# FORT GREENE PARK

## URBAN FOREST MANAGEMENT PLAN

City of New York
Parks & Recreation

Michael R. Bloomberg, Mayor
Adrian Benepe, Commissioner

# URBAN FOREST MANAGEMENT PLAN

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# EXECUTIVE SUMMARY

New York City's urban forest is comprised of trees growing along streets, in backyards, in parks, playgrounds and other publicly and privately owned open spaces, and in forested natural areas. Of the 5.2 million trees growing in New York City, an estimated 2.3 million trees—street, park, and forest—fall under the jurisdiction of Parks & Recreation. The City's 500,000 street trees are actively managed by the agency on an individual basis. Many forest trees are studied, mapped, and managed on a stand (group) basis according to long-standing management plans prepared for the agency's most prominent natural areas. Park trees—and their numbers are unknown—are the least understood and documented arboreal population managed by the agency. Yet park trees, individually and as a group, comprise some of the City's most valuable landscape specimens in terms of age, aesthetics, environmental and economic benefits, and community impacts. This report for Fort Greene Park—an arboreal and historic gem of a park in a highly urbanized setting in Brooklyn—is one of three separate planning efforts to inventory, characterize, and formulate systematic management strategies for the individual tree population of a significant park property in New York City. The plan examines the past and present forest resource in Fort Greene Park and gives recommendations for its future.

## Inventory Results

The inventory was conducted during the summers of 2001 and 2002 using a global positioning system (GPS) unit to record each tree's location, species, size, condition, and growing environment. In all, 917 trees were inventoried representing a total of 57 different species. Ginkgo, London planetree, and horsechestnut are the most common park trees representing 49 percent of the park's tree population.

Almost 38 percent of the park's 30 acres are covered by a forest canopy provided by relatively large, mature trees. Over half the trees in the park (59.5%) are greater than 12 inches in diameter. There are a fair number of flowering species in the park and many evergreens. The trees in Fort Greene Park tend to be large shade trees or dense, single-species plantings. The spatial distribution of the plantings reflects the geometry of a highly designed landscape, with allees, rows, and groupings that clearly serve specific—if sometimes conflicting—design purposes. Little focus over the past few decades has been on canopy tree replacement through new plantings.

Table 1: Fort Greene Park at a Glance

| | |
|---|---|
| Size | 30 acres |
| Location | Downtown Brooklyn |
| Year park was commissioned and named | 1847 |
| Number of trees | 917 |
| Number of tree species | 57 |
| Canopy cover | 37.8% (11.3 acres) |
| Stem density | 33 trees per acre |
| Largest tree | 64-inch London planetree in the monument plaza (Olmsted & Vaux) |
| Five most common tree species | Ginkgo, London planetree, horsechestnut, Norway maple, pin oak |
| Active recreational facilities | Tennis courts, 2 playgrounds, basketball court, 2 comfort stations |
| Passive recreational facilities | lawn area, monument plaza, stairs |
| Educational facility | Fort Greene Park Visitors' Center |
| Historic monument | Prison Ship Martyrs' Memorial |

Ninety-three percent of the trees are in excellent or good condition when they were inventoried. Just 60 trees (6.1%) were considered in poor condition, and 3 trees (.33%) were found to be dead at the time of inventory. The locations of these poor and dead trees were identified and mapped for immediate inspection (Map 15). Growing conditions in the park, however, are quite challenging for trees and are likely to impact overall longevity. Eighty percent

of the trees were growing in compacted or eroded soils. And tree vandalism is also an issue in Fort Greene Park, with almost 20 percent (179 trees) showing signs of human-inflicted damage.

Originally designed by Frederick Law Olmsted and Calvert Vaux in 1867, Fort Greene Park has experienced several renovations over the last century including a 1907 plan for the monument core by McKim, Mead and White, Gilmore Clarke's plantings in 1936 and a 1971 revision by A.E. Bye & Associates. Although most of the trees have been replaced through the years, design elements from each of the major eras still exist creating a layering effect throughout the landscape. There are likely ten actual trees standing from the Olmsted and Vaux era. Major formal landscape features still in tact include the horsechestnut alles along the perimeter streets designed by Olmsted & Vaux, a ginkgo grove designed by Gilmore Clarke but surrounding the McKim Meade and White monument plaza and a London planetree grove in the northwest corner also from Gilmore Clark though altered by AE. Bye.

### Management Recommendations

The inventory and analysis Fort Greene Park's arboreal resource are the preliminary steps to generating specific forest management recommendations. These recommendations are based on the following overall management goals:

- Maintaining canopy cover
- Maximizing public health benefits
- Providing a proper setting for passive recreation
- Maintaining year-round beauty
- Providing wildlife habitat
- Preventing soil erosion
- Reducing storm water run-off
- Framing views
- Reflecting historical landscape designs and uses
- Enhancing current and future park uses
- Offering educational opportunities.

The framework for these management recommendations is the division of the park into seven management zones, one of which would be the focus of each year's planting and maintenance activities. Detailed descriptions of each zone are in Appendix D. The following is a summary of the major short and long-term management recommendations contained in this plan.

**Figure 2:** Fort Greene Park Urban Forest Management Plan: Summary Recommendations

| Type | Recommendation | Description | Page |
|---|---|---|---|
| General | Master landscape plan | Develop a comprehensive landscape plan that reflects both historic planting plans and current community values and desires. Consult the National Park Service's Cultural Landscape Initiative. | 28 |
| | Zone rotation | Tree maintenance and planting should rotate through one designated management zone each year for seven years. | 23 |
| Maintenance | Immediate pruning and removal needs | All the "high priority" and "mid priority" trees should be inspected immediately and either pruned, removed, or otherwise treated. | 23 |

| Type | Recommendation | Description | Page |
|---|---|---|---|
| Maintenance (Continued) | Tree removal | Frequently look for and then quickly remove dead or almost dead trees to reduce risk to park patrons, prevent the spread of disease, and maintain the park's appearance. | 24 |
| | Tree health inspection | Every spring bring a trained arborist into the park to inspect the trees in the management zone that will be the focus of that year. He or she should identify trees in need of removal or pruning, suggest trees that would benefit from aeration, fertilization, mulching, and inspect trees for pests. (see map 15) | 24 |
| | Pest management | Adopt an integrated pest management system for all potential pests that could affect the park with an emphasis on ALB and Dutch Elm Disease. | 24 |
| | Tree stewardship | Establish a stewardship program to allow park patrons to care for young trees. | 33 |
| | High use area inspection | Annually inspect trees in playgrounds and other high use areas for dead wood, bark damage, etc. | 24 |
| | Soil erosion amelioration | Plant trees or erect fences to reduce soil erosion where necessary. | 27 |
| Tree Protection | Construction protection | Require contractors to use best practices to protect the trees in construction areas. | 28 |
| | Vandalism reduction | Use public outreach and education to reduce vandalism and accidental tree injury. | 28 |
| | Young tree protection | Fence young trees to prevent injury or vandalism. | 26 |
| Planting | Conifer stands | Plant evergreen trees to supplement pineta. | 31 |
| | Views | Maintain, and enhance views where possible. Do not plant new trees that will obscure views. | 31 |
| | Perimeter street tree allee | Determine the most appropriate species to maintain the integrity of the horsechestnut allee while minimizing the potential for future pest outbreaks. | 29 |
| | Replacement | Replace trees as old ones die to maintain the highest possible canopy cover | 31 |
| Outreach | Signage | Increase and improve tree signage around the park – both tree species labels and other descriptive signs. | 33 |
| | Tree Guide | Develop a great tree walk for Fort Greene Park's trees – provide patrons with maps and information to find the largest trees in the park. | 33 |
| | Bird watching | Establish a bird watching group in the park to highlight Fort Greene Park's trees as important migratory bird habitat. | 33 |
| Education | Management plan in schools | Use the management plan to show how important the trees are to the park, to discuss different species, invasives/exotics/natives and urban forest values. | 34 |
| | Data use | Make tree census data available for student use in math, statistics, and science projects. | 34 |
| Research | Inventory | Inventory the park's trees every 10 years. | 34 |
| | Mortality analysis | Use this inventory to track urban park tree mortality, both of newly planted trees and of established trees. | 34 |
| Management Information | Maintain Tree Data | Equip the park's forester with ArcPad in order to view and update park maps. | 35 |

# I. INTRODUCTION

## Project Rationale

New York City's urban forest is comprised of over 5 million trees, of which an estimated 2.3 million grow on public land under the jurisdiction of Parks & Recreation (Nowak & Crane, 2002). These trees grow primarily in three distinct environments: 1) along curbs and roadways, 2) in forested natural areas, and 3) in heavily used neighborhood parks. The half-million street trees have been inventoried, cataloged, and are intensively managed by the Agency. The woodlands and forests of Parks' natural areas, 17.3 percent of the total Parks acreage[1] , are also the focus of significant initiatives including long-term management plans, restoration projects, and ongoing scientific study.

The remaining trees, scattered across thousands of properties in all five boroughs, are integral structural elements of high-use park landscapes. From majestic allees to imposing individuals, many of these trees were planted as part of original park designs and have achieved specimen status over time. There are hundreds of thousands such trees, and they are an important component of the arboreal biomass that comprises New York City's urban forest canopy. Yet we know very little about them. This project is an effort to address this knowledge gap by creating a forestry management plan for a park with a significant—yet often overlooked—tree population. This is the first of three such efforts, and it is hoped that this initiative will be replicable for many other parks in New York City.

This project follows a trend in urban forestry to move from reactionary management of individual trees—typically characterized by an emergency-response approach to problems and complaints—to a proactive, systematic, and strategic focus on an urban forest system as a whole. While limited municipal funds for forestry programs often constrain proactive tree care, management planning efforts can increase the efficacy and reach of scarce resources and have significant impact on the landscape.

## Benefits of Trees

Trees in urban areas are valued differently than their rural counterparts. Traditional forestry is the management of trees or stands of trees for timber production and other values including wildlife, water quality, and ecological health. Urban forestry is the management of trees and other forest resources in urban community ecosystems for the environmental, economic, social, health, and esthetic benefits trees provide society. Urban forest managers can learn from the tradition of woodland forestry in developing systematic approaches to forest management, but they must do so within the context of the very specific benefits that urban trees confer as well as the constraints to maximizing these benefits.

For most people the desire to protect and enhance green infrastructure comes from an intrinsic respect for nature and an aesthetic appreciation for parks – park trees provide shade, beauty, educational opportunities, and a link to the past. Urban forests also convey a number of quantifiable public benefits that can be enhanced through management. Trees mitigate air pollution, provide climate control and energy savings, improve soil and water quality, reduce storm water runoff, and increase real estate value. They also provide wildlife habitat and can be a measure of community vitality. And research is beginning to show that

[1] According to NYC Parks' Natural Resources Group (NRG), 5,000 of Parks' 28,874.362 acres are classified as forest land.

some of these benefits of trees can lead to improved public health, especially for those with respiratory ailments. Trees enhance both the physical and spiritual landscape they inhabit.

## Site Selection and Description

Fort Greene Park was selected for this project because it is a focal point of the surrounding neighborhoods, it has strong community support, it has a significant landscape history and currently has beautiful trees. Fort Greene Park is a thirty-acre park near downtown Brooklyn, between DeKalb and Myrtle Avenues (see Map 1). Established in 1847, Fort Greene was Brooklyn's first park and it has a long and colorful history (see "The History of Fort Greene Park," p.5). Today the park serves as a valuable green space for residents of Fort Greene, Clinton Hill, and other surrounding communities. On a summer day the park is filled with children playing in the playgrounds, adults on lunch breaks, dog walkers, sunbathers, and urban wildlife.

The park is located in the middle of a blossoming area of Brooklyn. The Myrtle Avenue Revitalization Project is working to bring businesses to the neighborhood and to recreate a "Main Street" atmosphere along the avenue, including the section adjacent to the park. Simultaneously, the Fort Green Park Conservancy and the Committee for the Restoration of Fort Greene Park are working to bring back some of the park's historic design elements.

The park itself is a large green hill in the midst of a flat cityscape. A stone wall surrounds the park and large horsechestnuts form stately allées along three of the four surrounding streets. The eastern edge of the square-shaped park abuts the Brooklyn Hospital. Once inside the park, ascending paths wind up the hill past the park's two playgrounds, one basketball court, and a series of tennis courts (see Map 2). The natural areas of the park include shady hardwood groves, open fields, pineta, and wooded slopes.

The trees of Fort Greene Park are some of the oldest and largest in the borough. An interesting assortment of native and exotic specimens makes the park a fascinating place to spend an afternoon or a lunch break. The trees not only provide shade; they cool the surrounding air through transpiration, reduce ozone, carbon dioxide, and other pollutant levels, and provide important habitat for migratory birds.

The central focus of the park is the tree-lined stairway leading up to the Prison Ship Martyr's Monument – a 148-foot tall Doric column topped by a large urn. The enormous column is in the middle of a flat plaza on the top of the hill; this area is the locus of historical restoration efforts. A current Parks capital project will remove approximately 10 trees from the plaza, pave much of the central plaza (as per the McKim, Mead, & White plan, p. 7), and fund pruning and protection for the remaining large, historic trees.

New York City is within Plant Hardiness Zone 6 (USDA 2001), where average temperatures range from 72.3 °F in August to 32.7 °F in February, although extremes can be much hotter or colder. Average precipitation per year totals 40.38 inches and relative humidity averages around 70 percent. A "natural" forest in this zone would be of the northeastern mixed hardwood variety, dominated by oaks, hickories, and maples.

## Key Actors

Parks' Brooklyn Borough Commissioner oversees all operations within Fort Greene Park. Yet a number of different entities—within and outside of this reporting structure—are at

times involved in park projects. These entities are key actors in a variety of decisions that have the potential to impact the park's landscape. Identifying these key actors and their roles in park management is the first step towards achieving a more coordinated approach to decision-making on issues relevant to forest management planning.

On the site level, the park administrator coordinates all the operations, education, community relationships, and new initiatives for the park. This includes guiding this management plan and tracking all tree work. Locally, district maintenance and operations (M & O) crews perform basic park maintenance activities for all parks in the district and report to the district manager, not the park administrator. The tasks of M & O include litter and graffiti removal, as well as basic landscaping such as sweeping up leaf litter, mowing, and weed whacking.

Brooklyn Forestry, a borough-wide division that also reports to the Brooklyn Borough Commissioner, at times operates within the park. Forestry staff inspects, prunes, and removes trees and stumps, and supervises tree work contracts for all of the street and park trees in the borough. Most borough forestry activities are focused on street trees, but as resources become available and in emergencies they perform tree work in the park.

Other Parks' divisions that are outside of the borough reporting structure also impact the park's operations in a variety of ways. The outside entity with the largest influence on the park is the Capital Design and Construction division, which guides all major infrastructure changes in the park. New facilities (such as playgrounds, comfort stations, sports courts, the nature center) as well as major landscape restorations (such as the current renovation of the Prison Ship Martyrs' Monument area) all change the face of the park in ways that may impact forest management planning.

Central Forestry & Horticulture, a citywide division that runs the street tree planting program and the New York Tree Trust (among other programs), may also get involved in the park's landscape. Special projects such as the development of this and other management plans are spearheaded by the Tree Trust, as well as small privately funded pruning and planting initiatives. Central Forestry will also plant trees in the park (generally within playgrounds or along the park perimeter) at the request of park managers.

In addition to Parks staff, several private groups have influence over Fort Greene Park's landscape. The Fort Greene Park Conservancy is a community support group that raises money for the park, promotes the park within the community, and helps organize programming--holiday activities, sporting events, and other recreational events. The Conservancy also raised money to hire the current park administrator. The Fort Greene Association, the Fort Greene Park Users and Pets Society (PUPS), the Brooklyn Academy of Music, and several other groups are also dedicated to improving Fort Greene Park and its surrounding community.

Myriad direct and indirect decisions are made regarding the landscape of Fort Greene Park—where to site new buildings, when to remove a tree, how to prevent park users from abusing trees, where to plant a donated tree, what maintenance activities to direct. Many of these decisions originate from different key actors, and may not be coordinated from a landscape perspective. This plan will serve as a resource for all key actors operating in this arena and will help to guide all future decision-making that will impact the park's forest health and structure.

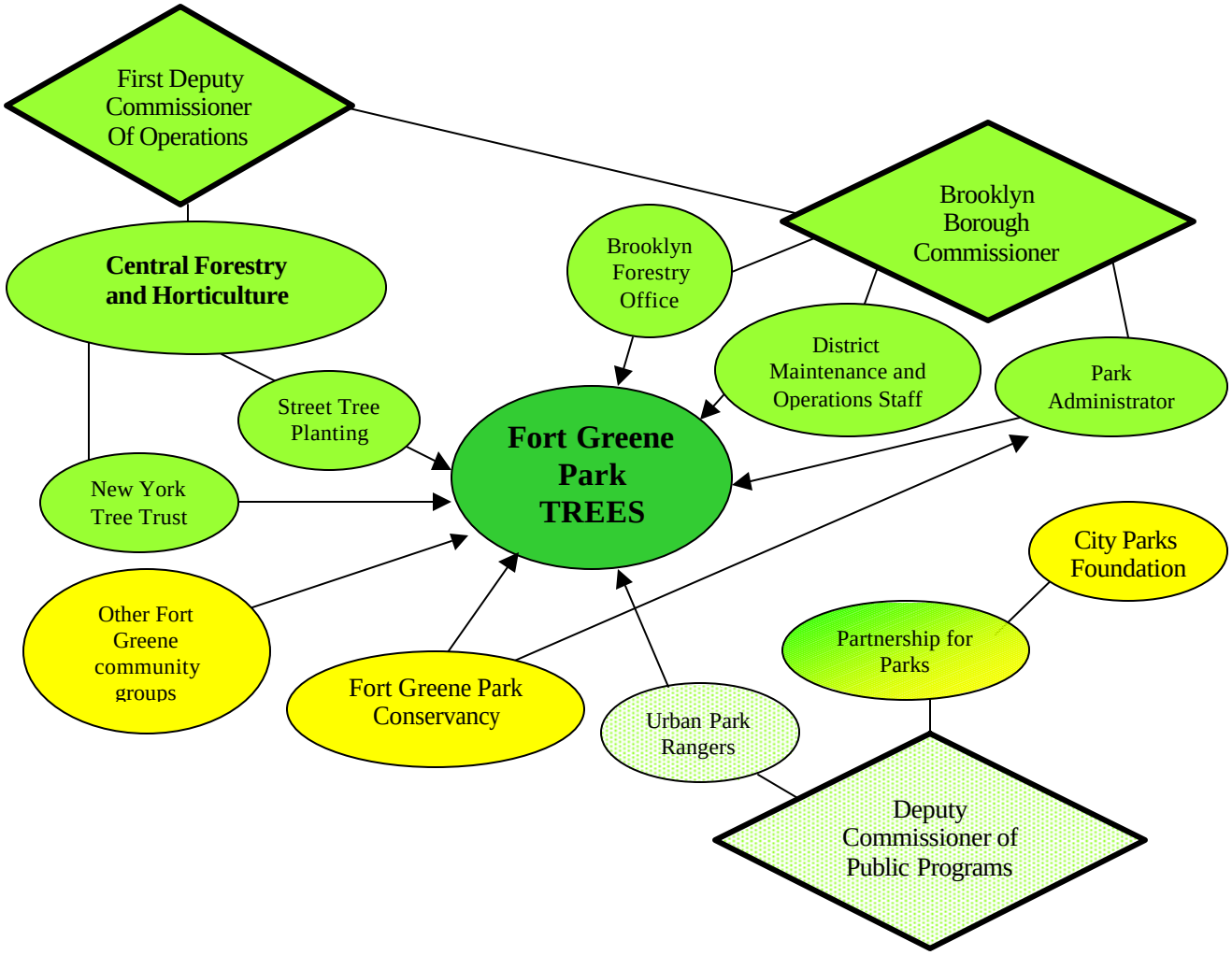



**Figure 1.** A diagram of the different entities that may impact the Fort Greene Park landscape. Green shapes represent Parks entities, yellow shapes are non-parks groups, and green-stippled shapes are groups that could, in the future, be involved in the park.

# II. THE HISTORY OF FORT GREENE PARK

Urban forest health is affected not only by daily anthropogenic stresses – such as pollution, human damage, compacted soils – but also by enduring environmental factors like geology, topography, and climate. Forest management strategies must consider the interactions of these forces within the context of the long life histories of the individual trees and the forest as a whole.

### Geology

The bedrock below Fort Greene Park is Manhattan schist, the same dense metamorphic rock that makes up most of Manhattan Island. The bedrock, however, is irrelevant to the park's topography and soil chemistry, as it is overlain by millions of years of glacial deposits.[2]

During the most recent glaciation, the Laurentide ice sheet covered the majority of the northeast, and it has been the most significant force behind our current topography. The glacier is responsible for the gently rolling hills of New York, Connecticut, and Massachusetts. Long Island represents the southernmost boundary of the ice. It is made of two terminal moraines: lines of rocky debris (glacial till) that are formed at the front end, or toe, of a glacier. As the Laurentide ice sheet receded, around 15,000 years ago, it deposited the Ronkonkoma and Harbor Hill moraines which make up the body of Long Island, overlapping in western Brooklyn. The rolling topography of Fort Greene Park is a result of these two moraines.[3]

### Pre-European Landscape

Before humans settled on the East Coast, virtually all the land east of the Mississippi River was covered in dense forest. The dominant trees in the New York metropolitan area were oaks, American beeches, American chestnuts, tulip trees, hickories, maples, and eastern hemlocks. Pheasants, rabbits, black bears, beaver, minks, wolves, cougars, and deer all roamed the area, enjoying the rich habitat. The arrival of Native Americans left the landscape relatively intact, though these first settlers used logs for building, cleared small plots of land for agriculture and occasionally burned the forest understory to facilitate hunting.

### European Settlement and the American Revolution

In 1609 Henry Hudson was the first European to set foot on the land surrounding the New York harbor and he sent reports back to Holland of the abundant natural resources in the northeast. Soon the intersection of Long Island and the mainland was dubbed New Amsterdam and the Dutch began to settle there, along with German, English, African, Scandinavian, French, and Jewish immigrants. Between 1626 and 1776 most of the land in the New York City area was cleared of trees and wildlife – the trees were used for timber or firewood, the animals were hunted or driven to more hospitable lands.[4]

In the 1630s immigrants from Belgium and the Netherlands began to settle at the southern end of Long Island. In 1646 the Dutch West India Company authorized the establishment of the village of Breukelen, which became the first municipality in what is now known as

[2] Rogers et al. 2004
[3] ibid
[4] http://www.ny.com/histfacts

New York State. In 1664 the area was taken over by the British, and, in 1683, Brooklyn became one of the six original towns in Kings County, one of the original counties in the province of New York.[5]

With the onset of the American Revolutionary War in 1776, American Major General Nathaniel Greene supervised the construction of Fort Putnam on the high grounds of what is now Fort Greene Park. The fort was named for Colonel Rufus Putnam, George Washington's Chief engineer. Col. Putnam designed the series of batteries along the Brooklyn shoreline from Fort Greene to Fort Defiance. During the Battle of Long Island (August 27, 1776), Fort Putnam was one of many forts that fell to the British. The British held thousands of prisoners on ships anchored in the East River during their occupation of New York from 1776 through 1783. Approximately 12,000 patriots are said to have died upon these prison ships. Their remains were buried hastily along the swampy shores of the Brooklyn Navy Yard.[6]

In the early 1800s, some of the prisoners' remains became exposed along the Brooklyn shoreline. Local citizens began to gather the washed-up bones of those who had come to be known as the Prison Ship Martyrs and a small monument was constructed near the Navy Yard by the Tammany Society.[7] Meanwhile, Fort Putnam was renamed for General Greene.

In 1812, under the threat of international conflict, Fort Greene was rebuilt. In the years that followed, once the threat of war had passed, local residents frequented the grounds of the old fort for rest and relaxation.[8]

### Brooklyn's First Park

In the mid-1840s, amid pressure to level the hilly, 30-acre plot of land at Fort Greene and amid some degree of local conflict, the City of Brooklyn designated the site for use as a public park. Walt Whitman, the poet and editor of the *Brooklyn Daily Eagle*, wrote many editorials demanding the establishment of the park, and he is often credited with its establishment. Whitman wrote on the need for a "lung" in the city of Brooklyn and appealed for a place of rest and recreation. He also wrote of the patriotic duty to acknowledge the Prison Ship Martyrs, whose current crypt was falling into disrepair.

In one 1846 editorial Whitman wrote regarding Fort Greene:

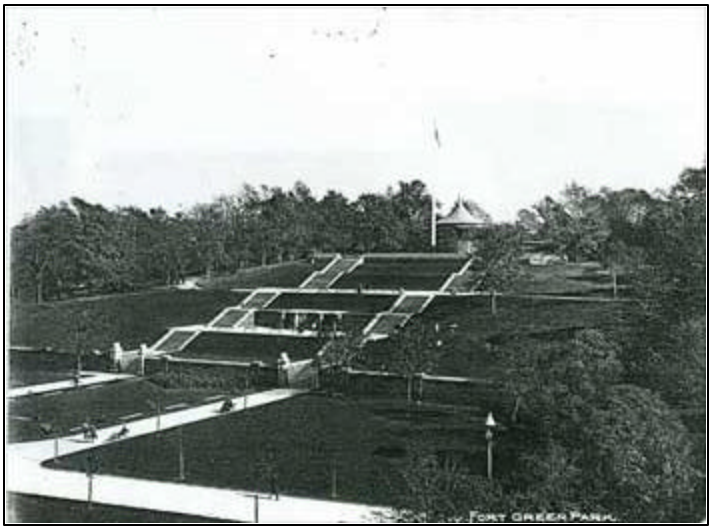
> Of course no man, with a clear eye to things, can deny the immensely sanative influence, in a city, of plentiful open grounds, totally unobstructed – parks, wide streets, large yards, &c…I shall now offer one more argument in favor of preserving that noble pile of earth. Why is it that hundreds congregate there every day during the warm season – and on Sundays thousands? Because nature itself seems to have formed it on purpose for a breathing place; and although not now in the midst of the greatest population, it, no doubt, will be in less than ten years. Who can calculate the multitudes that may receive the refreshing breeze from this spot? Who will not point to it as a proud monument of nature and art – the greatest the city can ever boast…[9]

[5] http://www.brooklynonline.com/history/
[6] Field, 1869
[7] Fort Greene Park Conservancy, 2004
[8] ibid
[9] Whitman, June 20, 1846

The state legislature finally approved an act to secure the park land in the spring of 1847, and construction of the newly renamed Washington Park began.[10]

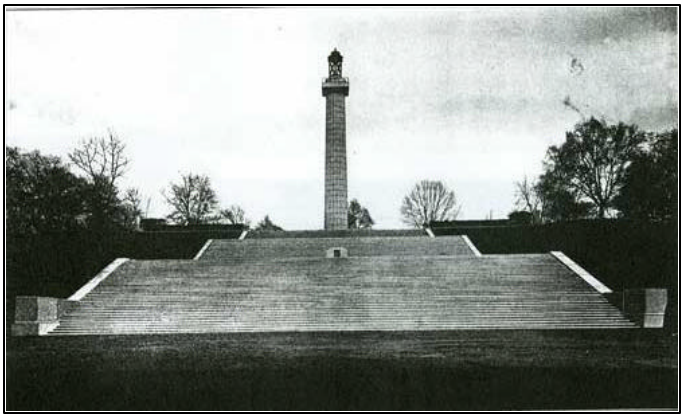
### From Washington Park to Fort Greene Park

In 1867 landscape architects Frederick Law Olmsted and Calvert Vaux, designers of Central and Prospect Parks, were commissioned to design a new Washington Park.[11] They proposed a series of shaded paths overlooking grassy lawns, a Central Park for downtown Brooklyn. At the top of the park's central hill a vine-covered walk would lead to two sets of stairs flanking the new burial crypt for the Prison Ship Martyrs. The stairs would then lead down to a parade ground – a circular, open space in the northwest area of the park overlooked by the monument. A small observatory for public education was also planned and constructed at the summit. Two historic canons, an artillery road, a retaining wall and a meeting ground were built, and a grand monument was to be planned.[12] Economic decline following the Panic of 1873, however, postponed the development of the park and work on the Martyrs' memorial was not completed.



The Prison Ship Martyrs' Memorial Monument hill reflecting the Olmsted & Vaux plan. Credit: New York City Parks Photo Archive.

In 1883 the Brooklyn Bridge opened to great fanfare, linking Manhattan and Brooklyn. As Brooklyn developed into a city suburb civic pride once again bloomed, and parks became a major focus of rejuvenation efforts. Washington Park, however, had fallen into decline by the century's end. The grounds were in poor condition, and maintenance of the park's infrastructure was lacking. Budget cuts and the building of a prison on St. Edwards Street led to changes in the park atmosphere. Moreover, much of Brooklyn's budget and attention had been directed to Prospect Park, detracting incentives for further development of other Brooklyn parks. In 1897 Washington Park was renamed Fort Greene Park, a name local residents had used since the park's establishment. On January 1, 1898, Brooklyn was incorporated as one of the five boroughs of New York City.



The McKim, Mead, & White monument design.
Credit: New York City Parks Photo Archive.

### Fort Greene Park During the 20th Century

In 1905, McKim, Mead and White, a prominent architectural firm, won a competition to design a monument dedicated to the Prison Ship Martyrs. Stanford White designed the monument, along with a new shelter at the top of the hill. On October 27, 1907, the cornerstone of the monument was laid and a 148-foot Doric column was erected with a bronze urn at its top. On November 14, 1908, President William Howard Taft presided at the completed monument's dedication ceremony. A functioning elevator and a staircase inside the monument allowed the public to enjoy a view of

[10] Whitman, April 30, 1847
[11] Commissioners of Prospect Park, 1868
[12] Vaux, 1867.

the entire city. Though the monument still stands today, the elevator ceased operating in the late 1930s when the park fell into disrepair. The neo-classical comfort station opened in 1905 today serves as the park's visitor center.[13]

Even as the monument was being constructed, parks administrators began to express concern regarding the state of the rest of the park. Olmsted and Vaux' winding paths proved to be lacking in drainage, and the park's forest was notably sparse. In 1911 money was allocated for more development[14] and by 1916, major changes had been made, particularly at the corner of Myrtle Avenue and St. Edwards Street. A playground, playing field, and farm garden were installed and a donated cottage was turned into a comfort station and playhouse. In addition, many trees and shrubs were planted throughout the park. [15]

The 1934 appointment of Robert Moses as Parks Commissioner brought even more change to Fort Greene Park, as it did to many parks in New York City. The Great Depression of the 1930s provided Moses with a massive, cheap labor force (through the Works Progress Administration) which allowed an unprecedented amount of park development. In 1935 Moses hired famed landscape architect Gilmore D. Clarke to redesign many of New York City's parks, including Fort Greene. When Clarke was finished, nearly every foot of the park had been regraded. The platform at the base of the Prison Ship Martyr's Monument was enlarged, the plaza's paved "wings" were added, and the triple rows of ginkgos were planted. Three rows of London planetrees were planted by the northwest playground, and the small octagonal comfort stations were built. Most significantly, Olmsted and Vaux's network of winding paths was demolished to make way for the current formal walkways that traverse the park. Playing fields were flattened, the tennis courts were rebuilt, and many more trees and shrubs were added to the park.[16]

An aerial view of Fort Greene Park in 1937, shortly after the wings were built, and the ginkgos and London planetrees were planted.
Credit: New York City Parks Photo Archive.

During subsequent decades, many middle class residents left the neighborhoods surrounding Fort Greene Park and single family homes were converted to rooming houses for low-income earners and military laborers. Construction of what was once the largest low-income housing project in the City occurred across from the park in 1944. Although a few small features of the park were remodeled during this period, the park suffered much neglect. Graffiti, litter and vandalism were commonplace in the park until a revitalization project was initiated in the 1970's.[17]

In 1971 the architectural firm Berman, Robers, & Scopidio, in cooperation with A.E. Bye's landscape architecture firm, proposed new plans for the park. The project involved remodeling and restoring the built structures in the park, including replacing the paved plaza surrounding the monument with white marble chips and lawn. Some regrading was done to

[13] Quennell Rothschild & Partners, 1984
[14] NYC Parks, 1911
[15] NYC Parks, 1916
[16] Quennell Rothschild & Partners, 1984
[17] ibid.

remove paths and level playground areas. The two large "podiums" were built at the base of the stairs up to the monument and many maples and locusts were planted on the borders of the park.[18]

In the 1980s an elaborate $10.8 million restoration plan was developed. This "program for action" included many necessary maintenance needs like refinishing many of the paths, repairing the playgrounds, fixing the drainage system, and planting trees and shrubs. The plan also called for several large construction projects that would remove some of the later design elements, like the monument plaza's wings and several of the paths. Suggestions were made regarding the restoration of the Doric column's stairwell and elevator and improvement of the horsechestnut allees surrounding the park. Despite the ambitious plan, few of these actions were implemented – the wings remain, the drainage system is still blocked, and the column is inaccessible.[19]

During the late 1980's, the white marble comfort station at the base of the monument was remodeled into a visitor center and Urban Park Rangers were hired to provide information on Fort Greene Park to the public. In 1995, a $1,166,000 capital reconstruction of the northwest playground was funded by Council Member Mary Pinkett. The project included installing a new spray shower/north arrow rosette, safety surfacing, pavement, benches, and fencing; re-roofing the comfort station; reconstructing the flagpole and the drainage and water systems; and planting new trees, shrubs, and groundcover.[20] Today the playgrounds continue to be major focal points of the park and are very well maintained by the park staff and patrons. Local historical societies continue to push for a massive restoration of the park to better reflect Olmsted and Vaux' original vision and fundraising efforts are underway.[21]

A view of the plaza from the southeastern corner, facing the visitors' center, as designed by McKim, Mead, and White (photo taken in 1934). This London planetree was probably part of the Olmsted and Vaux design and is still present today. Credit: New York City Parks Photo Archive.

### Current Park Happenings

A complete renovation of the monument plaza area is slated to begin in 2005. This capital project will partially restore the McKim, Mead, and White vision of the area by paving much of the plaza square, removing many of the trees in the plaza that are not of Olmsted & Vaux origin, and planting a hedge around the square. Despite protests from strict historic preservationists, the wings will remain intact, as will the ginkgos that surround them.[22]

The most pressing issue currently engaging park management and clientele of the park involves dogs. The Park Users and Pets Society is a large, vocal group of dog owners who have initiated off-leash hours (from 9 p.m. to 9 a.m.), with police and Parks' approval. While the dogs rarely affect the trees, and are therefore outside the scope of this plan, it is worth noting that the dog issue is far more contentious in the community than any forest-related issue.[23]

[18] ibid.
[19] ibid.
[20] Park Historical Sign, 1998
[21] Fort Greene Park Conservancy, 2004
[22] NYC Parks & Recreation, Capital Projects, 2004
[23] Based on observations at a Fort Greene Association meeting, November 15, 2004.

## A Timeline of Major Fort Greene Park Events

**April 25, 1845** – New York state legislature approves Act to designate Fort Putnam as a park.

**1850** – Washington Park opens as the first public park in Brooklyn.

**1855** – Prison Ship Martyrs Memorial Association recommends Washington Park as site for tomb.

**1867** – Olmsted and Vaux are commissioned to work on Washington Park.

**1872** – Sidewalks along Myrtle and Cumberland (now Washington Park) graded and planted with "chestnuts" (probably horsechestnuts), and memorial work begins.

**June 17, 1873** – Bones of Prison Ship Martyrs moved to the vault.

**1897** – Washington Park becomes Fort Greene Park.

**May 18, 1902** – statue of General Edward B. Fowler, Civil War hero, is unveiled in the park (it has since been removed).

**1905** – McKim, Mead, & White (architects) awarded the job of redesigning the monument & comfort station.

**November 14, 1908** – President W.H. Taft attends celebrations of the opening of the Revolutionary War Prison Ship Martyrs' Memorial Monument.

**1920s** – Tennis courts are built.

**1935-36** – Gilmore D. Clarke, working for Robert Moses, supervises plans for redesign of Fort Greene Park using WPA labor.

**July 23, 1959** – New playground in NW plaza designed by John J. Kassner & Co.

**1971** – New reconstruction plans by architects Berman, Robers, & Scorpido with A.E. Bye & Assoc. In 1972 the park trees are inventoried, before construction begins.

**1984** – Quennell Rothschild Associates writes new Master Plan for Fort Greene Park.

**2001** – Fort Greene Park is surveyed using a GPS unit.

# III. TREE SURVEY METHODOLOGY

The trees of Fort Greene Park were mapped and inventoried during the summers of 2001 and 2002 using a global positioning system (GPS). A GPS communicates with satellites to determine the user's position on the surface of the earth. Using the GPS unit, the field operator was able to assign a spatial coordinate to each tree[24]. In addition to the spatial position, the operator collected inventory information for each tree. This inventory information, called attribute data, included the following fields (see Appendix E in the supplement for an explanation of each field):

- Date visited
- Unique Tree Identification Number
- Tree species [25]
- Tree condition (excellent, good, poor, dead, shaft, or stump)
- Site condition (lawn, tree pit, bare soil, mulch, or planted bed)
- Location (park, perimeter, or playground)
- Soil condition (aerated, compacted, or eroded)
- Drainage (well-drained or poorly drained)
- Use (passive or active)
- Access (open or limited)
- Tree diameter at breast height (in inches, to the nearest half inch)
- Relationship
- Pests (yes or no)
- Multi-stem (yes or no)
- Maintenance needs (prune, remove, etc.)
- Comments

These fields were selected in consultation with other divisions of Parks based on survey protocols for other inventory projects (including natural area management plans and the street tree census.) We have further refined these fields for subsequent tree surveys; these changes are discussed in Appendix E.

Tree canopy "drip-lines" were also mapped for some of the trees (170). The data recorder walked along the edge of the canopy, recording points every three seconds to draw polygons that represented the canopy cover in the park.

The spatial position for each tree is within a meter of accuracy. This "sub-meter accuracy", as it is called, is maximized in the field by differentially correcting for errors by referencing a known location. This location—in this case a U.S. Coast Guard beacon in Sandy Hook, New Jersey—is picked up by the GPS unit and automatically used to make adjustments. The sub-meter accuracy was also checked in the office using the New Jersey Department of Environmental Protection's base station in Trenton. The base station compares the GPS data to its own records of satellite locations as a double check of accuracy. The data were then analyzed and mapped using ArcMap 8.3 Geographic Information System.

[24] The actual equipment used was a Trimble GPS Pathfinder ® Pro XR receiver in conjunction with a GIS TSCe ™ field device (datalogger) running TerraSync ™ 2.3 software (see Appendix D for settings).

[25] The large-leafed elms (thus excluding Siberian and Chinese) and the crabapples were not identified to the species level due to the extreme similarity between species within these two genera. It is highly probable, however, that many of the elms in Fort Greene Park are American.

# IV. TREE INVENTORY RESULTS AND ANALYSIS

This section describes the results of the tree inventory performed during the summers of 2001 and 2002. The definition of a tree for the purposes of this inventory is a woody plant of appropriate species, single or multi-stemmed, that is six feet or taller. All trees within the interior of the park that fit these criteria were counted, as well as those trees growing curbside around the park perimeter. There were 917 trees surveyed, of which 166 were classified as growing along the perimeter. For specific information on individual species, see Appendix C.[26]

Forest management plans and comprehensive surveys are rare for landscaped urban parks. As a result, many of our data comparisons are made to natural areas in and around New York City. However, it is important to remember that Fort Greene Park is not a natural landscape. The park is a highly designed landscape having been the focus of several prominent American landscape architects over the past 150 years. Elements from each plan can be found in the park today. Nearly every tree in the park was planted, and most reflect specific landscape designs.

## Tree Spatial Distribution

A sugar maple in Fort Greene Park. Many areas of the park have only large canopy trees.

In urban forestry, the amount of space occupied by tree canopy is an important measure of forest sustainability. Canopy coverage is an indication of the accrual of environmental and public health benefits of trees. These benefits include air cooling, air pollution mitigation, and storm water runoff reduction. We can expect to see a gradient of canopy coverage from high to low in urban areas between forests, parks, residential, and commercial areas of the city. In Brooklyn, the canopy cover of the partly forested Prospect Park is 50.9 percent, while the canopy cover of Community Board 1 – which includes areas hit hardest by a recent pest outbreak – is 3.0 percent.[27] The average canopy coverage in Brooklyn, including all street, park, and private property trees, is 11.4 percent. The canopy cover of Fort Greene Park – at 37.8 percent – falls into this gradient, although it was estimated in this inventory using a different methodology (Map 10: Estimated Park Tree Canopy).[28] In all, approximately 11.3 of the park's 30 acres are covered by tree canopy (this number excludes trees on the perimeter of the park). Areas without canopy coverage include the monument plaza, a few open fields, and the southeastern playground.

