearly an inch shorter than his left—was saved, as were the lilies. During Wilson's recuperation, members of his team dug up a quantity of bulbs, which followed Wilson back to Boston in the spring of 1911.

Wilson was so proud of the introduction that, despite the near-death experience and life-long injury, he stated that the "lily was worth it and more." In his 1925 monograph *The Lilies of Eastern Asia*, he went even further, proclaiming that "in adding it to western gardens the discoverer would proudly rest his reputation with the Regal Lily." I concur, this lily is a gem. But



Ernest Henry Wilson (right) and zoologist Walter Zappey rest along a footpath in central China in 1908.

Wilson was responsible for introducing over a thousand plants to Western cultivation, including scores of horticultural prizes. The ghostly dove tree (*Davidia involucrata*) haunted his dreams on his first expedition for Veitch Nursery, and the yellow poppywort (*Meconopsis integrifolia*) was his muse for the second. He had also introduced his favorite shrub of all time—the beautybush (*Kolkwitzia amabilis*)—and the paperbark maple (*Acer griseum*). Wilson considered the maple, whose namesake bark is loved by connoisseurs everywhere, Hubei's best. Perhaps these successes didn't register to him because another collector sent one dove tree seed to France before Wilson managed to collect his bundle, and the poppywort proved a bit too finicky to cultivate broadly. As for the other two woody plants, maybe it just took lon-

ger for their (and his) value to be realized? Or, was there something more to his statement—did Wilson really believe his reputation was at stake and only redeemed by this lily?

Little is written about Wilson's state of mind during his days of exploration, and his own correspondence barely sheds light upon such things. (Personal letters to his wife, Nellie, were destroyed by the family after the couple's death in 1930.) His journal entries have hardly seen the light of day due to his near-indecipherable penmanship, but one entry stands out beyond others, written on September 3, 1910, the day before the landslide. Wilson described his stomach trouble, his inability to keep warm, and the terrible road conditions. He noted the abundance of regal lilies (known then as *Lilium*

myriophyllum) upon the cliffs and described how, earlier in the day, two members of his team stayed behind in Sian Sou Qiao to investigate the region's conifers and to secure bulbs.

The final paragraph is the most profound. While a word or two still evade "translation," Wilson wrote of being in the same area two and a half years before. It had rained then, too, and I can imagine the drudgery, even misery, of being ill, sopping wet, loaded down with supplies, and trudging along a dangerous road still days away from civilization and convenience. "I little thought then I should ever return here!" Wilson lamented. "I am certainly getting very tired of the wandering life & long for the end to come. I seem never to have done anything other than wander wander through China!"

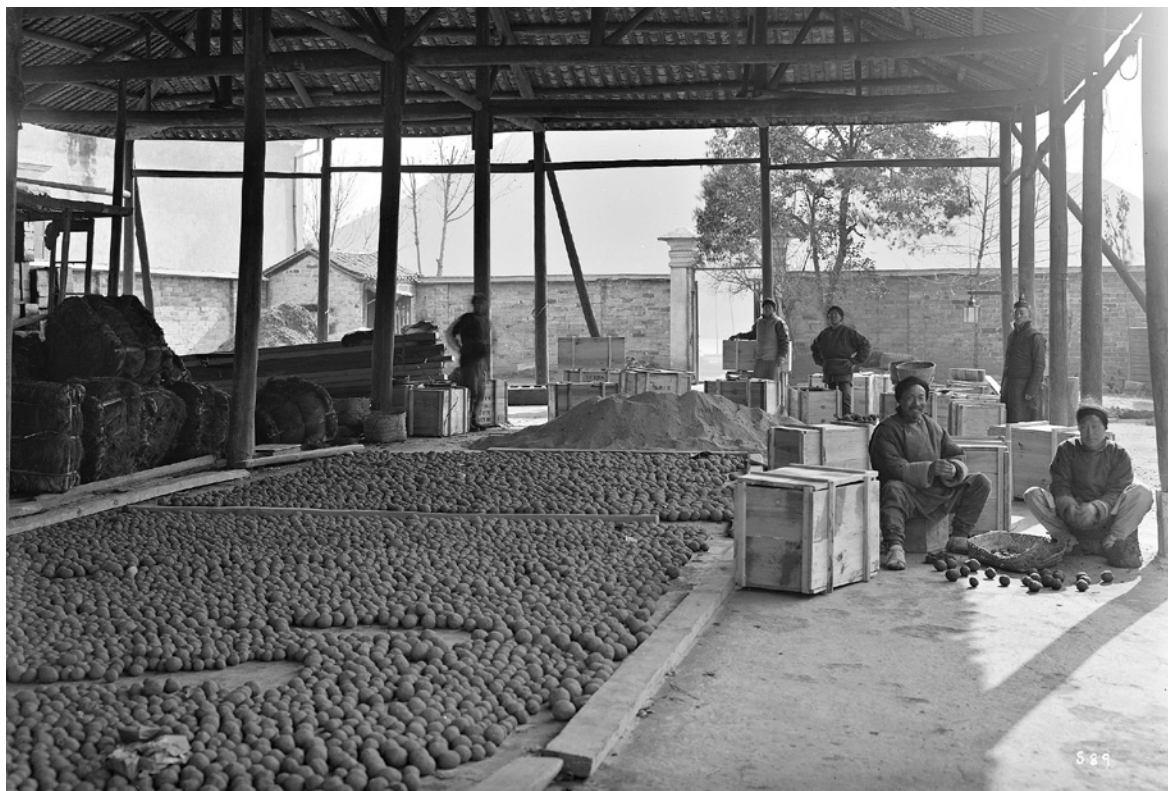
Between 1899 and 1911, Wilson spent almost eleven years wandering through China, despite having a wife and, eventually, a young daughter, Muriel, at home. He was tired of the explorer's life before he wrote this entry in 1910 and was reluctant to head back after returning from his second trip for James Veitch & Sons nursery in 1905. He was then working as a botanist at the Imperial Institute of Science in London and lived at Kew, just a short walk from the Royal Botanic Gardens' gate. But, the stubborn persistence of Arnold Arboretum director Charles Sprague Sargent (and his accomplice Ellen Willmott, who worked the local English angle) finally persuaded Wilson to return to China in 1907, for what he thought was a final time. Whereas his trips for Veitch were motivated more by profit than botany, his work for the Arnold Arboretum was a scientific endeavor, with value placed on the germplasm secured in seeds, cuttings, and plants, as well as on the collection of well-documented herbarium vouchers and photographs. Sargent, however, had arranged for a certain procurement of bulbs, which would help subsidize the 1907 expedition.

Wilson first met the regal lily in August of 1903 while traversing the Min River Valley; the following autumn he sent about three hundred bulbs to Veitch under collection number 1791. They arrived in England in the spring of 1905, flowered that summer, and were identified at Kew as *Lilium myriophyllum*, a species described by the French botanist Adrian René

Franchet in 1892. Much was made of the free-flowering plants, with Wilson writing about the collection that year in *Flora and Sylva*. In 1906, *Curtis's Botanical Magazine* profiled the new-to-cultivation species, complete with a beautiful illustration.

