At the heart of the story of the Arboretum’s woodlands lies a tension between the managed and the unmanaged, the natural and the constructed. From the beginning, the Arboretum’s woodlands were intentionally excluded from formal development to serve as an aesthetic contrast to the taxonomically grouped collections. The Arboretum’s first director, Charles Sprague Sargent, took careful inventory of the remnant woodlands included in the Arboretum’s indenture. Rather than clear these areas for collections, Sargent, in concert with the landscape architect Frederick Law Olmsted, preserved these masses of native trees, noting their natural beauty and educational potential. “In no other public garden are there such cliffs or a more beautiful remnant of a coniferous forest,” Sargent wrote of Hemlock Hill, one of the four main Arboretum woodlands. Of the other areas, he noted that large oaks and other deciduous trees—some more than two-hundred years old, according to his estimate—were valuable for illustrating “New England trees in their adult state.”

Since Sargent’s time, these four areas—North Woods, Central Woods, Hemlock Hill, and Great Wild Gardens: The Story of the Arboretum’s Woodlands

Danny Schissler

Stands of sweet birch (Betula lenta)—seen here in brilliant fall color—take advantage of canopy gaps on Hemlock Hill.
Peters Hill Woodland—have come to exemplify the concept of the “urban woodland,” providing benefits along with management challenges unique to urban forest fragments. Today, these woodlands provide a naturalistic backdrop to the cultivated collections, offering a sense of spontaneity—whether in a fleeting glimpse of wildlife, discovery of a rare wildflower, or an unexpected encounter with a venerable old tree. Despite the seeming wildness of these areas, the woodlands and the ecosystems they support hardly represent the sort of pristine New England forest we might imagine them to be. On the contrary, they exist at the intersection of the intended and unintended consequences of human decisions—a sustained biological triumph over repeated broad-scale disturbances, creating a colorful mosaic of the native, the non-native, and the outright invasive, while raising questions about the very definition of so-called natural woodlands.

Woodland Hill

The woodlands inherited by Sargent at the time of the Arboretum’s founding in 1872 bore the marks of widespread ecological disturbance, most of it regrown from worn cropland and pasturage. In a 1935 article on land-use history at
the Arboretum, research assistant Hugh Raup (who would later be appointed the first plant ecologist on the Arboretum staff) examined deeds of conveyance, records of will, and other historical documents to catalogue the extensive parceling and transfer of properties that would eventually form the Arboretum. From Raup’s historical rendering, we know with some certainty that during colonial settlement in the 1700s, the forested portion of the Arboretum’s lands befall the same dramatic ecological disturbance as most central New England forests. Rapid deforestation provided fuel and lumber; clear-cut land with fertile soil was cultivated; and upland areas with thin, rocky soils provided pasturage and orchard land.

During that period, much of the Arboretum acreage passed through generations of the Davis, Morey, and Weld families. Raup used dendrochronology (a method of tree-ring dating) to show that nearly all of this land—with the exception of the steep slopes of what would later become known as Hemlock Hill—had witnessed the wholesale removal of mature trees. Early on, a saw mill had even been constructed on Bussey Brook. Then, in 1806, a wealthy merchant named Benjamin Bussey began purchasing properties in the area. He consolidated the
land into an exemplary pastoral estate known as Woodland Hill, on which he would spend his well-earned retirement. Bussey was fascinated by horticultural and agricultural science, and among his three hundred acres of hillsides, meadows, ravines, and brooks, the retired merchant reared merino sheep and cultivated the land through the introduction of novel crop species, trees, and shrubs.

Bussey developed his country estate in accordance with the naturalistic English landscaping tradition that had recently permeated American design sensibilities. He targeted areas for reforestation as part of his landscape plan and opened his woodlands, in truly altruistic fashion, to any who wished to escape the bustle and din of nearby Boston. Margaret Fuller and her circle of transcendentalist thinkers visited Bussey’s Woods, now known as Hemlock Hill, and she wrote fondly of the soaring hemlocks and pines found along the brook. Despite the rhapsodic reflections inspired by these woodlands, Raup’s study of extant trees in 1935 suggests that the oldest hemlocks were scarcely older than thirty when Bussey acquired the hill among his first parcels and, hence, would have been little more than twice that age when Fuller became a frequent visitor.