The density of park trees across a given area is another forestry measure that can indicate how forest structure can impact park use, confer benefits, and provide a baseline against which to measure future change. The average stem density of trees in Fort Greene Park is 33 trees per acre. This is a relatively low number, and indicates that on average the trees are sparsely spread across the landscape. (For the other extreme, the stem density of one closed canopy urban woodland is 518.3 trees per acre, with an average

[26] The raw tree attribute data for all 917 trees in Fort Greene Park are available electronically at the Central Forestry & Horticulture, room 47, the Olmsted Center, as well as in the Parks Library at the Arsenal in Central Park.
[27] Nowak, 1998.
[28] Canopy cover was estimated in the field for 170 of the 917 trees in Fort Greene Park using the GPS to "draw" canopy polygons – it was not done for all the trees due to time constraints. The data for these 170 canopies was used to create a general formula relating tree diameter at breast height to canopy and was compared for accuracy to canopy estimates made using an aerial photograph ($p < 0.05$). This formula was applied to all the trees in the park (excluding street trees), then the canopies were mapped in GIS and "dissolved" together to account for canopy overlap.

tree diameter of 5.1 inches.[29]) Even with the low stem density, canopy coverage in Fort Greene Park is relatively high because the average girth of each tree (not accounted for in stem density) is a sizeable 16.4 inches in diameter.

It is important to remember that canopy coverage and stem density are both average measures that do not reveal the variability of tree distribution across a given landscape. Trees can be clustered or spread out based on topography, soil, and site management factors, with some densely populated areas and other treeless spaces such as open lawns. This is the case in Fort Greene Park, where there are many densely planted areas as well as a number of very old, large diameter open grown specimen trees.

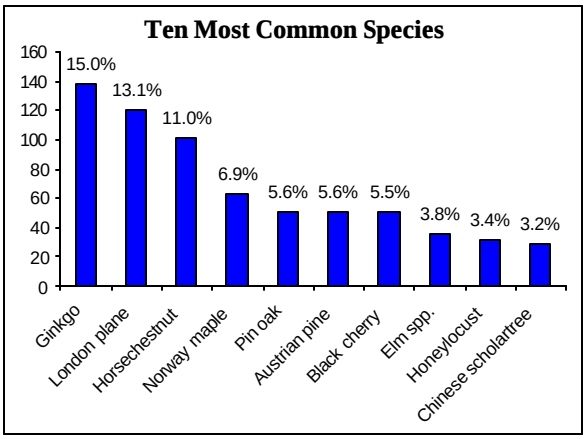



**Figure 2.** The ten most common species in Fort Greene Park. The three most common species account for nearly 40% of the trees in the park.

## Species Diversity and Composition

There are 57 different tree species growing in Fort Greene Park, but most occur in only very small numbers (Map 5).[30] The ten most abundant species are shown in Figure 2. The top five of these species account for 52 percent of the trees. The most prevalent species, ginkgo, represents 15 percent of the population. The next two most represented species are London planetree and horsechestnut. All three of these species, along with the fourth most common, Norway maple, were planted in dense stands, and individuals have been replaced over the years to maintain the major landscape features of the park (see Formal Plantings, p.17).

Diversity is an important measure of a forest's resilience. A more diverse forest, both in total number of species represented and in their relative abundance, is better able to adapt to environmental changes as well as disease and insect infestations. When just a few species dominate the composition of a tree population, these changes or infestations will significantly impact the entire population. A population that lacks species diversity is termed a monoculture.

The triple row of ginkgos that surround the wings of the monument plaza.

One measure of diversity is the extent to which a population is exposed to the risks associated with monoculture. This measure sets as a goal a tree population with no greater than 20 percent of any genus (i.e. maple, elm, oak) and no more than 10 percent of any species (i.e. red maple, American elm, red oak). The most common genus in Fort Greene Park is *Ginkgo*, which is also the most common species (*Ginkgo biloba*), making up 15 percent of the total tree population. Three species in the park – ginkgo, London planetree, and horsechestnut – have greater than 10 percent representation in the population. Another quick way to evaluate the diversity of a population is to look at the two most prevalent species and how much, combined, they are represented in the overall population. In Fort Greene Park ginkgo and London planetree make up 28.1 percent of the park's tree population.[31] While the Fort Greene Park forest is not

[29] Zipperer, 2002.
[30] The 57 species comprise 35 genera and 21 families.
[31] In the New York City street tree population, this number is 41.2% (Norway maple and London planetree); in Brooklyn the street tree population is 50.5% (London planetree and Norway maple).

particularly diverse, by these common measures it could be far less so.

Another way to analyze the species data is to examine the composition of the forest by grouping species by attributes. For example, species can be characterized as native and non-native. The tree population in Fort Greene Park is comprised of more non-native than native species (65% to 35%). A native tree is one that occurs naturally in a certain geographical area, while a non-native tree (also called an exotic) is typically transported into a region. Of the ten most common species in Fort Greene Park, four are native (horsechestnut, pin oak, black cherry, and American elm). The predominant species in the park, ginkgo, is non-native but a hardy, popular urban tree. Non-native species are often very successful in urban areas because they have adapted to adverse growing conditions or lack susceptibility to local pests and disease. On the other hand, the reproductive habits of a non-native species can cause havoc on native populations, by out-competing them in their own natural habitats. Norway maple is a very common New York City invasive species and is well represented in the park (63 trees, 6.9%). The Norway maple was at one time considered a hardy urban tree and was widely planted for ornamental purposes (as is the case in Fort Greene Park). However, today Norway maples suffer from disease and structural weaknesses. Their invasive tendencies have had negative impacts on forest composition in urban and rural areas. While Fort Greene Park's most common species—ginkgo--is exotic, it is not invasive.

A pinetum on the south end of the park with several smaller trees in the foreground (white pine and Colorado blue spruce planted in 2004) and larger Austrian and Japanese black pine in the background.

Another aspect of the species composition of Fort Greene Park is the presence of several pineta – planted clusters of coniferous trees. Evergreen trees are no longer a common site in parks – they are generally more susceptible to air pollution and winter deicing salt, and they have more specific soil chemistry requirements (most require well-drained soil) – however, they greatly enhance a park setting by providing visual interest in the winter landscape. Fort Greene Park includes several pineta which together comprise 8 percent (82 trees) of the park forest. The most common evergreens in the park are Austrian pine and Japanese black pine. Evergreens have been a significant part of Fort Greene Park's landscape since Olmsted and Vaux' original design (see p.19, "Historic Trees"). Over 77 percent of the 4800 trees Olmsted and Vaux planted were evergreen, a significant difference compared to the 8 percent of today.

Within the deciduous tree species in Fort Greene Park, 6.7 percent of the trees are small flowering ornamental species. The more showy species represented are crabapple (2.0%), hawthorn (1.4%), and redbud (1.0%). These trees have flowers that add color to the spring landscape, and berries that add beauty and attract migratory songbirds in the fall and spring.

It is important to be aware of a tree population's vulnerability to likely diseases and insects, many of which affect specific species or groups of species. Among the more prevalent tree pest and disease problems in New York City are the Asian longhorned beetle (*Anoplophora glabripennis*), pine needle blight (*Diplodia pinea*), eastern tent caterpillar (*Malacosoma americanum*), Dutch elm disease (*Ophiostoma ulmi*), and several species of native ash borers. Table 3 indicates the tree species in Fort Greene Park that are potentially susceptible to each of these problems. The Asian longhorned beetle is the greatest potential threat to the park as the

park is located squarely within a federal quarantine zone and the beetle has been found just two blocks away (see Map 7). There are 355 (38.7%) potential host trees in the park. Many of the pines in the park show evidence of the needle blight. While a trained tree pathologist or arborist did not survey the park, 21 trees were marked as showing obvious signs of insect damage. See p. 24 ("Pest Management") for a discussion of these common diseases, their histories, symptoms, and prevention methods.

**Table 3**. Major tree pests and diseases in New York City, which species in the park are susceptible, and how many trees in Fort Greene Park may be susceptible.

| Pest or Disease | Susceptible Species | Count | Percent |
|---|---|---|---|
| Asian longhorned beetle | maples, elms, horsechestnuts, hackberries, ashes, London planetrees | 355 | 38.7% |
| Pine needle blight | all pines | 81 | 8.8% |
| Eastern tent caterpillar | crabapple, cherry, hawthorn, beech | 78 | 8.5% |
| Dutch elm disease | all elms | 34 | 3.7% |
| Native ash borer | all ashes | 8 | 0.9% |

## Tree Size Distribution

In difficult growing conditions (such as urban areas with degraded and compacted soils), tree size is an imprecise proxy for tree age. Nevertheless, we use it here as such, but with the caution that it may not accurately reflect the real age of a tree without counting the growth rings through the use of an increment core.[32,33] The trees in Fort Greene Park range in size from small saplings to a 64-inch diameter London planetree in the monument plaza (see Map 17: Largest Trees in Fort Greene Park). Most of the trees in the park are relatively large, as might be expected in a landscape developed over a century ago with an aging tree popuation and only limited space for new plantings (see Figure 3). Almost 60 % of the trees in the park exceed 12 inches in diameter. The distribution of tree sizes loosely reflect the major planting events that occurred in the park in the 1930s and the 1970s.

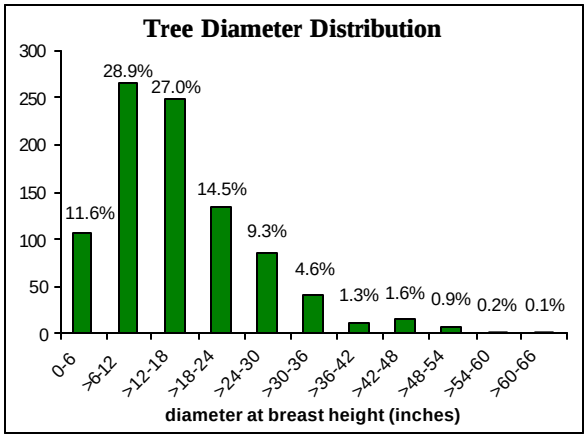



**Figure 3.** A tree diameter histogram for all the trees in Fort Greene Park, regardless of species or location. There are very few trees in the smallest size class, indicating a lack of planting in recent history.

Tree size is an important management consideration because it can be used to indicate which trees need special attention, and how that attention should be administered. The largest trees in the park require professional inspection and maintenance, both as a matter of forest canopy preservation as well as public safety. This need is irrespective of species or growing location. The small but mature flowering ornamental trees may require advanced care, and any small newly planted trees (both flowering and canopy species) should be watered and given extra protection from vandalism.

[32] An increment core is a pencil-sized piece of wood removed from the tree using an increment borer. The core shows a cross section of the rings of the tree from bark to pith, allowing tree age and health to be assessed.

[33] When a group of trees of the same species experiences similar growing conditions (soil, water, light) it is acceptable to use trunk diameter as a proxy for comparative age. As a result, though the data in this section is presented as size information, it is reasonable to assume that with in a species, trees in Fort Greene Park with larger diameters are older than their smaller counterparts.

When trees are graphed by species as well as size the picture does not change significantly. The aforementioned large, isolated plantings of individual species (ginkgos around the monument, London planetrees and Norway maples in the northwest corner, and horsechestnuts along the streets) do slightly skew this data but the over-all trend remains the same – many mid-sized trees, few small and few large ones. In addition, some of the trees in the smallest size class are ornamentals that will never become large canopy trees.

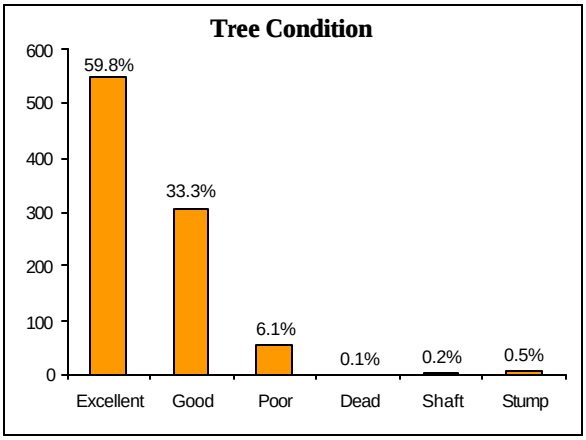



**Figure 4.** Condition for all the trees in Fort Greene Park. Most trees were marked as excellent or good.

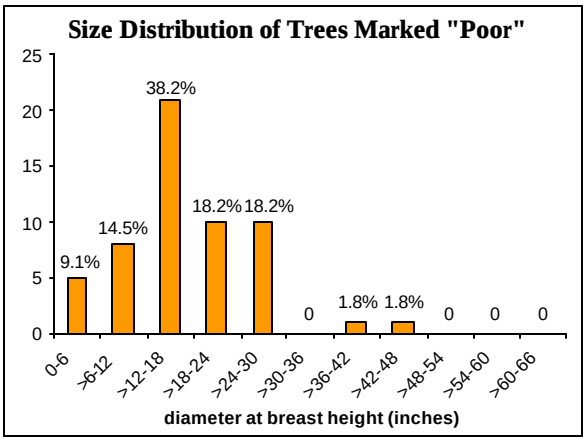



**Figure 5.** The size distribution of trees classified as in poor condition. There are 56 poor trees, in total.

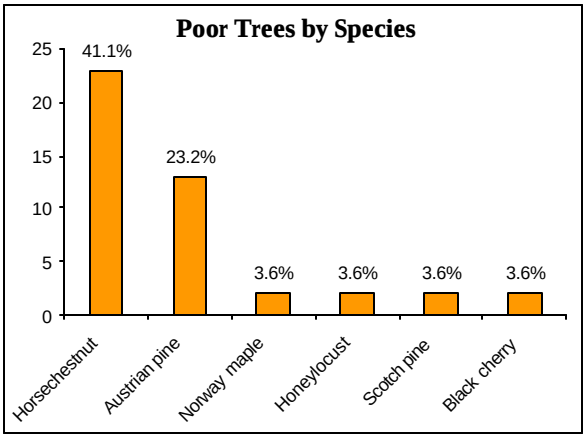



**Figure 6.** The six species with more than one tree marked poor. Percentages are of the 56 poor trees.

The inventory results for Fort Greene Park as they relate to tree size indicate a relatively even-aged population that is senescing without a program of ongoing replacement. Very few trees have been planted in the last 10 years, and few trees are self-seeding. This forest structure may be typical of an urban park that has limited space and has experienced shifting design approaches over the years. Yet it is important to address the even-aged forest structure by replanting areas where there is currently space, and replacing specimen trees individually as space becomes available (i.e. as they are removed). More discussion on tree size as it relates to management and planting considerations can be found in Chapter V: Forest Management Planning.

## Tree Condition

The condition of trees in the park was evaluated based on criteria including foliage vigor, evidence of dead wood and decay, and presence of insects or disease (see Appendix E for tree condition rating methodology). Trees were then classified as excellent, good, poor, dead, shaft, [34] or stump. Figure 4 shows the distribution of these six classes, and Map 8 shows where they are located in the park.

Over 93 percent of the tree population was considered to be in either excellent or good condition when they were inventoried. Just 63 trees fell into the poor, dead, shaft, or stump categories. By size, a significant number of the trees that were marked poor were large – 42 of the 56 poor trees (75%) were over 12 inches in diameter. Only one poor tree had a diameter greater than 40 inches: the 43-inch English elm in the northern wing of the monument plaza. Many of the other poor trees grow within the allees along the streets or in the plaza surrounding the monument (see Map 8). There were only three standing dead trees in the park at the time of the inventory – the largest is a 15-inch crabapple (split leader) on the western edge of the park.

When tree condition is considered by species (see Figure 6) the trees in the worst condition are horsechestnut and Austrian pine. There are 23 poor horsechestnuts, all of which are part of the allee plantings surrounding the park. While many of the horsechestnuts are thriving,

[34] A shaft is a dead tree with no limbs.

this large representation of horsechestnuts in the poor category reflects their tendency to suffer with limited underground growing space and compacted soil. There are 17 pine trees in the park that are in poor condition. Thirteen of these are Austrian pines, which are one of the more common hosts of the *Diplodia* pine needle blight.

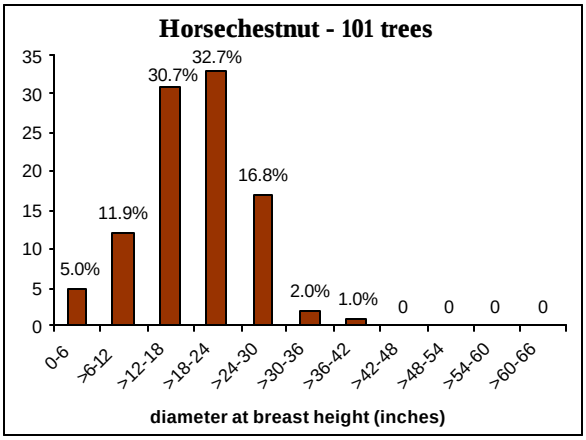



**Figure 7.** 96 of the 101 horsechestnuts are in allees surrounding the park. While the allees were an original Olmsted and Vaux design element, it is unlikely that many of the trees are from that era (i.e. around 130 years old).

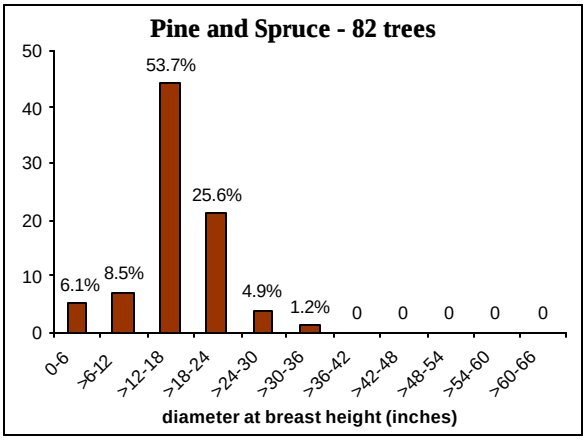



**Figure 8.** The pineta were planted in the 1930s and supplemented in the 1970s. Today many of the non-native pines suffer from a needle blight.

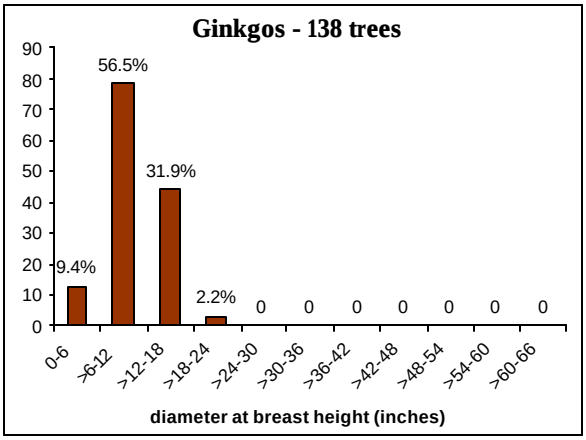



**Figure 9.** 130 of the 138 ginkgos in the park are part of the triple rows surrounding the wings of the monument plaza.

## Formal Landscape Features

There are 101 horsechestnuts in Fort Greene Park, and 96 of them are located in allees along Myrtle and DeKalb Avenues and St. Edwards Street. These shaded walkways were part of Olmsted and Vaux's original design (1867), however few if any of the original trees remain (there are only four trees over 30 inches d.b.h.). Along the three allees 29 trees have been planted which are not horsechestnuts. This is likely due to the absence of a plan guiding planting decisions, a scarcity of street-tree ready horsechestnuts in local nurseries, and, most recently, an agency policy to avoid planting ALB hosts in quarantined boroughs.

The pineta along the edges of the park were also planted in the 1930s and supplemented in the 1970s. The 81 pine trees and one spruce tree in Fort Greene give patrons the opportunity to see some rare species and to enjoy winter greenery. Only five of the evergreens are smaller than 8 inches in diameter (four were planted in 2004, see Figure 8).

There are 138 ginkgos in Fort Greene Park, 130 of which are in a dense formal planting surrounding the wings of the Prison Ship Martyrs' Monument plaza. This planting, which originated in 1936 as part of Gilmore Clarke's redesign, consisted of 172 trees. High mortality has resulted from a number of factors including competition from nearby large trees and dense spacing (the ginkgos are planted less than 10 feet apart), damage from construction projects, erosion, poor growing conditions, and lack of maintenance. Over the years some of the trees have been replaced, however the size range indicates that few ginkgos have been planted in the past few years [35] (see Figure 9). In addition, many of the trees are females, producing thousands of malodorous fruits every fall.

Clarke's design also included triple rows of London planetrees (see Map 9) in the northwest corner of the park (the meeting area) lining the walkway to the monument and surrounding the playground. Today they are still the only canopy species in this area with 91 trees. Their range in size (see Figure 10) indicates that many have been replaced since the original 1936 planting and that the replacement has continued through recent park history, but in general this population is aging, as are most species in the park. The other 29 London planetrees in the park represent several different planting periods. Six of the largest trees in the park (see Map 17) are London planetrees that were probably planted during the Olmsted and Vaux era.

[35] Gingko trees are very slow growing. Trees with relatively small diameters may be very old trees.

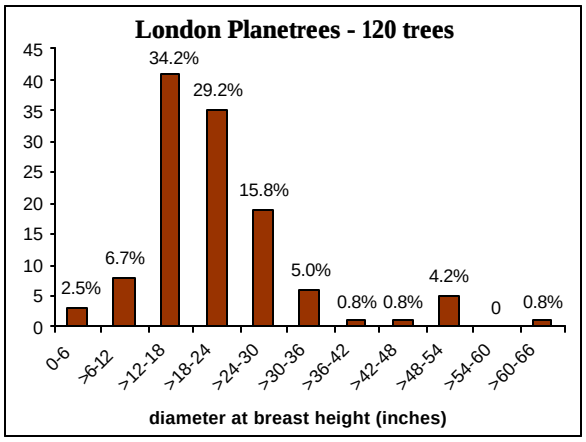



**Figure 10.** The London planetrees in the park represent several historic plantings -–the largest trees in and around the monument plaza date back to the 1800s, and the triple rows of mid-sized trees are from Gilmore Clark's design.

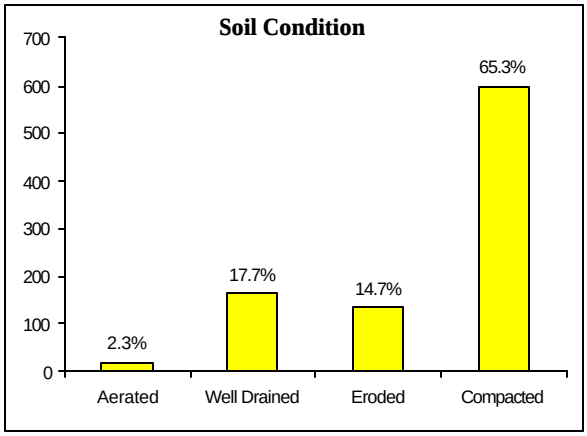



**Figure 11.** The condition of the soil at the base of a tree effects its ability to absorb water, oxygen, and nutrients. Soil condition also effects structural stability.

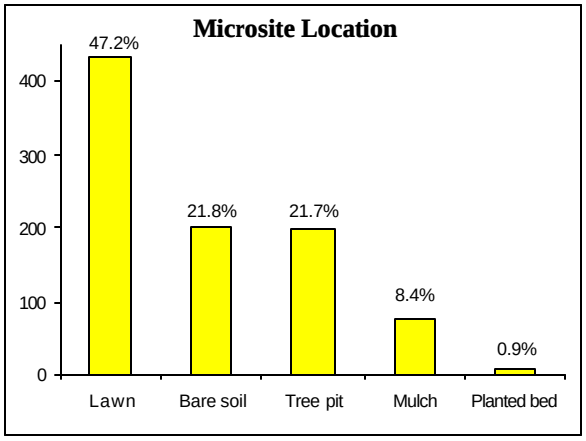



**Figure 12.** The land immediately surrounding a tree reflects that trees' needs and issues.

## Growing Conditions

Urban trees are subject to many stresses that would not be present in ideal growing conditions. City air contains more carbon dioxide, more ozone, and more pollution than air in rural areas. Urban park soil has been churned, moved, and compacted, increasing its bulk density and reducing pore space, preventing air and water from reaching tree roots. In addition, a lack of ground cover leads to increases in erosion, reducing tree stability and exposing roots to desiccation and injury.

*Soil Condition Around Trees*

The condition of the soil around each tree was noted as part of the inventory process. Soils were marked aerated (good), compacted (hard – no vegetation around base), well drained (dry but good), or eroded (roots exposed). Of the 917 trees in the park, only 20 percent (183 trees) were marked as growing in aerated or well drained soils (see Figure 11). These trees are growing in relatively loose soil, generally indicated by vegetation growing below the tree's canopy or decomposing mulch at the base of the tree. Compacted soil prevents air and water from moving through the ground, simultaneously suffocating and desiccating roots. Compacted soil is a common urban problem and Fort Greene Park is no exception – 65 percent (599 trees) suffer from compacted soil. As a small, steep park, Fort Greene also exhibits a large amount of soil erosion. Heavy foot traffic on steep slopes have caused large areas of the park to become bare of vegetation, with the result that rain washes the exposed sediment into drains and onto paths. 134 trees (14.6%) in the park are growing in highly eroded soils, mostly concentrated on the steep sides of the hill. Several of the eroded areas on slopes are beneath Norway maple trees, a species known to inhibit understory growth leading to eroded soils.

*Site Conditions Around Trees*

Trees were also classified based on the type of site they were growing in or around. The inventory categories were lawn, mulch, bare soil, tree pit, or a planted bed. Nearly half the trees (47.2%, 433 trees) were growing in lawn areas, 21.8 percent on bare soil, 21.7 percent in tree pits, and the rest (less than 10%) were mulched or in planted beds (see Figure 12). 290 (31.6%) of the trees in compacted soil were in lawn areas, indicating that grassy areas are by no means exempt from soil degradation.

## Human Damage

Many of the trees in Fort Greene Park show evidence of vandalism. Park patrons often forget that trees are living organisms and use and abuse them as they might lampposts or garbage cans. People pulling off bark or limbs, tying dogs to trees, and carving into trunks are not uncommon sights in the park. While the damage was not systematically documented in this study, many of the trees in the park had evidence of vandalism including large trunk wounds, wire, staples, or nails embedded in their

bark, cavities, slashed bark, broken branches, and burn scars, etc. The inventory noted 179 trees (19.5%) with some sort of human-related damage. Map 10 indicates that most of these trees are located in and around the paved areas within the park (the monument plaza, the stairs, and the northwestern playground).

Several trees are in conflict with park infrastructure, often caused by poor design. Some trees are growing through fences or over paving. Map 11 shows the 16 trees in the park with such conflicts. Infrastructure conflicts often happen when decisions are made without consideration for the future growth of the tree. These trees need special attention to remove conflicts and prevent unnecessary tree mortality.

There are 260 trees (28.4%) in the park marked as being in "active use" areas. Active use areas represent the most potential for human damage due to their close proximity to park patrons.

## Historic Trees

There is very little information available about planting programs prior to the 1930s, the period in which Parks' documents were centrally stored under Robert Moses' leadership. Due to the historic significance of Fort Greene Park, however, as well as the numerous plans that have been made for its improvement or remodeling, it is possible to infer some information about the park's trees prior to the 1930s. The following is a list of significant plantings and the dates when they occurred. Obviously many other plantings have taken place in the park, but these are documented.

*The Prison Ship Martyrs' Monument Plantings*

The areas around the Prison Ship Martyrs' Monument have been a central focus of architectural and landscape plans since the park's inception. The following is a list of the planting years, the landscape architect involved, and the trees from those plantings that are still present. There are several other trees in and around the monument plaza whose origins are unknown.

- 1867 – Olmsted & Vaux; four London planetrees, five English elms, one English oak.[36]
- 1936 – Gilmore Clarke; triple rows of ginkgos around the two wings.[37]
- Between Clarke and Bye; five ginkgos in the monument square (inferred from historic photos).
- 1971 – A.E. Bye; 16 Japanese zelkovas, two Norway maples, one honeylocust.[38]

*Park Plantings outside of the Monument Core*

- 1869 – 1,079 deciduous trees, 3,721 evergreen trees, 6,357 deciduous shrubs, 108 vines, and 52 herbaceous plants were planted in the park.[39] This was a large number of trees for the park, and thinnings were noted in the Parks' Annual Reports throughout the 1880s.
- 1872 – "Chestnuts" (probably horsechestnuts) were planted in allees along the streets around the park. They have been replaced over the years, nearly always with horsechestnuts.
- 1913 – Tree planting funded by the NY Board of Water Supply

[36] These trees are assumed to be from this era based on historic photos and the size of the trees themselves.
[37] Quennell-Rothschild & Assoc. 1984
[38] ibid.
[39] Culyer, 1870.

- 1936 – Triple rows of London planetrees around the northwest playground. They have been replaced with new London planetrees as the originals have died.
- 1971 – As part of A.E. Bye redesign, zelkova, ash, honeylocust, & Callery pear and many of the Austrian and Japanese black pines were planted as well as Norway maples planted in northwestern corner. Black locusts planted on the northeastern corner.

# V. FOREST MANAGEMENT PLANNING

In natural forests trees in all stages of growth and decay are important to the functioning of the ecosystem, and even when left alone a forest will convey many benefits to humans. The same cannot be said of urban parks. For example, activities such as mowing, and leaf collection and conditions such as soil compaction hinder natural regeneration. Intense visitor use necessitates pruning and prompt dead tree removal to maintain high safety standards. A sustainable urban forest requires careful management in order to maximize the benefits of green infrastructure while addressing the direct and indirect human influences on the trees.

## Management Goals

Urban forests convey a number of quantifiable benefits which can be enhanced through management. This section outlines the primary goals of this urban forest management plan.

*Canopy Cover and Public Health*

The foremost goal of this urban forest management plan is to protect and improve tree canopy. The canopy, in the form of individual leaves and their surface area, is the basic structure that provides the bulk of a tree's environmental and public health benefits.[40] Through transpiration, tree leaves cool the air, reducing ozone formation--a known asthma trigger. Cooler temperatures also lead to a reduction in heat related illnesses (strokes, hypertension and other cardiovascular diseases) as well as a reduction in energy use. Leaves clean the air by absorbing and reducing pollutants including nitrogen oxide, sulfur dioxide, and carbon monoxide.[41] Trees also help by reducing wind speed so that heavy particles settle out.[42] Views of leafy canopies decreased recovery time for hospital patients.[43] Each additional tree and each additional park space improves a city's air quality and its citizens' mental and physical health.

*Passive Recreation*

While healthy trees convey benefits to an entire city, the communities immediately surrounding the park enjoy the majority of benefits. Trees not only improve local air quality, they provide shade for park patrons and a pleasant backdrop of rest and relaxation. Through careful management and planting, trees can create inviting spaces for formal and informal gatherings.

*Aesthetic Values*

Trees have an inherent aesthetic value. Studies have shown that homes with large trees on their property sell for 10 to 15 percent more than homes in the same neighborhood with few or no trees.[44] In urban areas, property values often increase with street tree health and park area. It is no surprise that many of the highest property values in New York City are found surrounding the nicest parks.

The northeastern United States is known for its four distinct seasons. Our perception of the seasons is directly related to the trees – in the spring we enjoy multitudes of pink, white, and yellow blooms, then the thick green shade of the summer, the oranges, reds, and yellow

[40] Maco and McPherson,2002
[41] Nowak, 1994
[42] Harris, 1992
[43] Ulrich, 1984

leaves in the fall, and dark green pine needles in winter. Without trees, seasons are simply changes in temperature and precipitation. Trees provide the sights, smells, and sounds of each season.

*Wildlife habitat*

Most New Yorkers think of urban wildlife as pigeons, rats, and roaches. However, parks provide the opportunity for myriad other species including small mammals (e.g. squirrels, bats, the white footed mouse, chipmunk, fox, moles, and voles) and birds (e.g. warblers, chimney swifts, blue jays, cardinals, owls and woodpeckers). It is possible to actively manage the park to encourage song birds through tree planting, building nest boxes, and reducing predators.

*Erosion control/Storm water run-off reduction*

In natural landscapes soil is held in place by trees, shrubs, and groundcover. Not only do roots penetrate soil, essentially holding it in place, but leaves also catch raindrops as they fall, reducing their velocity before they hit the ground. Imagine standing under a tree during a downpour – you will still get wet, but the drops are large and slow, as compared to the shower you would experience standing out in the open. While park lawns do much to prevent erosion in parks, steep slopes and areas where grass cannot survive (areas with high foot traffic and beneath deep shade), need trees and other plantings to reduce the effects of rain and trampling on the soil. Healthy trees in wooded areas reduce the amount of storm water runoff entering the sewer system of the city, leading to reduced flooding. Wooded landscapes also improve the quality of storm water runoff with soil acting as a natural filter to the oils and grit that accumulate as rainwater washes over city streets.

*Views*

Trees both frame views and obstruct views. They can also be the subject of the view. Many designers use trees as architectural elements that provide a backdrop for buildings or define outdoor spaces. When planting new trees and pruning existing trees, it is important to keep in mind their dynamic nature over time and whether they were planted as viewshed elements.

*Cultural Heritage and Current Use*

A park's tree population is most often managed to maximize environmental and current user benefits. In an urban park, cultural and historic elements must also be considered. A growing discipline--Cultural Landscape Protection--stresses the careful management of landscapes to preserve the elements of them that "reveal aspects of our country's origins and development… [as well as] our evolving relationship with the natural world."[45] Tree management should strive to find a balance between the preservation of a park's evolving landscape history as well as current site conditions and community needs.

*Education*

Day to day life in New York City, with its skyscrapers and sidewalks, leaves little opportunity for citizens to interact with and learn about nature. Urban parks can provide that important connection and are a treasure trove of learning opportunities. A park's trees can be used as a vehicle for learning about environmental issues, while the park's forest can be managed with enhanced educational opportunities in mind.

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[44] Fazio (date unknown)

## Management Zones

Park tree management issues can be divided into three general categories: those that need to be addressed immediately such as dead or hazardous trees, chronic issues (pruning, pest inspection), and planning (planting and construction). The zonal management approach is a framework for systematically addressing the needs of individual trees over a specific area and time period. By placing the zones on a rotation, routine management issues including tree inspection, pruning, and planting, as well as site condition amelioration programs, can be approached sequentially. Acute needs, such as hazardous conditions, should always be addressed right away.

Fort Greene Park has been divided into seven management zones that were qualitatively selected based on the level of human use, tree species composition, street and path delineation, and topography (see Map 11). One zone consists of all the street trees surrounding the park. These perimeter trees are considered separately because they present different management concerns. Seven years is a reasonable cycle for pruning given the park's size and condition profile.[46] Table 4 lists the seven rotation zones (six internal and one perimeter) with a suggested order of rotation and other important criteria.

**Table 4.** The park's seven management zones in order of year of maintenance.

| Year | Zone | Area (acres) | Number of Trees | Tree Density (trees/acre) | Dead Trees | Poor Trees | Human Elements | Major Issues |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 5.38 | 123 | 22.86 | 2 | 3 | paths | viewshed, planting |
| 2 | 1 | 2.75 | 172 | 62.55 | 3 | 4 | monument, visitors' center | ginkgos, capital project |
| 3 | 5 | 7.22 | 92 | 12.74 | 0 | 9 | playground, paths | erosion, playground |
| 4 | 7 | 3884 curb feet | 166 | 23.4 feet/tree | 0 | 27 | street, benches | horsechestnuts |
| 5 | 3 | 4.15 | 157 | 37.83 | 2 | 12 | paths | erosion, pineta |
| 6 | 2 | 3.54 | 146 | 41.24 | 0 | 0 | playground, comfort stn, ball court | stairs, London planes |
| 7 | 6 | 5.80 | 61 | 10.52 | 1 | 1 | tennis courts | large, old trees |

## Maintenance

Healthy trees confer numerous benefits, yet poorly maintained trees can pose a considerable risk to the surrounding community. Broken branches and even entire trees can fall down, especially during inclement weather. In paved areas roots can cause cracks and buckles in pavement which may be tripping hazards. Leaves can clog gutters and fruits can rot and smell. While the benefits of trees far outweigh the costs,[47] careful maintenance is needed to manage hazards that are often predictable, detectable, and preventable. Excluding immediate, acute problems (blow downs, pest outbreaks, extreme vandalism) tree maintenance should be performed following the seven-year management zone rotation plan outlined above.

*Pruning*

As trees mature, branches grow and thrive while others naturally decline and die. In a natural forest, this branch dieback goes relatively unnoticed. In a park setting, safety and aesthetic concerns demand a higher level of maintenance. Young trees may need live wood removed or pruned to create a sturdy and pleasing branching structure as the tree grows. Large dead branches must be pruned from a mature tree's canopy. Other branches may be

[45] Birnbaum, 1994
[46] Miller, 1997.
[47] Hauer and Johnson, 2003

pruned to preserve or create views. Map 13 shows trees in Fort Greene Park with obvious dead wood and which are in need of pruning. These trees should be reinspected and pruned as needed immediately. Routine pruning can be addressed through the seven-year rotation plan (based on accepted pruning rotation guidelines) [48]. Small and/or young tree pruning is an activity that can involve trained volunteers if appropriately trained (see "Young Tree Maintenance", p. 25).

*Tree removal*

Trees can be in decline and still provide significant benefits, as long as risks are adequately addressed through pruning, cabling, or other arboricultural measures. Tree removal should be the last tool a manager uses, especially when the tree is historically important or a specimen. Parks has developed specific guidelines for when and under what conditions trees may be removed. The four situations in which tree removal are appropriate are (1) if the tree is dead, (2) if the tree is irreversibly diseased or in significant decline, (3) if the tree presents a hazard, or (4) if there is an unavoidable conflict between a tree and a construction project *and* the Commissioner approves the tree's removal.[49] Map 13 shows all of the trees in the park in need of immediate removal (dead or nearly dead trees) in red; at the time of the inventory there were nine. These should be reinspected immediately and removed.

Additionally, all dead wood materials need not be removed from the park. Dead wood left to decompose on the forest floor adds nutrients to the soil and provides habitat and food for local flora and fauna.

*Inspection*

Fort Greene Park benefits from a dedicated park staff and a vocal group of regular users who are quick to point out tree health issues. This is a good role for park users and a first line of defense, but the trees will also benefit from a regular schedule of inspection by a trained arboreal professional. Inspections should include close scrutiny of the target population for a number of tree health measures including decay, pests and diseases, unhealthy growing conditions, and vandalism. The inspector should document these problems and recommend appropriate arboricultural solutions or future monitoring as necessary.

Map 13 identifies all the trees within 30 feet of a path or playground that were marked as needing attention in the 2001/2002 survey. High priority trees (11 trees) are those marked "dead," "shaft," or "remove" in the survey and are near a path. Mid priority trees (56) are those marked "poor" or that have comments that indicate a need for inspection. An experienced arborist or forester should visit these trees immediately. Once immediate problems have been addressed, tree inspections should occur annually as part of the seven-year management zone rotation regime described on p.23.

*Pest and Disease Management*

Insects and pathogens are a natural part of a tree's lifecycle. In a natural forest native pests are usually present, however, the forest as a whole absorbs their detrimental effects on individual trees. When a pest has not evolved with a species it can have far more negative

[48] According to Miller, 1997 and Hartman, 2000 ideal pruning cycles should be calculated using tree size and condition to determine the marginal loss in tree value for each year a pruning rotation is extended. Milwaukee and Modesto are two cities that have made this calculation and have determined their ideal rotation to be 5 years and 7 years, respectively.
[49] Parks Tree Removal Protocol, 12/16/03 memo from Commissioner Benepe to full distribution.

effects. Regardless of a pest's origin, the value placed on individual park trees makes preventative measures like inspection and inoculation more important than in a large natural forest. Three threats of particular concern in Fort Greene are the Asian longhorned beetle, Dutch elm disease, and *Diplodia* pine needle blight.

The Asian longhorned beetle, identified by its white spots and dime sized holes it leaves in the trees it infests.

The Asian longhorned beetle (ALB) is a one-inch long black beetle with white spots on its abdomen. Native to eastern Asia, this pest kills trees by burrowing through the bark and inner core of the tree, disrupting the tree's circulating system and structural stability. Its primary hosts are maple, horsechestnut, willow, elm and poplar. Nearly 40% of Fort Greene Park's tree population are host species. While the ALB has not been spotted in the park, it was found two blocks away, near the intersection of Willoughby and Adelphi Streets (see Map 7). There is no treatment for a tree once it has been infested; removal is the only option. However, a new control treatment has been developed by the U.S. Department of Agriculture. Uninfested host trees are inoculated with the pesticide imidacloprid. This has been shown to reduce the population of adult ALB. In Fort Greene Park, primary host trees have been inoculated every year since 2001, the first year of treatment[50]. Fort Greene Park's host trees must be inspected regularly for the earliest possible detection of ALB (at the very least on a biannual basis).

Dutch elm disease (DED) is a major problem for most elm species in the northeast and has led to the loss of most American elms from the urban landscape. The primary indicators are yellowing or flagging leaves and dark streaks along the trunk and branches. There are 37 elms in the park, including several large, specimen trees, such as the English elm in the northern wing of the monument plaza. Again, regular inspections (at least two times during the growing season) and immediate removal of infected material is the best approach to reducing additional elm mortality from DED. See Map 15 for the locations of all the elms in the park.

*Diplodia pinea* is one of many pine needle blights in the United States. This blight is a native fungus that particularly effects non-native planted species, especially plantings of Austrian pine in the central and eastern U.S. Twelve of Fort Greene Park's 51 Austrian pines were noted as suffering from insect damage. The most obvious symptoms of *Diplodia* are brown needles and dying shoots, typically starting at the base of the crown. While one infection will not kill a tree, repeated infections will reduce a tree's ability to photosynthesize until it literally starves to death. To prevent further infection trees should not be pruned during the growing season (May through October). Fungicides applied for the two weeks following bud-break have been effective in protecting trees.