By the close of 1906, Sargent not only secured Wilson as the Arboretum's collector in China but found a partner to share some of the financial burden: John K. M. L. Farquhar. The Scottish-born nurseryman had established R. & J. Farquhar & Co. in 1884. It became one of the most prominent horticultural businesses in America, operating out of Boston. On Christmas Eve of 1906, Sargent wrote to Farquhar, "Since our conversation of the other day I have talked over the bulb business with Wilson and have reached the conclusion ... that for the species from western China, namely ... [*L.*] *myriophyllum* ... thirty-five cents a bulb would be a fair price, in view of the fact that these would have to be carried on men's backs for at least two hundred miles before water transportation is reached." Two days later, Farquhar accepted the proposal, signing a contract to receive two separate shipments of bulbs collected by Wilson, paying all freight costs and a steep price for each sound bulb delivered.

In the winter of 1907, Wilson found himself back in China and in no time reassembled his team in Yichang, Hubei Province. The collecting was good—Wilson began to accumulate vouchers, photographs, and plant material (including two *Acer griseum* seedlings that still grow in the Arboretum's collection). His first batch of lilies was also coming along nicely. According to the Farquhar contract, Wilson was to collect from "Central China" (namely Hubei) ten thousand bulbs, mostly the strident orange *Lilium henryi* but also *L. leucanthum* var. *chloraster* and *L. brownii*, both creamy white. (A collection like this would be unthinkable to modern collectors, not just logistically but because it is wholly unethical to dig up bulbs like this.) For those, Farquhar would pay \$0.25 each (about \$7 today). In a letter to Sargent before the turn of the year, Wilson commented that he would meet the quota but was worried about the cost of freight due to the quantity and weight of the cases. Rather than balling each bulb in clay, as he had done previously for Veitch, he informed



On February 2, 1909, Wilson photographed men in Yichang packing cases of lily bulbs for shipment. For this second shipment to Boston, all of the bulbs were balled in clay.

Sargent that “this year I intend to try packing in dry sand only. This method ought to succeed but I know I shall be broken up if it fails.”

On January 17, 1908, thirteen cases—containing eleven thousand bulbs in total—left Yichang, travelling by ship down the Yangtze for Shanghai, then to England, and eventually Boston. Wilson ended up compromising on the packing. The *Lilium henryi* were packed in sand; the other two species were balled in clay. “This is an experiment tried on the grounds of economy in freight and packing cases,” Wilson wrote in a letter to Farquhar on January 29. “For if it succeeds both parties benefit. If it fails both suffer loss.” Adjusting for inflation, the bounty would fetch a sum of about \$77,000 today. Farquhar would have his bulbs, Sargent a subsidized expedition, and Wilson the satisfaction of another job well done.

Wilson and his team departed Hubei that spring and headed west into Sichuan for the second part of what he thought was his final campaign. In late May and June of 1908, he saw his

“royal lady” in bloom in the Min River Valley near Wenchuan and Maoxian and made multiple herbarium vouchers under number 1446. (These were later designated as type specimens for *Lilium regale*.) No doubt, he was gearing up for the next round of bulb collecting to occur that autumn.

In August, Wilson received a letter from Sargent, sent April 25. The news was devastating. Sargent reported that of the six thousand or so bulbs of *Lilium henryi*, which were not balled in clay, only four to five hundred had survived. Although it appeared that those encased in clay fared better (at least the bulbs sent to Sargent), most cuttings, grafts, and seeds of tree species had also died. “The loss of the bulbs, however is a secondary matter as that is only the loss of money,” Sargent wrote. “In the loss of cuttings and grafts of plants like Willows, Poplars and Elms, the matter is much more serious because we have not seeds of these and you are not likely to be in a region to obtain them again.” Sargent added, “We are all, of course, greatly

disappointed over the outcome of this consignment, but, as I said before, I feel absolutely sure that you did what you thought was best."

After receiving this devastating message, Wilson responded, "I need not enter into my feelings of bitter disappointment and vexation on mastering its contents. In slang language I was 'knocked all of a heap.'" He promised Sargent he would "remedy the failure." On October 30, Sargent wrote to Wilson: "If it is possible to make up the loss in Farquhar's Lily bulbs, I hope you will do so, as we counted on the profit from these bulbs to pay a considerable part of the expenses of the expedition." This time, instead of the long-about method of getting to Boston via Europe, the bulbs would be shipped to the West Coast and travel across the continent on the Canadian Pacific Railroad (the method that Farquhar used to transport bulbs from Japan). And they would all be encased in clay, regardless of the extra freight costs.

According to Farquhar's contract, the second shipment of another ten thousand bulbs from "Western China" (namely Sichuan) would be shipped out in February 1909. This colorful motley would comprise equal numbers of *Lilium bakerianum*, *L. leucanthum*, *L. duchartrei*, *L. sutchuenense* (a synonym of *L. davidii*), and, of course, the regal lily. For these, Farquhar would pay \$0.35 for each sound bulb delivered to Boston (about \$9.90 today). Wilson rallied to meet this and then some. He added a few *L. lophophorum* to the mix and, in a letter to Sargent on December 29, reported that he had secured a total of twenty thousand lily bulbs, all balled in clay. "Last year's experiment in attempted economy has been enough!" he wrote. When the bulbs left Yichang for Boston, on February 20, 1909, the thirty-two cases included over two thousand bulbs of regal lily. "This collection is a large one, and has been got together at a great expenditure of energy, indeed, I hardly know how it has been obtained," Wilson wrote to Sargent on March 9. "If the bulbs arrive safely Messrs. Farquhar should not complain of there being nearly 20 instead of 10,000." Wilson continued with a boastful reflection: "It gives them, I make bold to say, the finest chance they will have of securing not only the largest collection of Lilies from

Western China that has ever been made but the only large one that will be made for decades to come." Wilson had no intention of returning.

Without a doubt, such a quantity of bulbs would satiate the enterprising nurseryman. The higher premium (\$0.35 a bulb) would satisfy the Arboretum's chief as well, for it would amount to almost \$200,000 today. And lastly, having rectified the previous year's failure, Wilson could wrap up his work in China and return to England and his family. He left Beijing in April via train, eventually taking the Trans-Siberian Railway across the expansive Russian landmass to Moscow. From there, he continued to the major cities of Europe, visiting nurseries, gardens, and herbaria along the way. By the middle of May, he reunited with his family in England and was soon looking at plants collected on earlier expeditions and reviewing the photographs that he took on the recent trip.

Waiting for Wilson at Kew, however, was a letter from Sargent, dated May 24. Sargent began by addressing an issue that must have caused him—and Wilson—some consternation: the issue of other botanical explorers in China. "Sometime ago you wrote me expressing regret that the opportunity had not been given you to remain longer in China. This I confess was a very great surprise to me for you had told me more than once that nothing would induce you to remain in China for more than two years." In 1905, Frank Meyer began to explore China on behalf of the United States Department of Agriculture (and the Arboretum, when he found woody species of interest). And in February of 1909, Sargent and Veitch Nursery jointly dispatched another Kew graduate, William Purdom, to pick up where Wilson was leaving off. While Wilson was eager to end the arduous work in China, he was also worried about his reputation and the prospect of being replaced. In the letter that Sargent referred to, dated March 9, 1909, Wilson discussed both Meyer and Purdom, and he admitted to "a slight feeling of chagrin at being passed over so completely in favour of another and without a word of warning." He continued: "It can be interpreted unfavourable on the work I have accomplished during the past two years. I merely mention this—I do not say I think it thus intended."