Bussey’s stewardship marked a period of rejuvenation for woodlands on the property, yet the ecological succession was nonetheless dictated according to the management practices of this genteel landowner. One local historian, drawing on the memory of older residents in 1897, noted that during Bussey’s tenure, woodland paths had been carefully tended all over Hemlock Hill and that an arbor had been erected near the summit, allowing visitors to reflect on the pastoral vista. This aesthetic approach to landscape maintenance was also outlined in Bussey’s will, where he dictated that, as long as his family still occupied the land following
his death, no trees should be removed, except when necessary “for the beauty of the groves and the walks.” Presumably Bussey would have applied a similar approach to other woodlands—or rather thickets of young trees—as he acquired them. The areas now known as Peters Hill Woodlands and the North Woods were primarily ten to fifteen years old when Bussey died in 1842, while the Central Woods—located on rocky soil that was largely unsuitable for agriculture—was between twenty-five and fifty years old.

When Sargent took the helm of the Arboretum, his impulse to preserve these woodlands likely spanned the aesthetic and the practical; his views on the multitude of ecological benefits provided by preserved forests—including reduced compaction, mulch creation, windbreaks, and improved soil moisture—are well-captured in his 1875 report, “A Few Suggestions on Tree Planting,” prepared for the Massachusetts Board of Agriculture. Sargent initially imagined that the woodlands would serve as plantations for the study of forestry and related sciences. In a letter to Boston’s Department of Parks in 1879, Sargent described a “scientific station” that would allow for the investigation of “the best methods of forest reproduction and management” as well as “a school of forestry and arboriculture in which special students may ... acquire the knowledge and training necessary to fit them for the care and increase of our forests.”

Eventually, Sargent abandoned this forestry plan, yet he retained the three woodland areas later known as Hemlock Hill, North Woods, and Central Woods, prescribing a basic management regime of occasional thinning—more or less maintaining Bussey’s vision for these wooded spaces. Later, a fourth woodland was added with the 1895 annexation of the sixty-seven-acre tract that became Peters Hill. A naturalistic blending of native woodlands and cultivated collections—producing a so-called
landscape effect—formed the foundation for Olmsted’s design and left a lasting impact on the institution’s identity. Ultimately, the long legacy of human intervention that had shaped the Arboretum’s woodlands would continue into the twentieth century and well beyond Sargent’s time, as staff members grappled with a succession of natural and unnatural disturbances in these areas.

**Managed Succession**

Among the Arboretum woodlands, Hemlock Hill most clearly shows the ongoing process of human intervention. On a cold September evening in 1938, a four-day rainstorm crescendoed across New England. Violent wind gusts buffeted forests south of Boston, and the Blue Hills Observatory recorded hurricane speeds of over 150 miles per hour. At the Arboretum, staff members hunkered down in the darkness of the Administration Building, listening to the creaks and groans of the trees. The worst of the storm lasted only a few hours. The next morning, staff awoke to a grim scene. The Arboretum suffered greatly: over fifteen hundred trees had been claimed by the winds. Much of the damage befell the Arboretum’s woodland areas, including Hemlock Hill, where at least four hundred native hemlocks (*Tsuga canadensis*) lay in splinters. Arboretum staff responded to this cataclysm by planting hundreds of hemlocks in their place, some as large as six feet tall.

