Balancing Adaptation and Legacy: How the Washington National Cathedral is Protecting its Olmsted Woods in the Era of Climate Change

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Introduction

The Role of Olmsted Woods

A defining characteristic of any Olmsted plan is a respect for the natural beauty and structure of the existing landscape. Frederick Law Olmsted, Jr. wrote that his duty was to "protect and perpetuate whatever of beauty and inspirational value inherent [is] in that landscape... and to humbly subordinate to that purpose any impulse to exercise upon it one's own skill as a creative designer."[1] He employed this approach in his two master plans (completed in 1910 and 1924) for the grounds of the Washington National Cathedral in Washington, D.C., and the benefits are still enjoyed by visitors today.

Figure 1. View of the Cathedral building from the gardens to the south (2017); Photo: Andropogon

The plan's organization of the Cathedral grounds, also referred to as the "Close," takes full advantage of the dramatic topography on the site, with the Cathedral building perched at the top of Mount Saint Alban, overlooking the Potomac River basin. The woods below the Cathedral building, now called Olmsted Woods, were preserved in the plans in order to emphasize the strength and form of nature as a complement to the strength and beauty of the Cathedral's built form. "The Cathedral will crown a densely wooded hill, standing tree embowered at the summit of easy and graceful slopes; it will

[1] Olmsted. (1928)

rise heavenward out of and above nature's strength and beauty, in towers and buttresses and pinnacles as a sublime, God-inspired anthem in stone.”[2]

In Olmsted's view, the Woods played a critical role in helping visitors to arrive at the Cathedral mentally prepared to reconnect with their faith. “The great charm of approaching the cathedral through and up a wooded hillside, having the city far behind and below, helping one to forget the hurly-burly, the busy-ness of a work-a-day world, must be taken advantage of to the fullest extent.”[3] Long before it was the subject of scientific studies, Olmsted fully understood and employed the concept of “biophilia”, which is defined as the human affinity for living systems, throughout his designs. Thanks to the many stewards of this historic landscape, Olmsted's vision of a lush, restorative escape from city life lives on through the publicly accessible landscape of Olmsted Woods.

Context and Character

Olmsted Woods encompasses five acres of woodland in the southern portion of the 59-acre Close of the Washington National Cathedral, which is located in the northwestern part of D.C., near the Naval Observatory and Embassy Row. Two streams within Olmsted Woods drain a 26-acre watershed, encompassing the southern half of the Close, a portion of the Cathedral building itself, St. Albans school, All Hallows Amphitheater, the Bishop's Garden, and a portion of Beauvoir Elementary school. Almost all of the Cathedral grounds are within the watershed of Rock Creek, a beloved but damaged stream system that suffers from the typical suite of urban