Although tree pathogens are a fact of life in urban and rural forests, there are a few techniques that can greatly reduce the chance of infection or outbreak. Regular inspections, even by volunteers or students, are the best way to identify potential problems. Careful disposal of potentially infected wood is imperative, as is sterilizing pruning tools between trees. For more information on pests see the Resources for Forest Managers section, p.40.

*Growing conditions*

A number of options are available to improve tree growing conditions. These options range in intensity and expense. An arborist or other trained professional should determine which

[50] In 2004 elm trees were not inoculated due to Parks' concern of imidacloprid's impact on beneficial insects.

trees will most benefit from the following treatments. Tree selection should be based on the seven-year management zone rotation plan outlined above, however, the largest trees in the park should be given priority consideration regardless of location (see Map 17. Largest Trees in Fort Greene Park).

- *Mulching* is an inexpensive way to slowly add nutrients to a tree's roots while increasing soil organic matter, retaining water, and insulating the base of the tree. Mulch is usually available from chipped branches and trees within the park.
- *Soil aeration* can be accomplished in a number of different ways in order to increase pore space in soil. Soil compaction is a very difficult condition to reverse and has chronically plagued trees in heavily used landscapes. Managers should explore new techniques including radial trenching using an airspade to excavate soil and replace dense fill with organic soil rich in nutrients and vertical mulching—a process removing vertical holes (2-3 feet deep 4-6 inches in diameter) from beneath a tree's canopy and backfilling with a light soil mixture.
- *Fertilization*, through injection or ground application, may help ailing trees and increase older trees' vigor. Fertilization should only be used to address known soil chemistry imbalances. Soil testing should always be done before the decision is made to fertilize. Other new biological stimulant techniques include Cambistat, a soil-applied tree growth regulator that slows tree growth, improving pest and drought resistance while enhancing root systems. Cambistat also has been shown to stimulate fine root growth on large trees, an application that can result in renewed vigor for elderly senescing trees and may be especially appropriate for some of our urban park specimen trees.
- *Conflicting infrastructure removal* mitigates damage from conflicts due to fencing and pavement. Fencing and concrete should be removed where required to allow for proper tree growth.

*Young Tree Maintenance*

As more young trees are planted in the park, the need for a young tree maintenance program will rise. Young trees require more frequent care than older trees. Depending on conditions they may need to be watered, mulched, pruned, and/or protected with temporary fencing, as they are more susceptible to vandalism and adverse environmental conditions.

Partnership for Parks' has a Citizen Stewards for Young Trees program for volunteers to adopt young trees in their neighborhood. Volunteers are trained in basic tree maintenance, and watering techniques, provided with tools (a hose, trowels, garbage bags, gloves, etc.) and are responsible for the care of the adopted tree. This program promotes citizen involvement in tree care and awareness of the urban forest. A similar program could be implemented in Fort Greene Park – individuals, families, or school groups could adopt newly planted trees within the park itself.

*Wildlife Management*

Fort Greene Park is an ecological island. It is surrounded on all sides by the built environment with no significant green link to other natural areas. As a result, it is highly unlikely that deer, raccoons, or other large mammals would ever populate the park. Squirrels, however, are abundant. New York City is also along the northeastern flyway and every year millions of migratory songbirds pass overhead on their way to and from warm wintering grounds in the south. To improve wildlife habitat in Fort Greene Park particularly for migratory birds with limited habitats, there should be some effort to maintain a healthy native tree population and encourage the planting of additional native trees. See the

"Outreach" section (p. 31) for additional ideas for including park visitors in park wildlife management.

*Tree Species specific issues*

A number of tree health issues affect only certain species. Elms and Austrian pines have been discussed in the Pest and Disease Management section. Park managers should be aware of these issues and pay special attention to them as they monitor the park's arboreal resource. The following species in Fort Greene Park have specific issues that should be monitored:

- **Pin oaks:** Pin oak is the fifth-most common species in the park and is represented in all size classes (4 to 33 inches in diameter). The numerous small drooping lower branches, distinctive to a pin oak's lateral branching structure, are often shaded out by upper branches. While these branches generally do not pose a significant risk to park visitors, they are a nuisance and are messy. They should be monitored, especially in areas of high human use. Several of the pin oaks are along paths and the street. There are 51 pin oaks in the park (See Map 16).
- **Norway maples:** At 6.9 percent of the population, Norway maple is the fourth most common tree in the park. Widely over-planted in cities beginning in the 1930s, it was once thought to be tolerant of most urban environmental ills including soil compaction, air pollution, and limited growing space. Now the species is broadly impacted by verticillium wilt, a fungus that weakens branches and overall tree vigor. Norway maples tend to be more susceptible to storm damage for this reason, and the two trees noted in poor condition should be inspected regularly. In addition, because of the Norway maple's dense canopy understory growth is completely prohibited. This leads to increased erosion on slopes and is evident in Fort Greene Park. Norway maples are also highly invasive, so sprouts should be removed immediately to prevent the establishment of additional trees.

*Location Specific Issues*

There are a number of issues in the park which are especially prevalent in certain locations. These areas should be monitored and action taken where necessary. The following areas are in need of special attention (see Map 9).

- **Playgrounds:** Hundreds of children from the various schools and day-care facilities around the park use the two playgrounds on a daily basis. It is especially important that the trees in and around the playgrounds be healthy, structurally sound, and limbed up to Parks' standard nine feet. There are 47 trees growing within 30 feet of a playground, 18 of theses trees are growing within the playgrounds' borders.
- **Eroded Slopes:** Fort Greene Park is, essentially, one large, steep hill. As a result, many areas suffer from erosion (see Map 9), made worse by people who walk on the eroded soil, further compacting and disturbing the areas. Eroded soils are less than ideal growing conditions for trees. The discussion of Zone 4 (p.D-14) outlines specific ways of ameliorating erosion in that area but can be applied to all eroded locations. In addition, the Natural Resources Group has had success with erosion control in natural areas and should be consulted for specific recommendations. 134 trees were identified as growing in eroded soils.
- **Monument Views:** The top of the hill in Fort Greene Park is one of the highest points in the area, allowing long views of the surrounding neighborhoods and even the Manhattan skyline. In addition, the views from the street to the top of the hill were an integral part of Olmsted and Vaux' original design. Today most of these views are obscured by tree branches. While restoring all the viewsheds is impossible, as it would necessitate the removal of many healthy trees, a thoughtful pruning plan could improve some views. Future plantings should consider where trees *shouldn't* go as much as they consider where trees should go.

## Tree Protection

*Construction Protection*

Construction in and around trees can lead to physical injury to tree trunks, soil compaction in the root zone, severed roots, smothered roots, split or broken branches, and new exposure to the wind and sun. When construction is necessary it is important for contractors to understand tree preservation and to use best practices in tree protection.

The best way to protect trees from construction damage is to protect the tree and the surrounding soil. A tree protection zone should be established and fenced off and contractors should be prohibited from moving or working within the fences. In order to prevent soil compaction and root injury, the fence should be placed at least as wide as the tree canopy's dripline but often wider. If the rooting area cannot be off limits, heavily mulching the soil can reduce compaction.

Driving near trees should be minimized; site access and equipment storage areas should be clearly delineated prior to the start of construction. Trenching near trees should be eliminated and trees should be protected from physical mechanical damage with tree wrap or tree guard. If trees are injured during construction they should be tended to immediately – broken branches should be removed and bracing or cabling should be put in place as necessary. For Parks' tree protection guidelines, see Appendix G.

In 2005 construction will begin on a capital project that will partially restore the Prison Ship Martyrs' Memorial plaza to the McKim, Mead, and White 1907 plans. Several trees will be removed, much of the plaza will be repaved, and the border hedges will be replanted. These activities will occur around two of the oldest trees in the park – two large London planetree trees that likely date back to the Olmsted and Vaux design (1867). These trees should be carefully protected during construction and monitored.

*Vandalism and Unintentional Tree Damage*

It is impossible to constantly police any park. It is possible, however, to raise awareness in the community about tree health and to increase people's respect for the trees in the park. Educating park patrons and local school children about the trees in the park may reduce incidents of tree vandalism (such as girdling and peeling bark) and encourage reporting of observed tree damage.

Accidental tree damage is also primarily a matter of education. Most people do not realize that slamming a car door (or fender) into a tree, urinating on a tree, hammering a nail into a trunk, or dumping hot coals at the base of a tree may all cause irreparable damage that can eventually lead to hazardous conditions and tree mortality. Even walking on a tree's roots, when done by hundreds of people a day, can seriously injure a tree.

Programs that raise the public's awareness of the trees in the park through emphasizing their historical significance and the benefits they provide can help influence visitor behavior. See the education and outreach sections of this chapter for more information on this topic.

## Planting

Tree planting in a developed park can significantly impact that park's landscape for years to come. Yet planting decisions, including the selection of species and location, are often made without the benefit of a long-term strategy or plan. As described in the Introduction to this report ("Key Actors"), a variety of different divisions and entities participate at different

times in decision-making activities that can shape the landscape. Tree planting might occur as part of a larger capital construction project, or be driven by a donor request or the need for a volunteer project. Each of these common scenarios has occurred in Fort Greene Park—as in many city parks—over the years.

There is a clear need for comprehensive landscape plans to guide the horticultural future of our most historical and arboreally valuable public parks. Such plans will minimize the unintended but gradual degradation of a designed landscape over time, as well as maximize the potential for a sustainable tree canopy and the associated benefits. The trees of Fort Greene Park—a relatively even-aged maturing population—are not only significant design elements but also part of a considerable canopy cover at this stage in their growth. The challenge for a park manager is to plant enough new and replacement trees each year to maintain the delicate balance between design and canopy cover without negatively impacting either. Without a clear plan to guide tree plantings, the park may gain trees but this balance will not be achieved.

A landscape plan will also help park managers quickly determine how best to apply funding that often becomes available in small and unpredictable amounts. A plan should not only specify *what* (species) and *where* (location) but *when* (timeframe) and *why* (underlying goals). Most importantly for Fort Greene Park, the collaborative process of developing a plan (involving landscape architects, the Park Administrator, and the surrounding community) will help resolve conflicting historic designs, community preferences, and current use issues.[51]

*Historical landscape planning*

All parks have a derived landscape, whether from an original park plan, an inherited estate design, or even from a remnant woodland stand. The longer a park has been established, the more likely it is to have accrued a number of landscape design inputs—some more admired than others, some more historically significant, and some in conflict with others. Fort Greene Park—first established in 1847—has had successive waves of influential designers impacting the park from its inception. As such, it is an important cultural landscape, and planting and management strategies ought to be sensitive to this layered history. At the same time, these multiple legacies must be balanced against each other as well as with current park needs.

The Historic Landscape Initiative of the National Park Service (NPS) provides a wealth of guidance for cultural landscape planning. This relatively new discipline is informed by the concept that "Wise stewardship protects the character, and or spirit of a place by recognizing history as change over time."[52] Under this model, the planning process includes extensive research and consensus building to inform the appropriate balance of four treatment options: preservation, rehabilitation, restoration, and reconstruction. These decisions go beyond planting, impacting maintenance and interpretation of the landscape, but would be the first step in developing a planting plan. The National Park Service's cultural landscape planning approach is likely the only one that will resolve conflicting designs and desires to move decision makers toward a proactive planting plan. This approach is strongly recommended.

[51] Brown, 2004
[52] Birnbaum, 1994.

The following sections are specific recommendations that should inform the landscape planning process and guide any interim plantings. Like tree maintenance, the suggested timeline for planting activities is outlined in the seven- year management zone rotation plan on page 22.

*Species Diversity and Selection*

A common guideline for maintaining species diversity in urban settings is the 10-20-30 rule. That is, no one species should make up more than 10 percent of the trees in a park, no more than 20 percent of any one genus, and no more than 30 percent of one family. Only ginkgo, London planetree, and horsechestnut violate the 10 percent of a species rule, and no genus or family exceeds the 20 and 30 percent rules. Today London planetrees are rarely planted in New York City due to their susceptibility to the fungal disease anthracnose and because they are already so ubiquitous in the City. They are, however, generally hardy urban trees and should be planted when necessary to preserve historic design elements. Similarly, ginkgos are excellent urban trees and though they are overabundant in the park (and an issue of some contention), they should not be removed entirely from consideration in future planting projects. Species diversity should not be the single most important factor driving species selection in Fort Greene Park due to its highly designed elements and the park's size and context within New York City's entire urban forest.

Different species offer different amenities to a park. Some trees grow very large and provide a great deal of shade, others grow tall and narrow, and still others remain small. Some trees flower profusely ("showy ornamentals"), others have tiny, almost invisible flowers. Some trees stay green year round, others drop their leaves in the fall. Trees may attract birds and insects by providing food or habitat. There are very rare species which can become "specimen species" in a park. New landscape plans should consider a balance of all these offerings. Currently 6.7 percent of the trees in the park are "showy ornamentals" and 8 percent are large-statured coniferous trees (Appendix B).[53]

When looking to increase species diversity or select species in general, designers should take into account a number of variables. These include the following:

- **Environmental site characteristics.** Consideration of the climate, air quality, soil types and chemistry, drainage regime, compaction levels, and slope during the species selection process should be of the highest priority in order to give a tree the best chance for survival. Once environmental site characteristics and limitations are considered, designers are usually left with a wide variety of species from which to choose. At this point, the other variables come into play.
- **Biological characteristics.** The surrounding vegetation, tree canopy, and present and/or potential vectors for insect or disease damage should be considered. Although we cannot anticipate every pest outbreak and invasive colonization that the future will hold, avoiding susceptible or weak species will promote urban forest longevity.
- **Use of native versus non-native species.** Consideration of what grew on the site before managers intervened can be useful in some cases. Native species may in some landscapes be more successful than non-native ones. Parks' Natural Resources Group (NRG) has developed a comprehensive list of native species that grow well in urban settings (Appendix F).[54] However, there are a number of non-native species that have a long and venerable history of use as ornamental plantings in urban settings. The use of non-native invasive species, including Norway maple and ailanthus, should be avoided.

[53] The Olmsted and Vaux plan (1867) involved the planting of thousands of trees, resulting in a 1 to 3 deciduous to evergreen ratio.
[54] Gargiullo, 2002

- **Use of historic species.** Species that were included on the original and/or subsequent planting plans of Fort Greene Park should be researched and considered. Reintroducing some of the species that were historically present would help to diversify the landscape.
- **Community input.** It is important to consider the values of park users and managers in the decision making process. Greater collaboration and dialogue can often result in a greater consensus for a given set of actions, with the result that the landscape has a better chance of surviving. The locations, types of trees (flowering, evergreen, deciduous), and underlying urban forest goals should all be discussed in this process.
- **Built and designed features.** The ultimate mature size of trees should be considered when selecting species planted near buildings, monuments and active recreation areas as well as within existing or potential viewsheds. Trees can impact these built features both positively and negatively through shading, dropping flowers or fruits and framing or obstructing views.

*Stem Density*

Determining how many trees to plant in an urban park is not an exact science. While one important management goal is to maximize canopy cover, many other factors must be taken into account.

- **Where are we now?** It is important to understand the specific characteristics of the current tree population in order to plan for the future. If the population is young and well-stocked, then planting may not be a priority. Fort Greene Park has a relatively old and even-aged population. The trees are at a point at which the canopy coverage is most likely as high as it will ever be. If the first generation planting is replaced one tree at a time, the maximum canopy cover that can be achieved and *sustained* with a new, uneven age population of trees will be less than the current maximum for trees that were all planted at the same time. [55] The loss of mature trees will lead to a significant loss of canopy coverage requiring a greater than 1:1 replacement in order to maintain the current conditions.
- **What do managers and users want the park to look like in the future?** Another way of expressing this is: what is the ideal stem density and canopy coverage for the park? Some Fort Greene Park visitors would like to see more views opened up and perhaps a lower stem density while others may be content with the amount of shaded and open areas in the park. Regardless of the eventual consensus, the current conditions are not static. As time passes trees will die. If new trees are added to the park only as mature ones die, the stem density will not change but the loss of large trees will lead to significantly less canopy coverage If the consensus is to maintain canopy coverage, trees should be planted in anticipation of canopy loss, thereby increasing stem density but sustaining the current level of canopy.

  The landscape planning process needs to include the setting of canopy cover and stem density goals. Managers must advocate for maximizing the canopy coverage (as a common good), in addition to maximizing the aesthetic quality of the urban forest--a direct visual benefit more likely to be chosen affirmatively by participants in the planning process.
- **How many mature trees die in an average year?** Annual tree survival rates are not known for park trees – at the time of this inventory there were 3 dead trees in Fort Greene Park. Three trees per year is not, however, an accurate mortality rate, as some of these trees may have died before the survey year and other dead trees may have been removed from the park in the same year. While we don't have a reliable number for park tree mortality Parks' does track the removal of dead street trees. The number of dead street tree removals does not capture all dead trees,

[55] Maco and McPerson, 2002

however, since we cannot assume every dead tree is reported. On average 7,200 dead or dying street trees are removed every year (1.5% of the total population). It is likely that the mortality rate for mature park trees is lower, as they experience far fewer stresses.

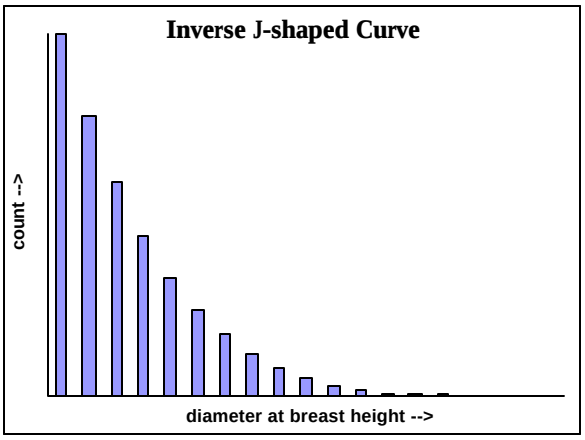


**Figure 13.** An inverse J-shaped curve, where there are many small trees and fewer larger ones. This tree size distribution is considered ideal by most natural woodland managers.

- **What is the survival rate of newly planted trees?** In naturally regenerating northeastern forests, managers know that most trees do not live to maturity due to significant population pressures such as resource competition, weather, and insect outbreaks. Therefore, it is necessary to maintain a large number of smaller trees in order to maintain a healthy canopy in perpetuity. This ideal size distribution curve for a natural woodland is illustrated in Figure 14 and termed an "inverse j". This distribution, with many young trees and fewer older trees, reflects the presence of the next generation available to replace older trees as they age and naturally die.

  In an urban park, money, space, safety, and aesthetics limit the number of trees planted. It is impractical to plant trees expecting to maintain a pronounced inverse j-shaped curve, but it is also unrealistic to expect every tree that is planted to survive to become a large canopy tree.

  While we do not have an average survival rate for newly planted park trees, parks does track mortality of street trees. Average mortality for street trees 2.5 years after planting is 11.4%. Again, we can expect this number to be lower in a less stressful park environment.

- **What infrastructure is available to care for newly planted trees?** While managers might identify an ideal number of trees to plant per year, thought must be given to how many new trees staff and volunteers can adequately maintain. Planting fewer well-cared for trees may be a better use of resources than planting many trees that cannot be maintained.

Taking into account all of the above factors and assuming a goal of maintaining current stem density, 10 trees should be planted each year[56]. This will certainly result in canopy loss. Some of the loss will be temporary while the new trees grow to maturity, but due to the even-aged nature of the park, some will be permanent. If, through the landscape planning process, it is found that the amount of loss is unacceptable, then additional locations for planting must be found and/or species need to be changed from smaller ornamental trees to canopy sized trees. Managers should continue to monitor mortality rates as well, since this influences the planting recommendation.

Using the zonal management approach, annual planting should primarily take place in the focus zones for that year. Exceptions should be made for tree losses in high profile and significant locations such as playgrounds where trees should be planted regardless of the current year's focus.

*Planting in Specific Locations*

There are a few areas of the park that are specifically in need of attention.

- **Eroded Slopes**: The areas detailed on Map 9 will greatly benefit from plantings of trees and shrubs, which hold soil in place and reduce the impact of raindrops. Once these areas are planted they should be fenced until well established to prevent foot traffic from further eroding the soil and/or disturbing new plantings.

[56] This number assumes that parks will have a lower mortality rate than the 1.5% for street trees—perhaps one third lower. This would suggest 9 trees should be planted per year (1% of the park's population). At the same time it accounts for young tree mortality, estimated at 11.4% for street trees. Planting one extra trees per year would account for this potential loss.

- **Pineta**: Mostly located around the edges of the park (Map 9), the pineta are important historic design elements in Fort Greene Park. Unfortunately, many of the trees are suffering from pest infestations. Native conifer species, which are more resistant to common pests, should be planted in these areas. The Olmsted and Vaux plan included a planting palette with an evergreen to deciduous ratio of 3 to 1. This suggests an opportunity for considering further conifer planting beyond the pineta for historic consideration.
- **Plaza wings:** The 130 ginkgo trees surrounding the plaza wings, from the 1936-37 Gilmore Clark design, are one of the major design issues in the park. Because they are slowly dying off, a decision must be made whether or not to replace the ginkgos. At the same time, the Fort Greene Park Conservancy has been lobbying for decades (Rothschild, 1984) to remove the living ginkgos and the plaza wings they surround, as they are not part of the original McKim, Mead, and White plan for the monument plaza (1907). However, the trees are healthy and Parks' has very specific policies regarding the removal of healthy trees (see p. 24). The ginkgos also represent a historic design element in the park. Though more recent than the McKim, Mead, and White plan, Gilmore Clarke's design for the park is a part of the park's cultural landscape and has a valid historical significance of its own.
- **Perimeter trees:** The horsechestnut allees surrounding Fort Greene Park are an original Olmsted and Vaux design element. They are host to the ALB, however, and are also unusual street trees because they are generally not tolerant of difficult urban conditions and confined growing spaces. In general the Parks Department avoids planting ALB host species in the quarantine zone. Exceptions have been made, however, to plant American elms (also ALB hosts) in similarly historic areas of Central Park and Riverside Drive in Manhattan. Over the years the horsechestnuts have not been consistently replaced, and other species have been substituted in infill plantings. A new landscape plan should set forth all future species that should be used in the allees, as well as the rationale for retaining horsechestnuts or using new species.
- **Southeastern playground:** This smaller playground is in need of shade – there are currently two Chinese elms and a honeylocust on the edge of the playground. More fast-growing trees that provide a large mature canopy could be planted, however any new planting should be sensitive to monument views. This is a high priority project for the public.
- **Monument Views:** Currently, most views of the monument from the base of the central hill in the park are obscured. As new trees are planted, preservation of what views remain as well as the impact of new tree growth on views should be considered.

### Outreach

With over a thousand visitors a weekend at the height of the summer season, there are many opportunities to involve the community in the management of Fort Greene Park's trees. The park is full of large, beautiful and historic specimens, many of which are native to the New York region and others which are unusual non-native ornamental species. People who enjoy the park may also enjoy knowing about its exceptional trees. Building a connection between park users and park trees is the foundation for long-term stewardship. Through a range of projects from increasing the potential for passive awareness (signs), to active recruitment for tree care through stewardship programs, the Park Administrator can continue to focus on bringing the park's trees to the attention of its patrons. Possible public involvement initiatives include the following:

- **Reach out to existing groups.** Several community groups are very active within Fort Greene Park, including PUPS and the Fort Greene Park Conservancy. Both of these groups would undoubtedly be interested in projects relating to forest health, and park administrators should make an effort to reach out to them.

- **Offer a forum for community participation in design decisions.** Hold workshops for public input into planting decisions and park design.
- **Use signage for education and increased awareness.** Increase and improve signage around the park, whether relating to tree species identification, self-guided tours, information on tree protection, and other useful and informative subjects.
- **Create a brochure.** Develop a "Great Tree Walk" brochure for Fort Greene Park that highlights the park's most significant trees along with their natural and cultural history (see Map 17: Ten Largest trees in Fort Greene Park).
- **Encourage stewardship.** Promote the Citizen Stewards for Young Trees program within the park, setting up regular workshops for steward training and allowing school groups to "adopt" newly planted trees (see Young Tree Maintenance, p.26).
- **Link urban forest issues to other recreational activities.** Establish a bird watching group, for example, that can build nest boxes and emphasize the value of fruiting trees for migratory songbirds.

### Education

The current Park Administrator spends a good deal of her time working with school groups to raise awareness of the park's myriad of natural offerings – every week she meets with Brooklyn Tech High School students to discuss environmental issues, often bringing in guest speakers; she works regularly with the P.S. 77 Autistic Adolescents program on community service projects; and she has met with many other school groups, ranging from Head Start to high school. Sharing this management plan (including the colorful maps) could further educational efforts by showing students how science informs park tree management as well as promoting park pride – Fort Greene Park is one of three parks in the entire city to have such a comprehensive census. Knowledge gained from this plan should also be integrated into current visitor center displays.

Older students could use the data set for more quantitative projects, including statistical analysis or carbon sequestration calculations. In addition, environmental education projects like creating a "Great Tree Walk" would greatly benefit the park. Interns from local high schools and colleges could be recruited and ensuring students' course credit or work-study support when they work at the park could strengthen ties to local schools. See the Research section below for more information on potential research ideas.

### Research

There are many opportunities for research in Fort Greene Park. Some proposals will be directly informed by this inventory, others came out of discussions about the park and its trees.

- **Forest Inventory:** The comprehensive nature of this management plan is intended to serve as a baseline for future data collection. Each tree in the park is now spatially located and is part of a digital database of information. Data of this depth is not common for park trees and therefore it is important that it be regularly maintained and updated. The trees in the park should be re-inventoried every 10 years – in a few decades Fort Greene Park may serve as a model as well as a site for long term urban tree analysis.
- **Soils:** The park would greatly benefit from a detailed soil map, including soil depths, drainage rates, pH, and amounts of organic material. Soil could even be tested for heavy metals and other pollutants if the resources were available. Creating a soil map would be an excellent project or summer internship for a graduate student interested in urban soils.

- **Forest History:** Fort Greene Park trees were surveyed in 1934, 1972, and 2001. A detail-oriented student could overlay these three surveys and attempt to determine which trees were planted in which era. It is quite possible that some trees were planted before 1934, and are still growing today. These trees should be identified and protected.
- **Carbon Sequestration Modeling:** The UFORE computer model was developed by the U.S. Forest Service to quantify the benefits of urban trees on their environment[57]. With some more data collection, a student or group of students could calculate the physical benefits in terms of air pollution reduction and carbon sequestration of the Fort Greene Park forest to the surrounding community (see the Resources section, p. 40)

### Information Management

This survey and management plan is a starting point for continued active management of the park forest resource. By carefully documenting changes in the forest structure (plantings, removals, pruning operations, incidents of vandalism) the park manager will be able to assess the success of these programs over time.

To assist in their work, a borough forester and the park administrator should be familiar with GIS. Paper maps are not the best way to utilize the tree inventory data, and so forest managers should, at the very least, be able to navigate ArcPad, the most basic ArcGIS program. ArcPad is a program designed to be run on a personal digital assistant (PDA), though it can also be run on a normal PC. By providing the forest and park manager with this program, a tutorial in how to use it, and a PDA, they would be able to view and update park maps as they see fit, and provide contractors with precise information with a relatively minor investment in equipment and training.

Additionally Parks is in the process of updating its street tree data management system in order to incorporate GIS and handheld applications, to track workflow, and to keep individual tree records over long periods of time. Once this system has been developed and integrated into the street tree system (2006), the next step will be to apply it to the city's parks as well. Because Fort Greene Park already has GIS data for its trees, it would serve as an excellent pilot park for that project as well.

A good forest management program should exist outside of the individuals who apply it. Trees typically live far longer than humans do and certainly longer than the average human career-span. As a result, managers should consider the long-term consequences of their data management, and should record forest changes with the understanding that the information may be useful decades from now. This plan serves as the first step in creating a comprehensive forest history for Fort Greene Park. This history will not only improve the park's own management, it will inform management of all of New York City's parklands.

[57] Nowak, et. al., 2003.

# VII. CONCLUSION

Fort Greene Park is one of the most historically significant parks in New York City and contains an important forest resource for Brooklyn and the entire city. The trees, covering nearly 40% of the park's 30 acres, are generally in good health and provide numerous benefits through their shady canopy and seasonally changing beauty. They are growing both in dense single species stands (ginkgo, London planetree, Norway maple) as well as individually as specimen trees. The population, however, is nearly even aged with the majority of the current trees planted in two waves: first in the 1930's and then in the 1970's. The older trees are in decline and require more intensive maintenance. At the same time, there is no next generation of trees currently growing in the park. The parks' significant historical design legacy demands a sensitive approach to all management decisions.

The many recommendations outlined in this report and its appendices can be summarized in a few focus areas.

- **Master Landscape Plan:** It is of the highest priority to develop a landscape plan for Fort Greene Park incorporating its important cultural and landscape history. Using the process and recommendations developed by the National Park Service's cultural landscape initiative will help resolve some of the long-standing issues. More trees should be planted in Fort Greene Park, sooner rather than later, and they should be trees that will grow large and replace some of the aging ones. Once a landscape plan is developed, managers can focus on planting one zone per year.
- **Zone Rotation:** The best-managed parks in New York City (Central and Prospect Parks) are divided into zones that are each managed by individuals. Although other parks may not have the staff to pursue such a program, they can still employ systematic management techniques to monitor their parks. The seven-year plan for Fort Greene Park will ensure that each part of the park is systematically monitored and maintained.
- **Tree Maintenance:** Trees identified as dead should be removed immediately. Trees listed as poor or in need of inspection should be looked at by a trained arborist. Trees marked "prune" should be evaluated, and pruned as funds are available. Maps 8, 13, and 14 offer information as to the locations of the most dangerous trees.
- **Community Outreach:** Wherever possible, decisions made regarding the trees in Fort Greene Park should involve the local community. This recommendation is not simply about being fair to the people who use the park most; it is about building a consensus in the community for moving forward. It will also raise the profile of trees to the park user and also a key in creating a sense of stewardship..

The Fort Greene Park Urban Forest Management Plan has the potential to be a valuable resource, not just for Fort Greene Park, but for the NYC Parks Department as a whole. This project will serve as a model for other parks, especially if it is employed as it was intended. The plan should, most importantly, allow existing resources to be distributed more efficiently, creating a larger and more positive impact on the park forest. In addition, if the data is regularly updated, the information from the park will inform citywide park management decisions. Finally, this report will serve as an excellent fundraising tool for programs in and around Fort Greene Park.

The project seeks to guide the agency and involve the local community in forest management and design decisions. Though the plan contains some prescriptions and many suggestions, it should primarily be used as a tool, not a recipe, for forest management. Forests, urban or rural, are dynamic systems that are frequently subject to random events

and must be managed as such. However, the components of this plan should serve as a resource for park managers in making forest management decisions.

This urban forest management plan is intended to guide Fort Greene Park's operations over a ten-year period, from 2005 to 2015. Following this term, a review of strategies will be necessary to allow for changing forest management issues and values. While many of the suggestions in this plan extend beyond this ten-year limit, it is important that the approach and data presented here be reviewed and updated periodically.

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City Hall Library, 31 Chambers Street, Rm. 112

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The Urban Forest Effects Model (UFORE), http://www.fs.fed.us/ne/syracuse/Tools/UFORE.htm

The National Arbor Day Foundation has several inexpensive booklets on tree management, including "How to Prune Young Shade Trees," "The Right Tree for the Right Place," "How to Save Trees During Construction," etc. order from http://www.arborday.org/programs/treecitybulletinsbrowse.cfm

The National Park Service Historic Landscape Initiative, http://www2.cr.nps.gov/hli/hli_p.htm

### Tree Safety and Hazard Assessment

Tree Risk Management and Hazard Assessment, Dr. Kim Coder, 1996, http://warnell.forestry.uga.edu/warnell/service/library/index.php3?docID=119

Prioritizing Tree Risk in a Community, Kane, Ryan, and Bloniarz, 2001, http://www.umass.edu/urbantree/publications/hazardarticle.pdf

See National Arbor Day link, above.

### Tree Pest Information

U.S. Forest Service, Forest Insect and Disease Leaflets, http://na.fs.fed.us/spfo/pubs/fidlpage.htm

U.S. Forest Service, St. Paul office, Department of Forest Health Protection, http://www.na.fs.fed.us/spfo/info_dir.htm

### Resources for Educators

National Arbor Day Foundation, Carly's Kids Corner, http://www.arborday.org/kids/carly/800x600.cfm

USDA Kids Pages, http://www.usda.gov/news/usdakids/

# APPENDIX A: MAPS


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## MAP 1. NEW YORK CITY AND FORT GREENE PARK

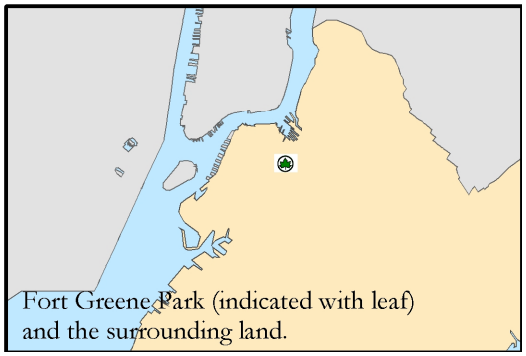
The location of Fort Greene Park within the borough of Brooklyn and the relationship of the Brooklyn to the surrounding geographic regions. Within Brooklyn, park lands are indicated in green and the major roads are indicated with the dark gray line.

## MAP 2. FORT GREENE PARK INFRASTRUCTURE

Fort Greene Park is a 30-acre park in the northern part of Brooklyn. The park's central focus is the Prison Ship Martyrs' Memorial Monument, a 148-foot tall Doric column dedicated to the men who died aboard prison ships during the Revolutionary War. The park also boasts several basketball and tennis courts, two playgrounds, a visitor's center, and a tomb for the prison ship martyrs' remains.


**Legend**

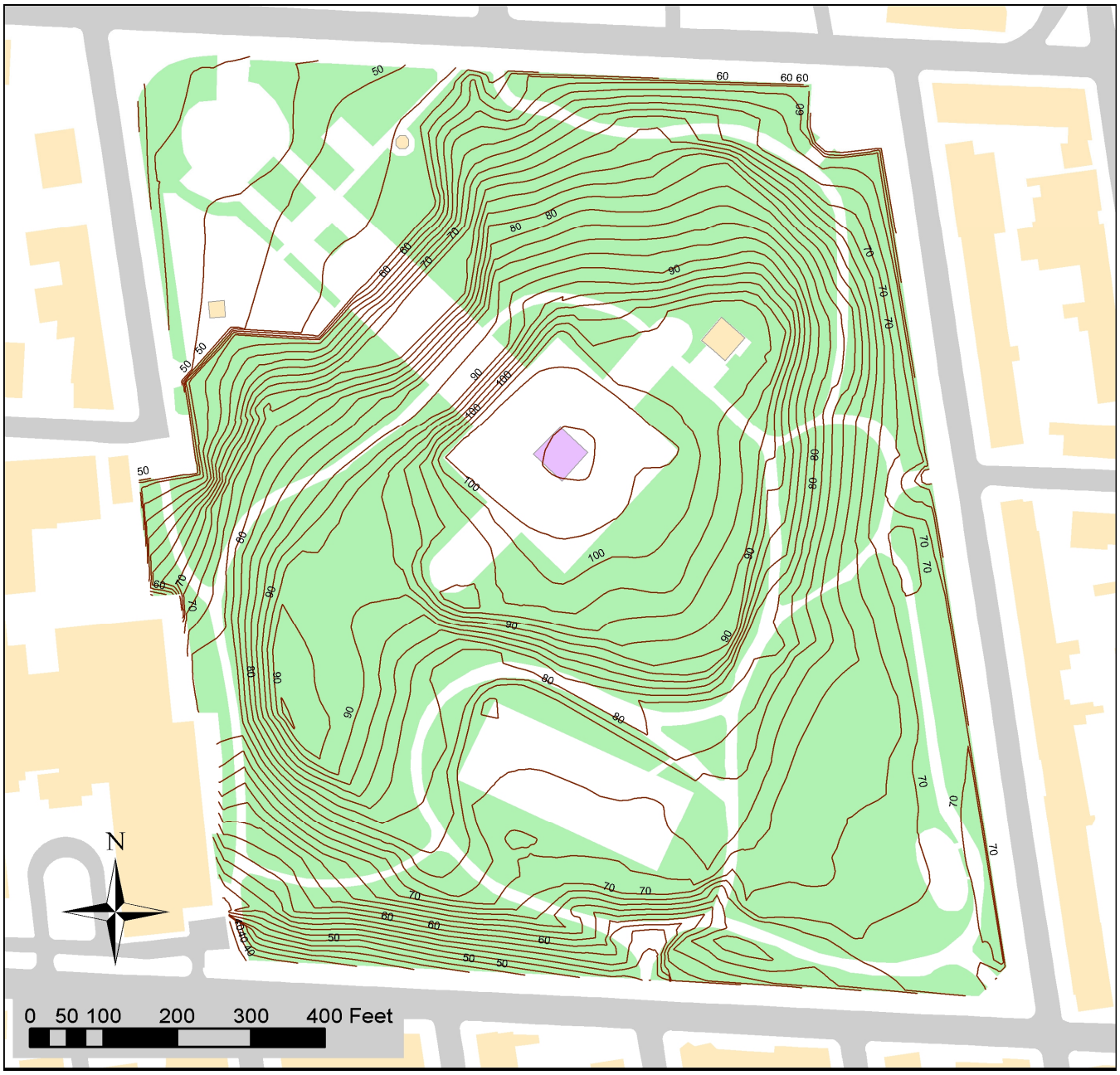
- Roads
- Park Greenspace
- Buildings
- Doric Column



Fort Greene Park (indicated with leaf) and the surrounding land.

## MAP 3. TOPOGRAPHY OF FORT GREENE PARK

Fort Greene Park is one large hill with its highest point in the center. Hence, the base of the Prison Ship Martyrs' Memorial Monument is the highest natural point in the park, at 104 feet. The topography along the street ranges from 40 to 70 feet.

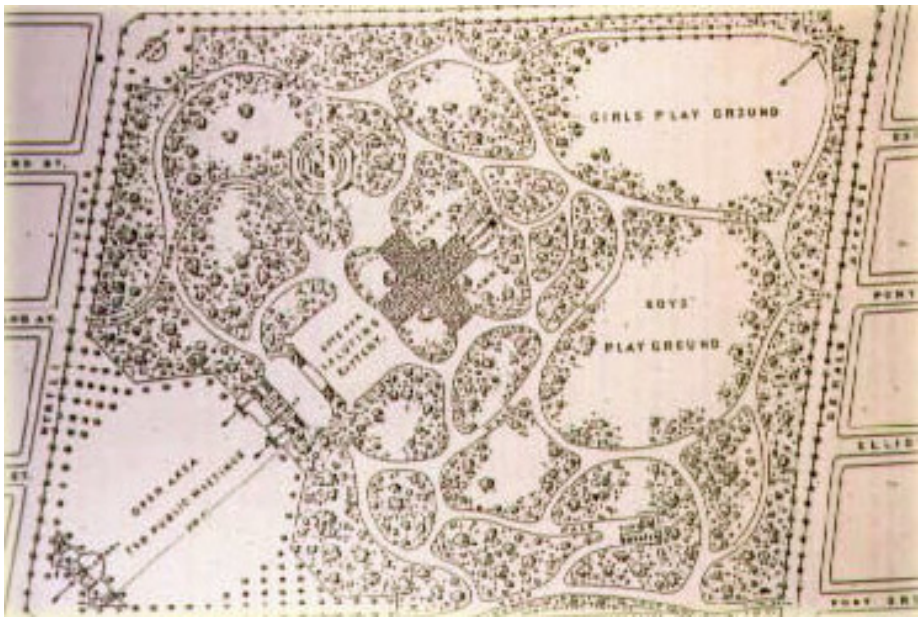



**Legend**

Topographical Contours

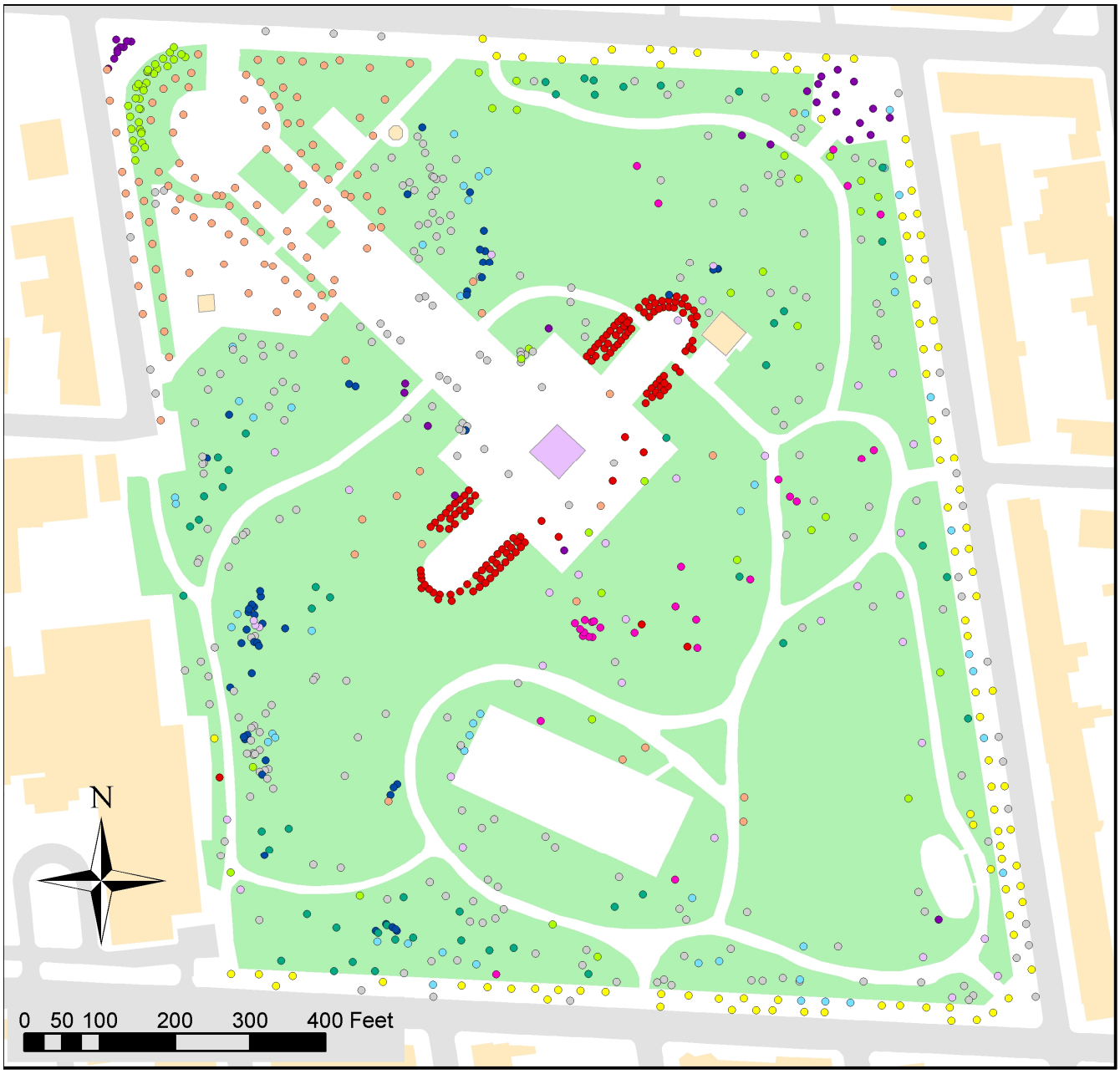
## MAP 4. OLMSTED & VAUX'S VISION OF THE PARK

This map shows the original design for Fort Greene Park. Note the densely wooded areas through the middle of the park and the defined playground areas.