The storm would prove to be the most destructive in the recorded history of New England, just one in a series of events that transformed the Arboretum’s natural woodlands—its marks still visible today. Yet in many ways, the natural history of Hemlock Hill, and the Arboretum woodlands in general, has been a story of ongoing landscape management. Without human intervention, ecosystems respond to disturbances like hurricanes, fire, and even secondary regrowth after agricultural land is abandoned, through the process of **succession**—or the gradual change in species structure in an ecological community. Since the beginning of this successional process for the Arboretum woodlands, starting when Bussey set aside reforestation land and allowed seedling thickets to become established, this gradual change has been continually manipulated, especially in response to large-scale disturbance like the hurricane. This management, of course, raises questions about the very conception of natural succession and whether strategies often intended to contribute to (and perhaps simply expedite) these ecological changes are, in fact, additional forms of disturbance.
In 1930, nearly a decade before the hurricane caused ecological upheaval across New England, Arboretum botanist Ernest Jesse Palmer presented an extensive survey of the Arboretum’s spontaneous flora, cataloging biodiversity throughout much of the grounds—including its woodlands. Alongside his thorough inventory of each area of the living collections and the underlying geology of the landscape, Palmer hinted ominously at the effects of aggressive exotic plants on native flora. His account is particularly notable for its description of the colonization of highly disturbed areas, such as the abandoned quarry south of Bussey Street, by an “uncommon” assemblage of herbaceous weedy species like green foxtail (Setaria viridis), black nightshade (Solanum nigrum), and common vetch (Vicia sativa). These species, notably absent from his inventories of the diverse and richly populated woodland areas, had only begun to take hold on the grounds. The time between Palmer’s and ours marks an ecological transition for many of the Arboretum’s natural areas, with the slow creep of invasive plants gradually shifting the compositions of species among these woodland fragments.

Most of the first weedy species to show up in New England arrived with European settlers beginning in the seventeenth century. Well-adapted to continually disturbed conditions, many of these species established themselves in parts of the Arboretum. A second wave of non-native introductions arrived on a network of exploration and plant trade connecting Western nurseries and botanical institutions with East Asia beginning in the 1860s, resulting in the rapid importation of thousands of potentially invasive species. Through its legacy of collection and distribution of exotic plants, the Arboretum played its part in popularizing many of these species, such as Oriental bittersweet (Celastrus orbiculatus) and Amur cork tree (Phellodendron amurense).

Today, the control of invasive plant species is outlined as an ongoing objective in the Arboretum’s Landscape Management Plan, although many of these interventions are conducted on an ad hoc basis, given that most horticultural resources are invested in the more manicured portions of the living collections. Nonetheless, occasional efforts have been devoted to this end. Peters Hill Woodland, for instance, was subject to a three-year project conducted by the Hunnewell interns, starting in 2008, with the last two years focused primarily on removing woody plants like cork tree and castor aralia (Kalopanax septemlobus), which had escaped from the surrounding collections. Control of the botanical composition of urban woodlands—particularly those in close proximity to historically disturbed areas—is often costly, however, requiring horticultural care be diverted from the accessioned collections. Moreover, the management of invasive species using mechanical and chemical methods raises questions about the very idea of preserving ecosystem processes, further muddying our understanding of how landscapes continually disturbed by human intervention could be construed as natural.

Introduced insects and pathogens have also inspired radical management changes in the
woodlands—a point illustrated by the arrival of hemlock woolly adelgid (Adelges tsugae) at the Arboretum in 1998. After the initial discovery of this destructive pest on Hemlock Hill, a substantial effort on the part of the Arboretum’s horticulture and curation staff culminated in the accessioning of over nineteen hundred existing trees (some nearly two hundred years old), allowing for the close monitoring of the spread of adelgid and its impact on the hemlock population. Today, the remaining mature hemlocks—many of them originally planted in response to the destruction of the Hurricane of 1938—owe their survival to annual treatment with a soil- and trunk-injected insecticide, imidacloprid. Where mature trees have fallen or been removed, dozens of recently planted Chinese hemlock (Tsuga chinensis)—naturally resistant to the ravages of the adelgid—reach up to fill canopy gaps. In 2006, the Arboretum also planted sapling oaks (Quercus montana, Q. coccinea, Q. velutina), shagbark hickories (Carya ovata), and sugar maples (Acer saccharum) on the southeast side of Hemlock Hill.