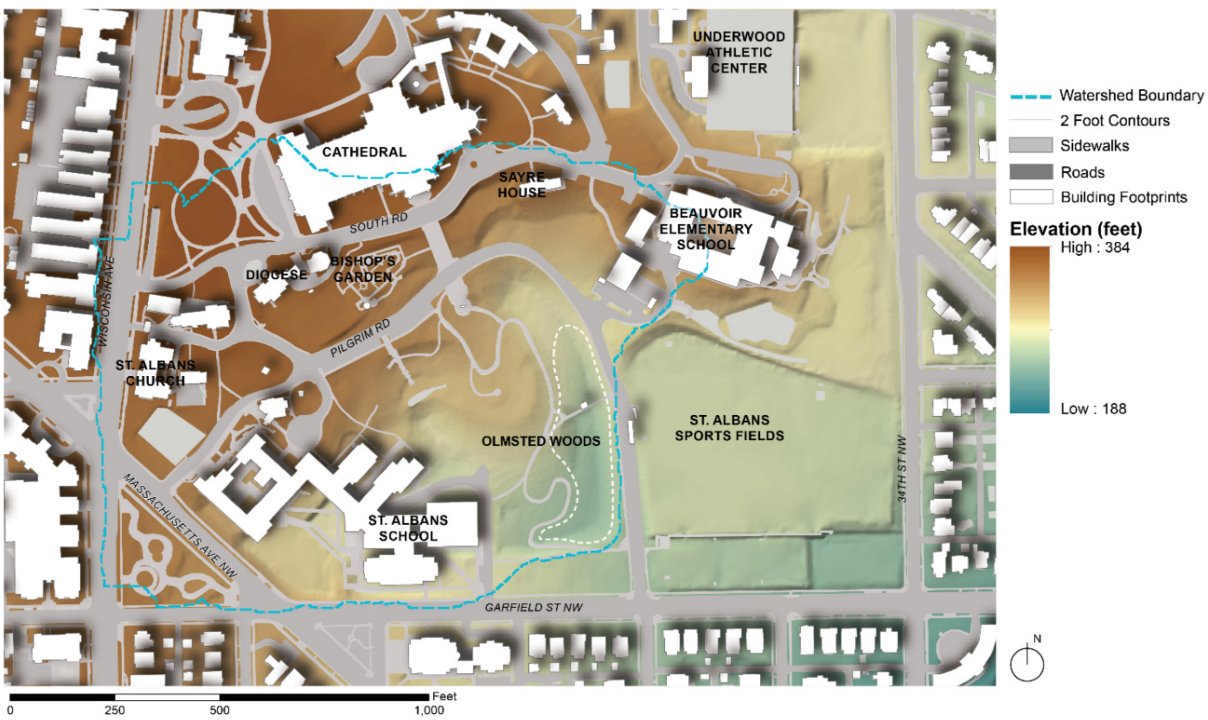

Figure 2. Elevation map of the Olmsted Woods watershed within the Cathedral Close; Image: Andropogon

water quality problems. Water drains from Olmsted Woods to the southeast and connects to Rock Creek via a stream system traversing nearby Normanstone Park.

[2] All Hallows Guild. (1919)

[3] National Park Service. (2022)

Olmsted Woods is one of the last remnants of an extensive oak and beech forest that once covered Mount Saint Alban, which is perched on the edge of the piedmont plateau above the Potomac River Basin. The Cathedral building is located at the highpoint of the site, visible from many miles away at some locations in D.C. The Woods are now part of a patchwork formed by the remaining natural areas between Glover Archibold Park to the west and Rock Creek Park to the east. These two parks cover over 2,000 acres and serve as critical wildlife and recreational connections to the Potomac River.

Increased urbanization and climate change have posed threats to the health of the Woods for decades, but recent weather extremes in the D.C. area have quickly exacerbated erosion issues and tree loss. A team of landscape architects and engineers who developed a master plan for the Woods in the late 1990s, in keeping with the original Olmsted plans for the Close, are currently revisiting the site to develop an updated restoration plan, which will help guide future investments in the context of a changing climate.

The Past

Early History

Prior to the arrival of European emigrants and the displacement of the local Native Americans, the head-of-tidewater ecosystem in what is now Washington, D.C. provided abundant fish, game, and agricultural opportunities for its residents. This area was a major trading center for the Nacotchtank, or Anacostan people, who settled a number of villages in what is now metropolitan D.C. One such village existed about two miles west of the Cathedral site, above the east bank of the Potomac River. Following the arrival of European emigrants, the Native American population in the D.C. area was reduced by nearly three quarters due to war, disease, and displacement. Their land was taken and resettled by European emigrants beginning in the early 1600s.[4]

The Cathedral property was purchased by Joseph Nourse in 1813. Nourse moved his family to the site after being appointed the first Registrar of the Treasury by George Washington. During this time, the land, referred to as Mount Saint Alban, was worked by enslaved people until the early years of the Civil War.[5]

Design History

In 1898, Henry Yates Satterlee, the first Episcopal Bishop of Washington, acquired the land to host the Protestant Episcopal Foundation.[6] The lush, wooded hilltop site was chosen with the intent of providing visitors with an escape from the bustle of urban life and an opportunity to reconnect with their faith.

Yates created the Cathedral Park Board and hired Beatrix Jones Ferrand as a landscape consultant to complete the initial site planning and planting plans.[7] In 1907, Yates hired Frederick Law Olmsted, Jr. to develop a master plan for the Cathedral's 59-acre grounds, and Olmsted remained involved with the site for the following thirty years.

Pilgrim Road, bordering the Olmsted Woods to the east and north, was a critical element of Frederick Law Olmsted, Jr.'s plan. The road was named for its primary purpose, which was to provide a peaceful setting for a pilgrimage through the woods, softly winding up Mount Saint Alban from Garfield Street to the Cathedral perched at the top of the hill. Olmsted's clustering of the Cathedral's auxiliary

[4] National Park Service. (2018)
[5] Washington National Cathedral. (2019)
[6] All Hallows Guild. (2018)
[7] Zaitzevsky. (2009)


Figure 2. The All Hallows Guild hosts a pilgrimage through the Woods, following the route of Olmsted's original path design (2006); Photo: Andropogon

buildings together at the high point of the site allowed for the woodland and stream on the south slope to be preserved as dedicated open space.