## MAP 5. COMMON TREE SPECIES

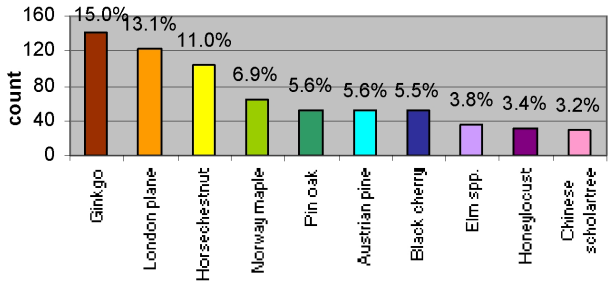
A map of trees by species in Fort Greene Park. The ten most common species are depicted in individual colors. The other 47 species are represented with grey dots. See Appendix C for a complete listing of tree species.




**Tree Species**

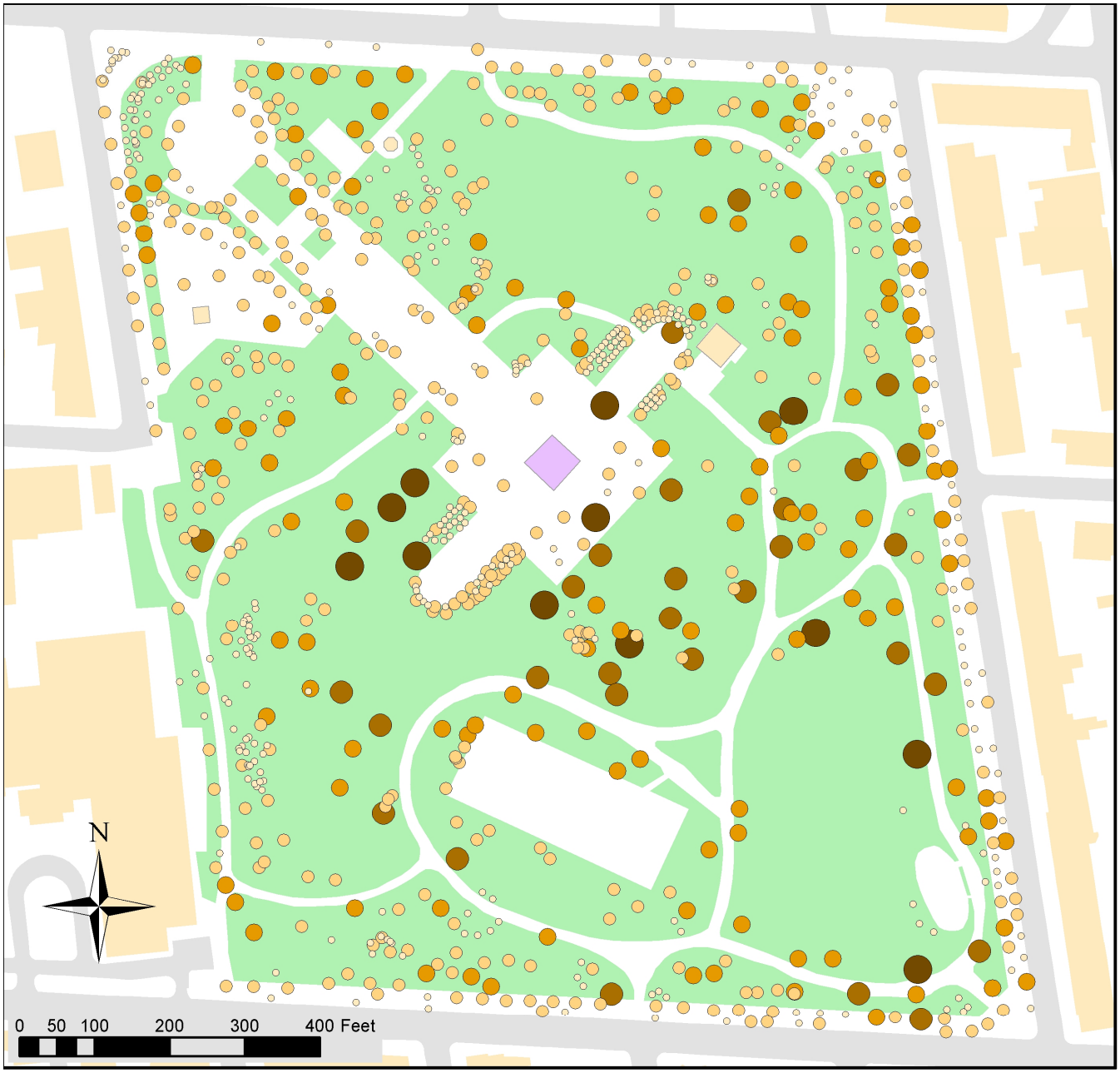
- Ginkgo
- London plane
- Horsechestnut
- Norway maple
- Austrian pine
- Pin oak
- Black cherry
- Elm spp.
- Honeylocust
- Chinese scholartree
- other species

A histogram of the 10 most common species in Fort Greene Park.



## MAP 6. TREE SIZE DISTRIBUTION

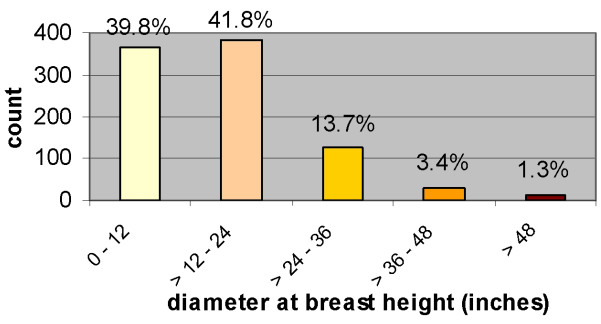
A map of the trees in Fort Greene Park colored and sized corresponding to their diameter at breast height.




**Tree Diameter**

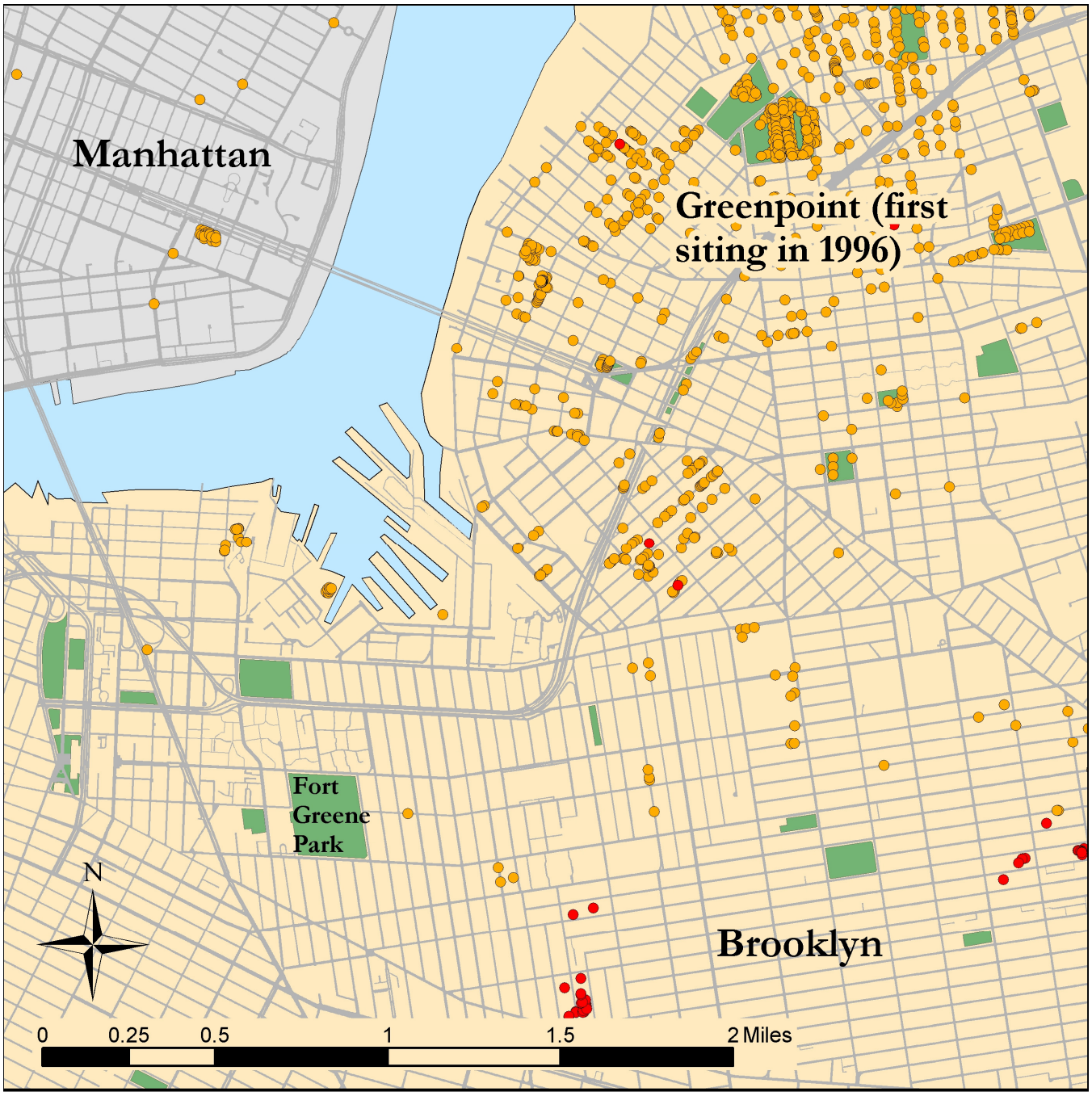
- 0-12 inches
- >12-24
- >24-36
- >36-48
- >48

A histogram of tree diameters in Fort Greene Park.



## MAP 7. ASIAN LONGHORNED BEETLE INFESTATION SITES

The Asian longhorned beetle (ALB) is a pest that attacks many common New York City trees. First sited in Greenpoint, a Brooklyn neighborhood, in 1996, it has since been found in other Brooklyn neighborhoods as well as Queens, Manhattan, and New Jersey. The below map shows the area surrounding Fort Greene Park and the ALB sitings in that area.




**ALB Infestation Locations**

- 2004 infestations
- past infestations

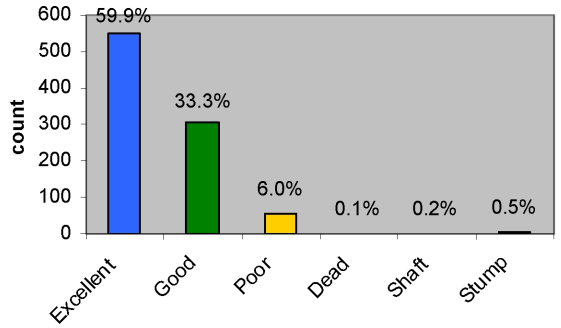
## MAP 8. TREE CONDITION

Tree condition was determined by considering trunk, root, and canopy condition.


**Tree Condition**

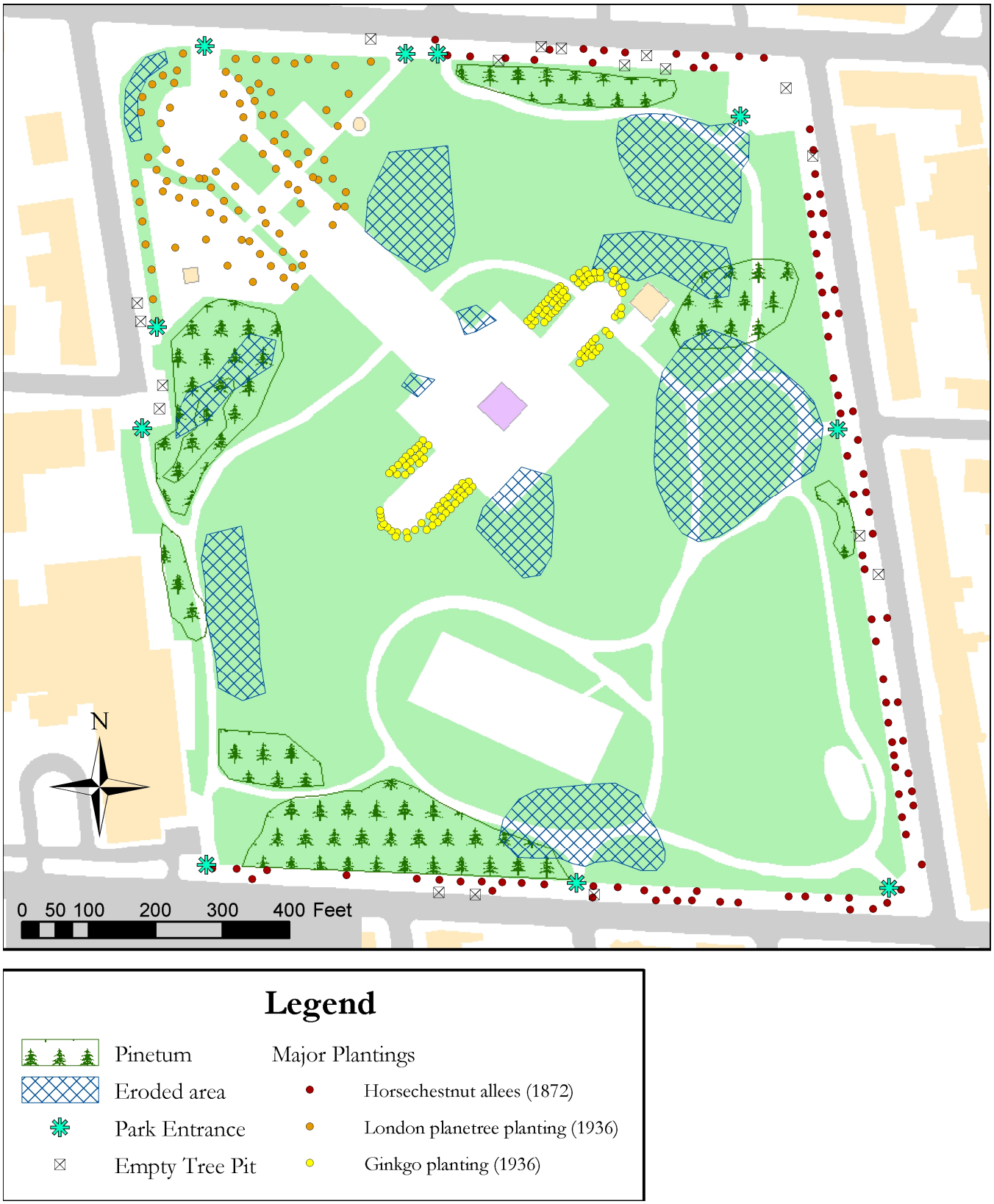
- Excellent
- Good
- Poor
- Dead
- Shaft
- Stump

A histogram of tree conditions in Fort Greene Park.



## MAP 9. LOCATION SPECIFIC ISSUES

This map indicates the areas in Fort Greene Park with special site issues. Erosion is a major problem in the park, especially near many of the entrances. The pineta are important design elements, as are the three major plantings (listed with the date they were initially planted – all have been supplemented since that time). The park entrances and empty street tree pits are also important park concerns discussed in Chapter V. Forest Management Planting.



## MAP 10. ESTIMATED PARK TREE CANOPY

Tree canopy was estimated based on GPS measurements for 170 of the park's 917 trees. The canopy cover for the entire park is 11.3 acres (37.8%), excluding street trees, which were not included in these calculations. Trees with no estimated canopy were those with very small diameters.

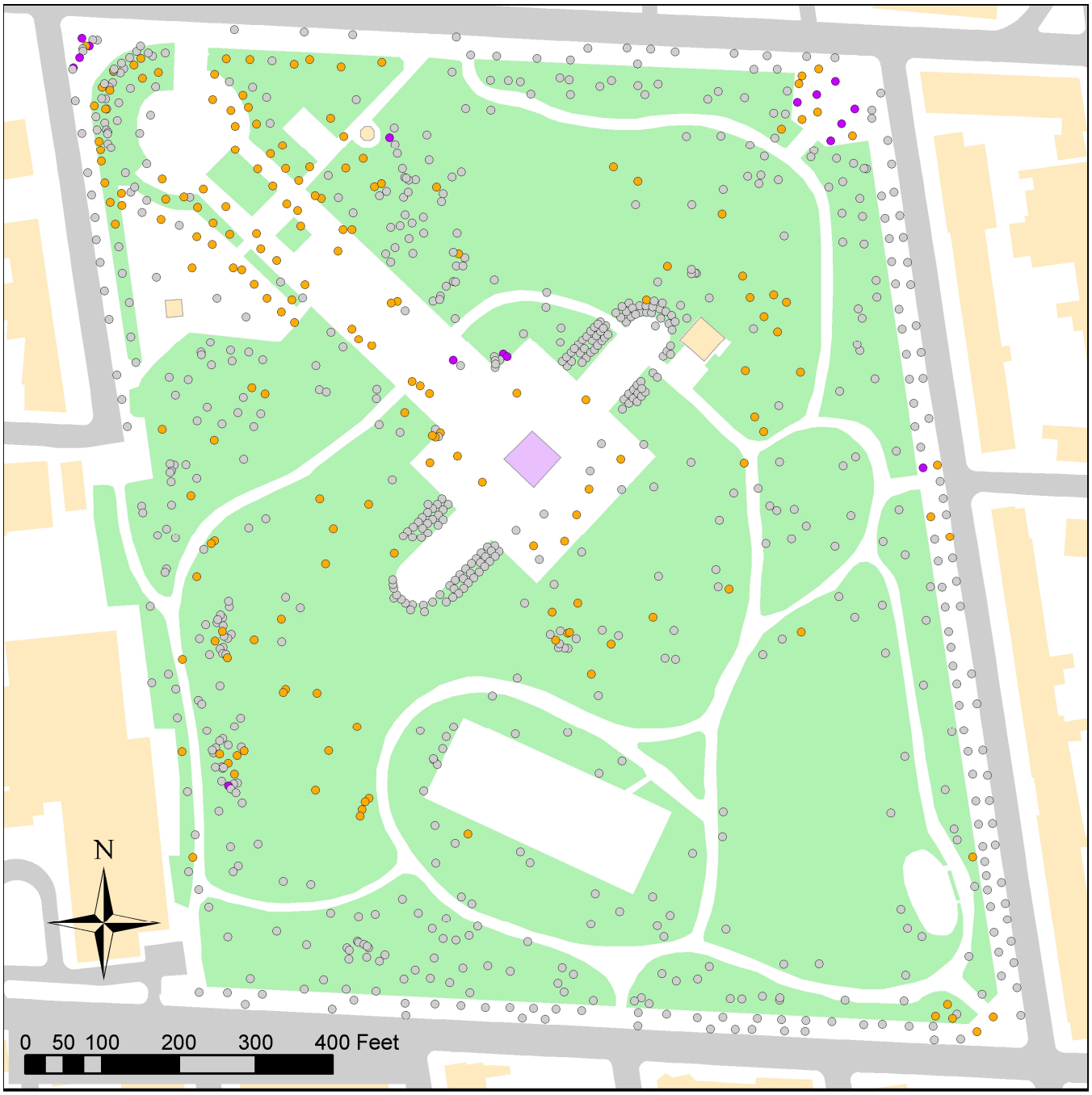

**Forest Canopy**

Canopy estimate

no estimated canopy

## MAP 11. RECORDED HUMAN DAMAGE

Human damage and infrastructure conflicts were not systematically recorded in the inventory, however, many tree injuries and problems were noted in the 'comments' field. This map shows those trees that suffer from apparently anthropogenic damage.

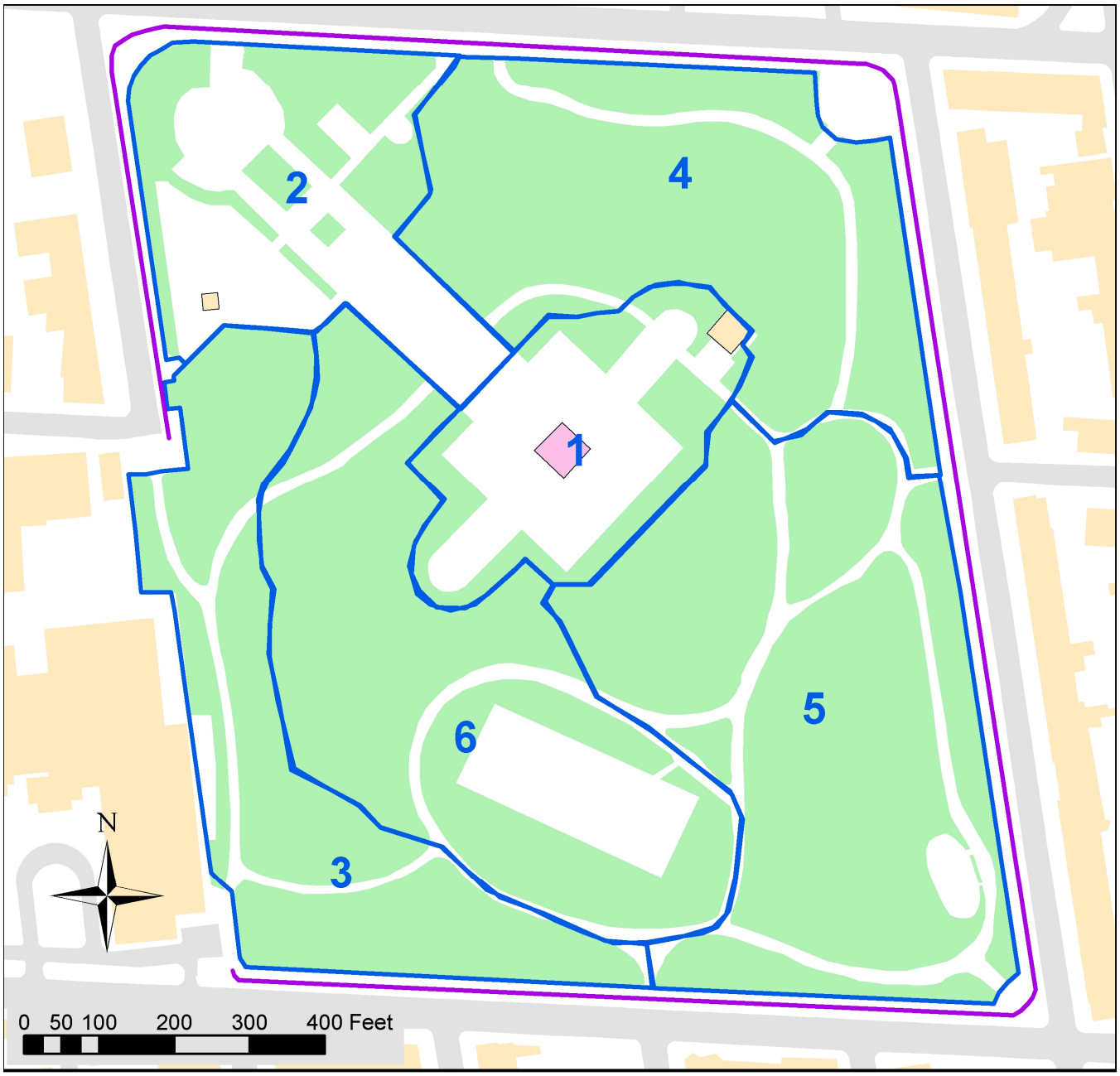



**Tree Species**

- Human damage (179 trees)
- Infrastructure conflict (16 trees)
- No damage recorded (722 trees)

## MAP 12. PARK MANAGEMENT ZONES

Crotona Park has been divided into seven management zones, which were qualitatively selected based on (1) human use - playgrounds, ball fields, history, etc. and the amount of activity they receive, (2) tree species composition, (3) street and paved path delineation, and (4) topography. Six of the zones are within the park. The seventh zone encompasses all the street trees.



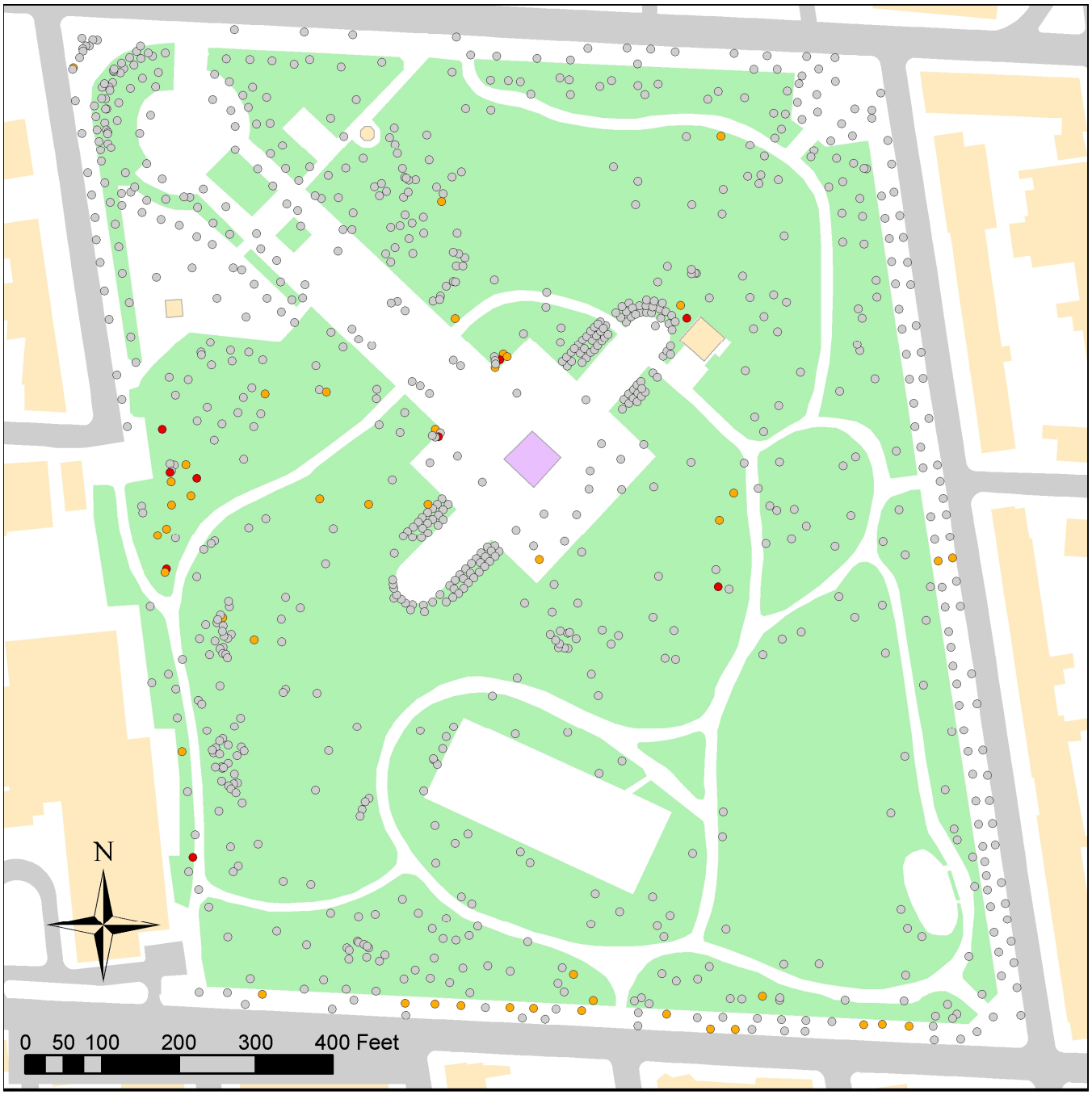

**Legend**

Interior Zones

Perimeter Zone

## MAP 13. PRUNING AND REMOVAL NEEDS

A map of trees categorized by their "maintenance 2" field. Trees marked "prune" have a noticeable amount of dead branches and trees marked "remove" are dead, dying, or in a precarious or dangerous position.




**Maintenance Needs**

- Remove (9 trees)
- Prune (45 trees)
- No needs recorded (863 trees)

## MAP 14. INSPECTION AND MAINTENANCE PRIORITIZATION

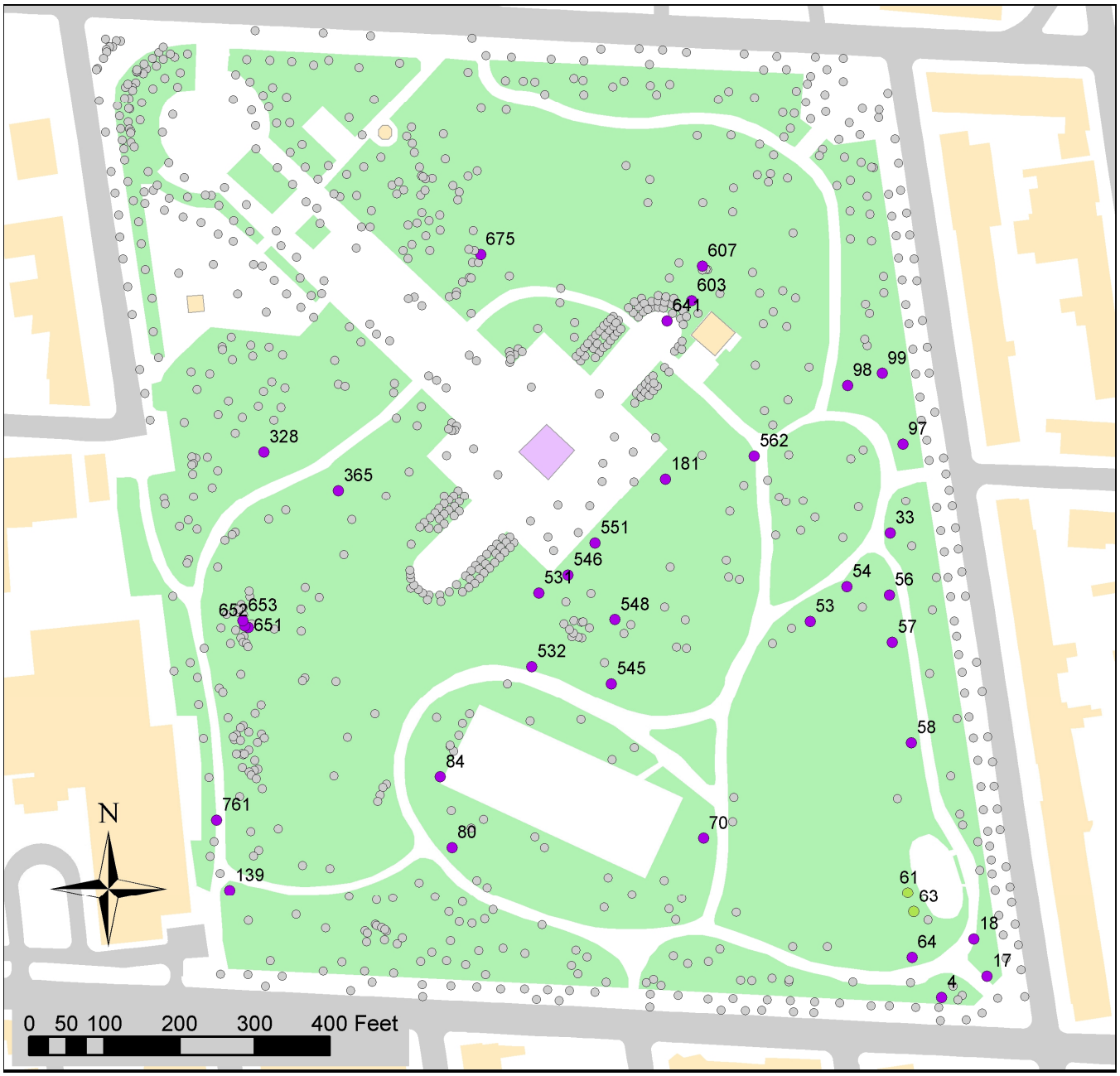
This map depicts all the trees that are healthy and/or more than 30 feet from a path in green (low priority); the trees that were marked poor, prune, or inspect and are within 30 feet of a path in yellow (mid priority); and trees marked dead or remove and within 30 feet of a path in red (high priority).


**Inspection Prioritization**

- High priority (11 trees)
- Mid priority (56 trees)
- Low priority (850 trees)

## MAP 15. ELMS

This map shows all the elms in the park, most of which are susceptible to Dutch elm disease (DED) and should be closely monitored. Large-leafed elms (American, Dutch, English, Wych, and smoothleaf) are difficult to identify in the field and so they are grouped together. These species are also those that are more susceptible to DED.

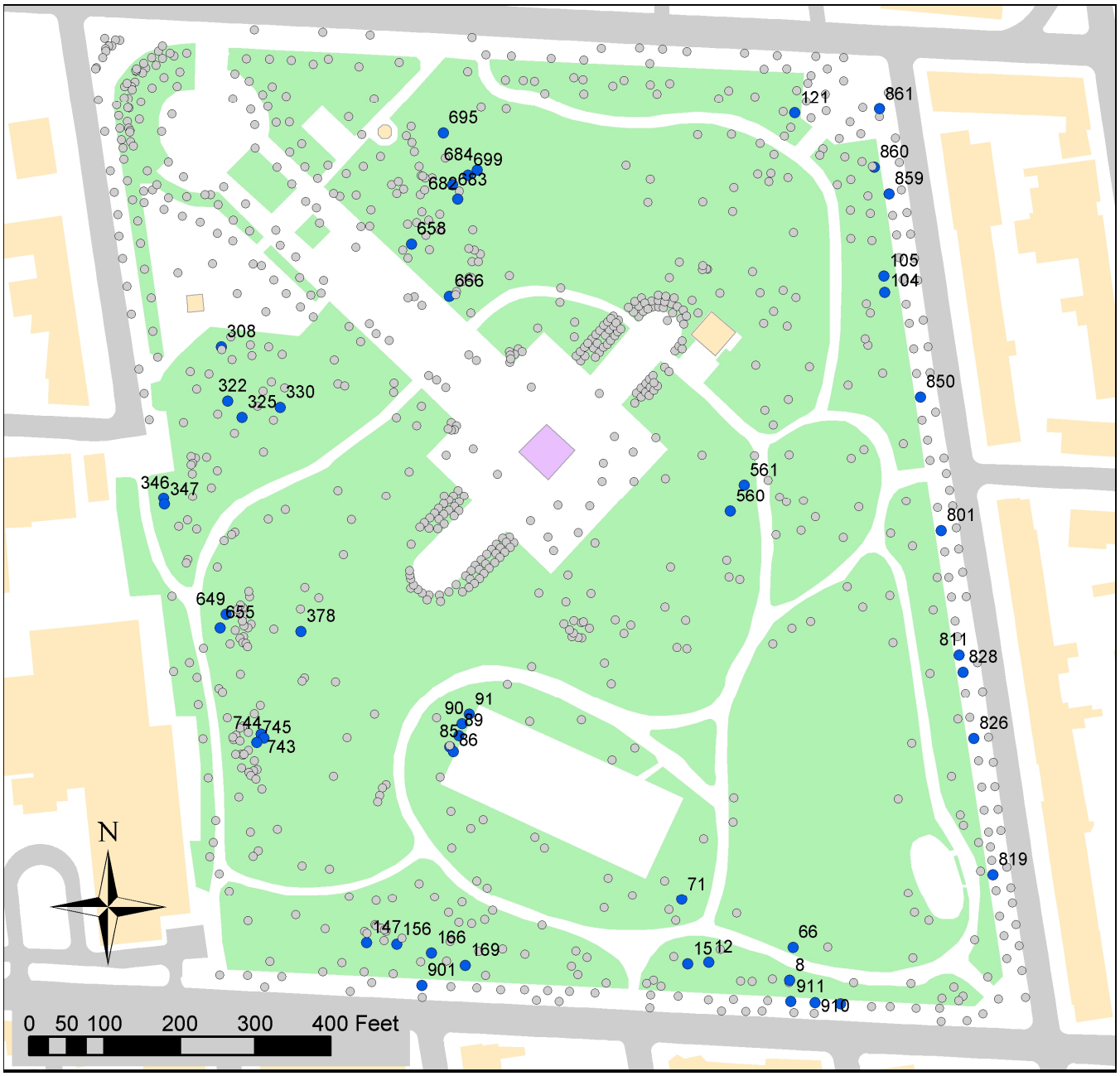



**Tree Species**

- Elm spp. (35 trees)
- Chinese elm (2 trees)
- other trees

## MAP 16. PIN OAKS

The numerous small drooping lower branches, distinctive to a pin oak's lateral branching structure, are often shaded out by upper branches leaving many small dead branches behind. As a result, it is important for park managers to be aware of the locations of the pin oaks in the park and to carefully monitor them for pruning needs. There are 51 pin oaks in the park.

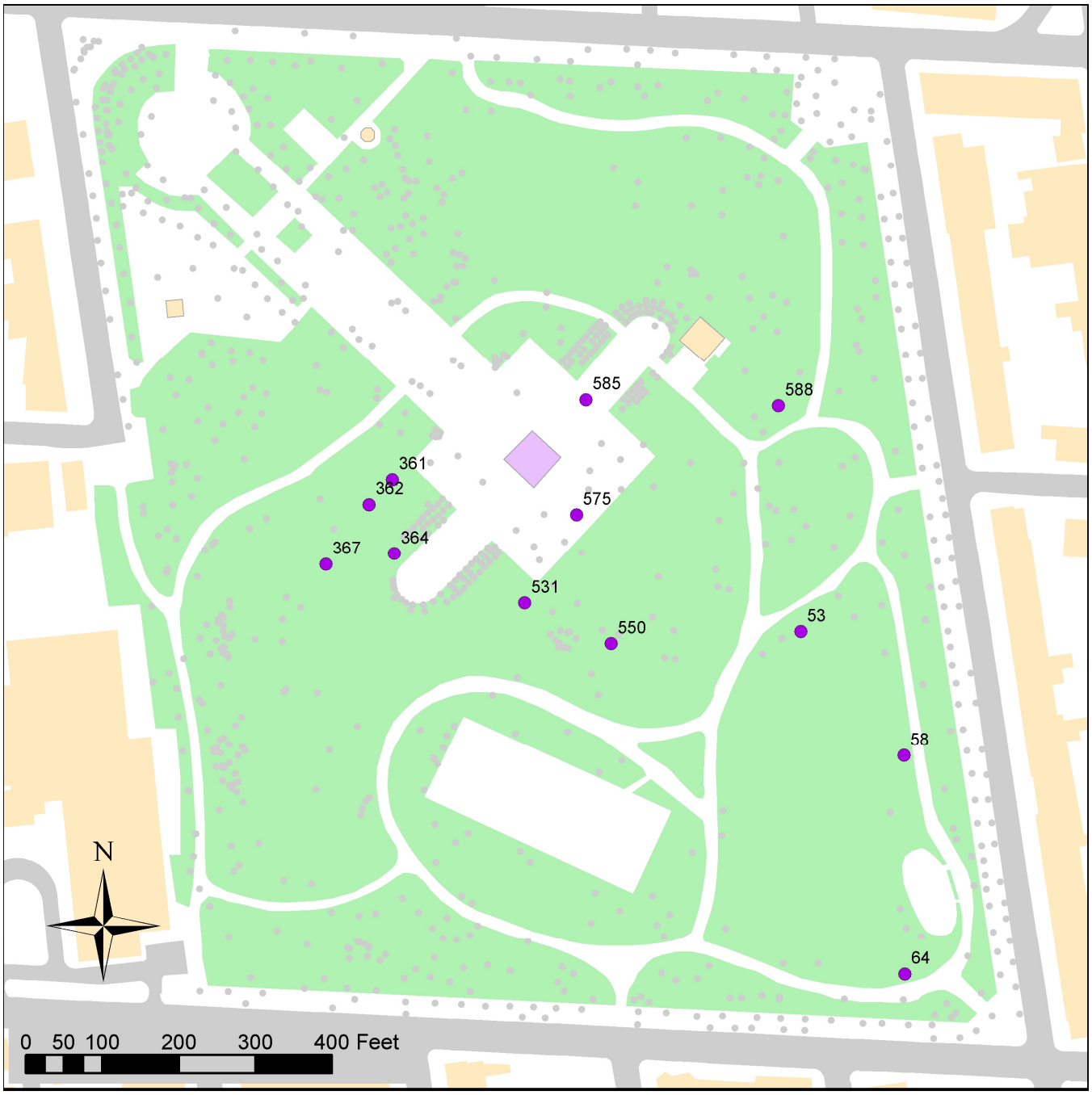



**Tree Species**

- Pin oak (51 trees)
- other species

## MAP 17. LARGEST TREES IN FORT GREENE PARK

This map displays the ten largest trees in the park, identified by their unique tree numbers. 364, the largest tree in the park, is a London plane with a diameter at breast height of 64 inches, located along the perimeter of the southern monument wing.