To echo Palmer’s observations from 1930, “The line between Nature’s great wild gardens and those planted and tended by man is not a hard and fast one ... Nature herself is the builder if not the designer, guided only by man’s selection and aid in planting, pruning and cultivating the things he deems most desirable.” Across its rocky terrain, Hemlock Hill bears the marks of past attempts to preserve what Sargent had once deemed “the great natural feature of the Arboretum” through generations of stewardship. While a walk in its cool and shady understory may mentally transport us to the “primeval” New England forest that even...
Palmer envisioned there, the turbulent history of this forest fragment and its resulting character is perhaps the most challenging to our notion of what constitutes a natural woodland.

Ecology of the Urban Woodland

Natural or not, the Arboretum’s woodlands support a great deal of biodiversity. In contrast to the cultivated collections, the successional composition, varied topography, and increased leaf litter and woody debris of these areas provide suitable habitats for a variety of native and non-native species. The woodlands harbor a variety of deciduous hardwoods, conifers, shrubs, herbaceous species, ferns, mosses, and fungi. The woodlands also provide habitats for a range of fauna that often avoid open forests and humans. Snags—dead trees that remain standing—and decaying holes in trunks provide shelter for cavity-nesting birds. Tall trees with dense canopies offer nesting opportunities for larger birds of prey. In the shady understory, reptiles and amphibians make homes among the leaf litter and decaying logs. Wild turkeys forage for acorns and nuts from beeches and hickories. A variety of mammals—coyote, deer, foxes, rabbits, raccoons, opossums, squirrels, chipmunks, voles, and field mice—utilize the Arboretum woodlands.

In addition to supporting biodiversity, these woodlands provide a range of ecosystem services that benefit outlying collections. Given the Arboretum’s location in a densely populated urban environment, the entire landscape faces an exceptional set of disturbance and climatological factors. The constant pressure of competing species, exotic wildlife, and invasive pests and pathogens is compounded by elevated air and soil temperatures, carbon dioxide, ozone and nitrogen levels, decreased humidity and water availability, soil compaction, and the presence of pollutants. The preservation of urban forests combats these factors by promoting soil building and moisture retention, erosion prevention, temperature control, and carbon sequestration. As Sargent had once envisioned, the Arboretum’s woodlands complement the surrounding cultivated collections aesthetically, as part of a naturalistic landscape design, and ecologically, as a buffer against the often harsh conditions of the urban environment.

While the Arboretum’s woodlands never became the forest plantations for the study of Canada mayflower (Maianthemum canadense) is an abundant spring ephemeral on Hemlock Hill, while spotted cranesbill (Geranium maculatum) is more commonly observed in Peters Hill Woodland.
North Woods

North Woods (2 acres) is situated along eskers that overlook the Leventritt Shrub and Vine Garden. The Arboretum acquired the westernmost part from the Adams Nervine Asylum in 1926, but the remainder has been part of the Arboretum since its founding. The eastern part of North Woods has diminished over time. This area is also home to quite a few non-native species that likely escaped from the cultivated collection, including cork tree (*Phellodendron amurense*), Korean mountain ash (*Sorbus alnifolia*), and Oriental bittersweet (*Celastrus orbiculatus*).

Geology and soils: Higher pH soils (A horizon: 4.21; B horizon: 4.47) than Hemlock Hill and Central Woods; glacially deposited eskers underlain by gravel and other sediment; groundcover mostly of deciduous leaf litter.

Mid and overstory: Dominated by sugar maple (*Acer saccharum*), with an abundance of sweet birch (*Betula lenta*); interspersed with white oak (*Quercus alba*) and shadbush (*Amelanchier arborea*).

Understory: Woody taxa include many escaped species from nearby collections such as sapphire berry (*Symlocos paniculata*), euonymus (*Euonymus spp.*), honeysuckle (*Lonicera spp.*), linden (*Tilia spp.*), and zelkova (*Zelkova spp.*); herbaceous groundcover includes sedge (*Carex spp.*) and aster (*Symphyotrichum spp.*).