Snow covered the hills south of Yichang, as Wilson prepared to leave China in 1909, for what he thought was the final time. Wilson took this photograph on January 21 of that year.

And then, Sargent dropped the other shoe. In addition to the thirty-two cases shipped to Farquhar, another five (including three cases of bulbs and other plants for Sargent's private garden and friends) were shipped to the Arboretum. Not only had the smaller shipment "arrived in the most unsatisfactory condition," Sargent wrote that the "bulbs sent to me were in much worse condition than those of the previous shipping. I do not think there is life in one per cent. of them." As if Wilson couldn't realize the magnitude of the loss on his own, Sargent spelled it out: "This is, of course, a serious matter for the Arboretum as it involves a loss of probably six or seven thousand dollars which there is now no way of making up." In a follow-up letter to Wilson on June 3, Sargent confirmed that Farquhar's bulbs suffered similarly. An annotated manifest noted that just 121 of the 2,182 regal lily bulbs were alive at the time of arrival. Despite careful packing, the bulbs rotted in the ship's cargo hold.

On June 9, Wilson wrote to Sargent: "The disastrous news you sent, re. the condition of shipments, is a severe blow to me." Wilson had spent two years of rigorous and dangerous work in China, away from his family and alone save the companionship of his Chinese team (which included Walter Zappey, who collected alongside Wilson for Harvard's Museum of Comparative Zoology). His own legacy's status loomed in his mind well before getting this latest news, and with this failure, Wilson likely felt his reputation would suffer. Perhaps recognizing Wilson's state, Sargent proposed that Wilson come to Boston that summer to work through the innumerable herbarium vouchers. Wilson—now unemployed and much in need of a salary—agreed, noting, "It will also allow the 'rounding off' of the expedition in a manner I hope completely to your satisfaction."

Sargent still described the expedition as successful in a letter to Ellen Willmott on August 23, no doubt because of the photographs, vouch-



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Wilson photographed the habitat of the regal lily on August 31, 1910, just a few days before the landslide. "A typical view in upper Min Valley," Wilson later captioned the image, "showing barren desolate nature of the country."

ers, and germplasm that had, in fact, survived. However, noting that the bulb debacle had cost the Arboretum nearly \$8,000 (about \$225,000 today), Sargent reminded her that she needed to remit to him the sum of £6.10.3 (about \$1,000 today) for her subscription to Wilson's expedition over the past two years.

That September, Wilson, his wife, and daughter sailed for Boston, and he was soon organizing his herbarium specimens and doing his best to properly identify those lacking names. Nothing documents the conversations that must have occurred between him and Sargent, but within a few months, Wilson was planning a fourth trip to China. How much of this was due to Sargent's coaxing and how much of it was Wilson's need for redemption, we do not know. It was likely a mixture of both. Wilson planned a yearlong trip to Sichuan, with a focus on conifers that had evaded him before. To subsidize the expedition, Farquhar would still pay \$0.35 for each bulb, while other private sponsors con-

tributed to the Arboretum's Chinese Exploration Fund in hopes of a few plants of their own. The Wilsons departed Boston for England in the winter of 1910. Nellie and Muriel remained with relatives while Wilson retraced his journey via train back to Beijing.

After the landslide and after doctors reset Wilson's leg, a Canadian Pacific Railroad train from Vancouver arrived in Boston. It was April 20, 1911, and the shipment carried Farquhar's complete order of bulbs, including some six thousand of the regal lily. They were immediately placed on the ground at the nursery and covered with soil. That summer, they flowered with wanton abandon, producing copious seeds by October. In Farquhar's *Autumn Catalog*, bulbs were already selling for \$1.50 apiece (\$40 today).

Farquhar's *Garden Annual* of January 1912 lauded the regal lily, particularly the flower's unoppressive, jasmine-like perfume, and pre-

dicted it the Easter lily of the future. The Massachusetts Horticultural Society awarded it a Gold Medal, and a beautiful illustration graced the November cover of *The Garden Magazine* (the American publication, not to be confused with the journal of the Royal Horticultural Society). Further admiration for it and other lilies appeared in an article in the same issue, with Farquhar's advertisements promoting their near-exclusive corner on the market.

Wilson—the one who brought the horticultural world the regal lily—saw his reputation climb with that of the plant. The species, profiled on page one of Farquhar's *Garden Annual* of 1913, was attributed to "the indefatigable plant collector, Mr. E. H. Wilson," who had collected it "in remote and hitherto unexplored regions." That June, Wilson set the taxonomic record straight in *The Gardeners' Chronicle*, distinguishing *Lilium regale* from *L. myriophyllum*, the regal lily's maiden moniker. In this short article, Wilson also told the tale about the bulbs' transport "on men's backs and by riverway 2,000 miles across China" while he "accompanied them in a stretcher or on crutches." While not as colorful and descriptive as his future retellings, Wilson was finding his voice. He was certainly getting much practice; in the same year, he published *A Naturalist in Western China*, a two-volume set of narratives about his travels.

Farquhar's field of regal lilies in Roslindale, barely one mile south of the Arboretum, was abundantly populated, drawing crowds each summer. The Horticultural Club of Boston—founded in late 1911 with John Farquhar and Wilson as inaugural president and secretary, respectively—made special fieldtrips to visit and witnessed some fifty thousand lilies in bloom in 1914. An article in *The Florists Exchange* titled "Hardy Flowers at Farquhar's in July" commented (perhaps with some hyperbole) on the lilies' display in 1916, noting that "as many as thirty-eight fully developed flowers have been counted from one bulb on one stem, and a four year bulb will carry six stems." It was a popular item for sale and was frequently advertised in all the magazines. Farquhar's sale prices barely dropped to \$1.25 a bulb through

the teens, though there was the occasional offer of bulbs for \$0.90 each. John Farquhar died in 1921, but the nursery continued under new leadership. Over the next decade, other nurseries such as Wayside Gardens (in Mentor, Ohio) and Baums (in Knoxville, Tennessee) promoted their own regal lily stock.

Despite predictions that the regal lily would displace the common Easter lily as a forced bulb, production challenges limited this endeavor. A 1921 "Talk of the Trade" article in *Horticulture Magazine* noted how bulbs had to be "carried over a year in a pot without having the flowers cut," which was impractical for most growers. Furthermore, a 1926 United States Department of Agriculture bulletin described how the market became flooded with smaller and smaller bulbs of poorer quality as growers offloaded stock, raising speculation about the species' worthiness.

When Farquhar's nursery published its 1929 *Garden Annual*, regal lily was no longer profiled on page one, but was bundled with the other hardy lilies towards the back. Bulbs sold for \$0.75 apiece, a price that continued to drop during the first few years of the Great Depression. Wilson, along with his wife, died in a car accident in the autumn of 1930. In 1932, R. & J. Farquhar Co. Nurseries went bankrupt and was resurrected as Dedham Nurseries. During the liquidation sale of all nursery stock, regal lily bulbs sold for just \$0.15 each.