**Tree Size**

- 12 largest trees
- other trees

The 12 largest trees in Fort Greene Park with their species and DBH.

| Tree # | Species | DBH | Tree # | Species | DBH |
|---|---|---|---|---|---|
| 364 | London planetree | 64 inches | 362 | London planetree | 51 |
| 58 | Elm | 58.7 | 588 | Red oak | 51 |
| 64 | Elm | 56.5 | 575 | London planetree | 50 |
| 361 | London planetree | 54 | 367 | London planetree | 49.5 |
| 53 | Elm | 53.4 | 585 | London planetree | 49.5 |
| 550 | Chinese scholartree | 51.5 | 531 | Elm | 48.5 |

# APPENDIX B. SCIENTIFIC NAMES OF SPECIES

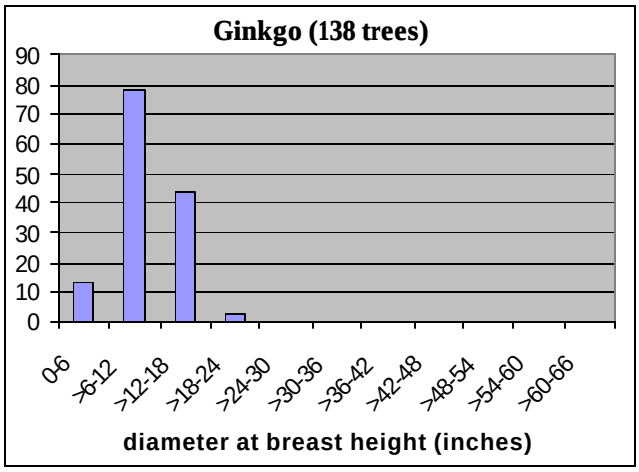
| Scientific Name | Common Name | Origin | Type |
|---|---|---|---|
| *Acer platanoides* | Norway maple | exotic | non-ornamental deciduous |
| *Acer pseudoplatanus* | Sycamore maple | exotic | non-ornamental deciduous |
| *Acer rubrum* | Red maple | native | non-ornamental deciduous |
| *Acer saccharinum* | Silver maple | native | non-ornamental deciduous |
| *Aesculus hippocastanum* | Horsechestnut | native | non-ornamental deciduous |
| *Ailanthus altissima* | Ailanthus | exotic | non-ornamental deciduous |
| *Carpinus caroliniana* | American hornbeam | native | non-ornamental deciduous |
| *Castanea dentata* | American chestnut | native | non-ornamental deciduous |
| *Cedrus atlantica* | Atlas cedar | exotic | non-ornamental deciduous |
| *Cercis canadensis* | Redbud | native | non-ornamental deciduous |
| *Celtis occidentalis* | Hackberry | native | non-ornamental deciduous |
| *Cornus florida* | Flowering dogwood | native | flowering ornamental |
| *Cornus kouza* | Kouza dogwood | exotic | flowering ornamental |
| *Crategus crus-galli* | Cockspur hawthorn | exotic | flowering ornamental |
| *Crataegus mollis* | Downy hawthorn | native | flowering ornamental |
| *Crataegus phaenopyrum* | Washington hawthorn | native | flowering ornamental |
| *Fagus sylvatica* | European beech | exotic | non-ornamental deciduous |
| *Fraxinus americana* | White ash | native | non-ornamental deciduous |
| *Fraxinus pennsylvanica* | Green ash | native | non-ornamental deciduous |
| *Ginkgo biloba* | Ginkgo | exotic | non-ornamental deciduous |
| *Gleditsia triacanthos* | Honeylocust | exotic | non-ornamental deciduous |
| *Koelreuteria paniculata* | Golden raintree | exotic | flowering ornamental |
| *Liquidambar styraciflua* | Sweetgum | native | non-ornamental deciduous |
| *Liriodendron tulipifera* | Tuliptree | native | non-ornamental deciduous |
| *Malus spp.* | Crabapple | exotic | flowering ornamental |
| *Malus floribunda* | Japanese crabapple | exotic | flowering ornamental |
| *Maclura pomifera* | Osage orange | exotic | flowering ornamental |
| *Magnolia stellata* | Star magnolia | native | flowering ornamental |
| *Morus alba* | White mulberry | exotic | non-ornamental deciduous |
| *Ostrya virginiana* | Ironwood | native | non-ornamental deciduous |
| *Paulownia tomentosa* | Royal paulownia | exotic | flowering ornamental |
| *Phellodendron amurense* | Amur corktree | native | non-ornamental deciduous |
| *Picea abies* | Norway spruce | exotic | evergreen |
| *Pinus nigra* | Austrian pine | exotic | evergreen |
| *Picea pungens* | Colorado blue spruce | exotic | evergreen |
| *Pinus resinosa* | Red pine | native | evergreen |
| *Pinus rigida* | Pitch pine | native | evergreen |
| *Pinus strobus* | White pine | native | evergreen |
| *Pinus sylvestris* | Scotch pine | exotic | evergreen |
| *Pinus thunbergii* | Japanese black pine | exotic | evergreen |
| *Platanus x acerifolia* | London plane | exotic | non-ornamental deciduous |
| *Prunus serotina* | Black cherry | native | non-ornamental deciduous |
| *Pyrus calleryana* | Callery pear | exotic | flowering ornamental |
| *Quercus alba* | White oak | native | non-ornamental deciduous |
| *Quercus bicolor* | Swamp white oak | native | non-ornamental deciduous |
| *Quercus cerris* | Turkey oak | exotic | non-ornamental deciduous |
| *Quercus palustris* | Pin oak | native | non-ornamental deciduous |
| *Quercus rubra* | Red oak | native | non-ornamental deciduous |
| *Robinia pseudoacacia* | Black locust | exotic | non-ornamental deciduous |
| *Styphnolobium japonicum* | Chinese scholartree | exotic | non-ornamental deciduous |
| *Tilia americana* | American linden | native | non-ornamental deciduous |
| *Tilia cordata* | Littleleaf linden | exotic | non-ornamental deciduous |
| *Tilia platyphyllos* | Bigleaf linden | exotic | non-ornamental deciduous |
| *Tilia tomentosa* | Silver linden | exotic | non-ornamental deciduous |
| *Ulmus parvifolia* | Chinese elm | exotic | non-ornamental deciduous |
| *Ulmus spp.* | Elm spp. | native (some) | non-ornamental deciduous |
| *Zelkova serrata* | Japanese zelkova | exotic | non-ornamental deciduous |

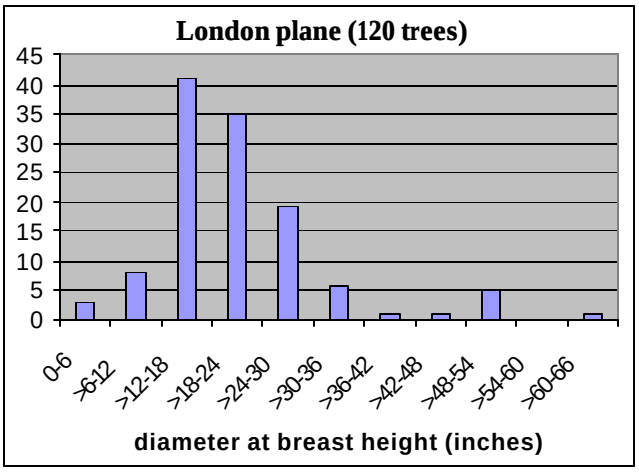
# APPENDIX C. TREE SURVEY SUMMARIES

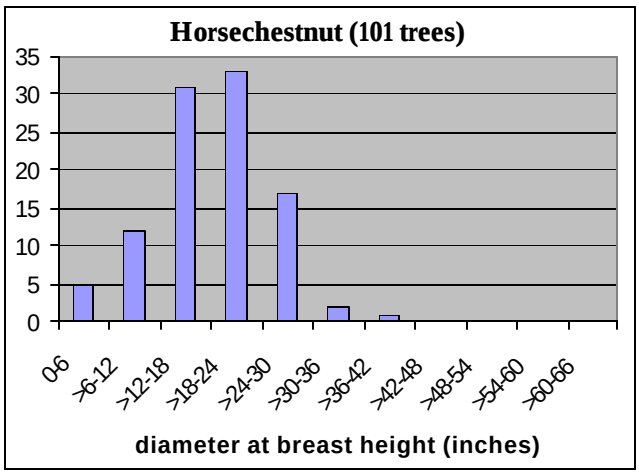
| Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
| Ginkgo | 138 | 15.0% | 10.86 | 13 | 78 | 44 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| London plane | 120 | 13.1% | 21.61 | 3 | 8 | 41 | 35 | 19 | 6 | 1 | 1 | 5 | 0 | 1 |
| Horsechestnut | 101 | 11.0% | 18.97 | 5 | 12 | 31 | 33 | 17 | 2 | 1 | 0 | 0 | 0 | 0 |
| Norway maple | 63 | 6.9% | 14.62 | 2 | 34 | 12 | 5 | 9 | 0 | 1 | 0 | 0 | 0 | 0 |
| Austrian pine | 51 | 5.6% | 17.25 | 0 | 3 | 29 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pin oak | 51 | 5.6% | 18.09 | 4 | 14 | 7 | 11 | 7 | 8 | 0 | 0 | 0 | 0 | 0 |
| Black cherry | 50 | 5.5% | 12.01 | 6 | 27 | 12 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| Elm spp. | 35 | 3.8% | 33.68 | 0 | 5 | 0 | 3 | 4 | 7 | 6 | 6 | 2 | 2 | 0 |
| Honeylocust | 31 | 3.4% | 10.79 | 2 | 21 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chinese scholartree | 29 | 3.2% | 25.09 | 3 | 6 | 7 | 4 | 2 | 5 | 1 | 1 | 0 | 0 | 0 |
| Japanese zelkova | 26 | 2.8% | 14.89 | 0 | 4 | 19 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hackberry | 19 | 2.1% | 9.57 | 9 | 4 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black locust | 18 | 2.0% | 9.97 | 3 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Crabapple | 16 | 1.7% | 10.03 | 5 | 7 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Japanese black pine | 16 | 1.7% | 13.63 | 0 | 4 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red oak | 16 | 1.7% | 31.37 | 0 | 0 | 0 | 2 | 6 | 6 | 1 | 0 | 1 | 0 | 0 |
| Silver linden | 13 | 1.4% | 16.92 | 2 | 6 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| Littleleaf linden | 12 | 1.3% | 12.57 | 2 | 6 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Redbud | 9 | 1.0% | 2.02 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| American linden | 9 | 1.0% | 9.03 | 4 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Washington hawthorn | 8 | 0.9% | 5.75 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| White pine | 6 | 0.7% | 12.60 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| White ash | 5 | 0.5% | 21.62 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Cockspur hawthorn | 4 | 0.4% | 10.25 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red pine | 4 | 0.4% | 19.63 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Callery pear | 4 | 0.4% | 9.87 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flowering dogwood | 4 | 0.4% | 1.00 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red maple | 3 | 0.3% | 24.30 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Silver maple | 3 | 0.3% | 17.97 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| American hornbeam | 3 | 0.3% | 16.73 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kouza dogwood | 3 | 0.3% | 2.83 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| European beech | 3 | 0.3% | 35.27 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| Green ash | 3 | 0.3% | 10.00 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tuliptree | 3 | 0.3% | 38.07 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| Osage orange | 3 | 0.3% | 16.30 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Star magnolia | 3 | 0.3% | 5.73 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Japanese crabapple | 3 | 0.3% | 1.00 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| White mulberry | 2 | 0.2% | 29.25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Amur corktree | 2 | 0.2% | 26.75 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Scotch pine | 2 | 0.2% | 15.65 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Turkey oak | 2 | 0.2% | 37.40 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Bigleaf linden | 2 | 0.2% | 18.00 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chinese elm | 2 | 0.2% | 1.00 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sycamore maple | 1 | 0.1% | 7.00 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ailanthus | 1 | 0.1% | 9.00 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chestnut | 1 | 0.1% | 14.00 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Atlas cedar | 1 | 0.1% | 1.30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Downy hawthorn | 1 | 0.1% | 1.00 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Golden raintree | 1 | 0.1% | 42.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Sweetgum | 1 | 0.1% | 16.70 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Royal paulownia | 1 | 0.1% | 17.50 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Colorado blue spruce | 1 | 0.1% | 0.50 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pitch pine | 1 | 0.1% | 20.10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| White oak | 1 | 0.1% | 29.00 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Swamp white oak | 1 | 0.1% | 35.50 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Ironwood | 1 | 0.1% | 15.20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Norway spruce | 1 | 0.1% | 1.00 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| dead | 3 | 0.3% | 7.67 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 917 | | (average dbh= 16.42) | 106 | 265 | 248 | 133 | 85 | 42 | 12 | 15 | 8 | 2 | 1 |

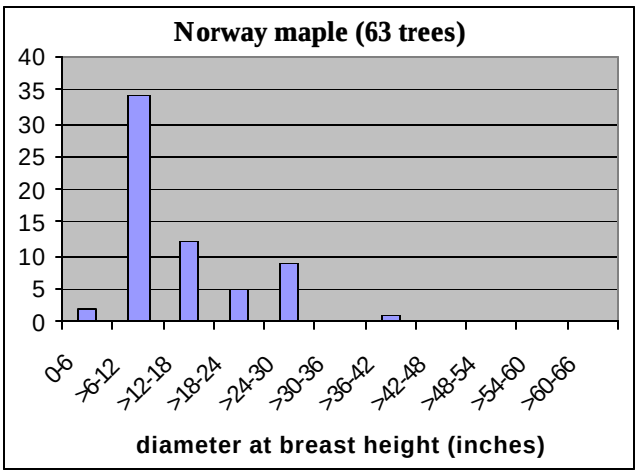
*Diameter Distributions for Individual Species*

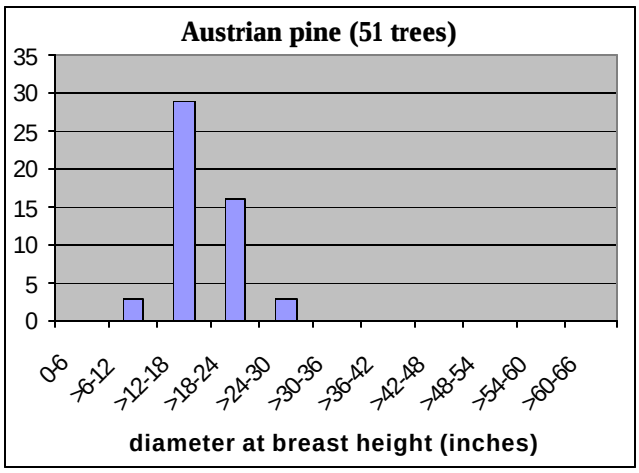
Graphs show all species represented by more than 10 trees in the park.

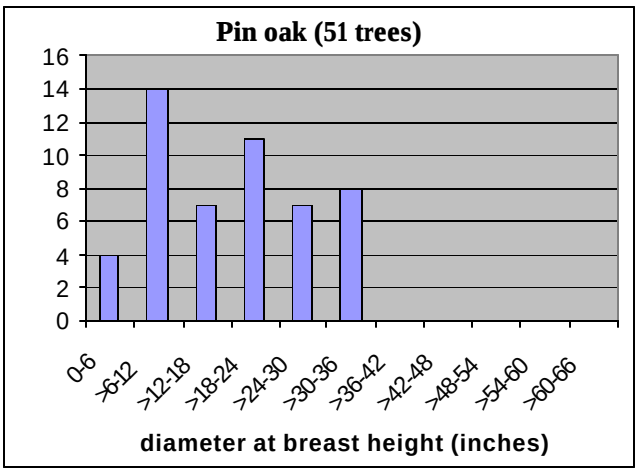


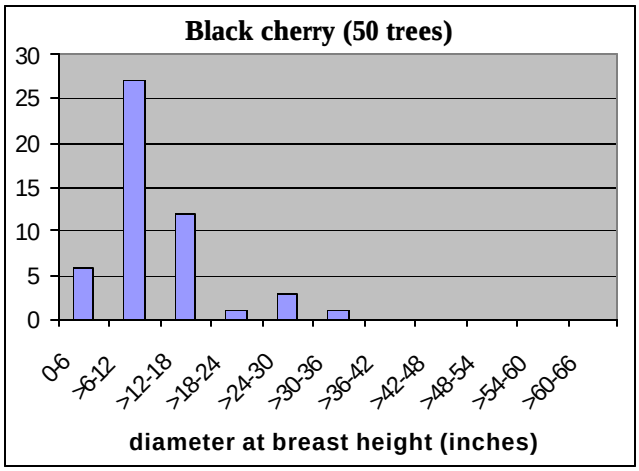



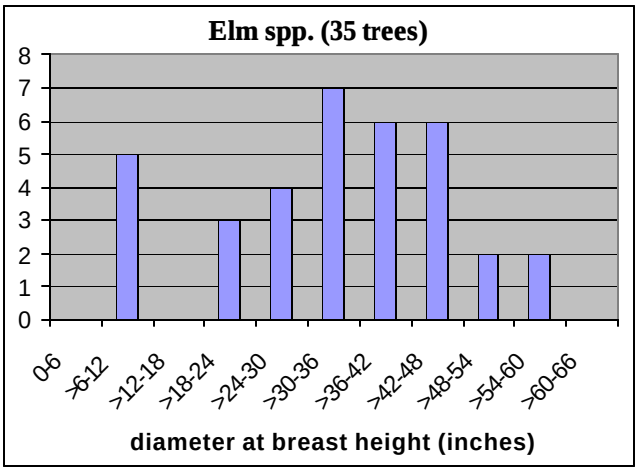



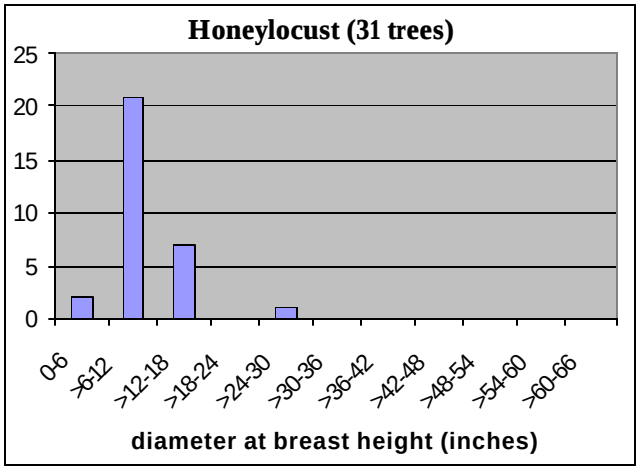



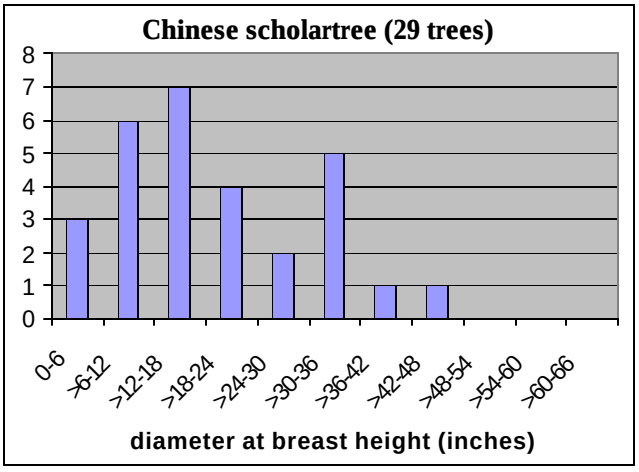



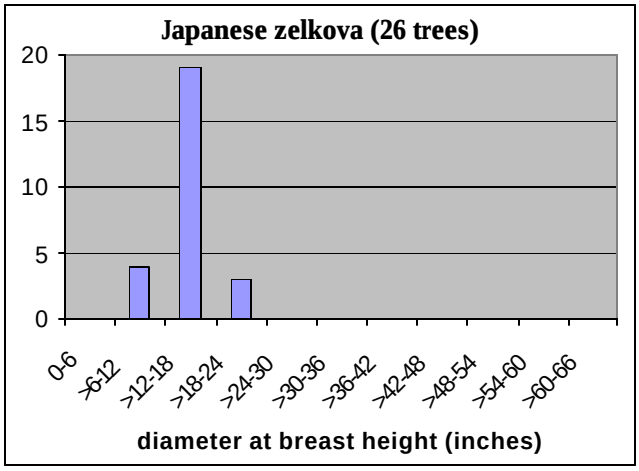



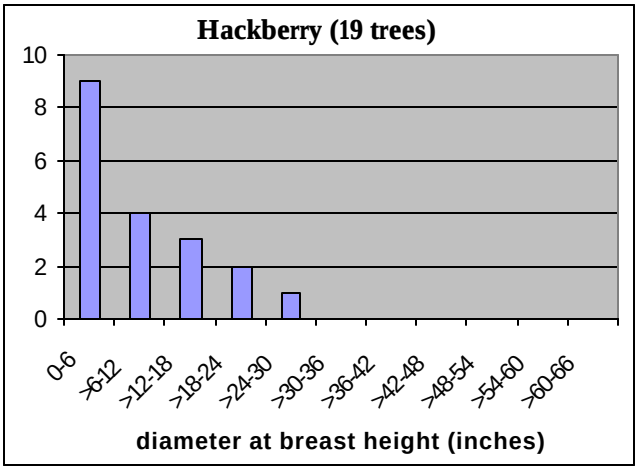

Black cherry (50 trees)
30
25
20
15
10
5
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

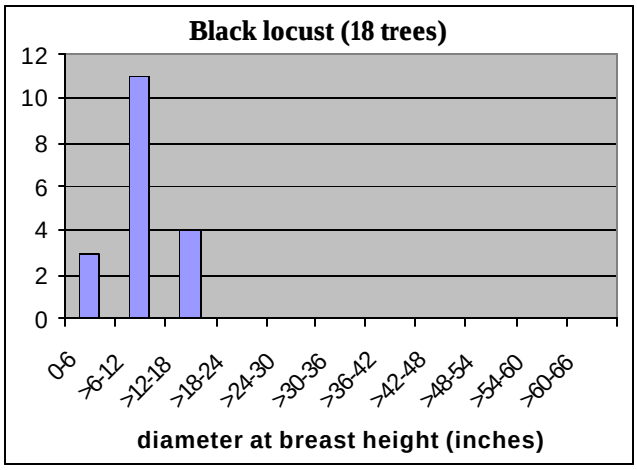

Elm spp. (35 trees)
8
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

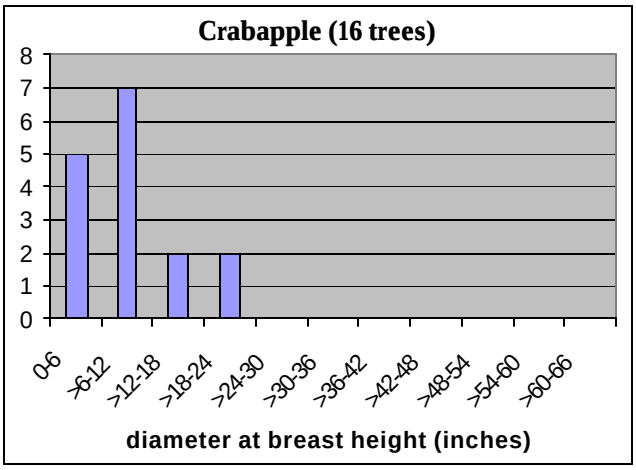

Honeylocust (31 trees)
25
20
15
10
5
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

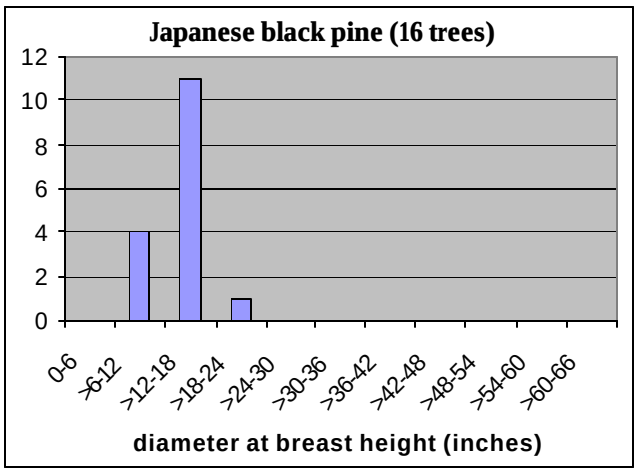

Chinese scholartree (29 trees)
8
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

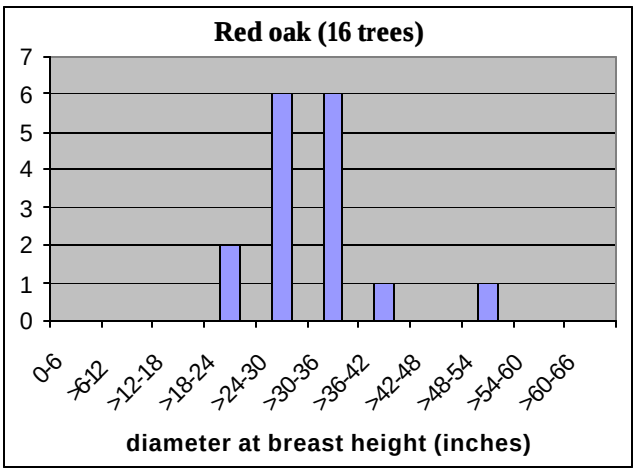

Japanese zelkova (26 trees)
20
15
10
5
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

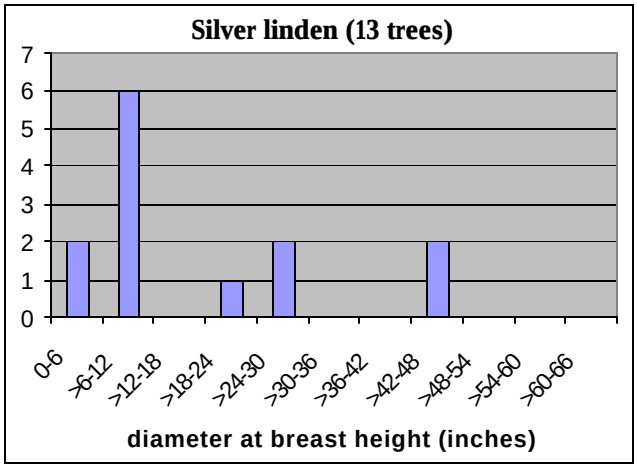

Hackberry (19 trees)
10
8
6
4
2
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

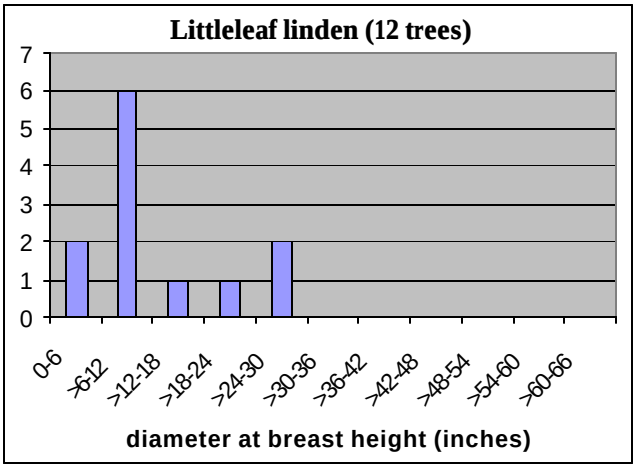

Black locust (18 trees)
12
10
8
6
4
2
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)


Crabapple (16 trees)
8
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)


Japanese black pine (16 trees)
12
10
8
6
4
2
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)


Red oak (16 trees)
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

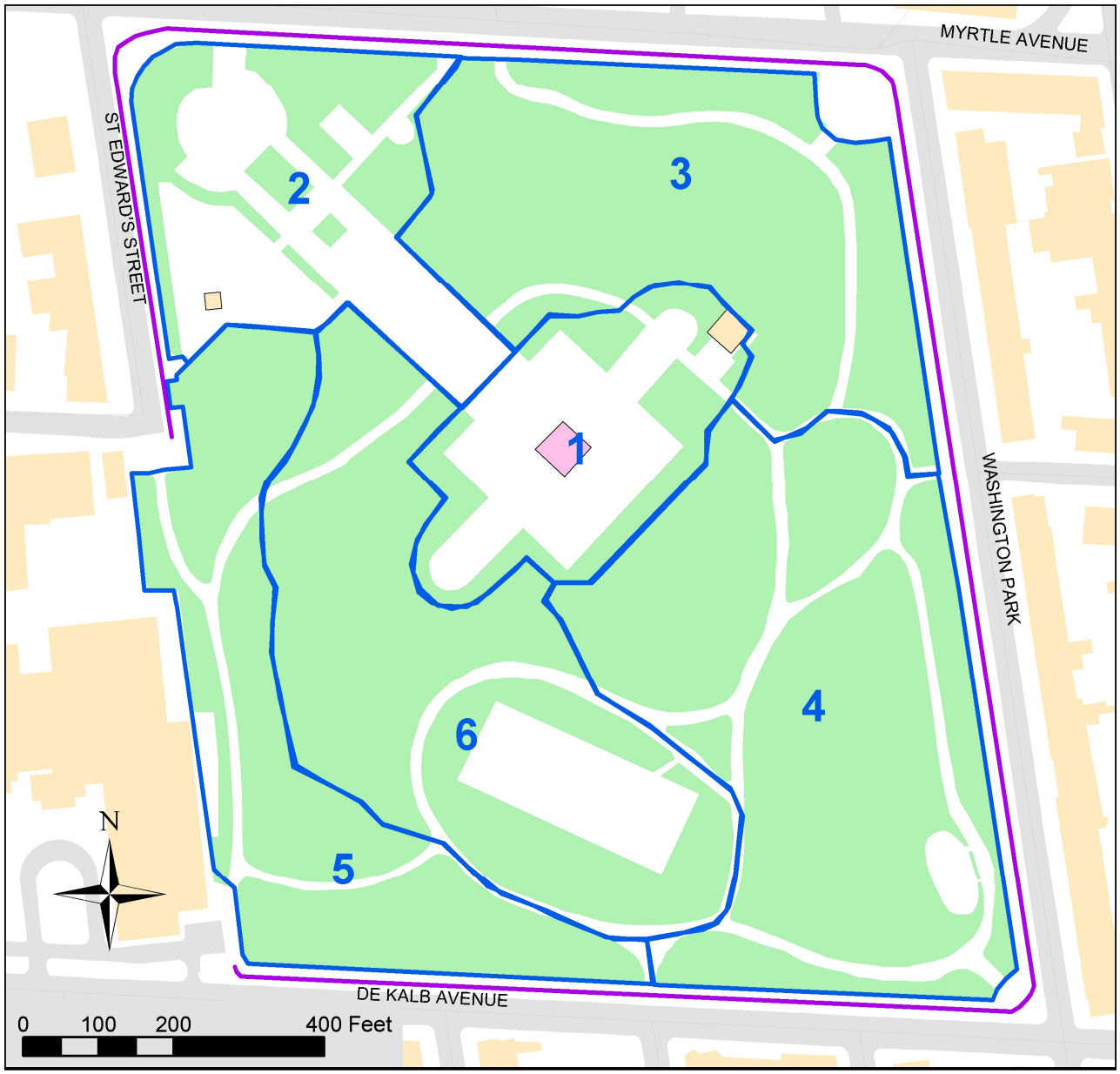

Silver linden (13 trees)
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)


Littleleaf linden (12 trees)
7
6
5
4
3
2
1
0
0-6
>6-12
>12-18
>18-24
>24-30
>30-36
>36-42
>42-48
>48-54
>54-60
>60-66
diameter at breast height (inches)

# APPENDIX D. ZONE MAPS AND INFORMATION

Fort Greene Park was divided into seven zones based on criteria such as land use, physical structures, tree species composition, and dominant issues. Map 11 (and below) shows these seven zones – six within the park and one consisting of all the perimeter trees. This appendix consists of detailed profiles of each zone including: (1) a narrative describing each zone with management suggestions (2) a graph illustrating the diameter distribution for all trees and the five most common species, (3) a tree condition chart, (4) a species list with diameter distributions, (5) a map showing tree locations, identified by species, and (6) a map showing the size classes and conditions of the trees.

On the following page is a table of basic information for each zone.



**Zone Table.** This table lists all seven zones, ordered by number. Each zone was classified as either high or low use based on the amount of human activity within the zone. Basic statistics include each zone's acreage, number of trees, average diameter at breast height (d.b.h.) and number of dead trees. High Priority trees are those that are within 30 feet of a path or sidewalk and that had a condition of dead or shaft, or had comments like "dying," "remove," "large wound," or "HUGE cavity!" Mid priority trees are also within 30 feet of a path but were marked poor or included comments like "sick," "damage," or "prune." All of these trees should be inspected immediately (see Map 13 in Appendix A for tree locations). The last column lists the recommended rotation year for each zone. An in-depth description of the zone management system begins on p.22 of the main text, and table 4 lists more descriptive statistics for each zone.

| Zone | Use | Area (acres) | Number of Trees | Average d.b.h. | High Priority Maint. Trees | Mid Priority Maint. Trees | Dead/Shaft/ Stump Trees | Rotation Year |
|---|---|---|---|---|---|---|---|---|
| 1 | high - plaza | 2.75 | 172 | 12.7 | 4 | 6 | 3 | 2 |
| 2 | high - plaza | 3.54 | 146 | 16.1 | 3 | 0 | 0 | 6 |
| 3 | low | 5.38 | 123 | 17.9 | 0 | 1 | 2 | 5 |
| 4 | high - field | 7.22 | 92 | 24.3 | 1 | 8 | 0 | 1 |
| 5 | low | 4.15 | 157 | 13.8 | 3 | 6 | 2 | 3 |
| 6 | low | 5.80 | 61 | 23.6 | 0 | 0 | 1 | 7 |
| 7 | high - sidewalk | 3884 curb feet | 166 | 15.0 | 0 | 35 | 0 | 4 |

# ZONE 1

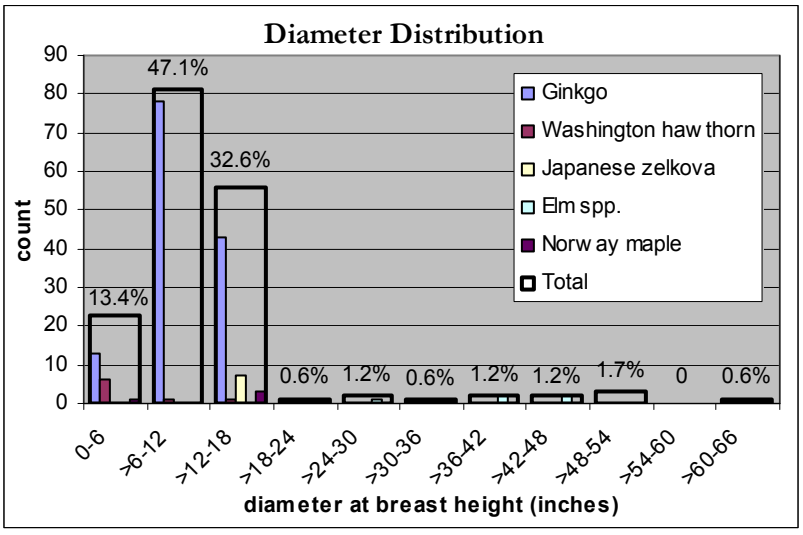
**Rotation year = 2**
**Total number of trees = 172**

Zone 1 consists of the Prison Ship Martyrs' Monument plaza and the lawn immediately surrounding the plaza. The area is dominated by 135 ginkgos, which were originally planted as part of the 1935-36 Gilmore Clarke park design. 130 of the ginkgos are planted in triple rows surrounding the two wings attached to the monument plaza. A 1972 survey[1] of the park indicates that there were 172 ginkgos surrounding the wings at that time, with 11 obvious gaps where trees had been removed and not yet been replaced. However, since that survey the southern wing area has been re-graded and the semi-circular path that bisected that wing has been removed – as a result, much of the ground is too steep to resurrect the original planting design. The 1972 survey also indicates that the only trees within the plaza square at that time were the two large London planes and five ginkgos. The six Japanese zelkovas, two Norway maples, and one honeylocust were apparently planted after this survey.

One hundred thirty tightly spaced ginkgos are growing around the monument wings.

A 2004 capital project will rebuild and restore much of the plaza to the 1907 McKim, Mead, and White design, but will leave the wings and the ginkgos from the 1935 project. The ginkgos are a great source of contention between Parks foresters and patrons who wish to resurrect the McKim, Mead, and White designs of the plaza. Neither the wings nor the ginkgos were a part of the 1907 plan, and so strict historical preservationists would like them to be removed. Removing trees without good reason (especially 130 relatively healthy trees) goes against Parks' policy, which was designed to preserve as much green infrastructure as possible in New York. And so this capital plan, in which benches will be rearranged, the hedge surrounding the plaza will be restored, several trees within the plaza will be removed, and much of the plaza will be paved, is intended to be a compromise. There has been no official decision to either abandon or restore this grove. Currently, when a ginkgo dies it is simply not replaced, and so the number of trees is slowly dwindling. Restoring the grove to its original plan is impossible due to the presence of large healthy London planes that, ironically, predate ginkgos planting. There have also been grading changes and erosion that would require considerable expense to ameliorate in order to replant the ginkgos in the original pattern. Maintaining the grove essentially as is would require extensive maintenance as well, given heavily compacted soils and too close spacing. Abandoning the grove (i.e. allowing the trees to naturally die off) has historic and canopy cover implications. The grove, as part of a significant redesign by Gilmore Clarke—Robert Moses' chief landscape architect--represents a legitimate part of the cultural history of the park. Additionally, the ginkgos provide a significant amount of canopy coverage that would be permanently lost. These issues need to be resolved during the creation of a master landscape plan.