Wildlife species of note: Great crested flycatcher (*Myiarchus crinitus*), eastern wood-pewee (*Contopus virens*), wood thrush (*Hylocichla mustelina*), red-eyed vireo (*Vireo olivaceus*), ovenbird (*Seiurus aurocapillus*), black-throated blue warbler (*Setophaga caerulescens*), black-throated green
warbler (Setophaga virens), black-and-white warbler (Mniotilta varia), eastern screech owl (Megascops asio), and eastern red-backed salamander (Plethodon cinereus).

Central Woods

Central Woods (6.5 acres) was maintained as pastureland before a period of regrowth beginning in the 1790s. This woodland is favored by wildlife species that prefer dense, mixed forests. While this woodland has been relatively undisturbed, containing few non-native species in comparison to other areas, the dominance of eastern white pine (Pinus strobus), a pioneer species, is the result of formal clearing in some areas several decades ago.

Geology and soils: Low pH soils (A horizon: 3.6; B horizon: 4.09) underlain by outcroppings of Roxbury conglomerate in many areas; heavy cover of duff and leaf litter compared to the other Arboretum woodlands.

Mid and overstory: Primarily dominated by eastern white pine, red oak (Quercus rubra), and white oak, with stands of immature eastern white pine and American beech (Fagus grandifolia).

Understory: Dominated by lowbush blueberry (Vaccinium angustifolium) and huckleberry (Gaylussacia spp.).

Wildlife species of note: Red-breasted nuthatch (Sitta canadensis), yellow-bellied sapsucker (Sphyrapicus varius), pine siskin (Spinus pinus), common redpoll (Acanthis flammea), purple finch (Haemorhous purpureus), red- and white-winged crossbill (Loxia curvirostra, L. leucoptera), great horned owl (Bubo virginianus), and coyote (Canis latrans).

White trillium (Trillium grandiflorum) and common milkweed (Asclepias syriaca) are among the many wildflowers found in the Arboretum’s woodlands.
The Arboretum’s woodlands provide habitat for a range of fauna, and some, like the red-backed salamander (*Plethodon cinereus*), are found almost exclusively within these areas.

**Hemlock Hill**

Hemlock Hill, the largest Arboretum woodland, occupies 22 acres. It has had a complex history of disturbance, including the 1938 hurricane and arrival of the hemlock woolly adelgid. This woodland is home to a number of unique birds, amphibians, ferns, and herbaceous perennials that prefer the shady understory of dense forestland. Prominent non-native plants include glossy buckthorn (*Frangula alnus*), castor aralia (*Kalopanax septemlobus*), mountain ash (*Sorbus* spp.), and hawthorn (*Crataegus* spp.).

**Geology and soils:** Low pH soils (A horizon: 3.75; B horizon: 4.19); steep rock outcroppings on northeast side; pit-and-mound formations formed by downed trees throughout.

**Mid and overstory:** Heavily dominated by eastern hemlock and some red oak, along with stands of eastern white pine and sweet birch succeeding mature trees.

**Understory:** Dominated by Canada mayflower (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*) and hay-scented fern (*Dennstaedtia punctilobula*), with shadbush (*Amelanchier arborea*) and mapleleaf viburnum (*Viburnum acerifolium*).

**Wildlife species of note:** Red-breasted nuthatch, pine warbler (*Setophaga pinus*), black-capped chickadee (*Poecile atricapillus*), tufted titmouse (*Baeo-lopous bicolor*), red-tailed hawk (*Buteo jamaicensis*), Cooper’s hawk (*Accipi-ter cooperii*), Virginia opossum (*Didelphis virginiana*), eastern red-backed salamander, and northern dusky salamander (*Desmognathus fuscus*).