The regal lily still sold through the mid-twentieth century but was no longer an exclusive object of desire. Gardeners can be trendy, and it was the post-war era, when modern breeding programs were seen as the source of new plants, not old-fashioned field expeditions from a bygone age. George Pride, writing in these pages in 1974, summed it up: "Although the Regal Lily has been superseded in favor with many gardeners by the fine modern trumpet strains of lilies, there are still gardeners who cherish and grow *Lilium regale* in its pristine, true species form and consider it still one of the best of all lilies." Brent and Becky's Bulbs of Virginia, one of the most well-known purveyors of geophytes in North America, currently sells the regal lily for \$3.30 each.

The Regal Lily

Lilium regale (myriophyllum)



The Horticultural Club of Boston imported the Regal Lily of the Regal Lily

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EDWARD H. WILSON, F. R. S.
Assistant to the Director, Arnold Arboretum, Boston

"Chinese Wilson" WILL WRITE EXCLUSIVELY FOR THE GARDEN MAGAZINE

THE EDITOR is naturally particularly gratified in being able to secure the services of Mr. E. H. Wilson, Assistant to the Director of the Arnold Arboretum, Boston, who will contribute a series of articles to THE GARDEN MAGAZINE, beginning with next month's number.

Mr. Wilson is well known to many American and European horticulturists. He has just returned from an extended visit to China, where he spent the summer of the last year in the garden. His latest travels into Western China, covering a great deal of territory, have resulted in the introduction of a remarkable host of new, simple, and beautiful plants, many of which are most

interesting to know that ornamental horticulture in America is a branch of American industry growing from Boston China and other parts of Asia because of the climatic similarities of the two regions.

Mr. Wilson is naturally well qualified to write for the American public in regard to plants that are not only beautiful, but also useful, and he has written for the Garden Magazine on the same subject. The articles he has contributed in this series will appear occasionally, usually for months, for the next year and will undoubtedly put before our readers much material that has never yet been placed before the gardening public in accessible or readable form.

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A most beautiful creamy white bloom with bright golden throat; outside of flower white tinted yellow at the base with delicate purple midribs, having three white petals and three narrow petals; beautiful rich green foliage.

very slim stem, growing from eighteen inches to three feet tall, producing sometimes as many as eight or ten blooms in the bulb. A rival to the Japanese in fragrance. The bloom will last for days after being cut, having wonderful





While the regal lily was never officially planted in the Arboretum collections during Wilson's lifetime, Wilson cultivated a stand near his home on South Street.

The original charter for the Arnold Arboretum, signed on March 29, 1872, declared that the living collections “shall contain, as far as is practicable, all the trees, shrubs, and herbaceous plants, either indigenous or exotic, which can be raised in the open air.” Even though herbaceous plants were included, Sargent, knowing the charge was too ambitious, soon adjusted the scope to focus solely upon woody plants. His reasoning also related to the Arboretum's relationship with the Harvard Botanic Garden, in Cambridge, and to his own desire to create something unique within the university. The botanic garden possessed well-ordered beds of herbaceous plantings, and it is likely Sargent had no interest in competing with them. He would set out to monopolize woody plants instead.

And thus, not even one of Wilson's wild-collected *Lilium regale* bulbs was accessioned at the Arnold Arboretum. In fact, regal lilies from China were first accessioned in the autumn of 2017. Xinfen Gao, a professor of botany at the Chengdu Institute of Biology, had collected seeds while doing fieldwork near Maoxian, along the Min River. To no surprise, plants grown at her house flowered freely every year and set copious seed. She provided some to Andrew Gapinski and me for the Arboretum's collections at the conclusion of our expedition to Sichuan in 2017. Over a hundred bulbs from this accession were planted in the collections last autumn.

This isn't the first time the species was grown on Arboretum property, however. Numerous lilies, including this one, grew in

Wilson's personal garden, an Arboretum-owned house across from the then Bussey Institute on South Street. And, in the fall of 1963, *Lilium regale* was included in a lily demonstration plot established at the Arboretum's Case Estates, in Weston.

With *Lilium regale* finally growing in the Arboretum's collections, I cannot help but ponder the persistent allure of the species. With dogged determination, Wilson pursued it for years, and the lily still draws others to the Min River Valley, including the whole entourage who worked on the CCTV documentary. Wilson noted the regal lily was limited to a fifty-mile stretch along the Min River, where it was nonetheless common. And, despite his removal of nearly nine thousand bulbs between 1903 and 1910, the species still flourishes and is not considered endangered (though it probably deserves protection). In fact, a recent paper by Wu Zhu-Hua and colleagues reported surprisingly high genetic diversity and no bottlenecks among the populations that scatter the cliffs along the Min, Heishui, and Zagunao Rivers (all within the Min River Valley). It seems that those ever-blowing gusts play a role in the regal lily's lasting reign, for the researchers attribute the species' survival to long-distance pollen and seed dispersal. When I was there, with the lilies' fragrance blowing in the wind, something else was also in the air: a siren's song—or rather a lily's song—to lure someone back again and again.

Acknowledgments

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Confronting Climate Change at an Urban Grassland: Preserving and Restoring the Grasslands at Green-Wood

Joseph Charap, Sara Evans, and Frank S. Rossi

According to standard ecoregion mapping of North America, New York City falls squarely within the eastern broadleaf forest—an ecosystem characterized by an overstory of tall, broadleaf trees, like American beech (*Fagus grandifolia*) and white oak (*Quercus alba*). The on-the-ground reality, however, is made obvious in the air: a plane flying low into LaGuardia International Airport offers its passengers a view of the city's expansive network of yards and parks, roads and parking lots. After generations of urbanization, New York City's tree canopy represents a mere 21 percent of its land cover. A comparable percentage is, in fact, represented by mixed grassland vegetation—the turfgrass in public parks, golf courses, and soccer fields. The city's cemeteries also house a significant portion of that vegetation, totaling an area of more than five Central Parks.

At 478 acres, the Green-Wood Cemetery, in Brooklyn, is an active cemetery, a National

Historic Landmark, and a curated arboretum, with a diverse and well-established collection of trees. It is also one of the largest urban grasslands in New York City. Founded in 1838, on land that was once forest, Green-Wood includes rolling hills and kettle ponds. This topography, reflective of the landscape's position on a terminal moraine, made it inhospitable for agriculture but an ideal location to site a new kind of cemetery. Green-Wood was among the first cemeteries (after Mount Auburn Cemetery, in Cambridge, Massachusetts, and Laurel Hill Cemetery, in Philadelphia, Pennsylvania) built in the United States during the rural cemetery movement, a period in the mid-nineteenth century in which concerns over disease and rapidly increasing urban populations compelled city planners to site new burial grounds in the nearby countryside, instead of inner-city churchyards. In addition to providing burial space, these romantic, natu-

realistic landscapes served as counterpoints to the bustle and tumult of cities, providing sites for passive recreation and spiritual reflection in an idyllic environment. Their development predated all public gardens and arboreta in the United States and would help institutionalize what became a quintessential American value: that all people, even city-dwellers, deserved access to green space.