In other areas of the Close, Olmsted designed the Bishop's Garden, which features formal planting beds, lawns, and stone walls. This garden hosts a number of plants which have biblical connections, including cedars and fig trees. Directly adjacent to the Cathedral building, he specified tall, evergreen plantings in order to achieve the feeling of a mature, historic landscape.[8] The amphitheater, sited on a slope below the main building, was designed to host outdoor services and other gatherings. Michael Vergason Landscape Architecture restored and formalized this area in 2005 to better accommodate Cathedral events and educational programming.

In Olmsted's original vision, Cathedral visitors would enter through the woods from the south instead of the entering from the north, as they most often do today. He imagined the woods as a place of respite where "the great sweeping branches of the trees seem to brush off, as it were, the dust of the city, so that one at last reaches the Cathedral cleansed in mind and in spirit."[9]
Florence Brown Bratenahl, the wife of the Cathedral's first dean and member of the All Hallows Guild, worked closely alongside Olmsted, serving as the Cathedral's landscape designer from 1928 to 1936. She was responsible for the design of the Pilgrim Steps and surrounding plantings, which rise from Olmsted Woods to the Cathedral, among many other landscapes within the Close. [10]

Stewardship

The All Hallows Guild is an all-volunteer nonprofit organization that was created in 1916 to "maintain the Cathedral's gardens and grounds as a haven of peace in the midst of the Capital City."[11] In

[8] All Hallows Guild. (2018)
[9] National Park Service. (2022)
[10] All Hallows Guild. (2018)
[11] All Hallows Guild. (2022)

the early days of the Cathedral development, the Guild worked to raise funds to bring mature specimen plants to the grounds in order to create the feeling of a mature landscape. They continue to provide for the care and beautification of the Cathedral's grounds, working closely with the horticultural staff to preserve the historic landscape and procure funding for renovations and maintenance. The Guild has engaged a number of design teams over the past 30 years to accommodate new construction projects on the Close and ensure that the grounds can adapt to a changing climate. In recent years, it has invested more than six million dollars to improve and maintain the gardens and grounds.

The Present

Threats to the Woods

From the beginning of the planning process, Olmsted was sensitive to the threat of surrounding uses that could negatively impact the Olmsted Woods experience, particularly threats to the mature trees and stream ecosystem. One hundred years later, the threats of a rapidly changing climate and increased runoff from impervious areas surrounding the site have become a reality.

The All Hallows Guild has been working diligently to protect the natural beauty of Olmsted's vision while improving access and responding to increased urban development in the surrounding area.

As part of the core urban fabric of Washington, D.C., the Cathedral grounds are vulnerable to changes in the urban environment that increase stormwater runoff and prevent groundwater infiltration. As buildings and athletic facilities have been added to the school campuses surrounding the Woods, an increase in impervious surfaces has caused higher peak flows in the two streams during storm events. This change, coupled with a major increase in the frequency and severity of storm events in the D.C. area, has caused major erosion, damage to native plants, and, most dramatically, the loss of many large canopy trees within the Woods.

Additionally, over the last decade, the Washington, D.C. region has experienced alternating spans of extreme droughts and flooding. This has compounded the stress on the mature oak trees within the Woods, many of which are dead or dying. The loss of these canopy trees has a significant impact, not only on the composition of the understory plants below, but also on the experience of walking through the deep shade of the woods and hearing birds and other wildlife in the dense tree canopy overhead.

The number of visitors to the Woods has also greatly increased over the past decade. More intensive use from students attending the three schools in and around the Cathedral grounds, both from programmed and unprogrammed visits, has strained the plantings in some gathering areas and along paths. During the height of the COVID-19 pandemic in 2020 and 2021, the Woods saw a major influx of visitors from nearby neighborhoods who were seeking an outdoor refuge to walk, exercise their dogs, and escape the indoors. The Guild has faced challenges with keeping these visitors on designated trails and ensuring that pet waste is properly removed.

Restoration Efforts

Andropogon Associates, a landscape architecture and ecological planning firm, has developed a long-term partnership with the All Hallows Guild, working to design and implement numerous restoration projects within the historic property over the last 25 years. The Guild has taken a phased approach to the implementation of the 1997 master plan, which was created by an interdisciplinary design team led by Andropogon.