Within the plaza area, there are a few large trees in need of special attention and care – the English elm and the two London planes, all of which are probably relics of the Olmsted & Vaux design but are also in conflict with the later McKim, Mead, and White design. The English elm has been in decline for many years, and the upcoming capital project will hopefully address this issue by removing the concrete at the base of the tree and turning the area into a planting bed to avoid further root compaction.




| Condition | Count | Percentage |
|---|---|---|
| Excellent | 26 | 15.1% |
| Good | 139 | 80.8% |
| Poor | 4 | 2.3% |
| Dead | 0 | 0.0% |
| Shaft | 2 | 1.2% |
| Stump | 1 | 0.6% |

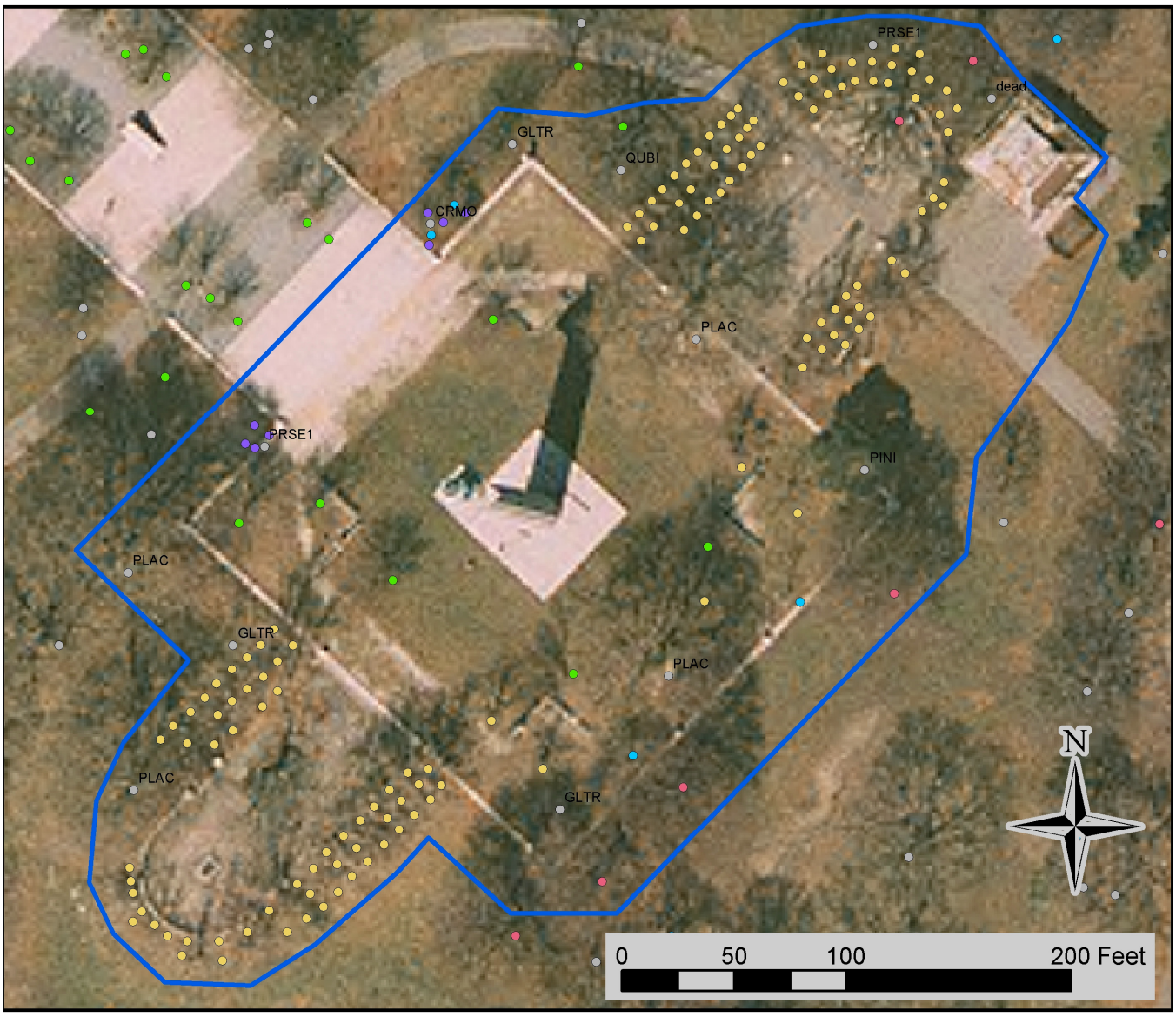
[1] The 1972 survey was executed by Gerald T. O'Buckley & Associates and it is available at NYC Parks & Recreation's Map File office in Olmsted Center. It appears that this survey was done before the implementation of the Berman, Robers, & Scorpido / A.E. Bye & Associates park design that was commissioned in 1971. While this survey is an invaluable resource, it is important to note that many of the trees on the survey were obviously misidentified – for example, the English elm on the north wing of the monument plaza is listed as a London planetree, and the large elms just southeast of the plaza are listed as oaks.

The elm was treated with Cambistat two years ago in hopes of spurring fine root regeneration and improving the tree's vigor. The application of mulch, a light pruning, and permanent tree protection fencing would greatly benefit this beautiful tree. Protecting all three trees during the capital construction phase is very important to extending the life of these historically important specimens (see Appendix G Tree Protection Guidelines).

There are two additional important trees in this zone: two large London planes just outside the plaza, including a 64-inch-diameter tree along the southeastern wing, the largest tree in the park. Finally, the areas to either side of the stairs are significantly eroded. These two spots (along with many other sites within the park) would greatly benefit from some dense plantings of herbaceous plants, shrubs, and small trees to stave off additional soil loss on the slope. These plants would minimize the impact of rain on the ground while holding the existing soil in place.

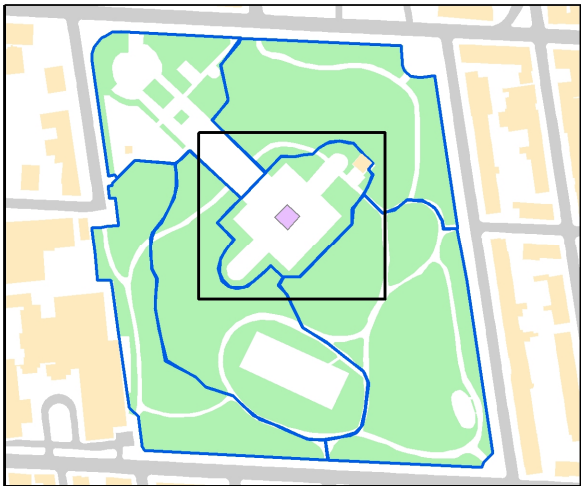
| | | | | | Diameter Distributions (inches) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species Code | Common Name | Count | Percentage | Mean d.b.h. | 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
| GIBI | Ginkgo | 135 | 78.5% | 10.7 | 13 | 78 | 43 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CRPH | Washington hawthorn | 8 | 4.7% | 5.8 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ZESE | Japanese zelkova | 7 | 4.1% | 15.8 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ULSP | Elm spp. | 5 | 2.9% | 38.6 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 0 |
| ACPL | Norway maple | 4 | 2.3% | 11.9 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLAC | London plane | 4 | 2.3% | 54.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| GLTR | Honeylocust | 3 | 1.7% | 10.5 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRSE1 | Black cherry | 2 | 1.2% | 11.3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CRMO | Downy hawthorn | 1 | 0.6% | 1.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PINI | Austrian pine | 1 | 0.6% | 26.8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| QUBI | Swamp white oak | 1 | 0.6% | 35.5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| dead | unidentifiable | 1 | 0.6% | 0.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 172 | (zone mean dbh=12.7) | | 23 | 81 | 56 | 1 | 2 | 1 | 2 | 2 | 3 | 0 | 1 |

## MAP 18. ZONE 1 SPECIES

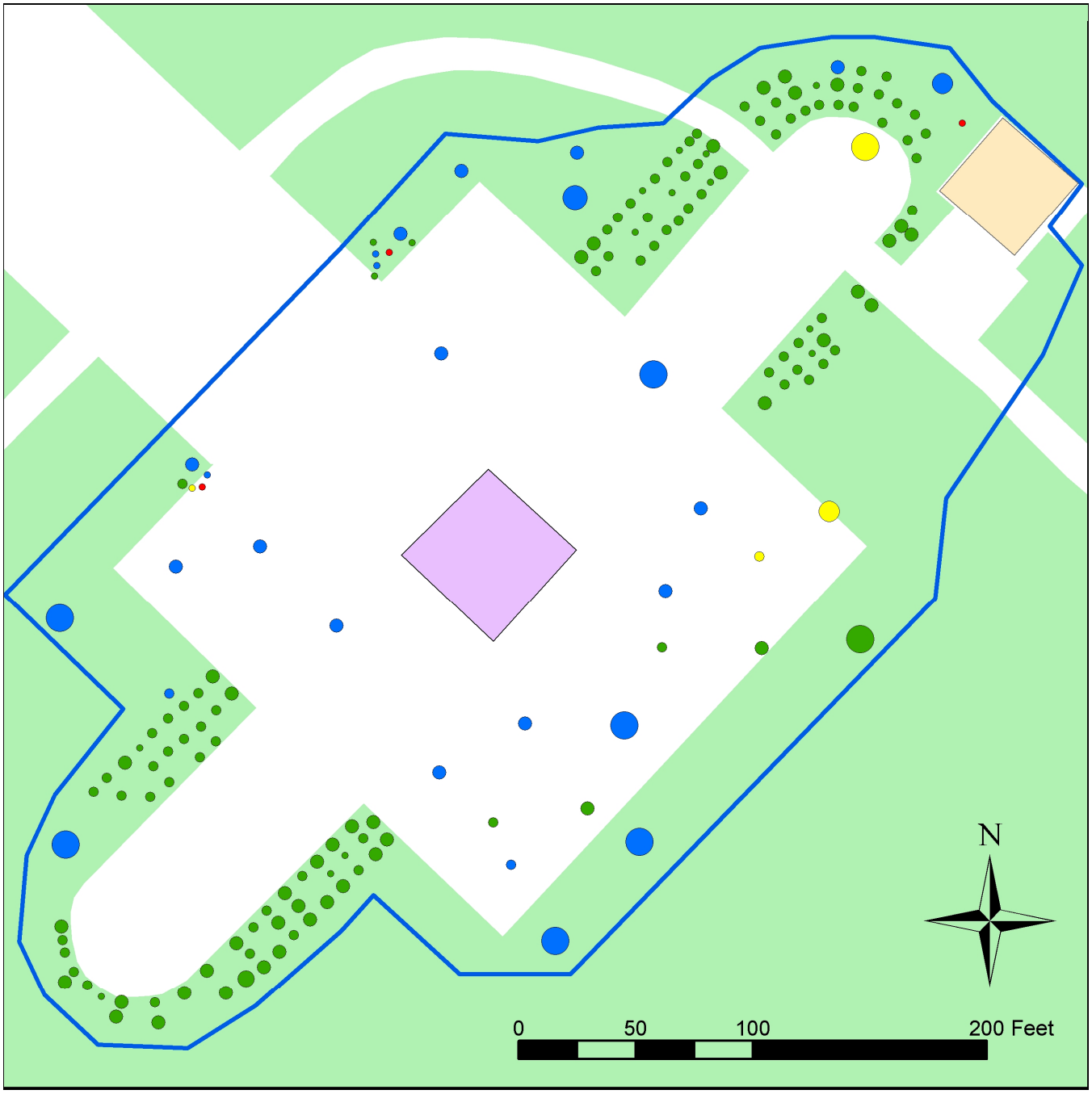



**Common Tree Species**

- Ginkgo
- Washington hawthorn
- Japanese zelkova
- Elm spp.
- Norway maple
- other species



## MAP 19. ZONE 1 TREE SIZE AND CONDITION




**Tree Condition and Size in Zone 1**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

# ZONE 2

**Rotation year = 6**
**Total number of trees = 146**

Zone 2 includes the stairs up to the monument, the Prison Ship Martyrs' crypt, a large circular plaza, the larger of the park's two playgrounds, a basketball court, two comfort stations (one closed), and a wishing well. The zone is dominated by 92 London plane trees planted as part of the Gilmore Clarke 1935-36 redesign. The original design included two triple rows of London plane trees lining the wide path that leads to the monument stairs and surrounds the circle in the northwest corner of the park. The original design has been slightly altered since then reflecting a number of changes to paths and entrances. Empty planting spaces should be filled as they become available as per the triple rows.

The area at the base of the monument stairs is often used as an amphitheatre with the stairs used as seats. Park users have requested that the branches of the London planes surrounding the performance space be pruned where they block views from the stairs to the stage.

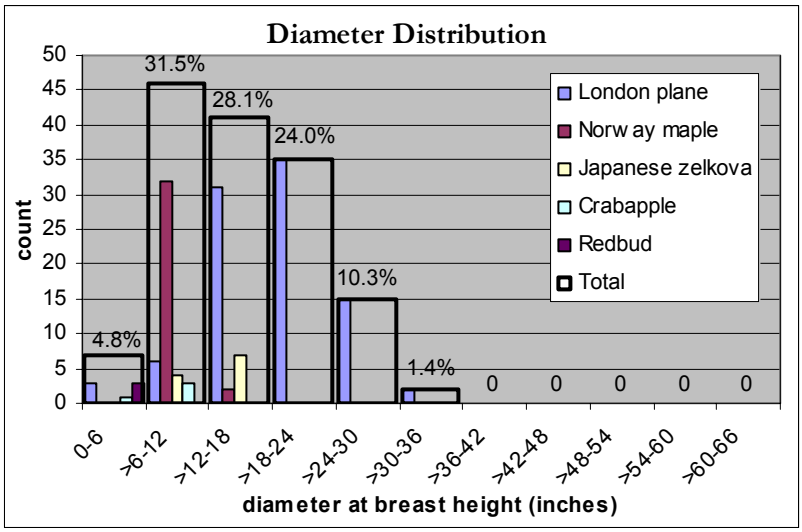
The other significant planting in the zone is the cluster of 34 Norway maples, which were probably planted as part of the 1970s A.E. Bye redesign. This grove is very dense creating a dark corner. The grove could be maintained but not as densely. As the trees die, they should not be replaced with Norway maple trees but with another suitable species.

Finally, the 11 Japanese zelkovas planted on the stairway landings are in need of attention. These trees, part of the A. E. Bye design, are inappropriately placed and are suffering as a result. They are in conflict with the drainage system and a path requiring vehicular access. There are currently empty "planting" spaces. The empty places should not be filled and the existing zelkova trees should not be replaced as they die. The planting holes should then be resurfaced to avoid a tripping hazard.

There are few trees in this zone aside from the three major group plantings and there is little unpaved room left for trees. However, the northern grassy area could be planted with shade resistant canopy species to grow up under the maturing London planes.

The playground in this zone is very large and well maintained, and the trees are all marked as being in excellent condition. However, because this playground is so frequently used, it is important that these trees be inspected on a regular basis.

A view of the monument from the northwest corner of the park (Olmsted & Vaux' parade grounds) through the triple row of London planes, a legacy of Gilmore Clarke.



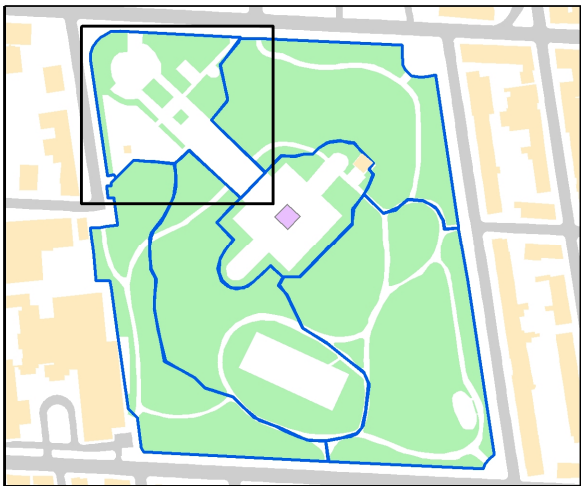

| Condition | Count | Percentage |
|---|---|---|
| Excellent | 130 | 89.0% |
| Good | 16 | 11.0% |
| Poor | 0 | 0.0% |
| Dead | 0 | 0.0% |
| Shaft | 0 | 0.0% |
| Stump | 0 | 0.0% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAC | London plane | 92 | 63.0% | 19.4 | 3 | 6 | 31 | 35 | 15 | 2 | 0 | 0 | 0 | 0 | 0 |
| ACPL | Norway maple | 34 | 23.3% | 10.4 | 0 | 32 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ZESE | Japanese zelkova | 11 | 7.5% | 12.9 | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MA2 | Crabapple | 4 | 2.7% | 7.4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CECA | Redbud | 3 | 2.1% | 2.5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MOAL | White mulberry | 1 | 0.7% | 10.5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRSE1 | Black cherry | 1 | 0.7% | 15.5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 146 | (zone mean dbh=16.1) | | 7 | 46 | 41 | 35 | 15 | 2 | 0 | 0 | 0 | 0 | 0 |

## MAP 20. ZONE 2 SPECIES


**Common Tree Species**

- London plane
- Norway maple
- Japanese zelkova
- Crabapple
- Redbud
- other species



## MAP 21. ZONE 2 TREE SIZE AND CONDITION

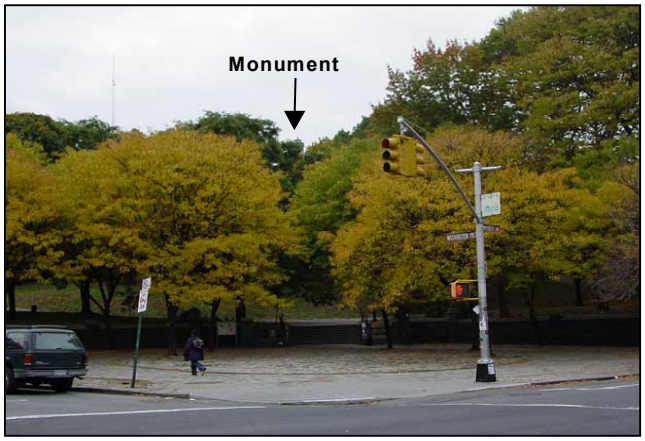

**Tree Condition and Size in Zone 2**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

# ZONE 3

**Rotation year = 5**
**Total number of trees = 123**

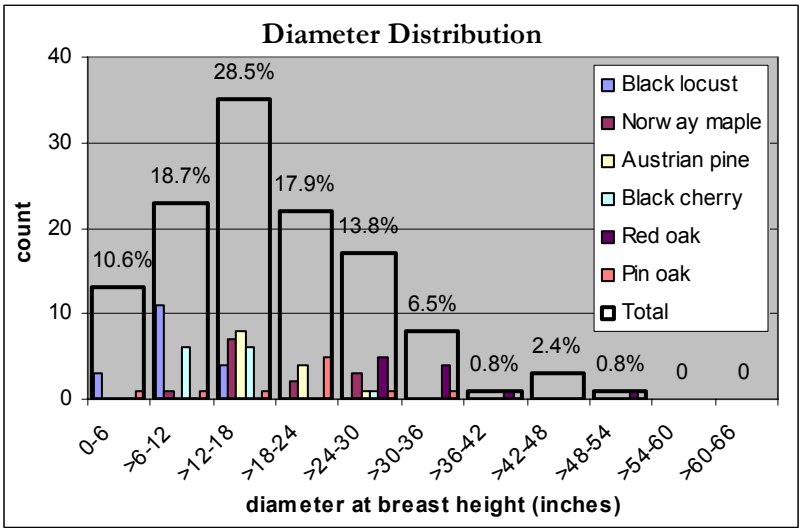
Zone 3 encompasses the northeast corner of the park and includes three park entrances. It is a large zone but sparsely wooded although with 123 trees there are many more than were present in 1972 (28 trees as per survey, see p. F-3). The trees present in 1972 were primarily Norway maples, pines, and oaks, which are among the dominant trees today, with the addition of black locust, the most prevalent species at this time. A 51-inch-diameter red oak (#588) in the southern part of the zone is the eighth largest tree in the park. Most of the trees added after 1972 (black locusts and black cherries) were planted on the slopes along the stairs and behind the visitors' center, probably an attempt to reduce erosion. Today, additional trees, most likely self-seeded, keep soil in its place. Despite this, erosion continues to be a problem. Planting smaller trees and shrubs in these areas would help ameliorate erosion by holding additional soil in place and reducing the velocity of raindrops.




An obscured view of the monument from the northeast entrance to the park – several of the McKim, Mead, & White-designed viewsheds are obscured by dense foliage.

Another planting consideration for this zone concerns the views from park entrances to the monument. The McKim, Meade, and White plan of 1907 stressed the maintenance of views to the monument. Viewshed rehabilitation is also a priority for the Fort Greene Park Conservancy today. Currently, when the trees are in leaf, the views from outside the park are completely obscured by the foliage (see photo). Careful pruning of existing trees and species selection of new trees could improve the park forest while allowing better views from the street to the monument.

There are currently remnants of two pineta along the edges of this zone. These could both be enhanced with additional evergreen planting.



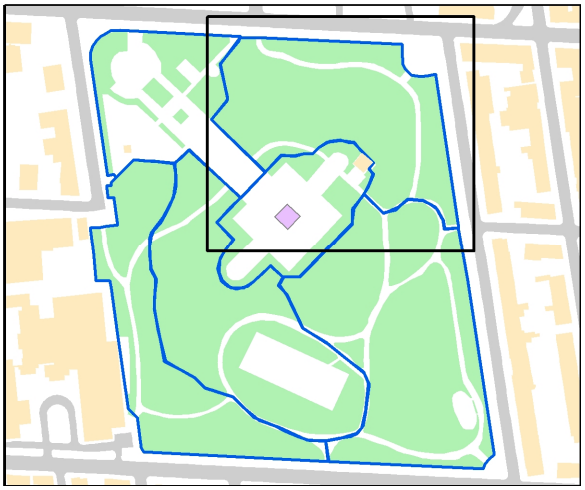

| Condition | Count | Percentage |
|---|---|---|
| Excellent | 101 | 82.1% |
| Good | 17 | 13.8% |
| Poor | 3 | 2.4% |
| Dead | 0 | 0.0% |
| Shaft | 0 | 0.0% |
| Stump | 2 | 1.6% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROPS | Black locust | 18 | 14.6% | 10.0 | 3 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACPL | Norway maple | 13 | 10.6% | 18.8 | 0 | 1 | 7 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| PINI | Austrian pine | 13 | 10.6% | 17.7 | 0 | 0 | 8 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRSE1 | Black cherry | 13 | 10.6% | 14.1 | 0 | 6 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| QURU | Red oak | 11 | 8.9% | 32.6 | 0 | 0 | 0 | 0 | 5 | 4 | 1 | 0 | 1 | 0 | 0 |
| QUPA | Pin oak | 10 | 8.1% | 18.6 | 1 | 1 | 1 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| CEOC | Hackberry | 5 | 4.1% | 14.1 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| STJA | Chinese scholartree | 5 | 4.1% | 19.7 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ULSP | Elm spp. | 5 | 4.1% | 30.6 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 |
| COFL | Flowering dogwood | 4 | 3.3% | 1.4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PITH | Japanese black pine | 4 | 3.3% | 14.1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ZESE | Japanese zelkova | 4 | 3.3% | 17.9 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GLTR | Honeylocust | 3 | 2.4% | 19.8 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLAC | London plane | 3 | 2.4% | 30.0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| COKO | Kouza dogwood | 2 | 1.6% | 2.0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FASY | European beech | 2 | 1.6% | 36.8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| TICO | Littleleaf linden | 2 | 1.6% | 18.0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CADE | Chestnut | 1 | 0.8% | 14.0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CEAT | Atlas cedar | 1 | 0.8% | 1.3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FRAM | White ash | 1 | 0.8% | 21.6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MA2 | Crabapple | 1 | 0.8% | 6.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| QUAL | White oak | 1 | 0.8% | 29.0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TITO | Silver linden | 1 | 0.8% | 27.0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 123 | (zone mean dbh=17.9) | | 13 | 23 | 35 | 22 | 17 | 8 | 1 | 3 | 1 | 0 | 0 |

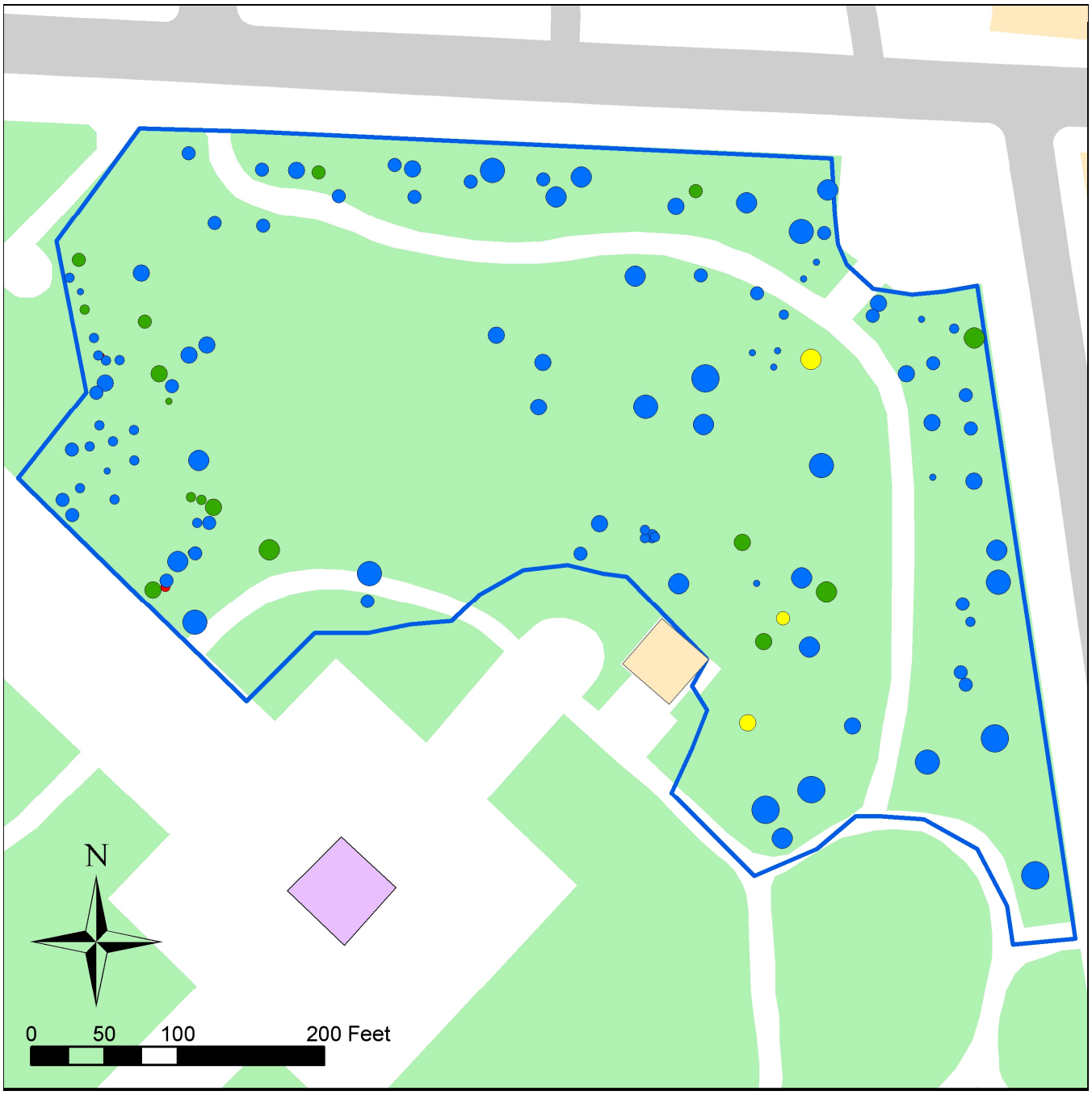
## MAP 22. ZONE 3 SPECIES


**Common Tree Species**

- Black locust
- Norway maple
- Austrian pine
- Black cherry
- Red oak
- Pin oak
- other species



## MAP 23. ZONE 3 TREE SIZE AND CONDITION




**Tree Condition and Size in Zone 3**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

# ZONE 4

**Rotation year = 1**
**Total number of trees = 92**

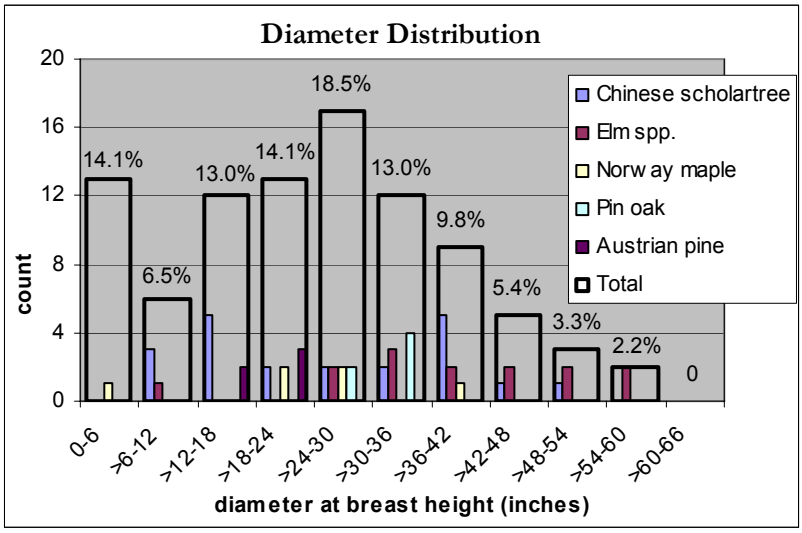
Zone 4 makes up the southeast corner of the park and includes three park entrances, the smaller playground, and the only large, flat, treeless meadow in the park. This zone has the lowest stem density (12.74 trees/acre) of all the zones and has the highest percentage of trees marked poor or dead of any zone. While the meadow partially accounts for the low stem density, even the wooded areas are fairly sparse. Fourteen percent of the trees in this zone (13 trees) are less than 6 inches in diameter, and they are mostly canopy tree species, indicating that some of the more recent planting in the park has been focused on adding canopy trees here. Five of the 12 largest trees in the park are in zone 4 – four elms and one Chinese scholartree. The zone also has the largest average tree size. The ailing trees in this zone are mainly pines suffering from the diplodia blight, elms in need of attention, and one large Norway maple that is split and rotting.

Eroded soils on the eastern hillside expose once buried tree roots and concrete drain box and deposit silt on the stairs and sidewalk.

The most prevalent issue in this zone is erosion. The area west of the Washington Avenue entrance is so eroded that the concrete drain at the bottom of the hill once buried sits nearly a foot above the current ground level (see photo). A silt fence has been installed to keep soil from covering the path to the entrance, but this does nothing to protect the hillside itself or the trees rooted in it. The most effective way to curb erosion on this hillside would be to first fence the area to prevent people and dogs from compacting and degrading the soil. Topsoil or mulch could then be added, using logs and wood from trees in the park to create steps, levelling the slope of the hill. Then, native grass/wildflower seed could be sown, and it all could be covered with a jute blanket (which will biodegrade in a year) while the soil settles and the seeds sprout. In the following year trees, shrubs, and herbaceous plants might be planted, and, after a few years of maintenance, the fencing could be removed. It should be noted that there are several large Norway maples in this zone. It is virtually impossible to establish an understory beneath Norway maples trees due to their shallow roots and dense shade. They are also the first to leaf out in the spring and one of the last trees to drop leaves in the fall, narrowing the opportunity for sun to penetrate its dense shade. Resources should not be wasted in trying to establish an understory beneath a Norway maple. A project of this size requires careful planning and follow-up but could be executed by volunteers with only a small amount of money invested.

A frequent park user request within this zone has been to plant shade trees around the playground. Recently two Chinese elms and a honeylocust were planted; however, neither of these species are fast growing shade trees. Planting additional trees of appropriate species around the playground would please patrons and help increase canopy cover. Species and placement should be sensitive to maintaining and enhancing monument views.

This zone inclues a remnant of a pineta that could be enhanced by additional tree planting. There is also a 20" DBH osage orange tree in this zone. This large specimen's branches arch low to the ground creating a distinctive silhouette. It also produces a large 4-6 inch orange-like fruit.



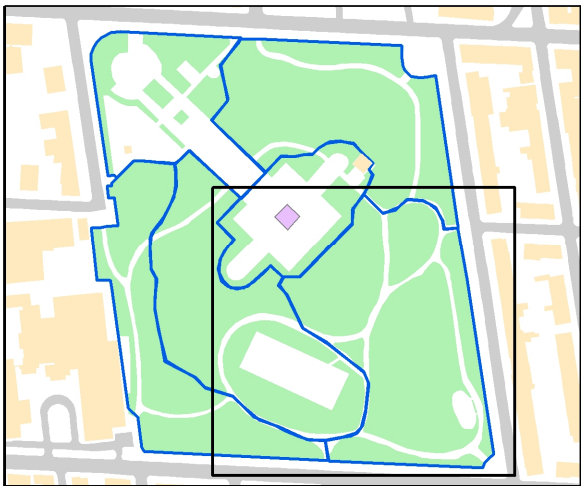

| Condition | Count | Percentage |
|---|---|---|
| Excellent | 59 | 64.1% |
| Good | 24 | 26.1% |
| Poor | 9 | 9.8% |
| Dead | 0 | 0.0% |
| Shaft | 0 | 0.0% |
| Stump | 0 | 0.0% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STJA | Chinese scholartree | 21 | 22.8% | 25.5 | 0 | 3 | 5 | 2 | 2 | 2 | 5 | 1 | 1 | 0 | 0 |
| ULSP | Elm spp. | 14 | 15.2% | 39.8 | 0 | 1 | 0 | 0 | 2 | 3 | 2 | 2 | 2 | 2 | 0 |
| ACPL | Norway maple | 6 | 6.5% | 22.9 | 1 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| QUPA | Pin oak | 6 | 6.5% | 30.1 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 |
| PINI | Austrian pine | 5 | 5.4% | 18.6 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CECA | American hornbeam | 4 | 4.3% | 1.2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLAC | London plane | 4 | 4.3% | 19.5 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| AEHI | Horsechestnut | 3 | 3.3% | 12.7 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| MASO | Star magnolia | 3 | 3.3% | 5.7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIST | White pine | 3 | 3.3% | 24.2 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| ACRU | Red maple | 2 | 2.2% | 35.2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| ACSA2 | Silver maple | 2 | 2.2% | 14.9 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| GIBI | Ginkgo | 2 | 2.2% | 19.3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAPO | Osage orange | 2 | 2.2% | 18.2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PISY | Scotch pine | 2 | 2.2% | 15.7 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TICO | Littleleaf linden | 2 | 2.2% | 24.4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| ULPA | Chinese elm | 2 | 2.2% | 0.8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FASY | European beech | 1 | 1.1% | 32.3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| FRAM | White ash | 1 | 1.1% | 29.0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| GLTR | Honeylocust | 1 | 1.1% | 3.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOPA | Golden raintree | 1 | 1.1% | 42.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| LITU | Tuliptree | 1 | 1.1% | 44.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| PATO | Royal paulownia | 1 | 1.1% | 17.5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIRI | Pitch pine | 1 | 1.1% | 20.1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| QURU | Red oak | 1 | 1.1% | 27.2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TIAM | American linden | 1 | 1.1% | 29.3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 92 | (zone mean dbh=24.3) | | 13 | 6 | 12 | 13 | 17 | 12 | 9 | 5 | 3 | 2 | 0 |

## MAP 24. ZONE 4 SPECIES


**Common Tree Species**

- Chinese scholartree
- Elm spp.
- Norway maple
- Pin oak
- Austrian pine
- other species



## MAP 25. ZONE 4 TREE SIZE AND CONDITION


**Tree Condition and Size in Zone 4**

| | | DBH | |
|---|---|---|---|
| Excellent | | < 6 inches | > 18 - 24 |
| Good | | > 6 - 12 | > 24 - 30 |
| Poor | | > 12 - 18 | > 30 - 36 |
| Dead/Shaft/Stump | | | > 36 |

# ZONE 5

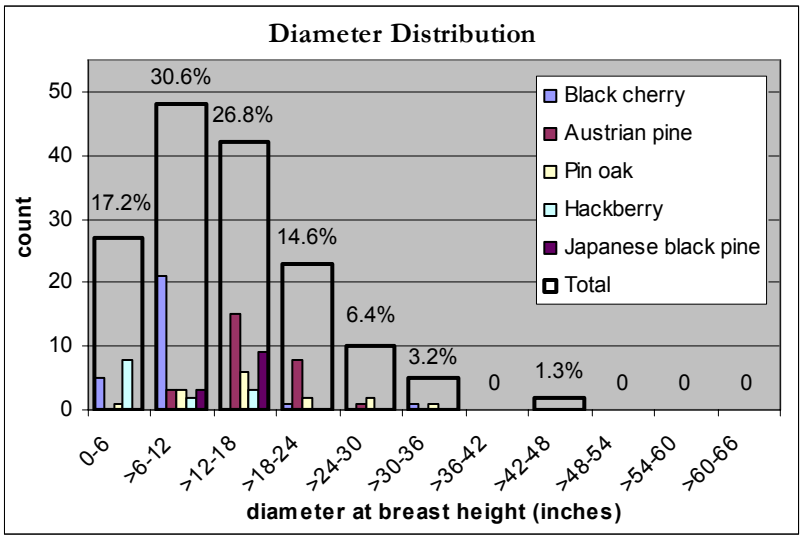
**Rotation year = 3**
**Total number of trees = 157**

Zone 5 is a relatively low use area in Fort Greene Park. The western side of the zone is adjacent to a Brooklyn Hospital building, and the southwest corner entrance is rarely used. This zone is most notable for its tree species diversity, its topography, and for having the most trees marked poor of any internal zone. Dense groups of pine trees (pineta) were planted in the 1970s. Although many of the pines in these clusters are impacted by diplodia blight, they are a significant feature of the park, providing winter greenery and textural diversity. Since the diplodia blight rarely effects native species, planting more native evergreens (like the two white pines added in 2004) would maintain the winter interest while resisting the blight.

One of the few new trees in the park, these pines were planted in memory of _____ who died on September 11, 2001 in the World Trade Center. Behind the grove are mature pine trees.

This zone also contains one of the steepest and most eroded slopes of the park. This area does have many trees planted as well as self seeded black cherry trees, but there is no understory, and erosion has left many exposed roots. The hillsides of this zone should be addressed in several different ways: where foot traffic is a problem, either add steps (or repair the ones that are already there) or create a barrier to prevent people from using the area as a shortcut. Where thin-soil erosion is the issue, using a combination of artificial (silt fences, jute blankets, etc.) and natural (planting shrubs and herbaceous vegetation) methods will be most effective in preventing more soil loss. Regardless of which method is used, severely eroded areas should be fenced to prevent foot traffic from adding to the problem and/or damaging erosion control infrastructure.

One tree of note in this zone is a 45" Turkey oak, growing in the southeast corner. This species, named for the country, not the bird, is native to southern Europe. Though they are hearty urban trees, they are not commonly found in New York City parks.



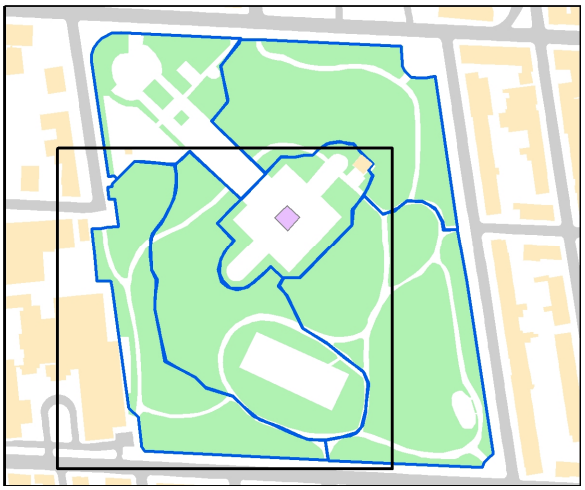

| Condition | Count | Percentage |
|---|---|---|
| Excellent | 106 | 67.5% |
| Good | 37 | 23.6% |
| Poor | 12 | 7.6% |
| Dead | 1 | 0.6% |
| Shaft | 0 | 0.0% |
| Stump | 1 | 0.6% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
| PRSE1 | Black cherry | 28 | 17.8% | 9.3 | 5 | 21 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| PINI | Austrian pine | 27 | 17.2% | 16.5 | 0 | 3 | 15 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| QUPA | Pin oak | 15 | 9.6% | 17.0 | 1 | 3 | 6 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| CEOC | Hackberry | 13 | 8.3% | 6.9 | 8 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PITH | Japanese black pine | 12 | 7.6% | 13.5 | 0 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MA2 | Crabapple | 11 | 7.0% | 11.4 | 3 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ULSP | Elm spp. | 6 | 3.8% | 17.6 | 0 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| ACPL | Norway maple | 5 | 3.2% | 22.1 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| TITO | Silver linden | 5 | 3.2% | 13.7 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| CRCR | Cockspur hawthorn | 4 | 2.5% | 10.3 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| QURU | Red oak | 4 | 2.5% | 29.1 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| FRAM | White ash | 2 | 1.3% | 12.5 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAFL | Japanese crabapple | 2 | 1.3% | 1.0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIRE | Red pine | 2 | 1.3% | 19.0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIST | White pine | 2 | 1.3% | 1.0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| QUCE | Turkey oak | 2 | 1.3% | 37.4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| TICO | Littleleaf linden | 2 | 1.3% | 11.9 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| dead | unidentifiable | 2 | 1.3% | 11.5 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACPS | Sycamore maple | 1 | 0.6% | 7.0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACSA2 | Silver maple | 1 | 0.6% | 24.0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AEHI | Horsechestnut | 1 | 0.6% | 22.0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AIAL | Ailanthus | 1 | 0.6% | 9.0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| COKO | Kouza dogwood | 1 | 0.6% | 4.5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GIBI | Ginkgo | 1 | 0.6% | 15.5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAPO | Osage orange | 1 | 0.6% | 12.5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MOAL | White mulberry | 1 | 0.6% | 48.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| OSVI | Ironwood | 1 | 0.6% | 15.2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHAM | Amur corktree | 1 | 0.6% | 19.5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIAB | Norway spruce | 1 | 0.6% | 1.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PIPU | Colorado blue spruce | 1 | 0.6% | 0.5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| STJA | Chinese scholartree | 1 | 0.6% | 24.5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 157 | (zone mean dbh=13.8) | | 27 | 48 | 42 | 23 | 10 | 5 | 0 | 2 | 0 | 0 | 0 |

## MAP 26. ZONE 5 SPECIES


**Common Tree Species**

- Chinese scholartree
- Elm spp.
- Norway maple
- Pin oak
- Austrian pine
- other species



## MAP 27. ZONE 5 TREE SIZE AND CONDITION


**Tree Condition and Size in Zone 5**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

# ZONE 6

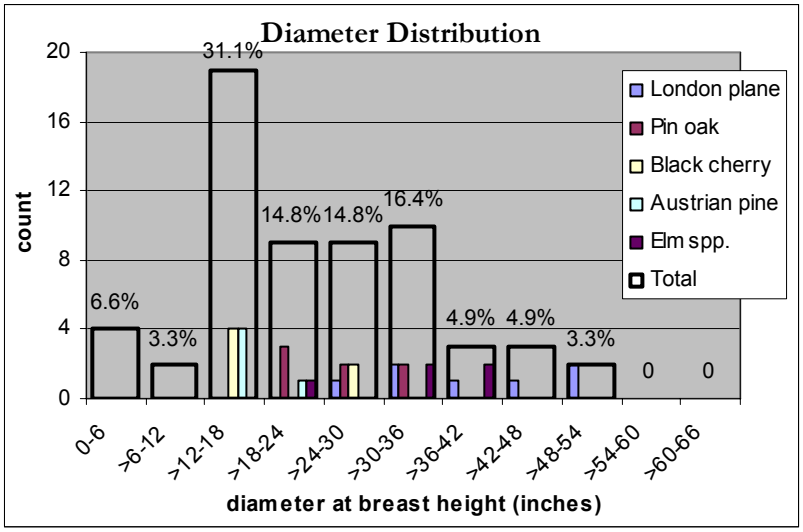
**Rotation year = 7**
**Total number of trees = 61**

This silver linden (#381) is split and hollow, has many exposed roots, and has undergone many "salvaging" measures including cabling, cementing the cavities, and wrapping wire around the trunk to prevent the cavity from filling with garbage. The tree continues to thrive.