Green-Wood, at the time of its founding, was believed to combine an ideal set of virtues: it was close enough for a daytrip from Manhattan and far enough away that the land around it would never get developed. Since that time, Green-Wood's surroundings have radically transformed. Now bordered by the densely populated residential neighborhoods of Windsor Terrace, Park Slope, Sunset Park, and Kensington, Green-Wood's perimeter is directly flanked not by countryside but by the less-than-bucolic Metropolitan Transit Authority's Jackie Gleason Bus Terminal and a Con Edison substation. Over the past two centuries, the rapid development and urbanization of Green-Wood's immediate surroundings have increased the cemetery's relative socio-ecological value. Sunset Park, for instance, has the least amount of green space per capita among New York City neighborhoods. In the face of urbanization and increased disturbances from climate change, Green-Wood has returned to its roots as a community-focused public garden. This is a timely and crucial return for Green-Wood's resilience as a greenspace and for supporting the ecological health of the New York City region.

In recent years, Green-Wood's collection of trees and shrubs has gained increased recognition and accolades. Among other things, Green-Wood has collaborated with United States Forest Service on a project that led to the discovery of a new, as yet unpublished, species of wood-boring beetle (*Agilus* sp.), and Green-Wood's oak (*Quercus*) collection is now a Nationally Accredited Plant Collection. These efforts have highlighted the institution's importance within New York City's urban forest and have supported research vital for forest preservation. But what of Green-Wood's grasslands? Literally overshadowed by the larger, more charismatic

trees and shrubs, Green-Wood's expansive grasslands are by far its most complex, dominant, and resource-dependent vegetation. Alterations to the management practices of these grasslands, therefore, may stand to have the most impact on the sustainability and resilience of Green-Wood in the face of climate change.

Urban Grassland Ecosystem Services

Over the last twenty years, with the advent of improved data capture and analytic technologies, researchers and policy makers have become increasingly interested in quantifying the relationship between humans and the natural world. The United Nations codified the conceptual framework of this relationship, known as ecosystem services, in the Millennium Ecosystems Assessment report published at the turn of the twenty-first century. The anthropocentric view of ecosystem services asserts that the natural world serves the needs of humans in measurable ways: by regulating climate and ecosystem health, producing raw materials, supporting natural systems through chemical processes, and providing cultural benefits.

Humans, however, often impact the natural world in ways that demonstrably undermine those services. Urban grasslands showcase this tension. Grasslands provide a permeable surface for stormwater to penetrate, helping mitigate runoff from increasingly frequent extreme precipitation events. They provide habitat for wildlife and space for human recreation on a cushioning vegetated surface. Concurrently, at the soil surface, a seething foundry of microbial activity sequesters greenhouse gases, fixes nitrogen, and processes pollutants. Yet, by definition, urban grasslands, especially cemeteries, are associated with regular surface disruption from mowing and excavation, which destabilizes the soil surface, increasing erosion and releasing stored greenhouse gases. Turf is considered the most widespread irrigated crop in the United States, and its management also requires fossil fuels and a multitude of chemicals, including fertilizers, herbicides, fungicides, and growth regulators. The overall maintenance cost to the American consumer is steep: according to the market research group

Facing page: Urban grasslands at the Green-Wood Cemetery, in Brooklyn, provide essential ecosystem services for the surrounding high-density neighborhoods.



Bermudagrass (*Cynodon dactylon*) spreads with aggressive rhizomes and above-ground stolons, presenting a serious management problem for Green-Wood staff.

IBISWorld, households spent around \$30 billion on landscape maintenance in 2019, with most of those services centered around lawn-care. Expectations for high-intensity maintenance are especially pronounced at cemeteries, because they are publicly accessible landscapes of great emotional resonance, segmented by private ownership.

Although ideal for a rural cemetery, Green-Wood's glacially influenced topography is ill-suited for frequent mechanical mowing: the uneven ground is susceptible to scalping by mower blades and is further scraped by machinery navigating its steep slopes. The high-frequency mowing program causes surface disruption that leaves areas of bare soil and renders Green-Wood's grassland vulnerable to invasive organisms. Bermudagrass (*Cynodon dactylon*) is among the most aggressive invaders. Concerns about unsustainable mowing practices and the rapid expansion of Bermudagrass ultimately led to a collaboration between Green-Wood and the College of Agricultural Life Sciences at Cornell University. The three-year partnership officially commenced in 2017

and has focused on developing intelligent and climate-sensitive strategies for grassland preservation and restoration.

Intelligent Grassland Restoration

Bermudagrass is a warm-season species found in the humid transition zone in the southern United States. It was likely introduced from eastern Africa through ship ballast and intentional planting as a pasture grass. With the reduced frequency of lethal winter temperatures, grasses and forbs more characteristic of warmer areas are now persisting farther north. The observed northern expansion of Bermudagrass has also been accelerated in urban environments by the heat island effect.

While it is unknown how Bermudagrass arrived at Green-Wood specifically, the population has flourished over the past decade and continues to increase. Bermudagrass spreads with aggressive rhizomes and above-ground stolons, producing an impenetrable monoculture that quickly covers newer, prostrate grave-stones. The success of its colonization is in part due to Green-Wood's function as an active

cemetery with more than one thousand burials each year. Cemetery staff excavate and relocate soil whenever a grave is dug, and Bermudagrass moves with soil and spreads into recently disturbed plots, outcompeting other vegetation. The aggressive nature of Bermudagrass creates two problems: its rapid growth requires more frequent mowing to sustain an aesthetic expected by Green-Wood's lot owners and other visitors, and the dormant stage of straw-brown vegetation during the cooler months creates a poor visual aesthetic that is highly unfavorable to the majority of cemetery stakeholders.

In order to develop an intelligent grassland management system that is capable of controlling Bermudagrass at Green-Wood, the team knew that it would be essential to assess shifts in plant populations in response to maintenance. The researchers from Cornell are currently investigating the use of new agricultural technologies that can analyze satellite imagery to establish baseline Bermudagrass population levels. This technology will require on-the-ground observations to test its accuracy and will ultimately be integrated into existing mapping systems that are widely used by

urban grassland managers. The researchers have also deployed microclimate sensors in three areas of the cemetery that present unique vegetative characteristics due to topography and light intensity. Together, these technologies will allow the team to differentiate plant populations, measure the level of soil disturbance, and define microclimates and soil types across Green-Wood's landscape.

Intelligent grassland management also relies on tools from a larger toolbox, including refined methods of soil handling, weed seed-bank management, and adaptive seed mixtures. The team initiated trials in 2017, which have already yielded positive results. These last two years were the wettest in recorded history, which caused the team to assess fungal disease susceptibility among varieties in the first new seed mixture. But additional mixtures, some containing native species, have established nicely within three months and are now persisting under regular disturbance with little weed competition. These findings suggest that site-specific plant selection can help to address the persistent disturbance associated with the urban environment.

FRANK ROSSI



FRANK ROSSI



To better understand grassland habitats at Green-Wood, a team of researchers from Cornell and Green-Wood have installed microclimate sensors. They also conducted soil samples with colleagues from the United States Department of Agriculture's Natural Resource Conservation Service.