Restoration efforts spanning from 2000 to 2008 helped alleviate problems associated with invasive species, erosion, soil compaction, polluted runoff, and overuse. Landscape architects from Andropogon Associates partnered with engineers at Cahill Associates to develop a suite of both large-and small-scale interventions to slow stormwater and improve biodiversity in the stream and woodland ecosystems while maintaining public access to the Woods. Specific goals of the restoration were to:

- Increase groundwater flow by infiltrating as much stormwater into the ground as possible without cutting trees or disturbing the Cathedral grounds, roads, or parking to a large extent.
- Reduce peak volume and velocity of stormwater by slowing runoff from paths and stabilizing path pavement materials.
- Prevent further erosion and degradation of the Woods by stabilizing the east and south ravines with native materials.

Soil tests located suitable sites where water could be taken out of pipes, captured in infiltration trenches, and used to water the new plantings installed on woodland slopes. Boulders and cedar logs were slid into the ravines on specially made conveyors for the construction of in-stream check dams and check logs. A RainStore storage bed was installed at the head of a ravine to capture water from the Cathedral roof and slowly release the flows into the channel to feed an ephemeral pool. Phased installation of native woodland plantings also helped to gradually restore the native forest structure.

Figure 4. Stormwater diagram from Andropogon's 2000 Master Plan; Image: Andropogon

Figure 5. RainStore stormwater detention device during installation in 2003 (left), and the same location in 2005 (right); Photos: Andropogon

The team also formalized the "Pilgrim's Path" as a stone footpath, which provides access to the main building from the south in keeping with Olmsted's original vision. The path was carefully threaded through the woods to improve visitor access while minimizing impacts. Tree root aeration measures and stormwater infiltration pits built during path construction remained in place as part of the permanent woodland restoration program. Quiet, contemplative seating areas were also added as part of the path improvements, and these areas have become favorites for local birders.

In 2018, in connection with its Integrative Research practice, Andropogon completed an assessment of the Olmsted Woods in order to understand how the interventions completed from 2000 through 2008 were performing and what improvements could be made to ensure the continued protection of the woods. This effort was spurred by the loss of the bridge spanning the creek to connect the Pilgrim's Path with Pilgrim Road due to a fallen oak tree that severely damaged the structure in 2012.

The team found that the check dams have performed well and allowed the stream bed to stabilize, but they are in need of repairs and additional structural supports. In order to slow and treat the stormwater entering the Woods, the design team recommended the following interventions:

- Continue to stabilize the existing steep slopes, particularly in areas where stormwater enters the ravine, by planting native groundcover plants (seeding or landscape plugs) in conjunction with soil bioengineering techniques, such as live staking, live fascines, brushlayering, and branchpacking.
- In areas where scouring and undercutting are occurring in the stream channel, stabilize banks by shoring up or expanding existing check dams. Check logs can be replaced or added.