Zone 6 is a low use zone internal to the park that includes the tennis courts, an open grassy area, the hillside to the south of the monument stairway, and several of the largest trees in the park. The tennis courts are frequently used, well maintained, and even well shaded. The area by the stairs should be planted with small trees and shrubs to control the current erosion problem. The rest of this zone is dominated by some very large, beautiful trees, with nearly no younger generation – of the six trees in the zone that are less than 12 inches in diameter, only one (a bigleaf linden) is a canopy tree species.

Many of the individual trees in this zone are in need of special attention. In particular, a 45" diameter silver linden in the center of the zone (#381, on map) is hollow, filled with garbage, wrapped in wire mesh, eroded at its base, and cabled in its canopy. This tree continues to thrive, however it should be closely monitored. Two of the twelve largest trees in the park are in this zone; both are London planetrees located near the monument.

Planting in zone 6 should focus on perpetuating the canopy. Several trees of a species that will eventually contribute a significant canopy could be planted in advance of those trees that will almost certainly die in the coming years.



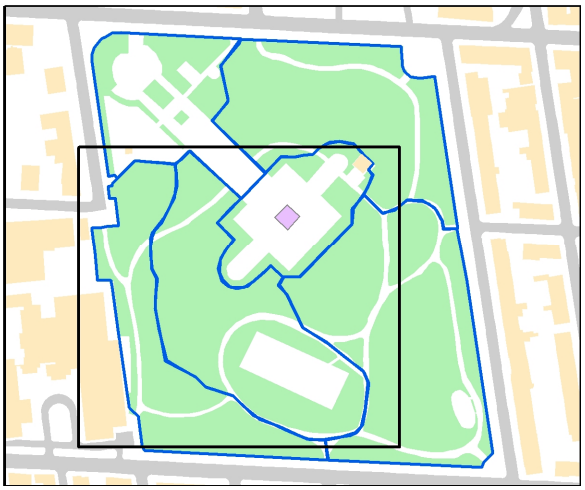

| Condition | Count | Percentage |
|---|---|---|
| Excellent | 53 | 86.9% |
| Good | 6 | 9.8% |
| Poor | 1 | 1.6% |
| Dead | 0 | 0.0% |
| Shaft | 0 | 0.0% |
| Stump | 1 | 1.6% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
| PLAC | London plane | 7 | 11.5% | 39.3 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 0 | 0 |
| QUPA | Pin oak | 7 | 11.5% | 25.5 | 0 | 0 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| PRSE1 | Black cherry | 6 | 9.8% | 19.7 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| PINI | Austrian pine | 5 | 8.2% | 17.0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ULSP | Elm spp. | 5 | 8.2% | 33.8 | 0 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| ZESE | Japanese zelkova | 4 | 6.6% | 15.9 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CACA | American hornbeam | 3 | 4.9% | 16.7 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GLTR | Honeylocust | 3 | 4.9% | 14.5 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CECA | Redbud | 2 | 3.3% | 2.9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LITU | Tuliptree | 2 | 3.3% | 35.0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| PIRE | Red pine | 2 | 3.3% | 20.3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| PYCA | Callery pear | 2 | 3.3% | 15.7 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| STJA | Chinese scholartree | 2 | 3.3% | 25.4 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TIPL | Bigleaf linden | 2 | 3.3% | 18.0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TITO | Silver linden | 2 | 3.3% | 43.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| ACPL | Norway maple | 1 | 1.6% | 27.0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| CEOC | Hackberry | 1 | 1.6% | 21.2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FRAM | White ash | 1 | 1.6% | 32.5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| LIST | Sweetgum | 1 | 1.6% | 16.7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MAFL | Japanese crabapple | 1 | 1.6% | 1.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHAM | Amur corktree | 1 | 1.6% | 34.0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| PIST | White pine | 1 | 1.6% | 1.0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 61 | (zone mean dbh=23.6) | | 4 | 2 | 19 | 9 | 9 | 10 | 3 | 3 | 2 | 0 | 0 |

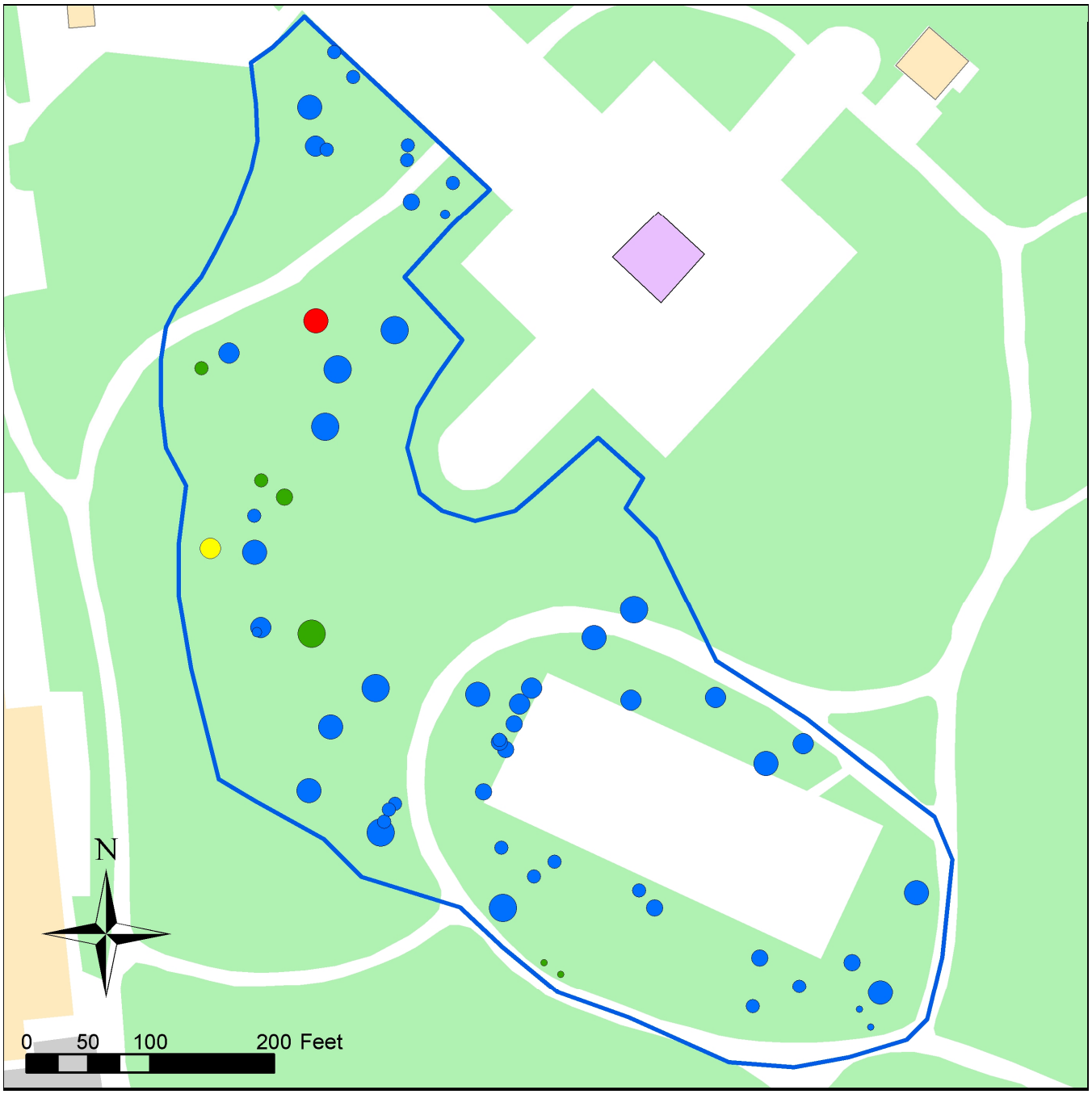
## MAP 28. ZONE 6 SPECIES


**Common Tree Species**

- London plane
- Pin oak
- Black cherry
- Austrian pine
- Elm spp.
- other species



## MAP 29. ZONE 6 TREE SIZE AND CONDITION




**Tree Condition and Size in Zone 6**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

## ZONE 7 – PERIMETER TREES

**Rotation year = 4**
**Total number of trees = 166**

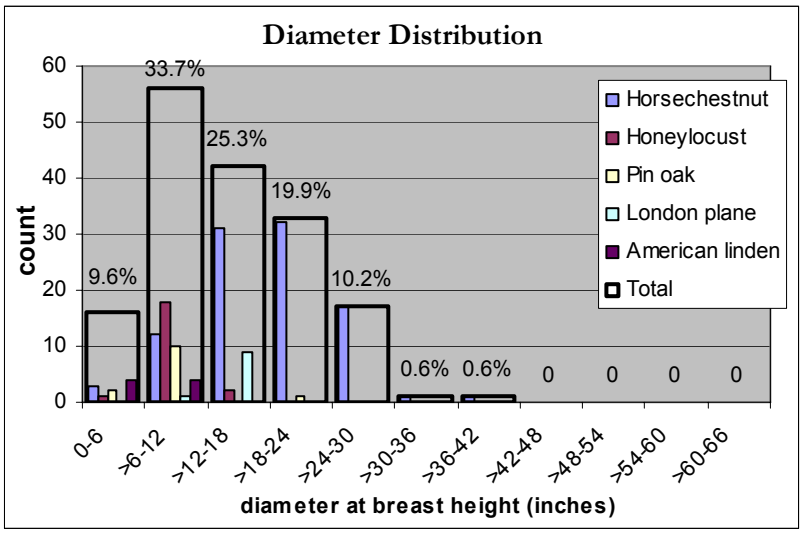
Fort Green Park is surround by city streets on three and half of its four borders. The other half border is shared with Brooklyn Hospital. One of the most distinctive features of the park perimeter is the horsechestnut allees that line two and a half of the streets. They were originally conceived by Olmsted and Vaux and were first installed in 1872. While it is unlikely that any of the original trees remain, 97 trees (71%) have been maintained as horsechestnuts. There have been ad hoc infill plantings in the allees with other species over the years including pin oak, linden, and honeylocust.

Horsechestnuts are one of the primary hosts of the Asian longhorned beetle, a pest that is currently infesting New York City trees and that was found only two blocks from Fort Greene Park. Not only does this mean that Fort Greene Park's horsechestnuts (and other susceptible species) should be inspected regularly for the beetle, it also means that future species for planting should be carefully selected. The City's current policy is not to plant ALB susceptible species in ALB infested areas, however, exceptions have been made for historically significant plantings. A case could be made that the horsechestnut allees surrounding Fort Greene Park are historically significant – they were part of an Olmsted and Vaux design and have been maintained for over a century. If the trees were regularly inspected, and if inoculations prove to be successful, planting horsechestnuts in the allees to maintain these historic streetscapes would not be unreasonable. The relative merits of other suitable substitutions should be considered along with the risks of maintaining the historic grove. There are currently 18 planting sites along the street, 13 of which are in the horsechestnut allee areas.

The Washington Park horsechestnut allee, one of Olmsted & Vaux' original design features for the park. Over the years some of the horsechestnuts have been replaced with other species, like the pin oak in the left foreground.

The two northern corners of the park have dense plantings of honeylocusts. After these trees were planted paving stones were added and now many of the trees have or will soon grow over them. These pavers should be removed at least around the bases of the trees. A better option might be to remove the pavers and concrete entirely, plant flowerbeds, and install permanent fences to protect them.

Finally, of all of the existing trees on the street, 27 were marked poor, and these should be inspected as soon as possible.




| Condition | Count | Percentage |
|---|---|---|
| Excellent | 73 | 44.0% |
| Good | 66 | 39.8% |
| Poor | 27 | 16.3% |
| Dead | 0 | 0.0% |
| Shaft | 0 | 0.0% |
| Stump | 0 | 0.0% |

| Species Code | Common Name | Count | Percentage | Mean d.b.h. | Diameter Distributions (inches) 0-6 | >6-12 | >12-18 | >18-24 | >24-30 | >30-36 | >36-42 | >42-48 | >48-54 | >54-60 | >60-66 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AEHI | Horsechestnut | 97 | 58.4% | 19.1 | 3 | 12 | 31 | 32 | 17 | 1 | 1 | 0 | 0 | 0 | 0 |
| GLTR | Honeylocust | 21 | 12.7% | 9.4 | 1 | 18 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| QUPA | Pin oak | 13 | 7.8% | 9.4 | 2 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PLAC | London plane | 10 | 6.0% | 14.6 | 0 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TIAM | American linden | 8 | 4.8% | 6.5 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TICO | Littleleaf linden | 6 | 3.6% | 7.0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TITO | Silver linden | 5 | 3.0% | 7.4 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FRPE | Green ash | 3 | 1.8% | 10.0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PYCA | Callery pear | 2 | 1.2% | 4.0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACRU | Red maple | 1 | 0.6% | 2.5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | 166 | (zone mean dbh=15.0) | | 16 | 56 | 42 | 33 | 17 | 1 | 1 | 0 | 0 | 0 | 0 |

## MAP 30. ZONE 7 SPECIES


**Common Tree Species**

- Horsechestnut
- Honeylocust
- Pin oak
- London plane
- American linden
- other species
- plantable sites

## MAP 31. ZONE 7 TREE SIZE AND CONDITION


**Tree Condition and Size in Zone 6**

| | | DBH | |
|---|---|---|---|
| Excellent | | | > 18 - 24 |
| Good | < 6 inches | | > 24 - 30 |
| Poor | > 6 - 12 | | > 30 - 36 |
| Dead/Shaft/Stump | > 12 - 18 | | > 36 |

# APPENDIX E. METADATA

"Metadata" refers to data and information that is necessary to find, understand, and replicate this study. All the information included in this plan can be found in hard copy and electronically at the Fort Greene Park Visitor Center, the offices of Central Forestry & Horticulture (Olmsted Center, Flushing, Queens), and in the Parks library at the Arsenal in Central Park. Below is an explanation of the in-field data recording procedure and where the data can be found, including a flow chart of the data.

## Data Collection Procedures Used

*Start a new file each day; name file using park initials and date (i.e. FG072403)

*You need at least 4 satellite contacts and a PDOP (position dilution of precision) of less than 6 – datalogger will not record points when there are too few satellites or too high a PDOP.

**Tree Point**

Collect data standing at the trunk. Wait at the spot until you have recorded at least 6 points. If you have to move off the site, you should pause the point collection, mark your site, then resume when you return to the site. If you are not picking up any satellites at the trunk, offset the point, recording the exact offset in the datalogger. Important – the offset should be recorded as the bearing of the tree from you to the tree, not vice versa. Record the offset distance to the nearest ¼ foot.

**Date Visited**

Automatically recorded by the unit.

**Unique tree number**

Sequentially number trees visited.

**Species**

Record species using the scientific name's species code (first 2 letters of genus and species)

**Tree Condition**

To determine the condition, rate the crown, branches, leaves, trunk, and roots individually on a scale of 1-7, sum the ratings then excellent = 25-35; good = 15-24; and poor = 5-14.

*Excellent*- full, well balanced crown and limb structure, minimal dead branches, leaves normal size and color, no dead/broken branches, trunk solid, bark intact, no exposed roots, healthy soil conditions.

*Good*- Crown uneven or misshapen, some mechanical damage to bark or trunk, some sign of insect or disease, leaves somewhat below normal size and quantity, some dead or broken branches (less than half the tree), some mechanical injury to roots, some exposed roots.

*Poor*- Large dead limbs with over one-half of the tree dead/removed, large cavities, drastic deformities, leaves significantly below normal size and quantity, severe insect or disease damage, girdling and kinked roots, compacted or waterlogged soil, significant root exposure.

*Dead*- dead tree, leaves absent, twigs brittle.

*Shaft*- All branches removed, trunk left standing, sprouts may or may not be evident.

*Stump*- Stump shorter than breast height, leaves entirely absent or present only on stump sprouts.

**Soil**

*Aerated*- not compacted

*Compacted*- usually bare soil, highly used

*Eroded*- exposed roots and no humus layer; soil has been washed away and roots are visible

**Drainage**

*Well drained*- no standing water after heavy rain

*Poorly drained*- surface water due to "natural" conditions

**Site Condition**

Record the condition of the area in which the tree is growing

*Lawn*- grass growing to base of tree or close to base

*Tree pit*- within paved area

*Bare soil*- little to no vegetation growing around the tree (consider a 3-5 ft radius around trunk, depending on tree size); different from "eroded" under "Soil" because soil may be eroded or intact

*Mulch*- in mulched bed or mulched within lawn area

*Planted bed*- in landscaped area with understory shrubs and herbaceous material

**Location**

Record where tree is growing

*Perimeter*- street tree around park

*Playground*- within a playground inside the park

*Park*- all other areas

**Use**

*Passive*- any tree in a meadow, open space, or lawn that is used for passive activities such as sun tanning, reading, light ball playing. Trees near paths but within meadows are considered passive.

*Active*- any tree within the confines of basketball courts, baseball fields, playgrounds, picnic, plaza, and barbeque areas. Also trees along un-paved paths.

**Access**

*Open*- Large trucks can easily access the tree

*Limited*- gates, fences, or structures may impede access.

**Relationship**

There are 5 relationship fields. Record the tree's relationship to various park features. Record features within 10 feet of the trunk and features within a 50-foot radius of the trunk that may impact the tree or that may be impacted by the tree were it to fall.

Within 10 feet from the trunk record: benches, utilities, built structures, paths/sidewalks, plazas, lampposts, water bodies, fire hydrants, water fountains, barbecues, parking lots, picnic areas, roads, flagpoles, drains, fences, and walls.

Within 50 feet from the trunk record: tennis courts, baseball fields, basketball courts, handball courts, the swimming pool, and playgrounds.

**Diameter at Breast Height (DBH)**

Using a diameter measuring tape, record the diameter at 4.5 feet. At tree is multi-stemmed if it forks below 1 foot. If multi-stemmed, then record the average of the diameters and note YES in the multi-stemmed field. If the tree forks between 1 and 4.5 feet it has a split leader – measure the trunk 12 inches above the split and record the sum of the stems. Note "SL" in the Comments field. If the ground is sloped, measure the DBH while standing on the uphill side. Record to the nearest half-inch.

**Comments**

Record split leader (SL), bark damage, trunk wound, decay, cavity, nails or staples, trunk slashed, insect damage, etc.

**Maintenance Needs**

Record current, obvious needs, like prune, remove, erosion control, or inspect.

### Data Dictionary Suggestions

Because the protocol for data collection was not designed with this particular park's issues in mind, there are a few areas that could use further research. For example, the GPS data dictionary did not provide space to record things like substrate (rocks, thin soil, good soil) and whether or not the tree was planted. Without this data it is difficult to quickly identify which trees are new plantings and which are naturally regenerating thickets. Also, with no "damage" field issues like fire damage, vandalism, and limb damage were not consistently recorded. When data dictionaries are being developed the goal should be to minimize the use of a "comments" section, as it these text fields are difficult to query (for example, several people worked on the data collection in Fort

Greene Park and each recorded trunk scars differently and inconsistently; as “bark damage,” “trunk damage,” “scar,” or “vandalism”). In parks with several thousand trees, scrolling through the data set to look for errors is a time consuming and tedious process.

## GPS Settings Used in TerraSync 2.30

### Logging Settings

Log Velocity Dat – yes
Log SuperCorrect Data – yes
Log QA/QC Data – No
Antennae Height – 5.5 ft (depends on height of person)
Allow Position Update – Confirm
Confirm End Feature – No (optional)
File Name Prefix – (not changing)
Between Feature Logging
    Style – Time
    Interval – Off

### GPS Settings

GPS Receiver Port – COM1 = 9 pin, COM2 = 26 pin
Productivity/Precision Scale – 50/50 (in middle)
DOP Type – PDOP
Max PDOP – 6.0
Min SNR – 6.0
Min Elevation – 15º (check base station elevation)
Velocity Filter – Off

### Real Time Settings

Choice 1: Integrated Beacon
Choice 2: Integrated WAAS
Choice 3: Use uncorrected GPS
Real Time age limit – 1 min

### Coordinate System

System – US State Plane 1983
Zone – NY/Long Island 3104
Datum – NAD 1983
Altitude reference – HAE
Coordinate Units - Feet
Altitude Units – Feet
Display USNG – Off

### Units

Distance Units – Feet
Area Units – Square Feet
Angle Units – Degrees
Offset Format – Horizontal/Vertical
North Reference – Magnetic
Magnetic Declination – Auto

### External Sensors

Not using

**Reload resets factory defaults** - NO!

**Data Dictonary**

Log rate for points – 5 second intervals

Minimum positions – 6

### Post-Collection Data

Several fields were added to the data set through spatial analysis; all data was mapped using ESRI's ArcGIS 8.3.

**Management Zone** – the park was divided into seven management zones, and each tree falls into one of the seven.

**Path Proximity** – trees growing within 30 feet of a path were marked 1, other trees marked 0.

**Maintenance Priority** – trees were ranked High, Mid, or Low priority based on their proximity to a path, health, and needs

**Human Damage** – based on the comments and maintenance fields human damage (1) was determined

**Planting** – there are several major single-species plantings in Fort Greene Park. Trees that fall into these areas were noted.

### Other Shapefiles

Tree canopy was measured for 170 trees using the GPS to create polygons that correspond to individual trees. This data was used to relate d.b.h. to canopy area and then predict canopy cover for the entire park.

Other shapefiles were developed on the desktop using aerial photos and field observations.

### Data Archive

Two CDs contain the digital information used in this report. They can be found in the Parks Library at the Arsenal, in the Fort Greene Park Visitors Center, and at the Central Forestry & Horticulture offices in Olmsted Center.

On a CD titled "Fort Greene Park Urban Forest Management Plan, December 2004" the following information can be found:

- FortGreeneParkUFMP.pdf – a PDF of this management plan.
- fortgreeneanalysis.xls – A Microsoft Excel 97 file of the data and analysis used in this management plan
- fortgreenetrees.csv – A CSV (comma delimited text) file of the data for all 917 trees in Fort Greene Park, as recorded between 2001 and 2002.
- fortgreeneparkufmp.txt – a text file of the body of this management plan.
- A folder titled "GPS Information" with daily GPS files (.cor) of the trees surveyed.

An additional CD titled "Fort Greene Park GIS Information, December 2004" contains the following:

- A folder titled "Maps" that contains .mxd files for each map in this document.
- A Personal Geodatabase with the layers used to make the above maps.

# APPENDIX F. NATIVE SPECIES PLANTING SUGGESTIONS

### Species Planting Suggestions

The information presented here was taken from *Native Plants for Metropolitan New York Natural Areas*, written by Margaret B. Gargiullo in 2002 as an internal Parks document. The entire document is very relevant to planting in Crotona Park, although only the most pertinent sections are reproduced here – the list of native trees, their site requirements, and brief descriptions. To obtain a copy of the book contact NRG or Central Forestry.

### MISSION

This book was compiled to aid landscape architects, designers, land managers, native plant growers and restorationists in the New York City Metropolitan area to realize the full scope of plant materials that are native to this region. I hope that this document will help promote propagation and planting of a wider range of native plants and aid in the choice of appropriate plat materials for mitigation and restoration projects.

As more land is lost to development, there is less living space for natural populations of native plants. In order to prevent loss of native species, as their habitats are destroyed, these plants must be returned to appropriate habitats in restoration projects. It is no longer likely that native plants will repopulate naturalizing sites on their own, because seed sources are not available. It is incumbent upon those of us who are revegetating natural areas to restore not only the dominant plants but also the minor elements of the plant community so they will not become extinct in this region.

### TREES OF THE NEW YORK REGION

Key to Plant Characteristics

Drought/Water Tolerance (adapted from Army Corps of Engineers)

OBL = Obligate wetland plant; >99% in standing water or wet soil

FACW = Facultative wetland plant; 67-99% found in wetlands; can be in wetland or moist upland soil

FAC = Facultative plant; 34-66% in wetlands; sometimes in wetlands, tolerate moist upland soil

FACU = Facultative upland plant; 1-33% in wetlands; tolerate moist to dry soil

UPL = Upland plant; 0% in wetlands; almost never in wetlands, tolerate dry soil

** a plus indicates that the plant is less drought tolerant, a minus indicates that it is more drought tolerant.

Other characteristics

A = needs or tolerates acidic soil

B = attractive to butterflies or their larvae

C = colonial

D = dioecious (sexes on different plants – plant one male for every 4-5 females)

E = evergreen

F = good fall color

H = attractive to hummingbirds

K = needs limestone (calcareous) soil; should tolerate concrete debris

N = legumes and other nitrogen fixers form root nodes containing bacteria that take nitrogen from the atmosphere and transorm it into compounds that plants can use. Will improve sterile soil.

S = shade tolerant

s = at least moderately tolerant of salt

Shade tolerance index: very tolerant = 8-10; tolerant = 6-7.9; moderate = 4-5.9; intolerant = 2-3.9; very intolerant = 0-1.9

**Trees Requiring Moist Soils** (* indicates that plant is usually available and common in NYC)

**Acer negundo* (box elder, ashleaf maple): FAC+, A, K, s. to 60 ft. soil pH 5-8. Shade index 1.8. Primary or secondary species for restoration on flood plains and in moist fill soils in open sites.

**Acer rubrum* (red maple): FAC, A, F, S. to 100 ft. soil pH 4.5-7. Shade index 6-8. Primary species for restoration of swamp forests, flood plains, wetland mitigations. Street tree.

**Acer saccharinum* (silver maple): FACW, A. to 90 ft. soil pH 4-7. Shade index 5.8. Primary species for restoration of swamp forests, flood plains, wetland mitigations. A fast growing tree to establish light shade and shelter while slower growing species, such as swamp white oak, become established.

*Betula nigra* (river birch): FACW, A. to 75 ft. soil pH 4-6.5. Shade index 2-4. Secondary species for restoration of swamp forests, flood plains, stream and river bank stablilizations, wetland mitigations.

*Chamaecyparis thyoides* (Atlantic white cedar): OBL, A, E. to 75 ft. soil pH 3-5.5. Shade index low. Minor element for restoration of outer edges of marshes or acid bogs. Park tree or evergreen screen in full sun, moist to wet soil.

*Fraxinus nigra* (black ash): FACW, A, F, K. to 75 ft. soil pH 4.4-8.2. Shade index 2-4. Secondary species for increasing diversity in swamp forest and wetland mitigations.

*Fraxinus pennsylvanica* (green ash): FACW, F, K. to 75 ft. soil pH 6-8. Shade index 2-4. Secondary species for swamp forests, flood plain restorations, and wetland mitigations.

*Larix laricina* (tamarack, American larch): FACW, A. to 60 ft. soil pH 4.5-7.5. Shade index 0.8. Secondary species or minor element for swamp forest restoration and wetland mitigations.

**Liquidambar styraciflua* (sweetgum): FAC, F. to 100 ft. soil pH 6-7. Shade index 2-4. Primary component of swamp forests, flood plain forests. Street or park tree.

*Magnolia virginiana* (sweet-bay magnolia): FACW+, A, S. to 60 ft. soil pH 5-6. Shade index high. Minor species for swamp forest restoration and wetland mitigation where appropriate.

*Nyssa sylvatica* (black tupelo): FAC, A, D, F, S. to 90 ft. soil pH 5-6. Shade index 2-4. Secondary species. Street or park tree.

**Platanus occidentalis* (American sycamore): FACW, K. to 150 ft. soil pH 6.5-8.5. Shade index intermediate. Primary or secondary species. Street or park tree.

*Populus balsamifera* (balsam poplar): FACW. to 80 ft. Secondary species for flood plain restoration, river and stream banks.

**Populus deltoides* (eastern cottonwood): FAC, B, s. to 150 ft. soil pH 5.5-7.5. Shade index 2.2. Primary species for flood plain restoration.

*Populus heterophylla* (swamp cottonwood): FACW+, A, B, C, D. to 60 ft. soil pH 4.6-5.9. Shade index 2.2. Minor element in swamp forest restorations. Plant both sexes.

*Quercus bicolor* (swamp white oak): FACW, A, B. to 70 ft. soil pH 5-7.5. Shade index 4-6. Secondary species for increased diversity, aesthetics, and wildlife value in restoration of swamp forests, flood plain forests, stream banks.

**Quercus palustris* (pin oak): FACW, A, B. to 80 ft. soil pH 4.5-6.5. Shade index 0-2. Primary species in swamp forest restorations, flood plains. Street and park tree.

*Quercus phellos* (willow oak): FAC+, B, D, K. to 80 ft. soil pH 4.5-6. Shade index low. Secondary species for flood plain and river bank restorations.

*_Salix nigra_ (black willow): FACW+, B, D, K. to 40 ft. soil pH 6-8. Shade index 1.4. Primary species for flood plain and river bank restorations.

_Thuja occidentalis_ (northern white cedar): FACW, E< K. to 45 ft. soil pH 6-8.5. Shade index 4-6. Minor element in wetland mitigations, evergreen screens.

**Trees Tolerating Drier Soils**

_Acer pensylvanicum_ (moosewood, striped maple): FACU, S. to 36 ft. Minor restoration species north and west of NYC.

_Acer saccharum_ (sugar maple): FACU, F, S. to 100 ft. soil pH 5.5-7.3. Shade index 10. Secondary species for upland forests.

_Acer spicatum_ (mountain maple): FACU-, S. to 30 ft. Minor species for upland forests north and west of NYC.

_Betula alleghaniensis_ (yellow birch): FAC, B. to 80 ft. soil pH mildly acidic. Shade index low. Minor element in forest restoration esp. north of NYC. Park tree.

*_Betula lenta_ (black birch, sweet birch): FACU, A, B, F. to 70 ft. soil pH 4-5. Shade index 4-6. Secondary species for increased diversity and aesthetics in forest restoration. Park tree.

_Betula papyrifera_ (paper birch): FACU, A, B, F, K. to 80 ft. soil pH 5-8.5. Shade index moderate. Minor element in forest restoration. Park tree.

*_Betula populifolia_ (gray birch): FAC, A, B, F. to 30 ft. soil pH 5-7.5. Shade index 1. Primary species for restoration on open, bare mineral soil. Goes well with Eastern red cedar and little bluestem or broom sedge. Park tree.

_Carpinus caroliniana_ (American hornbeam, ironwood): FAC, A, B, F, S. to 40 ft. soil pH 4-7.5. Shade index 8-10. Secondary or minor species for increased diversity and aesthetics of forest understories. Park tree in moist, well-drained soil.

_Carya cordiformis_ (bitternut hickory): FACU+, B, F, K. to 90 ft. soil pH 5.5-8.5. Shade index 5.8. Secondary species in upland forest. Park or street tree.

_Carya glabra_ (pignut hickory): FACU-, B, F. to 90 ft. soil pH 5.5-8.5. Shade index 5.8. Secondary species in upland forests. Park or street tree.

_Carya ovalis_ (sweet pignut-hickory, false shagbark): UPL, B. to 80 ft. Secondary species in upland forests. Park or street tree.

_Carya ovata_ (shagbark hickory): FACU-, B, F. to 90 ft. soil pH 6-6.5. Shade index 5.4. Secondary species in upland forests. Park or street tree.

_Carya tomentosa_ (mockernut hickory): UPL, B, F. to 80 ft. soil pH 6-6.5. Shade index 2-4. Secondary species in upland forests. Park or street tree.

*_Celtis occidentalis_ (common hackberry): FACU, B, K. to 70 ft. soil pH 6.5-8.5. Shade index 4-6. Primary species for vegetation of fill soils with concrete debris or high pH. Street or park tree.

_Cornus florida_ (flowering dogwood): FACU-, B, F, S. to 40 ft. soil pH 5.5-7. Shade index 8-10. Secondary or minor understory species. Park tree.

_Diospyros virginiana_ (persimmon): FAC-, C, D. to 40 ft. soil pH 6-6.5. Shade index 2-4. Minor element for increased wildlife value, diversity, and aesthetics. Plan female and male trees. Slope stabilization.

_Fagus grandifolia_ (American beech): FACU, A, S. to 90 ft. soil pH 4.1-6.5. Shade index 9.3. Secondary species. Late successional tree that comes into maturing forests.

*Fraxinus americana* (white ash): FACU, A, D, F. to 80 ft. soil pH 5-7.5. Shade index 6-8. Secondary species, should tolerate some fill soils. Park tree. Plant both sexes.

*Juglans nigra* (black walnut): UPL, A, B, K. to 100 ft. soil pH 4.6-8.2. Shade index 4. Secondary species for vegetation of open fill sites. Park tree.

**Juniperus virginiana* (eastern red cedar): FACU, A, B, D, E, K. to 60 ft. soil pH 4.7-8.5. Shade index 0-2. Primary species for vegetation of open fill, sandy dredge soils. Plant both sexes (4-5 females for each male).

**Liriodendron tulipifera* (tulip tree): FACU, B, F, H. to 120 ft. soil pH 6-6.5. Shade index 4-6. Primary species for sites with good quality moist soil. Park tree.

*Morus rubra* (red mulberry): FACU, K, S, s. to 60 ft. soil pH 6.3-8. Shade index 4-6. Secondary Secondary species for forest restoration. Should tolerate concrete debris. Plant both sexes.

*Ostrya virginiana* (hop hornbeam): FACU-, A, B, K, S. to 30 ft. soil pH 4.2-8. Shade index 8-10. Understory tree for increased diversity. Park or street tree. Good subsitute for Zelkova.

*Picea rubens* (red spruce): FACU, A, E. to 90 ft. soil pH 4-5.5. Shade index 8-10. Secondary species for rock northern NYC metro regions. Park tree in northern suburbs.

*Pinus echinata* (shortleaf pine): UPL, A, E. to 90 ft. acidic soil. Minor element in sandy soil south of Staten Island.

*Pinus resinosa* (red pine): FACU, A, E. to 100 ft. soil pH 4-6.5. Shade index 2.4. Secondary species for reforestation of rocky or pine barrens habitats, northern NYC metro region. Park tree in northern suburbs.

**Pinus rigida* (pitch pine): FACU, A, E. to 60 ft. soil pH 3.5-6.5. Shade index 0-2. Primary species on sandy, coastal plains. Should work for gravelly or sandy bare mineral soil.

*Pinus strobus* (white pine): FACU, A, E. to 110 ft. soil pH 4-6.5. Shade index 4.4. Secondary or minor element in upland forests. Does well on somewhat acid fill soils. Park tree.

*Pinus virginiana* (Virginia pine): UPL, A, E. to 30 ft. soil pH 4.6-7.9. Shade index low. Minor element in sandy, acidic soils along with pitch pine.

**Populus grandidenata* (big-toothed aspen): FACU-, A, B, C. to 60 ft. soil pH 5-6.3. Shade index 1. Primary species in well-drained mineral soil. May be of use as a "nurse tree" for sheltering slower growing species.

**Populus tremuloides* (quaking aspen): UPL, A, B, C. to 50 ft. soil pH 4.5-6.5. Shade index 0.7. Primary species in well-drained mineral soil. May be of use as a "nurse tree" for sheltering slower growing species.

*Prunus americana* (hedge plum): FACU-, B, C. to 24 ft. soil pH 6.5-7.5. Shade index 2-4. Minor element in old fields or open areas. Park tree.

*Prunus pensylvanica* (pin cherry): FACU-, B, C. to 45 ft. soil pH 6-7.5. Shade index 0.7. Secondary or minor species in old fields, eroded open slopes.

*Prunus serotina* (wild black cherry): FACU, A, B, F, K. to 75 ft. soil pH 6-8. Shade index 2.4. Secondary species in fill, open areas, eroded, open slopes, burns, wildlife corrideors. Concrete rubble-demolition debris.

*Prunus virginiana* (chokecherry): FACU, A, B, F, K. to 30 ft. soil pH 6.5-7.5. Shade index 4-6. Secondary species for open areas, slope stabilization, wildlife corridors. Should tolerated well-drained fill soils.

**Quercus alba* (white oak): FACU-, A, B, F. to 75 ft. soil pH 6-7.5. Shade index 5.7. Primary or secondary species for large gaps, old fields. Park tree.

**Quercus coccinea* (scarlet oak): UPL, A, B, F. to 75 ft. soil pH 6-6.5. Shade index 2-4. Primary or secondary species for large gaps, old fields, rocky slopes, in well-drained native soils. Park or street tree.

*Quercus marilandica* (blackjack oak): UPL, A, B. to 50 ft. soil pH 4-5. Shade index 2-4. Primary or secondary species in oak barrens, pine barrens, and back dune coastal woodlands.

*Quercus muhlenbergii* (Chinquapin, yellow oak): UPL, A, C, K. to 50 ft. soil pH 5-8.5. Shade index low. Secondary species in fill with concrete debris.

**Quercus prinus* (chesnut oak): UPL, A, B. to 70 ft. soil pH 6-6.5. Shade index 4-6. Primary or secondary speceis for large gaps, old fields, rocky slopes, in well-drained native soils. Park or street tree.

**Quercus rubrua* (red oak): FACU-, A, B, F. to 90 ft. soil pH 4.5-6.5. Shade index 7.8. Primary species for upland gaps. Park or street tree.

*Quercus stellata* (post oak): UPL, A, B. to 60 ft. soil pH 4.6-6.5. Shade index 2-4. Secondary or primary species in sandy soil with pitch pine and blackjack oak.

*Quercus velutina* (black oak): UPL, A, B. to 80 ft. soil pH 6-6.5. Shade index 6-8. Secondary or primary species for restoration of open, disturbed areas, mineral soil, eroded slopes.

*Sassafras albidum* (sassafras): FACU-, A, B, C, D, F. to 50 ft. soil pH 6-7. Shade index 2-4. Secondary species for revegetation of open, disturbed areas, mineral soil, eroded slopes.

*Tilia americana* (American linden, basswood): FACU, S. to 80 ft. soil pH 6.5-7.5. Shade index 8. Minor element for increased deversity in moist, sheltered, or partly shaded sites. Park or street tree.

# APPENDIX G. TREE PROTECTION GUIDELINES

**Parks & Recreation**

## CAPITAL PROJECTS PERMIT—TREE PROTECTION

1. **Design provisions**. Tree protection begins in the planning and design stages of every project. From decisions made about utility placement and grading, to the location of curbs and equipment and work staging areas, the amount of damage that trees sustain throughout the construction process is often determined on paper long before construction begins. A critical element of tree protection is the protection of the soil and the root systems growing within that soil. Root systems often extend far beyond the dripline of the tree canopy. Disturbance of the root system can result in severe injury to the tree. The critical root zone is the ground area surrounding a tree or group of trees that must be protected in order to avoid serious damage to that tree(s). The area defined as the tree protection zone is the designated critical root zone of a tree or group of trees. To protect the critical root zones the following standards shall apply.
    a. **Tree consultant.** Parks may require the permittee to hire a Consulting Arborist during phases of design and construction [see specification].
    b. **Site protection plan.** Parks will require the submission of a site protection plan prior to the issuance of a construction permit. For details of the tree protection plan see Section 7 below.
    c. **Tree removal.** No trees shall be removed without the written permission of the Agency, and without a separate permit from the Borough Forestry division. Restitution for any tree removals shall be calculated according to the Basal Area Replacement formula (see Section 6 below).
    d. **Tree protection zone(s).** The protection zone of a specimen tree or stand of trees shall be the *greater* of (1) the total area beneath the tree(s) canopy as defined by the farthest canopy dripline of the tree(s); or (2) the total area of the circle created by measuring one foot radius from the trunk for every inch of the tree's diameter at breast height; or (3) as directed by the Agency. Trees that are known to be particularly sensitive to construction and trees with narrow growth habits may require larger tree protection zones.
    e. **Utilities and grading.** In general, all utility siting and grading plans should avoid tree protection zones.
    f. **Site activities.** Construction site activities such as access routes, staging areas, materials and equipment stockpiling, truck or tool washing, etc. shall be arranged as to prevent disturbances to the tree protection zones within or outside of the contract limit line.
    g. **Curb and pathway installation.** Avoid curb installation adjacent to existing trees. Consider soft surfaces for paths near trees. If curb replacement is necessary, hand form the curbs adjacent to tree roots rather than excavating with machinery for mechanical forms.
    h. **Tree protection zone disturbances.** No disturbance shall occur within the protective zone of individual trees or stands of trees without prior approval of the agency.
2. **General construction provisions**. Soil compaction is difficult or impossible to reverse. Compaction reduces the amount of oxygen, water, and nutrients available to trees, and damages fine roots (most of which occur in the top 6 to 8 inches of the soil). To protect trees during construction the following general provisions shall apply. **Under no circumstances shall storage of equipment or material be permitted within the CRZ.**
    a. **Soil protection.** Areas where there is likely to be soil and/or root damage inside or outside of the tree protection zone due to the passage of heavy equipment shall be covered with at least six inches of mulch and/or plywood sheets, as specified by the Agency. Mulch should be maintained during the course of construction and removed after the end of construction. Removal shall be by hand or as specified by the Agency.
    b. **Erosion control.** Appropriate soil erosion and sediment control measures shall be installed outside of the tree protection zone(s) to prevent sedimentation from reaching the designated tree protection zone(s). Erosion control measures must be maintained in good working order for the duration of the construction project and/or until all site development activities have ceased.
    c. **Tree contractor qualifications.** Tree work is to be performed by an arborist holding certification from the International Society of Arboriculture (ISA). The Agency is to receive notification 48 hours before any tree work is to begin.
    d. **Overhead clearance.** All contact between equipment and overhead tree limbs should be avoided. Bending or breakage of limbs is prohibited. If clearance pruning is proposed, it shall not take place

without the written permission of the Agency, and then shall only be performed with professional equipment as per the Agency's standards and specifications for such work. [see specifications].

e. **Excavation and trenching.** Roots over 1 inch in diameter within the site construction limits shall not be cut without the written permission of the Agency and under the supervision of an approved arborist.

f. **Irrigation.** All trees within the limits of the construction site are to be watered to a depth of at least one (1") inch (the equivalent of 750 gallons of water per 1000 square feet of tree protection zone), once a week with soaker hoses or as directed by the Agency. If a water source is unavailable at the site, then the contractor must provide tree irrigation bags or a water truck to apply the requisite amount of water. In addition, watering shall be performed according to the provisions in Section 4.c.

g. **Runoff.** No pooling of water or continuous running water shall occur within the tree protection zones other than that during the irrigation process.