The goal is not to eliminate the presence of Bermudagrass but to find ways to realistically manage its presence, a balance which would occur in concert with restoration of the grasslands. Future seed mixtures will be designed to create ephemeral flowering regimes that support specialized pollinator species and will include grass species that thrive on reduced mowing, allowing the turf to store carbon deeper in the soil profile. Colleagues at Oklahoma State University are also conducting genetic fingerprinting of Green-Wood's existing Bermudagrass population, in order to identify its unique traits. As part of a progressive adaptation strategy, we hope to establish Bermudagrass cultivars that would better meet the needs of urban grasslands in the future.

Climate-Smart Mowing

While distinctly rural in design, Green-Wood's landscape also reflects qualities of the lawn cemeteries that came after the rural cemetery movement: flatter areas of turf bordered by trees. Lawn cemeteries prioritized turf for its assumed ease of maintenance and its neat, uniform appearance. To maintain a manicured aesthetic, however, these lawns demand either vegetation that grows slowly and moves by underground rhizomes, or a consistent, low height-of-cut mowing regimen (often a complete rotation through the landscape every seven days). At Green-Wood, depending on the rate of growth, the maintenance of this aesthetic can equal between thirty-two and thirty-five annual mows, which require over ten thousand gallons of gasoline to complete, emitting roughly two hundred thousand pounds of carbon dioxide into the atmosphere. Operational challenges that come with this level of turf maintenance are compounded by the complexity of Green-Wood's landscape, leading to worn-out vegetation and rutted soils.

The team of researchers, along with Green-Wood staff and contracted specialists from the landscape management company BrightView, are implementing a data-driven process that is more sensitive to climate change. They initiated a study in the summer of 2019 to reduce mowing frequency by 85 percent on approx-

imately two hundred acres, chosen for their topographical features and known levels of visitation. The team tracked equipment usage to assess actual mowing times and collected detailed observation of grassland response in terms of species richness. After three months, the acreage under the experimental reduced-mowing program was scaled back for several reasons: the disparate areas made it difficult to manage revised specifications; aesthetic concerns were voiced by staff members; and critical feedback came from cemetery stakeholders. While the general public voiced strong enthusiasm for the program, some lot owners saw the longer grass as a symbol of neglect. We learned that it is often best to implement changes like this gradually, allowing for increased community engagement throughout the process.

Nevertheless, much was gained during this first effort. The data gathered have enabled us to align mowing frequency with growth rate, thereby permitting a slight increase in cutting height, while respecting the expectations of stakeholders. These efforts will be strengthened as we continue to sow new seed mixtures in high-visitation areas, incorporating plants that require less mowing, while simultaneously increasing species richness.

Quietly Planning to Raise Awareness

The association between humans and grasslands is intimate and well-established: grasslands regenerate the soil for crops, sustain grazing animals, and fulfill an innate human desire to connect with the natural world. While a growing body of research is devoted to ecosystem services provided by urban grasslands, the people who most directly interact with these urban spaces are often unaware that the landscapes are, in fact, grasslands. This is more than semantics. Seeing cemeteries, public gardens, parks, sports fields, and golf courses as urban grasslands forces a paradigm shift. In this light, the grassland is not exclusively a feature of ruralness but rather one that is present in urban environments, within walking distance. This shift can help the public see that green vegetation is everywhere: in parks and gardens, on playing fields, and in cemeteries. The urban



In 2019, meadows were allowed to develop at Green-Wood. The meadows provided improved ecosystem services and lead to overall emission reductions. Photo by Art Presson.

grassland concept unites all these patches of green and makes them part of a dynamic landscape. It encourages curiosity from a soccer player about the care and health of a ground on which she runs, and it transforms an apartment building's backyard lawn into an opportunity to combat climate change, simply by doing less.

Raising awareness of the importance of urban grasslands like Green-Wood is a critical step toward sustainable, intelligent management. To this end, Green-Wood and Cornell are forming an Urban Grasslands Institute at Green-Wood, intended to share our findings and communicate the value of these often overlooked grasslands to a diverse urban population. The success of such an initiative is dependent on broader collaborations. The leaders of the project have invited a national group of experts from the field to consult on issues such as species selection and soil type, and will continue to look for opportunities to grow this knowledge base and expand its reach.

As socio-cultural issues evolve, the Urban Grasslands Institute at Green-Wood will share information about a combination of technologies and smarter management practices, helping homeowners and grassland managers prepare for the challenges of a rapidly changing urban climate. While not explicitly articulated, one of the underlying goals of the project is to reform the discordant, one-size-fits-all model of landscape maintenance promoted by the lawn-care industry, which has directly shaped the public's views of acceptable turf management. We hope to present a more nuanced model that optimizes the relationship between the biological and cultural functions of a landscape.

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Each Year in the Forest: Winter

Andrew L. Hipp

Illustrated by Rachel D. Davis

**... Except for the point, the still point,
There would be no dance, and there is only the dance.
—T.S. Eliot, "Burnt Norton"**

The forest year has neither beginning nor end. It has, however, landmarks along its coiling journey. By December, the worms are slow in the soil. Pillbugs and woolly bears become still as the puddles freeze. Painted ladies and mourning cloak butterflies are tucked under sheaves of tree bark. At our home in the Chicago region, snow comes and goes. One weekend, we have enough to cross-country ski. By the next it has melted away. Some years, we have yet to plant the garlic.

In a warm December, a few spring wildflowers start making headway on the next year. Colonies of bullet-shaped mayapple shoots emerge from the soil, leaves folded inside like tiny hands in prayer. Spring beauties sprawl beneath the leaf litter at the base of a sugar maple tree or under a rotting log, strap-like leaves curled and vulnerable, stems fragile. Foliage of the

false rue anemone looks as ready for the new year as it will in March. Do these individuals survive under the snow all winter long? Are they making a calculated move that will give them an edge in the spring rush? Or are they making a tactical error?

No matter what year, winter arrives with unexpected greens. Dark, leathery leaves of white bear sedge grow as broad as banana peels, while the narrow-leaved sedges cluster like mop heads in the forest understory and pool in shady depressions. Fronds of the spinulose wood fern recline against the oak leaves. Seductive entodon moss carpets the decomposing boles of fallen red oaks that started growing in the mid-1800s. The moss works intermittently through winter when there are few other plants to see, collaborating across the seasons with fungi and slime molds, algae and bacteria, and mice and invertebrates to digest and break apart the fallen tree. Evergreen leaves are gearing up to spend winter under the snow, ready to photosynthesize whenever the light is bright enough to fire up their chloroplasts. They are scaling back their hours to part-time.

II

The soil freezes and thaws repeatedly. Under the sugar maples, bundles of needle ice form at the surface of exposed soils, each an inch or so long and packed together like fists full of glass straws. Without an insulating layer of leaves, the ice heaves knots of soil into spires reminiscent of the stone formations in southern Utah's Canyonlands. The ice melts slowly in my ungloved hand, perfectly clear near the top and middle, swimming with soil particles near the base. If the soil beneath is warm enough, the frozen clods can be brushed loose like granola off a countertop, revealing a cool, moist bed of fine crumbles and worm castings.