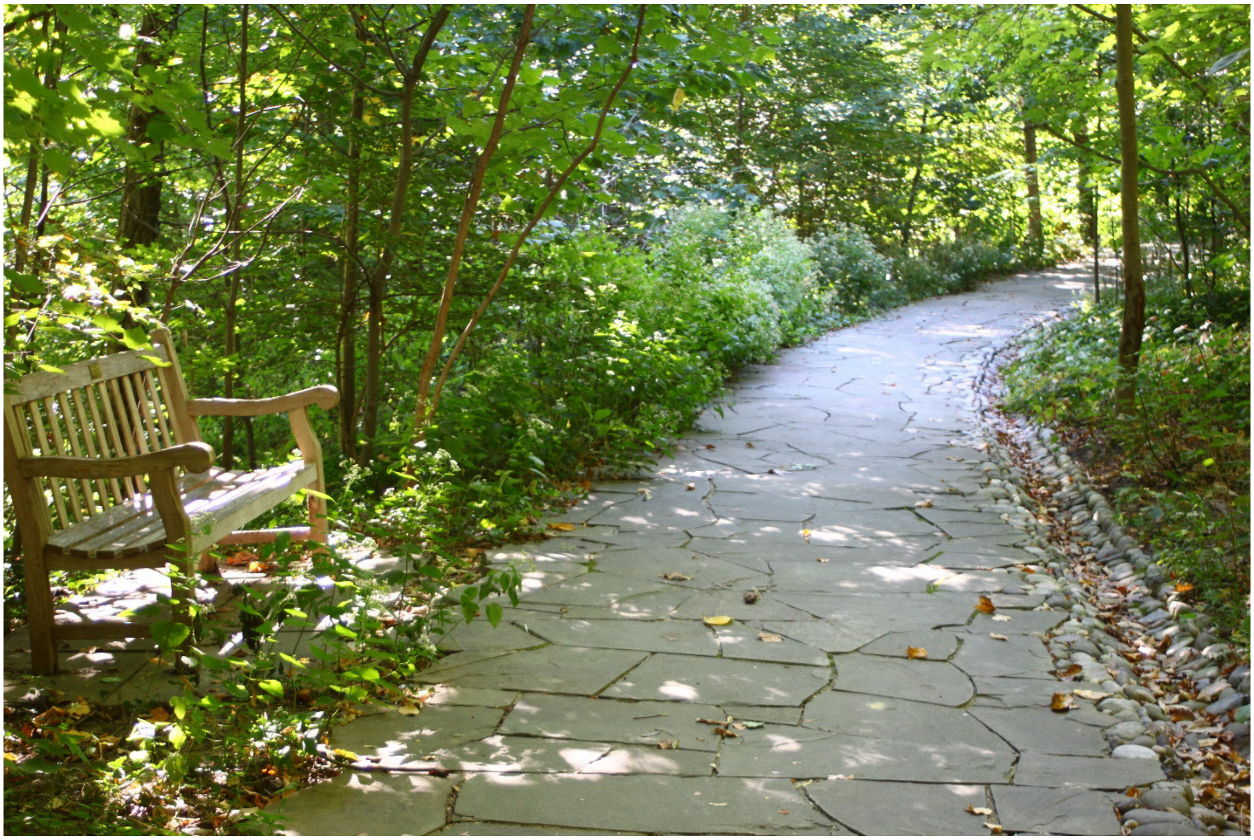
Figure 6. Stabilized path materials and stone stormwater swales continue to help manage runoff from the Pilgrim's Path (2017); Photo: Andropogon

- Explore the potential reuse of the steel helix structures from the old bridge in order to create an additional large check dam or to structurally support other water-slowing features.
- Continue the removal of invasive species and replant with "pleasantly pushy" native groundcovers, native shrubs, and native trees.
- Monitor upstream stormwater flows during wet weather with pressure transducers and visual observation to pinpoint the largest contributors to stormwater runoff to the East Ravine. Install monitoring equipment in the RainStore device to understand how its performance has changed over time.
- Create a "tree gap action plan" to mitigate continued loss of canopy trees. This includes phased plantings of the next generation of canopy trees or other vegetation that can outcompete invasive plants in the area.

Following the 2018 assessment, the loss of trees within Olmsted Woods began to accelerate at an alarming rate. Oak trees, and particularly white oaks, were most likely to die suddenly or show signs of stress. This trend tracked with anecdotal accounts of oak tree losses in other parts of Washington, D.C. as well. Andropogon discovered a similar situation during a site visit in 2021 to the St Elizabeth's campus, another Olmsted-designed landscape overlooking the confluence of the Potomac and Anacostia

Figure 7. Section diagram of log check dams (left), and after 2002 installation in Olmsted Woods (right): Image & photo: Andropogon

Rivers. There, oak trees located within drainage areas, particularly those below recently disturbed sites, seemed to be at a much higher risk for death or disease.

The Future

A New Framework

The All Hallows Guild and Andropogon are embarking on a new effort to develop a Restoration Framework Plan to serve as a road map for future investments, helping the Guild to prioritize projects that will have the most dramatic impacts on the health of the woods and stream corridor. The team is taking a watershed-based approach to the planning process with the understanding that water is the most integral part of this ecosystem. Andropogon will partner with civil engineers at Meliora Design, whose staff was involved in the previous phase of improvements for the Woods.

This plan will take into account existing and future runoff from areas adjacent to the Woods, including St. Albans and Beauvoir Schools, nearby roads, the small buildings just above the Woods, and the Cathedral building itself. The team will propose strategies to increase infiltration within the Woods through improved and/or additional treatment systems such as check dams, native plantings, and infiltration trenches. They will also work with the surrounding schools to develop stormwater solutions within their campuses and beyond that can serve as educational opportunities while also protecting the ecological health of the Woods.

As part of Andropogon's Integrative Research practice, the team will monitor the performance of previously installed stormwater treatment devices, including an underground detention system and infiltration trenches within Pilgrim Road. The team has engaged Invisible Structures, the manufacturer of the RainStore stormwater detention system (the first of its kind when it was installed in 2002) to help provide monitoring equipment that will help the team understand what impact the structure has had, as well as what maintenance or repairs may be necessary.