**Peters Hill Woodland**

The 2.5-acre woodland on the eastern slope of Peters Hill was the subject of the Hunnewell intern project for three years (2008–2010). In 2008, the intern class surveyed the vegetation and came up with management recommendations pertaining to invasive species removal, which the following two classes carried out. Peters Hill is the most species-rich of the woodlands and provides space for the greatest number of non-native species, most notably cork tree, crabapple (*Malus* spp.), hawthorn, and Korean mountain ash.
Geology and soils: Comparatively high pH soils (A horizon: 4.28; B horizon: 4.51) due to a lack of conifers; steep slopes forming a wet ravine that provides water throughout most of the year; heavy presence of woody debris, duff, and leaf litter.

Mid and overstory: Dominated by red oak, followed by sassafras (*Sassafras albidum*), black oak, cork tree, yellow birch (*Betula alleghaniensis*), castor aralia, and a variety of other native and non-native hardwoods.

Understory: Dense understory with at least twenty-three woody species in the sample plot; abundance of native and non-native saplings, primarily cork tree; many common herbaceous perennials.

Wildlife species of note: Great crested flycatcher, scarlet tanager (*Piranga olivacea*), rose-breasted grosbeak (*Pheucticus ludovicianus*), black-throated green warbler, eastern wood-pewee, wood thrush, chimney swift (*Chaetura pelagica*), common nighthawk (*Chordeiles minor*), and common garter snake (*Thamnophis sirtalis*).

Survey methods

Woody flora was documented in a 2017 survey, based on two randomly assigned ten-meter-radius circular plots within each of the four woodlands. In Peters Hill Woodland, only one circular plot was examined along with a recreated transect first studied by the Hunnewell interns, class of 2008.

In addition, each study area was sampled as part of the 2017 landscape-wide soil survey. Ten auger samples, separated into A and B horizons, were taken within each of the four study areas and composited, producing one A- and one B-horizon sample for each natural land. These samples were sieved, air-dried, and sent to the University of Massachusetts for analysis.
arboriculture that Sargent had imagined, the unique ecosystems of these areas have served researchers working across a range of scientific disciplines. Sheltered habitats situated among woodland microclimates—such as the shady, moist understory of Hemlock Hill—have offered opportunities to study native salamander species. Mature trees in Central Woods are used in climatological and phenological studies. Peters Hill Woodland, along with the “urban wild” of Bussey Brook Meadow, present unique successional models of minimally managed urban vegetation and the ecosystem services provided by cosmopolitan assemblages of species found in such areas. Most recently, former Living Collections Fellow Jenna Zukswert collaborated with other staff members to conduct an Arboretum-wide survey of soils and species composition within the woodlands. Data acquired through these projects can help researchers understand the response of urban woodlands and their inhabitants to a changing climate.

Resistance of Nature

Since the time of Benjamin Bussey and the wayward philosophers for whom he opened his lands, the forest fragments now situated on the Arboretum’s grounds have offered a space for rejuvenation and a retreat from the hum of city life. Sargent and Olmsted—both profoundly influenced by an English tradition of naturalistic park design—incorporated these woodlands as a visual backdrop for the accessioned plant collections, adapting land that Olmsted described in a 1880 letter to author Charles Eliot Norton as largely unfit for cultivation. Today, the Arboretum’s woodlands provide visitors a sense of tranquility and privacy...
often missed among the more open and ordered character of the cultivated collections. Here, the allure of wildness and the excitement of spontaneity play out in chance encounters with the seemingly natural.

But the character of such spaces begs the question: what is truly natural in an era of accelerated ecological upheaval? What role do such spaces—shaped continuously by the interplay of environmental stochasticity and human impulse—play in the Arboretum landscape today? And finally, how might we manage these spaces to reap the spiritual and ecological benefits they provide, while acknowledging the realities of our rapidly changing urban environments? In the words of Palmer, “There is a constant effort of Nature to reassert her sway and reclaim for herself the areas that men have planted. Even in the best kept gardens this jealous resistance of Nature is not entirely overcome.” At the Arnold, the genius of Sargent and Olmsted’s collaborative vision lives on in these naturalistic, if not entirely natural, interstitial spaces between the cultivated and the wild—not only in their physicality, but in the way they touch our primal selves, helping us forget, if only for a moment, that we’re walking in a garden.

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