The year pivots on the week flanking the winter solstice. We awaken to darkness and return home in darkness. On my bike ride into work, a white-footed mouse darts across the road and disappears into a shrub. It navigates the tangle of branches, and the light I turn on it plays on its back as though



Pillbug and Earthworm



Deer Mouse



White-Breasted Nuthatch



Gray Squirrel



Downy Woodpecker

the mouse were a convict scaling a prison wall. Owls call in the morning while I walk in through the woods. In the darkness, the trees are silhouetted against the cloudy sky. The sugar maples are magnificent, messy-headed beasts with trunks as wide as picture windows that heave out of the soil and head straight up for several stories before bursting into crown. But oak branches stretch out even under the canopy, vestiges of an ancient savanna. Oaks and beeches hang onto a good portion of their leaves. White and red oaks are everywhere, with hop hornbeam, musclewood, black cherry, and hackberry filling in where they can. I'm freed to forget, for the space of the walk, everything I need a hand lens to see.

The days hang still. There is the Christmas bird count with its coots and mallards, juncos and chickadees. The woods are filled with nuthatches, woodpeckers, golden-crowned kinglets, brown creepers, screech owls, barred owls and, down from the north, a saw-whet owl. There are always a few bluebirds. We pad around the house for the first few lengthening days of late December and January. The cardinals start to sing.

Then snow falls and blankets everything. In the midst of a snowstorm that lasts for hours, geese may be heard calling to each other from a nearby pond. As the sun goes down, the clouds shed enormous, cottony flakes. The snow goes on all night. We awaken to a clear sky, with Jupiter swinging up above Venus's left shoulder, the moon high in the southwest, a few steps from the planets. Paper birch fruits skid across the surface of the snow. Norway spruce needles from nearby backyards pepper the drifts. If it is cold and dry enough, the wind whips the fallen snow into sharp ridges that run along the margins of fallen tree trunks, forming slot canyons that reveal duff spilling out from beneath the trunks. Snowflakes link arms, cantilevering from the tree branches. Hoar frost sprouts from the ice along the creek like moss sculpted in porcelain. Water bubbles along beneath.

III

Snow hides, then it records and reveals. Mammal tracks run everywhere, except during the bitterest cold. White-footed mice gallop, tails licking the surface, forepaws and hind paws paired. Their tunnels weave through the snow, leading to crystal-edged holes. A scrabbling near one end of a mouse trail captures the frustrations of a fox. Meadow voles scurry, paws alternating. But we often don't see them. They begin their paths as tunnels between grass nests and the bases of tree trunks, but they often pop up for a quick view before they dive back down. When temperatures rise, these portals through the surface of the snowpack sweat a frosty collar, and the roofs of the tunnels become thin, translucent, graying over the darkness inside. When the roofs cave in, the tunnels are etched into the melting snow. They freeze again. Then the snow melts away and is gone altogether for a few weeks. Channels appear chewed into the grass. The snow returns.

This coming and going of snow is common throughout the winter in southern Wisconsin and northern Illinois, where I have lived almost all of my life, and it's fundamentally different from the persistent snowpack of the north, which insulates the ground through the coldest weeks.¹ During January 2019, when temperatures hit -30°F (-34°C)—so cold that a cup of boiling



Red Oak Buds

water, tossed in the air, would vaporize into a cloud of fog before it hit the ground—the mice and voles carried on under the snow, feeding on tubers and plant stems, girdling willows. At the bottom of the snowpack, the bottom layers sublimate away, leaving a crystalline rooftop with an air gap for the mice to occupy.² They are out of the line of sight of hawks and coyotes, though within earshot. The unlucky mouse may meet its maker crushed in the talons of a great horned owl that plucked it from the snow. Aside from that risk, the snow is the mouse's blanket and the earth its furnace.

I fixate on tracks. I spent a week of 2019 mistaking skunk tracks for raccoon. Downers Grove is an exceptionally skunky town, so I should know better. Part of the blame goes to my preconceived notions about when skunks ought to be out. It's not warm enough for them, I thought. That's the downside of experience: it insinuates itself between you and what you're looking at. I'll give another part of the blame to the powdery snow, which was too airy to take more than a vague impression. But a week later, just a little warmer, and the snow was excellent for tracks. Opossum prints showed the rear-paw thumb as clearly as a textbook. I could have measured the claws on the gray squirrels and the lengths of the white-footed mice paws. The "raccoon" I had been following resolved clearly to skunk, with defined claws in lieu of the asymmetrical prints of the raccoons, which themselves showed up along a ditch that day with crystal clarity.

Sharp-tipped maple seedlings and barren seed heads of wild leeks pierce the snow. Then the snow melts away, and I hardly notice them. A dusting over the top of a severed oak draws my attention to the white rot inside, throwing into relief the dark sutures between colonies of turkey-tail fungus devouring the wood. Dark, root-like networks of honey mushroom rhizomorphs become visible against the boles of fallen trees as the bark disintegrates. During the growing season, they invade roots of uninfected trees and work their way up beneath the bark, where the fungus infects the wood and causes decay. They aren't more prevalent in the winter, but snow masks so much that I notice things I would never see without it.

IV

Near the middle or end of February, winter starts to break. If it's very warm, bluebirds and mourning doves and chickadees will sing their hearts out as they shuttle around the neighborhoods. Red-bellied woodpeckers bark. Male redwing blackbirds return ahead of their potential partners and showboat around the ponds and ditches, singing from the spear-tips of the previous year's cattails and from the tops of the smaller trees. One morning a song sparrow returns: I hear it before I see it. It is a kind of springtime, but ephemeral, not the spring we planned for.

In the exceptionally warm winter of 2017, fog descended on the region one February night, and we awoke to temperatures near 50°F (10°C), a winter-resident robin singing, beating the sunrise by an hour and a half. I got to

*Skunk and Tracks*

the Morton Arboretum a bit before five. Fog hissed against the high-tension lines near the gate. I parked my bike and walked in through the unevenly blackened forest. The arboretum was a pioneer in burning oak woodlands to control weeds and promote understory diversity. The natural resources crew burns every year, and that February marked the beginning of one of the best burn seasons I've witnessed since I started working there in 2004. Raindrops hit the charred leaves at intervals, heavy, less resonant than they would have been on freshly downed leaves. This had been a particularly thorough burn, but even so, strips and patches of unburned leaves remained, and some logs that might have burned well went untouched while others smoldered for days. Flames were still darting out from the ragged end of a log. How must it have felt to come across spontaneous fire like this in the wild when it was still easier to carry coals from place to place than to start them from scratch? Over and over, groups of people must have rediscovered this mystery and felt grateful.

Chorus frogs called from the lowlands near the interstate. I retrieved my bike, and on the ride into the herbarium, I heard the unmistakable whistling of a woodcock flying low overhead. He landed and uttered a single "peent" in the field between the planted buckeyes and the woods adjoining the lake sedge marsh. I waited a few minutes, but he had no more to say. This was early for the woodcock's return. Its migration north is perhaps more variable than other birds', who synchronize with the increasing day length. Songbirds moving through may live on insects that navigate the furrows in the warming tree bark. They search for groggy moths and butterflies, and berries still hanging from the trees. The woodcock, by contrast, follows the worms northward as they awake. Its prehensile bill is good for poking holes in the



Woodcock



Song Sparrow

soil and snagging prey. Woodcocks are reputed to eat more than their weight in earthworms each day.³ The woodcock is not like the chorus frog, who can begin singing in the spring, stop when the weather gets cold, begin again, and then stop all summer long before its fall renaissance. The woodcock is different: when it returns, spring must be around the corner. The woodcock is committed to it.