Improving Maintenance Capabilities

Just above Olmsted Woods, Andropogon and Meliora are also developing designs for an expanded maintenance facility to accommodate a broader range of activities while better protecting the Woods from stormwater runoff. This will allow the Cathedral to retain chipped wood and mulch from tree removals on site, resulting in a reduced carbon footprint for maintenance activities by keeping valuable nutrients on site and minimizing truck miles traveled. The team will work to slow stormwater in upland areas above the Woods by developing a path system that formalizes circulation routes and serves as a check dam to slow water on steep slopes.

Urban Forest Maintenance and Management

Another key step toward improved maintenance and management of the Woods was to inventory, assess, and map all trees over 12 inches in diameter. The Guild and Andropogon recently partnered with the University of Pennsylvania Morris Arboretum Urban Forestry (UF) Consultants to perform the tree inventory and assessment. The Morris UF team also developed GIS tree mapping, tools, and guidance that will continue to help the Guild to maintain and manage tree health and safety within the Woods. The UF team also assisted in the development of long-term strategies that will help the Guild to plan for replacement of dying or dead trees, to set up a treatment regimen for susceptible trees, and to adopt and implement maintenance and management practices that will help to further protect trees from threats and impacts.

The Morris Arboretum Urban Forestry team used the ArcGIS Collector© mobile app to map existing trees on site, recording inventory data for each tree on factors related to size, species, risk rating, complementary care, and maintenance recommendations. Mapping developed by the UF team primarily featured application areas that will help the Guild and Cathedral to focus their near-term maintenance activities on, like tree removal and general pruning recommendations. The tree inventory GIS data will also improve management capabilities to support planned care and treatment regimens and/or targeted drought protection for susceptible species like ashes, elms, chestnuts and oaks.

A main objective of a tree assessment is to decrease tree-related hazards/risk, thereby reducing the likelihood and severity of damage. Liability cannot totally be eliminated, but proper planting and aftercare, combined with regular pruning and periodic inspections, can decrease the likelihood that weaknesses or defects will cause a tree to become hazardous. Increased public appreciation for urban woodland places also increases visitation and the need for ongoing maintenance of the tree canopy to identify and mitigate potential safety risks. While trees are valuable assets, their great size and bulk potentially increases risk if not properly and routinely inspected and remedied of detected problems. In a not-for-profit context it is critically important to use limited resources effectively. Seeking appropriate balance toward sustainable goals, the Morris UF team recommended the following prioritized tree maintenance activities:

1. ***Reduce Tree-Related Risk***
2. ***Maintain Tree Health***
3. ***Provide Young Tree Care***

Operationally, these priorities help to set the expectation that safety is a top priority and must be managed proactively. Then, as safety concerns are addressed, resources can be allocated to maintain environmental health conditions for existing large, highly valued trees to preclude events that may shorten life expectancy or allow damage. The next priority is to protect and nurture recently planted trees to reach full landscape potential and maturity. Utilizing the GIS tree inventory to plan and record maintenance and management activities is the key to maintaining and improving the value of both the data asset and the tangible natural and built environmental assets of the Olmsted Woods.

Woodland tree conditions change gradually over time, but they can also change overnight. The Guild is now planning and budgeting for periodic updates to the GIS tree inventory and assessment, along with the associated arboricultural tasks necessary to reduce safety risks. This will help to maintain tree health and to promote longevity of the Woods as a thriving set of natural systems in an ever-changing urban context. Since tree conditions can change gradually or immediately, it becomes even more important to practice and document routine periodic monitoring, inspection, and maintenance activities, and to be aware that event-based, post-storm inspections may become advisable as conditions warrant.

Understanding Tree Loss

In order to better understand the impacts of climate change on the existing tree canopy, the Guild, Andropogon and the Morris team are also working together to investigate and help curb the loss of oak trees on the site. Along with improving maintenance and management capabilities, the GIS tree inventory and assessment will also be used to help the Guild adopt long-term strategies to plan and manage ongoing treatment and replacement of dying or dead trees.

The UF tree inventory included 77 oaks, and many of these were declining more than expected for their age, position in the landscape, and environmental conditions. In research and discussions with state and national forest managers, oak decline has been evident throughout Mid-Atlantic region during the past few years. Oak decline refers to a progressive dieback and eventual mortality of oak trees. It is believed to be often triggered by drought. The National Park Service's National Capital Area office reports the following regarding oak decline:

> Symptoms include early browning of leaves, thinning of canopy cover, and loss of branches, which can eventually lead to tree mortality. Understanding and preventing this phenomenon has been challenging, given that no single factor is responsible for what is generally defined as Oak Decline. A host of stressors including climate, tree age, site conditions, and history of disease interact to weaken trees over time, ultimately leading to sudden death when the tree's resources are exhausted . . . In the National Capital Area, Armillaria root rot fungus, two-lined chestnut borer beetle (*Agrilus bilineatus*), and bacterial leaf scorch (caused by *Xylella fastidiosa*) are commonly blamed for killing oaks, even though they typically only attack trees that

are already in a state of decline.[12]

Figure 8. Stressed trees and major gaps in canopy due to tree loss on east side of ravine (2021); Photo: Andropogon

A central question concerning Andropogon's most recent design and research efforts for Olmsted Woods has been, "In our efforts to restore a landscape, what exactly are we restoring to?" Perhaps the word 'regeneration' would be more appropriate. For better or for worse, the ecological and social climate of Olmsted's era is long gone, and what survived or thrived in that context is no longer feasible in many cases. In order to protect the legacy of Olmsted landscapes while ensuring their longevity in an era of climate change and social change, designers and land stewards must look beyond the traditional approaches and find creative ways to solve the problems of our present era while still telling the stories of the past.

Modelling Existing Conditions

Geographic information system (GIS) technologies are not only crucial for maintenance and management activities, but they are also used to develop operational models of the real world to inform planning exercises for the future. These activities can enable us to visualize and better understand natural patterns and flows of existing systems, and how potential intervening human interactions may either interrupt and degrade or integrate and improve both internal and surrounding relational systems. Geospatial tools enable more informed understanding of both the local, site-specific environmental factors like slope, aspect, and infiltration that affect tree health, as well as informing the broader

[12] Borowy. (2020)

regional context of soil types, microclimate, hydrology, and geology that indicate the function and structure of systems operating on every site.

Designing for Future Conditions

As part of the process of developing planting plans, designers must balance a number of factors when choosing species, including not only which plants support the most biodiversity, but also which species will be most resilient in the face of anticipated permanent temperature changes and more frequent extreme weather events. In the case of Olmsted Woods, continued oak decline in the D.C. area may mean that many oak species (Quercus alba, or white oak, in particular) will not be viable in the coming decades. In order to respond to this problem while respecting the original intent of the Olmsted design and the programmatic goals of the Guild, one strategy being employed is to take a multi-faceted approach by both protecting existing young oaks and introducing a wider variety of tree species. New plantings and desirable volunteer trees will also be mapped, recorded, and monitored using the mobile data collection and GIS plant records management tools.

In an attempt to keep as many oaks on site as possible, the Guild is beginning to phase in the next generation of canopy trees from seedlings existing on site, which have proven to be much hardier than nursery stock. This requires identification and mapping of healthy seedlings in the forest floor, providing protection from deer browsing or competition from non-native plants, and working to build healthy soil networks surrounding young trees. Larger caliper trees can be installed in the areas of highest visibility in order to maintain the character of the Woods as mature trees are lost.

In order to diversify their investment in the canopy trees, the Guild is also working with Andropogon and Morris Arboretum to identify species that are expected be more resistant to climate-change related stress over the coming decades. These species may include other oak species more common in climates further south, such as Quercus falcata (Southern red oak), Quercus lyrata (overcup oak), Quercus phellos (willow oak), or Quercus shumardii (Shumard oak). Because over half of the trees in Olmsted Woods are in the Fagaceae family (oaks and beeches), the inclusion of trees in other families such as maples, elms, hickories, yellowwoods, and black gums is also very important to ensure that the Woods is diverse enough to survive a potential blight. Continued support for existing evergreens such as Ilex opaca (American holly) and understory trees such as Cornus florida (dogwood) will also be critical in establishing a diverse and resilient ecosystem.

For already realized threats, such as the emerald ash borer, the Guild is working with Morris Arboretum to identify, map/document, and manage the trees that are most worthy of long-term investments in treatment regimens as well as those that are candidates for removal. Since many of these trees are already diseased, safety and risk assessment play a major role in these decisions.