V

We couldn't bear incessant spring exuberance. So, we are allowed a short break. Just as the most vivid dreams come when we are falling into sleep or stretching out of it, so the attenuation of stimuli in winter heightens our awareness. We notice praying mantis egg cases that we had missed in the fall. We pass a frozen pond and think of water milfoil and coontail and bladderwort on its floor, turions twisting toward March, common duckweed suspended below the surface of the ice or frozen into it, snapping turtles drifting noiselessly beneath the surface. We think back to the toads we saw moving through in June and wonder where they have buried themselves.

The season meanders northward. One afternoon near the end of February, an enormous flock of sandhill cranes flies over. I may be inside with the dog, or in the garage with my bike flipped upside down, oiling the chain, when I hear their call from the south, like a sound that would have been familiar to the dinosaurs, though they never actually had a chance to meet. I run out to watch the cranes pass, impossibly high, sometimes concealed inside a cloud. They sound as loud as if they were in a park at the end of the block. They stream by, croaking, strings of them twisting away behind the tipmost point that glides on ahead. They catch sight of a marsh below and grow disoriented, suffer a few moments of uncertainty, continuing to drift northward like a cloud. Then they regroup, and then they are gone. Whatever I was thinking of when the cranes first started calling has mostly drained away, but not utterly, and the cranes are gone so soon that the thoughts flood back in. I wander back to what I was doing.

We are not the same people we were last December. The cycles of freezing and thawing have heaved something loose. We are ready for spring.

PLANTS REFERENCED

<i>Acer saccharum</i> – sugar maple	<i>Fagus grandifolia</i> – American beech
<i>Allium tricoccum</i> – wild leek	<i>Lemna minor</i> – common duckweed
<i>Betula papyrifera</i> – paper birch	<i>Myriophyllum</i> sp. – water milfoil
<i>Carex albursina</i> – white bear sedge	<i>Ostrya virginiana</i> – hop hornbeam
<i>Carex lacustris</i> – lake sedge	<i>Picea abies</i> – Norway spruce
<i>Carpinus caroliniana</i> – musclewood	<i>Podophyllum peltatum</i> – Mayapple
<i>Celtis occidentalis</i> – hackberry	<i>Prunus serotina</i> – black cherry
<i>Ceratophyllum demersum</i> – coontail	<i>Quercus alba</i> – white oak
<i>Claytonia virginica</i> – spring beauty	<i>Quercus macrocarpa</i> – bur oak
<i>Dryopteris carthusiana</i> – spinulose wood fern	<i>Typha</i> × <i>glauc</i> a – hybrid cattail
<i>Enemion biternatum</i> – false rue anemone	<i>Quercus rubra</i> – red oak
<i>Entodon seductrix</i> – seductive entodon moss	<i>Utricularia</i> sp. – bladderwort



Praying Mantis Case

Endnotes

- ¹ Curtis, J. T. 1959. Environment. In *The Vegetation of Wisconsin* (pp. 25–48). Madison: The University of Wisconsin Press.
- ² Peter Marchand writes eloquently about this in his fascinating 1987 book, *Life in the Cold: An Introduction to Winter Ecology*. Hanover and London: University Press of New England.
- ³ Ehrlich, P. R., Dobkin, D. S., and Wheye, D. 1988. *The Birder's Handbook: The Field Guide to the Natural History of North American Birds* (p. 140). New York: Simon and Schuster/Fireside.

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Promise of Bark: *Eucommia ulmoides*

Kathryn Richardson

On July 1, 1910, Ernest Henry Wilson was traveling through Yunyang County, China—then part of eastern Sichuan Province—collecting plant material for the Arnold Arboretum. The region is extremely mountainous, with footpaths snaking along vertiginous river valleys, through naturally formed rock tunnels, and past old fort barrack sites. Wilson photographed many large trees in the region, and his passage was crisscrossed by men carrying loads of salt and other commercial products. He photographed one of these men shouldering two large bundles of bark that were suspended from either end of a wooden rod. This was a shipment of *du-zhong*, a medicinal bark from the hardy rubber tree (*Eucommia ulmoides*), which was prescribed then, as it still is today, for kidney and liver ailments, among other health issues.

Wilson never observed wild populations of *Eucommia ulmoides*—the only species in its family, *Eucommiaceae*—although he frequently saw two or three medium-sized trees planted near houses. Overharvesting and deforestation were likely (and continue to be) the cause for the rarity of sightings in the wild, but bark for medicine was abundant in cultivation. This medicinal use, however, was not the sole interest of botanists in Europe and North America. When the bark is harvested, dried, and gently broken, a latex-like product becomes visible. This characteristic aroused commercial interests.

In 1911, Charles Sprague Sargent, the founding director of the Arnold Arboretum, wrote, in the *Bulletin of Poplar Information*, about considerable excitement that had arisen around the species. “This is a hardy tree ... to which a good deal of space has recently been given in the daily papers as the ‘Hardy Rubber-tree,’ and as a possible source of rubber in cold climates,” Sargent wrote. If true, this use would provide a considerable breakthrough, given that commercial rubber was produced from a Brazilian species, *Hevea brasiliensis*, which could only be cultivated in the tropics. Five years later,

however, Sargent returned to the subject with a more dismal assessment, noting that the plant “has been of more interest to the energetic newspaper report than it can ever be to the manufacturer of rubber goods.”

The Arboretum’s oldest specimen of *Eucommia ulmoides* (accession 14538* A) grows along Linden Path, not far from the Hunnewell Building. The plant was received from James Veitch & Sons nursery in 1907 and was likely collected on an earlier Wilson expedition. The tree now graces visitors with its thick, sturdy branches that extend upward in a stair-like fashion. The bark is deeply ridged and furrowed, and has become a home for various moss and lichen. The elm-shaped leaves emerge in the spring. When gently pulled apart, the leaves reveal strings of latex within, each as thin as spiders’ silk. Although Sargent’s predictions about the commercial use of this latex product would prove accurate in North America and Europe, the *Flora of China* indicates that the rubber-like product has been successfully used for insulating electrical cables, sealing pipes, and even filling teeth. Medical research has increasingly pointed to the benefits of the bark for lowering blood pressure.

Today, wild populations of *Eucommia ulmoides* are heavily protected. The International Union for Conservation of Nature lists the species as vulnerable to extinction in the wild and estimates that fewer than one thousand mature individuals remain in widely scattered populations, mostly on steep slopes that are difficult to access. Collectors on recent Arboretum expeditions have never witnessed the species in the wild, although, like Wilson, they have observed the trees in cultivation. Whether wild or cultivated, *Eucommia* provides a direct reminder about the importance of plants beyond the garden walls: as medicine, as dreams of rubber, and as livelihoods for those who harvest and share what the plants have provided.

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