Carbon Sequestration

First and foremost, designers can begin working more closely with clients to shift their maintenance and operations practices to a more carbon-neutral approach that, in many cases, is also a shift closer to what would have existed during Olmsted's time. Specific interventions may include the following strategies:

- Reductions in operational carbon, or carbon generated by operations and maintenance activities
- Reductions in the embodied carbon of materials used on site
- Reduction of carbon expended in the production and transport of materials
- Increased capacity for carbon sequestration, or the removal and storage of carbon from the atmosphere in the soil and biomass

In order to increase biomass, designers and landowners can expand forested areas, convert lawn to warm-season grasses where feasible, and invest in building healthy soils. A permanent move away from the use of synthetic fertilizers, synthetic pesticides, and unnecessary irrigation will help build soils that are capable of supporting a biodiverse ecosystem, resulting in a more experientially rich landscape and significant long-term cost savings. This shift also presents an opportunity to educate visitors about the ecological systems within their region, as well as the need to embrace the fundamental element of change within the landscape.

The aforementioned strategies to improve carbon storage capacity and ecosystem services can also contribute to climate resiliency far beyond the boundaries of a particular site, serving as a model for management of other Olmsted-designed sites. With the support of educational programming, visitors can learn about the impacts of specific operations strategies and why they should consider implementing these practices on their own properties.

Watersheds

Planning at a watershed scale has more importance than ever in the era of climate change. However, watershed boundaries are often vastly different from ownership boundaries or boundaries between land uses. Therefore, it is of utmost importance for landowners to understand two things:

- What in their watershed do they have complete control over and can, therefore, create the most change?
- What partnerships can be forged with others in the same watershed that will have impacts at a larger scale than individual efforts?

In order to develop design solutions that position the Cathedral as a good upstream and downstream neighbor, understanding the site's role in its regional and local watershed is essential in preserving the Woods for future generations. The Olmsted Woods can communicate to its visitors the urgent need for a collective effort to improve water quality throughout the region.

Conclusion

Frederick Law Olmsted, Jr.'s vision for the grounds of the Washington National Cathedral remains as relevant today as it was during its conception, perhaps even more so. While the world reels from the impacts of a global pandemic and a rapidly changing climate, it is more important than ever for residents and visitors within the urban environment to have access to spaces of respite where they can reconnect with the natural world. As was Olmsted's intent for the Cathedral Close, this connection can continue to help guide people through their daily struggles and illuminate the beauty in the world around them.

However, this relationship is threatened by the myriad of stresses that humans have placed on the landscape. In many ways, Olmsted Woods is a poster child for the climate-change-induced stress that is now prevalent on so many other historic landscapes. The "strength and beauty" of nature, which was such a critical piece of Olmsted's vision for the Cathedral experience, is being compromised by environmental conditions that are changing too rapidly for ecological systems to respond and adapt. Changes in species composition, and with it a loss of diversity and habitat, have made landscapes like Olmsted Woods incredibly vulnerable at a time when their loss will be particularly detrimental. The ecosystem services that these landscapes can provide, coupled with the unique experience of place that they offer, is what makes them so culturally significant and so urgently in need of protection.

It is the challenge for designers and stewards of these places to work toward ecological stability as much as possible in the arenas that they can control and to advocate for broader, systemic changes at the levels that they cannot control on their own. It will only be through continued stewardship and investments from groups like the All Hallows Guild that the benefits of these special places will be felt throughout another hundred years and beyond.

Works Cited

All Hallows Guild. (1919). *Notes from the Memory of a Talk Given by Mr. Frederick Law Olmsted*.

All Hallows Guild. (2018). *Gardens of Washington National Cathedral: A Self-Guided Tour*.

All Hallows Guild. (2022). *Who We Are: The Garden Guild of Washington National Cathedral.* https://allhallowsguild.org/about/history/

Borowy, Dorothy. (2020). Oak Decline. National Park Service. https://www.nps.gov/articles/oak-decline.htm

National Park Service. (2018). *Native Peoples of Washington, D.C.* https://www.nps.gov/articles/native-peoples-of-washington-dc.htm

National Park Service. (2022). *Washington National Cathedral*. https://www.nps.gov/places/washington-national-cathedral.htm

Olmsted, Jr., Frederick Law. (1928). *Report of the State Parks Survey of California* http://www.parks.ca.gov/pages/795/files/Olmsted_Report_SP_Survey_1928.pdf

Washington National Cathedral. (2019). *They Knew This Land: Honoring Lost Voices on Mt. St. Alban*. https://cathedral.org/event/race-and-place-on-mount-st-alban/

Zaitzevsky, Cynthia. (2009). *Long Island Landscapes and the Women Who Designed Them*. W.W. Norton & Co.