3. **Protective barriers**. Tree roots can extend up to five times the dripline of the tree. Trees of different species, age, and/or condition may require wider zones of protection. Tree decline after construction is primarily a result of damage to tree root systems. Mechanical damage to tree trunks is also very destructive and can inhibit the transport of nutrients and water within the tree, as well as allow entry of decay and diseases. The following provisions for tree trunk and zone protection shall apply.

   a. **Tree trunk protection.** Tree guards with tree wraps shall be installed on all trees within the contract limit line or limits of the construction zone. [See specification].

   b. **Root zone protection.** Protective fencing shall be installed along the perimeter of the tree protection zones for individual trees or groups of trees within the contract limit line or limits of the construction zone.

   c. **Fencing.** Fencing materials shall follow Parks specifications and standards and shall be construction (chain link) fencing, or orange polyethylene (snow) fencing or range fencing, as specified by the Agency. The minimum height of fencing shall be four feet (4').

   d. **Signage.** All tree protection fenced zones shall be so indicated with signage posted visibly on the fenced in area. Signs are intended to inform subcontractors and the public of the tree protection process. (Wording for sign—"tree protection zone")

   e. **Installation and maintenance.** All protective barriers must be installed prior to and maintained in good working condition throughout the construction period. Barriers can not be moved or removed until the end of the construction period and/or until all site development activities have ceased, unless prior written approval is obtained from the Agency.

4. **Tree protection zone encroachment**. No encroachment of the designated tree protection zones shall occur without the written permission of the Agency, and without the on-site presence of the Agency's representative or an approved arborist. If encroachment is permitted, the following preventative measures shall be employed.

   a. **Soil protection.** To mitigate soil compaction the tree protection zone must first be mulched with a minimum 6- inch layer of mulch and/or plywood sheeting, as specified by the Agency. Mulch should be maintained during the course of construction and removed after the end of construction. Removal shall be by hand or as specified by the Agency.

   b. **Methods of excavation.** Any excavation for utility or infrastructure installation within a tree protection zone or elsewhere on the site as designated by the Agency shall be done by hand or pneumatic excavation, or micro tunneling [see specifications]. Trenching shall not occur within the tree protection zone. Roots over 1 inch in diameter shall not be cut without the written permission of the Agency, either inside or outside of the tree protection zone. All roots shall be pruned according to ISA standards using appropriate tools to make clean cuts. Use of heavy equipment such as a backhoe to cut roots shall be prohibited.

   c. **Treatment of exposed roots.** Where such excavation does occur for the removal of existing features or the installation of new work, the excavated area shall be backfilled immediately and/or roots shall be kept constantly moist with burlap covered with white plastic. Burlap shall be checked a minimum of two (2) times a day, once in the morning and once in the afternoon, for a maximum of forty-eight (48) hours, until backfill is complete as directed by the Agency. If directed, soaker hoses shall be installed to facilitate properly moist conditions of excavated areas.

   d. **Removal of existing infrastructure.** Exercise extreme care in removing concrete or asphalt within the tree protection zone, lifting rather than dragging paving pieces. Tools and equipment for this activity shall be approved by the Agency prior to the start of excavation. Protect exposed surface roots immediately with a six-inch layer of mulch irrigated as above in 4.c.

   e. **Planting.** Planting beds that are installed within tree protection zones can only be done with the written permission of the Agency and the presence of a Consultant Arborist. All excavation and plant

installation is do be done by hand, with minimal soil disturbance. No roots over 1-inch in diameter shall be cut. Plants shall not be placed within 3 feet of the tree trunk. All provisions of Section 5 (below) shall apply.

5. **Grade changes**. Grade changes are severely damaging to trees. Soil removal can result in the loss of tree roots, many of which occur within the top six to eight inches of the soil. The addition of soil can smother tree roots, by reducing the amount of water and oxygen reaching the soil area where roots occur.
    a. **Grade reduction.** Soil removal within the tree protection zone is prohibited without the written approval of the Agency. Soil removal method to be determined by the Agency. Removal shall be performed under the supervision of an approved arborist or an Agency representative.
    b. **Grade increase.** Fill up to three inches *may* be permitted with the written approval of the Agency. Fill exceeding three inches shall not occur without the prior installation of an aeration system or other detail approved by the Agency, such as a tree well, retaining wall, terracing, or other such mechanism. [see specifications].
6. **Site restoration**. At the completion of the construction project and in response to field conditions, any of the following site restoration/mitigation measures may be required by the Agency in addition to those specified in the tree protection plan. These measures shall be assumed at the expense of the permittee, and shall not be done without the approval of the Agency.
    a. **Soil analysis.** Soil testing may be required to determine fertilization and soil amendment applications.
    b. **Compensatory soil decompaction**/enrichment (scarification, vertical mulching and/or fertilization, radial trenching). [see specification].
    c. **Soil aeration**, i.e. the injection of air or pressurized water into the soil (Terravent or other similar method, see specification).
    d. **Pruning** of dead or diseased tree branches, and/or dead tree removal.
    e. **Root collar excavation**, to remove any soil that accumulated around the base of the tree during construction.
    f. **Tree irrigation**, for up to one year after the end of construction [as per specification].
    g. **Mature tree regeneration**, i.e. Cambistat injection [see specification].
    h. **Soil replacement** in eroded areas.
7. **Remedial actions**.
    a. **Tree/plant injury.** The permittee shall assume, at his own expense, any remedial work such as pruning, watering, fertilizing, or soil compaction mitigation required and/or necessary to prevent loss of plant material when trees and shrubs are injured by the permittee and or a subcontractor, as determined by the Agency. This work shall be accomplished under the Agency's standards and specifications for such work.
    b. **Tree destruction.** Any trees damaged during the course of construction shall be replaced according to Section 6.c. below. The monetary assessment shall be the difference (in tree equivalents) between the tree's ISA appraisal before and after damage. The removal of a tree without a permit is a criminal misdemeanor punishable by a fine not to exceed $15,000 and/or imprisonment for up to one year, in addition to civil damages.
    c. **Tree replacement.** Restitution for any permitted tree removals shall be made according to the Basal Area Replacement formula, with adjustments for tree condition as per the International Society of Arboriculture appraisal method if determined by the Agency.
    d. **Tree protection deficiencies.** In addition to the remedial actions described above, failure to follow these tree protection guidelines will result in assessment of liquidated damages of $500 for each provision that is deficient. When a tree protection deficiency is identified, it must be remedied within 24 hours of notification by the Agency. Failure to correct the deficiency within this timeframe may result in an additional assessment of liquidated damages of $1,000 for deficiency. If a third notification is required for a deficiency, the permitee will be assessed an additional $2,500 per deficiency.
8. **Site protection plan requirements**. A Site Protection Plan shall be formulated by the permittee and approved by the Agency before a permit is issued. All provisions for tree and site protection on the site must conform to the Agency's current standards and specifications. The plan shall be submitted as a separate drawing to include the following. Unless otherwise approved by the Agency, the plan shall be prepared by an approved arborist.
    a. Contract limit line and/or limits of the construction zone.
    b. All tree protection zones.
    c. Approximate location of all specimen trees or stands of trees.

d. Exact location of all specimen trees or stands of trees, when their preservation is questionable, or might result in a change of the proposed site design.
e. Indication of those trees proposed for removal, including the reason tree(s) are not candidates for transplant. The removal of any tree is subject to Agency approval.
f. Indication of those trees proposed for preparatory pruning.
g. Indication of those trees proposed for transplant. Include a transplanting plan and schedule.
h. Indication of those trees proposed for compensatory fertilization.
i. All areas of clearing and land disturbance, such as excavating, grading, trenching, etc.
j. Areas designated for hand or pneumatic excavation, micro tunneling for utilities (under jacking), etc.
k. Proposed locations of underground utilities.
l. Proposed locations of irrigation systems, as well as number of tree and shrub gator bags.
m. Proposed locations of planting beds, if they occur within or adjacent to tree protection zones.
n. Staging areas for vehicle parking, equipment and materials storage and/or stockpiling, vehicle or tool washing, debris burn and/or burial holes if applicable.
o. Site and vehicular access routes.
p. Location of temporary wooden tree guards with tree wrap.
q. Location of construction (chain link) fencing and/or orange polyethylene safety fencing for individual trees or groups of trees in lawn or natural areas.
r. Location of protective mulch (at least six inches) or plywood where the passage of heavy equipment is likely to cause soil and root damage.
s. Location of any tree wells, retaining walls, or erosion control measures on site.
t. Location of any grade changes, including raising or lowering of soil elevation.
u. Location of soil replacement and/or soil amendment areas.
v. Location and depth of all curbs or pathways to be installed or replaced, including areas designated to hand form curbs to avoid tree root damage. Also include notes on drawings describing procedures for excavation for curbs and existing walkways within tree protection zones.
w. Areas selected for compensatory soil decompaction/enrichment measures [see specification—refers to vertical mulching or radial trenching].

36 Preservation Briefs
Technical Preservation Services
HPS
National Park Service

# Protecting Cultural Landscapes
## Planning, Treatment and Management of Historic Landscapes

**Charles A. Birnbaum, ASLA**

» Developing a Strategy and Seeking Assistance
» Preservation Planning for Cultural Landscapes
» Developing a Historic Preservation Approach and Treatment Plan
» Developing a Preservation Maintenance Plan and Implementation Strategy
» Recording Treatment Work and Future Research Recommendations
» Summary
» Selected Reading

**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

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**Cultural landscapes can range from thousands of acres** of rural tracts of land to a small homestead with a front yard of less than one acre. Like historic buildings and districts, these special places reveal aspects of our country's origins and development through their form and features and the ways they were used. Cultural landscapes also reveal much about our evolving relationship withthe natural world.

A ***cultural landscape*** is defined as "a geographic area,including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." There are four general types of cultural landscapes, not mutually exclusive*: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.* These are defined below.

***Historic landscapes*** include residential gardens and community parks, scenic highways,

**Patterns on the land have been preserved through the continuation of traditional uses, such as the grape fields at the Sterling Vineyards in Calistoga, California. Photo: NPS files.**

rural communities, institutional grounds, cemeteries, battlefields and zoological gardens. They are composed of a number of character-defining features which, individually or collectively contribute to the landscape's physical appearance as they have evolved over time. In addition to vegetation and topography, cultural landscapes may include water features, such as ponds, streams, and fountains; circulation features, such as roads, paths, steps, and walls; buildings; and furnishings, including fences, benches, lights and sculptural objects.

Most historic properties have a cultural landscape component that is integral to the significance of the resource. Imagine a residential district without sidewalks, lawns and trees or a plantation with buildings but no adjacent lands. A historic property consistsof all its cultural resources--landscapes, buildings, archeological sites and collections. In some cultural landscapes, there may be a total absence of buildings.

This Preservation Brief provides preservation professionals, cultural resource managers, and historic property owners a step-by-step process for preserving **historic designed** and **vernacular landscapes**, two types of cultural landscapes. While this process is ideally applied to an entire landscape, it can address a single feature, such as a perennial garden, family burial plot, or a sentinel oak in an open meadow. This Brief provides a framework and guidance for undertaking projects to ensure a successful balance between historic preservation and change.

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## DEFINITIONS

***Historic Designed Landscape--***a landscape that was consciously designed or laid out by a landscape architect, master gardener, architect, or horticulturist according to design principles,or an amateur gardener working in a recognized style or tradition. The landscape may be associated with a significant person(s), trend, or event in landscape architecture; or illustrate an important development in the theory and practice of landscape architecture. Aesthetic values play a significant role in designed landscapes. Examples include parks, campuses, and estates.

***Historic Vernacular Landscape--***a landscape that evolved through use by the people whose activities or occupancy shaped that landscape. Through social or cultural attitudes ofan individual, family or a community, the landscape reflects the physical, biological, and cultural character of those everyday lives. Function plays a significant role in vernacular landscapes. They can be a single property such as a farm or a collection of properties such

as a district of historic farms along a river valley. Examples include rural villages, industrial complexes, and agricultural landscapes.

***Historic Site--***a landscape significant for its association with a historic event, activity, or person. Examples include battlefields and president's house properties.

***Ethnographic Landscape--***a landscape containing a variety of natural and cultural resources that associated people define as heritage resources. Examples are contemporary settlements, religious sacred sites and massive geological structures. Small plant communities, animals, subsistence and ceremonial grounds are often components.

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## Developing a Strategy and Seeking Assistance

Nearly all designed and vernacular landscapes evolve from, or are often dependent on, natural resources. It is these interconnected systems of land, air and water, vegetation and wildlife which have dynamic qualities that differentiate cultural landscapes from other cultural resources, such as historic structures. Thus, their documentation, treatment, and ongoing management require a comprehensive, multi-disciplinary approach.

**The "Boot Fence," near D.H. Lawrence Ranch, Questa, California, is an example of a character-defining landscape feature. Photo: Courtesy, Cheryl Wagner.**

Today, those involved in preservation planning and management of cultural landscapes represent a broad array of academic backgrounds,training, and related project experience. Professionals may have expertise in landscape architecture, history, landscape archeology, forestry, agriculture, horticulture, pomology, pollen analysis, planning, architecture, engineering (civil, structural, mechanical, traffic), cultural geography, wildlife, ecology, ethnography, interpretation, material and object conservation, landscape maintenanceand management. Historians and historic preservation professionals can bring expertise in the history of the landscape, architecture, art, industry, agriculture, society and other subjects. Landscape preservation teams, including on-site management teams and independent consultants, are often directed by a landscape architect with specific expertise in landscape preservation. It is highly recommended that disciplines relevant to the landscapes' inherent features be represented as well.

Additional guidance may be obtained from State Historic Preservation Offices, local preservation commissions, the National Park Service, local and state park agencies, national and state chapters ofthe American Society of Landscape Architects, the Alliance for Historic Landscape Preservation, the National Association of Olmsted Parks, and the Catalog of Landscape Records in the United States at Wave Hill, among others.

**Another example of a very different landscape feature is this tree planting detail for Jefferson Memorial Park, St. Louis, Missouri. Photo: Courtesy, Dan Kiley.**

A range of issues may need to be addressed when considering how a particular cultural landscape should be treated. This may include the in-kind replacement of declining vegetation, reproduction of furnishings, rehabilitation of structures, accessibility provisions for people with disabilities, or the treatment of industrial properties that are rehabilitated for new uses.

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## Preservation Planning for Cultural Landscapes

Careful planning prior to undertaking work can help prevent irrevocable damage to a cultural landscape. Professional techniques for identifying, documenting, evaluating and preserving cultural landscapes have advanced during the past 25 years and are continually being refined. Preservation planning generally involves the following steps: historical research; inventory and documentation of existing conditions; site analysis and evaluation of integrity and significance; development of a cultural landscape preservation approach and treatment plan; development of a cultural landscape management plan and management philosophy; the development of a strategy for ongoing maintenance; and preparation of a record of treatment and future research recommendations.

The steps in this process are not independent of each other, nor are they always sequential. In fact, information gathered in one step may lead to a re-examination or refinement of previous steps. For example, field inventory and historical research are likely to occur simultaneously, and may reveal unnoticed cultural resources that should be protected.

The treatment and management of cultural landscape should also be considered in concert with the management of an entire historic property. As a result, many other studies may be relevant. They include management plans, interpretive plans, exhibit design, historic structures reports, and other.

These steps can result in several products including a Cultural Landscape Report (also known as a Historic Landscape Report), statements for management, interpretive guide, maintenance guideand maintenance records.

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## CULTURAL LANDSCAPE REPORTS

A Cultural Landscape Report (CLR) is the primary report that documents the history, significance and treatment of a cultural landscape. A CLR evaluates the history and integrity of the landscape including any changes to its geographical context, features, materials,and use.

CLWs are often prepared when a change (e.g. a new visitor's center or parking area to a landscape) is proposed. In such instances, a CLR can be a useful tool to protect the landscape's character-defining features from undue wear, alteration or loss. A CLR can provide managers, curators and others with information needed to make management decisions.

A CLR will often yield new information about a landscape's historic significance and integrity, even for those already listed on theNational Register. Where appropriate, National Register files should be amended to reflect the new findings.

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## Historical Research

Research is essential before undertaking any treatment. Findings will help identify a landscape's historic period(s) of ownership, occupancy and development, and bring greater understanding of the associations and characteristics that make the landscape or history significant. Research findings provide a foundation to make educated decisions for work, and can also facilitate ongoing maintenance and management operations, interpretation and eventual compliance requirements.

A variety of primary and secondary sources may be consulted. Primary archival sources can include historic plans, surveys, plats, tax maps, atlases, U. S. Geological Survey maps, soil profiles, aerial photographs, photographs, stereoscopic views, glass lantern slides, postcards, engravings, paintings, newspapers, journals, construction drawings, specifications, plant lists, nursery catalogs, household records, account books and personal correspondence. Secondary sources include monographs, published histories, theses, National Register forms, survey data, local preservation plans, state contexts and scholarly articles.

Contemporary documentary resources should also be consulted. This may include recent studies, plans, surveys, aerial and infrared photographs, Soil Conservation Service soil maps, inventories, investigations and interviews. Oral histories of residents, managers,and maintenance personnel with a long tenure or historical association can be valuable sources of information about changes to a landscape over many years. For properties listed in the National Register, nomination forms should be consulted.

## Preparing Period Plans

In the case of designed landscapes, even though a historic design plan exists, it does not necessarily mean that it was realized fully, or even in part. Based on a review of the

archival resources outlined above, and the extant landscape today, an *as-built period plan* may be delineated. For all successive tenures of ownership, occupancy and landscape change, *period plans* should be generated. Period plans can document to the greatest extent possible the historic appearance during a particular period of ownership, occupancy, or development. Period plans should be based on primary archival sources and should avoid conjecture. Features that are based on secondary or less accurate sources should be graphically differentiated. Ideally, all referenced archival sources should be annotated and footnoted directly on *period plans.*

Where historical data is missing, period plans should reflect any gaps in the CLR narrative text and these limitations consideredin future treatment decisions.

## Inventorying and Documenting Existing Conditions

Both physical evidence in the landscape and historic documentation guide the historic preservation plan and treatments. To document existing conditions, intensive field investigation and reconnaissance should be conducted at the same time that documentary researchis being gathered. Information should be exchanged among preservation professionals, historians, technicians, local residents, managers and visitors.

**Understanding the geographic context should be part of the inventory process. This aerial photograph at Rancho Los Alamitos, Long Beach, CA, was taken in 1936. (See, below.) Photo: Rancho Los Alamitos Foundation.**

To assist in the survey process, National Register Bulletins have been published by the National Park Service to aid in identifying,nominating and evaluating designed and rural historic landscapes. Additionally, Bulletins are available for specific landscape types such as battlefields, mining sites, and cemeteries.

Although there are several ways to inventory and document a landscape,the goal is to create a baseline from a detailed record of the landscape and its features as they exist at the present (considering seasonal variations). Each landscape inventory should address issues of boundary delineation, documentation methodologies and techniques, the limitations of the inventory, and the scope of inventory efforts.

These are most often influenced by the timetable, budget, project scope, and the purpose of the inventory and, depending on the physical qualities of the property, its scale, detail, and the inter-relationship between natural and cultural resources. For example, inventory objectives to develop a treatment plan may differ considerably compared to those needed to develop an ongoing maintenance plan. Once the criteria for a landscape inventory are developed and tested, the methodology should be explained.

This present-day view of Rancho Los Alamitos shows present-day encroachments and adjacent developments that will affect the future treatment of visual and spatial relationships. Photo: Rancho Los Alamitos Foundation.

## Preparing Existing Condition Plans

Inventory and documentation may be recorded in plans, sections, photographs, aerial photographs, axonometric perspectives, narratives, video-or any combination of techniques. Existing conditions should generally be documented to scale, drawn by hand or generated by computer. The scale of the drawings is often determined by the size and complexity of the landscape. Some landscapes may require documentation at more than one scale. For example, a large estate may be documented at a small scale to depict its spatial and visual relationships, while the discrete area around an estate mansionmay require a larger scale to illustrate individual plant materials, pavement patterns and other details. The same may apply to an entire rural historic district and a fenced vegetable garden contained within.

When landscapes are documented in photographs, *registration points* can be set to indicate the precise location and orientation of features. Registration points should correspond to significant forms, features and spatial relationships within the landscape and its surrounds. The points may also correspond to historic views to illustrate the change in the landscape todate. These locations may also be used as a management tool todocument the landscape's evolution, and to ensure that its character-defining features are preserved over time through informed maintenance operations and later treatment and management decisions.

All features that contribute to the landscape's historic character should be recorded. These include the physical features described above (e.g. topography, circulation), and the visual and spatial relationships that are character defining. The identification of existing plants, should be specific, including genus, species, common name, age (if known) and size. The woody, and if appropriate, herbaceous plant material should be accurately located on the existing conditions map. To ensure full representation of successional herbaceous plants, care should be taken to document the landscape in different seasons, if possible.

Treating living plant materials as a curatorial collection has also been undertaken at some cultural landscapes. This process, either done manually or by computer, can track the

condition and maintenance operations on individual plants. Some sites, suchas the Frederick Law Olmsted National Historic Site, in Brookline, Massachusetts have developed a field investigation numbering system to track all woody plants. Due to concern for the preservation of genetic diversity and the need to replace significant plant materials, a number of properties are beginning to propagate historically important rare plants that are no longer commercially available, unique, or possess significant historic associations. Such herbarium collections become a part of a site's natural history collection.

Once the research and the documentation of existing conditions have been completed, a foundation is in place to analyze the landscape's continuity and change, determine its significance, assess its integrity, and place it within the historic context of similar landscapes.

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## READING THE LANDSCAPE

A noted geographer, Pierce Lewis, stated, "The attempt to derive meaning from landscapes possesses overwhelming virtue. It keeps us constantly alert to the world around us, demanding that we pay attention not just to some of the things around us but to all of them--the whole visible world in all of its rich, glorious, messy, confusing, ugly, and beautiful complexity."

Landscapes can be read on many levels--landscape as nature, habitat, artifact, system, problem, wealth, ideology, history, place and aesthetic. When developing a strategy to document a cultural landscape, it is important to attempt to read the landscape in its context of place and time.

Reading the landscape, like engaging in archival research, requires a knowledge of the resource and subject area as well as a willingness to be skeptical. As with archival research, it may involve serendipitous discoveries. Evidence gained from reading the landscape may confirm or contradict other findings and may encourage the observer and the historian to re-visit both primary and secondary sources with a fresh outlook. Landscape investigation may also stimulate other forms of research and survey, such as oral histories or archeological investigations, to supplement what appeared on-site.

There are many ways to read a landscape-whatever approach is taken should provide a broad overview. This may be achieved by combining on-the-ground observations with a bird's-eye perspective. To begin this process, aerial photographs should be reviewed to gain an orientation to the landscape and its setting. Aerial photographs come in different sizes and scales, and can thus portray different levels of detail in the landscape. Aerial photographs taken at a high altitude, for example, may help to reveal remnant field patterns or traces of an abandoned circulation system; or, portions of axial relationships that were part of the original design, since obscured by encroaching woodland areas. Low altitude aerial photographs can point out individual features such as the arrangement of shrub and herbaceous borders, and the exact locations of furnishings, lighting, and fence

alignments. This knowledge can prove beneficial before an on-site visit.

Aerial photographs provide clues that can help orient the viewer to the landscape. The next step may be to view the landscape from a high point such as a knoll or an upper floor window. Such a vantage point may provide an excellent transition before physically entering the cultural landscape.

On ground, evidence should then be studied, including character-defining features, visual and spatial relationships. By reviewing supporting materials from historic research, individual features can be understood in a systematic fashion that show the continuum that exists on the ground today. By classifying these features and relationships, the landscape can be understood as an artifact, possessing evidence of evolving natural systems and human interventions over time.

For example, the on-site investigation of an abandoned turn-of-the-century farm complex reveals the remnant of a native oak and pine forest which was cut and burned in the mid-nineteenth century. This previous use is confirmed by a small stand of mature oaks and the presence of these plants in the emerging secondary woodland growth that is overtaking this farm complex in decline. A ring count of the trees can establish a more accurate age. By *reading* other character-defining features, such as the traces of old roads, remnant hedgerows, ornamental trees along boundary roads, foundation plantings, the terracing of grades and remnant fences--the visual, spatial and contextual relationships of the property as it existed a century ago may be understood and its present condition and integrity evaluated.

The findings of on-site reconnaissance, such as materials uncovered during archival research, may be considered primary data. These findings make it possible to inventory and evaluate the landscape's features in the context of the property's current condition. Character-defining features are located *in situ*, in relationship to each other and the greater cultural and geographic contexts.

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### Historic Plant Inventory

Within cultural landscapes, plants may have historical or botanical significance. A plant may have been associated with a historic figure or event or be part of a notable landscape design. A plant may be an uncommon cultivar, exceptional in size, age, rare and commercially/unavailable. If such plants are lost, there would be a loss of historic integrity and biological diversity of the cultural landscape. To ensure that significant plants are preserved, an inventory of historic plants is being conducted at the North Atlantic Region of the National Park Service. Historical landscape architects work with landscape managers and historians to gather oral and documented history on the plant's origin and potential significance. Each plant is then examined in the field by an expert horticulturist who records its name, condition, age, size, distribution, and any notable botanic characteristics.

Plants that are difficult to identify or are of potential historical significance are further examined in the laboratory by a plant taxonomist who compares leaf, fruit, and flower characteristics with herbarium specimens for named species, cultivars and varieties. For plants species with many cultivars, such as apples, roses, and grapes, specimens may be sent to specialists for identification.

If a plant cannot be identified, is dying or in decline, and unavailable from commercial nurseries, it may be propagated. Propagation ensures that when rare and significant plants decline, they can be replaced with genetically-identical plants. Cuttings are propagated and grown to replacement size in a North Atlantic Region Historic Plant Nursery.

### Site Analysis: Evaluating Integrity and Significance

By analyzing the landscape, its change over time can be understood. This may be accomplished by overlaying the various period plans with the existing conditions plan. Based on these findings, individual features may be attributed to the particular period when they were introduced, and the various periods when they were present.

It is during this step that the *historic significance* of the landscape component of a historic property and its integrity are determined. Historic significance is the recognized importance a property displays when it has been evaluated, including when it has been found to meet National Register Criteria. A landscape may have several areas of historical significance. An understanding of the landscape as a continuum through history is critical in assessing its cultural and historic value. In order for the landscape to have integrity, these character-defining features or qualities that contribute to its significance must be present.

**The landscape of Lyndhurst, Tarrytown, New York, is significant in American culture and work of a master gardener, Ferdinand Mangold. Photo: National Trust for Historic Preservation.**

While National Register nominations document the significance and integrity of historic properties, in general, they may not acknowledge the significance of the landscape's design or historic land uses, and may not contain an inventory of landscape features or characteristics. Additional research is often necessary to provide the detailed information about a landscape's evolution and significance useful in making decision for the treatment and maintenance of a historic landscape. Existing National Register forms may be amended to recognize additional areas of significance and to include more complete descriptions of historic properties that have significant land areas and landscape features.

*Integrity* is a property's historic identity

evidenced by the survival of physical characteristics from the property's historic or pre-historic period. The seven qualities of integrity are location, setting, feeling, association, design, workmanship and materials. When evaluating these qualities, care should be taken to consider change itself. For example, when a second-generation woodland overtakes an open pasture in a battlefield landscape, or a woodland edge encloses a scenic vista. For situations such as these, the reversibility and/or compatibility of those features should be considered, both individually, and in the context of the overall landscape. Together, evaluations of significance and integrity, when combined with historic research, documentation of existing conditions, and analysis findings, influence later treatment and interpretation decisions.

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## Developing a Historic Preservation Approach and Treatment Plan

Treatment may be defined as work carried out to achieve a historic preservation goal--it cannot be considered in a vacuum. There are many practical and philosophical factors that may influence the selection of a treatment for a landscape. These include the relative historic value of the property, the level of historic documentation, existing physical conditions, its historic significance and integrity, historic and proposed use (e.g. educational, interpretive, passive, active public, institutional or private), long-and short-term objectives, operational and code requirements (e.g. accessibility, fire, security) and costs for anticipated capital improvement, staffing and maintenance. The value of any significant archeological and natural resources should also be considered in the decision-making process. Therefore, a cultural landscape's preservation plan and the treatment selected will consider a broad array of dynamic and inter-related considerations. It will often take the form of a plan with detailed guidelines or specifications.

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### TREATMENTS FOR CULTURAL LANDSCAPES

*Prior to undertaking work on a landscape, a treatment plan or similar document should be developed. The four primary treatments identified in the Secretary of the Interior's Standards for the Treatment of Historic Properties, are:*

***Preservation*** *is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.*

***Rehabilitation*** *is defined as the act or process of making possible a compatible use for a*

*property through repair, alterations,and additions while preserving those portions or features which convey its historical or cultural values.*

***Restoration*** *is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.*

***Reconstruction*** *is defined as the act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.*

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Adopting such a plan, in concert with a preservation maintenance plan, acknowledges a cultural landscape's ever-changing existence and the inter-relationship of treatment and ongoing maintenance. Performance standards, scheduling and record keeping of maintenance activities on a day-to-day or month-to-month basis, may then be planned for. Treatment, management, and maintenance proposals can be developed by a broad range of professionals and with expertise in such fields as landscape preservation, horticulture, ecology, and landscape maintenance.

The selection of a primary treatment for the landscape, utilizing the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, establishes an overall historic preservation approach, as well as a philosophical framework from which to operate. Selecting a treatment is based on many factors. They include management and interpretation objectives for the property as a whole, the period(s) of significance, integrity, and condition of individual landscape features.

**When the American Elm was plagued with Dutch Elm Disease, many historic properties relied on the Japanese Zelkova as a substitute plant (see below). Photo: NPS files.**

For all treatments, the landscape's existing conditions and its ability to convey historic significance should be carefully considered. For example, the life work, design philosophy and extant legacy of an individual designer should all be understood for a designed landscape, such as an estate, prior to treatment selection. For a vernacular landscape, such as a battlefield containing a largely intact mid-nineteenth century family farm, the uniqueness of that agrarian complex within a local, regional, state, and national context should be considered in selecting a treatment.

The overall historic preservation approach and treatment approach can ensure the proper retention, care, and repair of landscapes and their inherent features. In short, the Standards act as a preservation and management tool for cultural landscapes. The four potential treatments are described above.

**Compared to the American Elm (above right), it is readily apparent that the form and scale of this tree is really quite different, and would be an inappropriate substitute plant material within a restoration or reconstruction project. Photo: NPS files.**

Landscape treatments can range from simple, inexpensive preservation actions, to complex major restoration or reconstruction projects. The progressive framework is inverse in proportion to the retention of historic features and materials. Generally, preservation involves the least change, and is the most respectful of historic materials. It maintains the form and material of the existing landscape. Rehabilitation usually accommodates contemporary alterations or additions without altering significant historic features or materials, with successful projects involving minor to major change. Restoration or reconstruction attempts to recapture the appearance of a property,or an individual feature at a particular point in time, as confirmed by detailed historic documentation. These last two treatments most often require the greatest degree of intervention and thus,the highest level of documentation.

In all cases, treatment should be executed at the appropriate level, reflecting the condition of the landscape, with repair work identifiable upon close inspection and/or indicated in supplemental interpretative information. When repairing or replacing a feature, every effort should be made to achieve visual and physical compatibility. Historic materials should be matched in design, scale, color and texture.

A landscape with a high level of integrity and authenticity may suggest preservation as the primary treatment. Such a treatment may emphasize protection, stabilization, cyclical maintenance,and repair of character-defining landscape features. Changes over time that are part of the landscape's continuum and are significant in their own right may be retained, while changes that are not significant, yet do not encroach upon or erode character may also be maintained. Preservation entails the essential operations to safeguard existing resources.

Rehabilitation is often selected in response to a contemporary use or need--ideally such an approach is compatible with the landscape's historic character and historic use. Rehabilitation may preserve existing fabric along with introducing some compatible changes, new additions and alterations. Rehabilitation may be desirable at a private residence in a historic district where the homeowner's goal is to develop an appropriate landscape treatment for a front yard, or in a public park where a support area is needed for its maintenance operations.

When the most important goal is to portray a landscape at an exact period of time,

restoration is selected as the primary treatment. Unlike preservation and rehabilitation, interpreting the landscape's continuum or evolution is not the objective. Restoration may include the removal of features from other periods and/or the construction of missing or lost features and materials from the reconstruction period. In all cases, treatment should be substantiated by the historic research findings and existing conditions documentation. Restoration and re-construction treatment work should avoid the creation of a landscape whose features did not exist historically. For example, if features from an earlier period did not co-exist with extant features from a later period that are being retained, their restoration would not be appropriate.

**The historic birch allee at Stan Hywet Hall, Akron, Ohio, which had suffered from borer infestation and leaf miner, was preserved through a series of carefully executed steps that took 15 years to realize. Photo: Child Associates.**

In rare cases, when evidence is sufficient to avoid conjecture, and no other property exists that can adequately explain a certain period of history, reconstruction may be utilized to depict a vanished landscape. The accuracy of this work is critical. In cases where topography and the sub-surface of soil have not been disturbed, research and existing conditions findings may be confirmed by thorough archeological investigations. Here too, those features that are intact should be repaired as necessary, retaining the original historic features to the greatest extent possible. The greatest danger in reconstruction is creating a false picture of history.

False historicism in every treatment should be avoided. This applies to individual features as well as the entire landscape. Examples of inappropriate work include the introduction of historic-looking benches that are actually a new design, a fanciful gazebo placed in what was once an open meadow, executing an unrealized historic design, or designing a historic-looking landscape for a relocated historic structure within "restoration."

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## LANDSCAPE INTERPRETATION

Landscape interpretation is the process of providing the visitor with tools to experience the landscape as it existed during its period of significance, or as it evolved to its present state. These tools may vary widely, from a focus on existing features to the addition of interpretive elements. These could include exhibits, self-guided brochures, or a new representation of a lost feature. The nature of the cultural landscape, especially its level of significance, integrity, and the type of visitation anticipated may frame the interpretive approach. Landscape interpretation may be closely linked to the integrity and condition of the landscape, and therefore, its ability to convey the historic character and character-defining features of the past. If a landscape has high integrity, the interpretive approach may be to direct visitors to surviving historic features without introducing obtrusive

interpretive devices, such as free-standing signs. For landscapes with a diminished integrity, where limited or no fabric remains, the interpretive emphasis may be on using extant features and visual aids (e.g., markers, photographs, etc.) to help visitors visualize the resourceas it existed in the past. The primary goal in these situations is to educate the visitor about the landscape's historic themes, associations and lost character-defining features or broader historical, social and physical landscape contexts.

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## Developing a Preservation Maintenance Plan and Implementation Strategy

Throughout the preservation planning process, it is important to ensure that existing landscape features are retained. Preservation maintenance is the practice of monitoring and controlling change in the landscape to ensure that its historic integrity is not altered and features are not lost. This is particularly important during the research and long-term treatment planning process. To be effective, the maintenance program must have a guiding philosophy, approach or strategy; an understanding of preservation maintenance techniques; and a system for documenting changes in the landscape.

**Central Park has developed an in-house historic preservation crew to undertake small projects. A specialized crew has been trained to repair and rebuild rustic furnishings. Photo: Central Park Conservancy.**

The philosophical approach to maintenance should coincide with the landscape's current stage in the preservation planning process. A Cultural Landscape Report and Treatment Plan can take several years to complete, yet during this time managers and property owners will likely need to address immediate issues related to the decline, wear, decay, or damage of landscape features. Therefore, initial maintenance operations may focus on the stabilization and protection of all landscape features to provide temporary, often emergency measures to prevent deterioration, failure, or loss, without altering the site's existing character.

After a Treatment Plan is implemented, the approach to preservation maintenance may be modified to reflect the objectives defined by this plan. The detailed specifications prepared in the Treatment Plan relating to the retention, repair, removal, or replacement of features in the landscape should guide and inform a comprehensive preservation maintenance program. This would include schedules for monitoring and routine maintenance, appropriate preservation maintenance procedures, as well as ongoing record keeping of work performed. For vegetation, the preservation maintenance program would also include thresholds for growth or change in character, appropriate pruning methods, propagation and replacement procedures.

To facilitate operations, a property may be divided into discrete management zones. These zones are sometimes defined during the Cultural Landscape Report process and are typically based on historically defined areas. Alternatively, zones created for maintenance practices and priorities could be used. Examples of maintenance zones would include woodlands, lawns, meadow, specimen trees, and hedges.

Training of maintenance staff in preservation maintenance skills is essential. Preservation maintenance practices differ from standard maintenance practices because of the focus on perpetuating the historic character or use of the landscape rather than beautification. For example, introducing new varieties of turf, roses or trees is likely to be inappropriate. Substantial earth moving (or movement of soil) may be inappropriate where there are potential archeological resources. An old hedge or shrub should be rejuvenated, or propagated, rather than removed and replaced. A mature specimen tree may require cabling and careful monitoring to ensure that it is not a threat to visitor safety. Through training programs and with the assistance of preservation maintenance specialists, each property could develop maintenance specifications for the care of landscape features.

Because landscapes change through the seasons, specifications for ongoing preservation maintenance should be organized in a calendar format. During each season or month, the calendar can be referenced to determine when, where, and how preservation maintenance is needed. For example, for some trees structural pruning is best done in the late winter while other trees are best pruned in the late summer. Serious pests are monitored at specific times of the year, in certain stages of their life cycle. This detailed calendar will, in turn, identify staff needs and work priorities.

Depending on the level of sophistication desired, one approach to documenting maintenance data and recording change over time is to use a computerized geographical or visual information system. Such a system would have the capability to include plans and photographs that would focus on a site's landscape features.

If a computer is not available, a manual or notebook can be developed to organize and store important information. This approach allows managers to start at any level of detail and to begin to collect and organize information about landscape features. The value of these maintenance records cannot be overstated. These records will be used in the future by historians to understand how the landscape has evolved with the ongoing care of the maintenance staff.

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## Recording Treatment Work and Future Research Recommendations

The last and ongoing step in the preservation planning process records the treatment work as carried out. It may include a series of as-built drawings, supporting photographic materials, specifications and a summary assessment. New technologies that have been successfully used should be highlighted. Ideally, this information should be shared with

interested national organizations for further dissemination and evaluation.

The need for further research or additional activities should also be documented. This may include site-specific or contextual historical research, archeological investigations, pollen analysis, search for rare or unusual plant materials, or, material testing for future applications.

Finally, in consultation with a conservator or archivist-to maximize the benefit of project work and to minimize the potential of data loss--all primary documents should be organized and preserved as archival materials. This may include field notes, maps, drawings, photographs, material samples, oral histories and other relevant information.

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## DEVELOPING A PRESERVATION MAINTENANCE GUIDE

In the past, there was rarely adequate record-keeping to fully understand the ways a landscape was maintained. This creates gaps in our research findings. Today, we recognize that planning for ongoing maintenance and onsite applications should be documented--both routinely and comprehensively. An annual work program or calendar records the frequency of maintenance work on built or natural landscape features. It can also monitor the age, health and vigor of vegetation. For example, onsite assessments may document the presence of weeds, pests, dead leaves, pale color, wilting, soil compaction--all of which signal particular maintenance needs. For built elements, the deterioration of paving or drainage systems may be noted and the need for repair or replacement indicated before hazards develop. An overall maintenance program can assist in routine and cyclic maintenance of the landscape and can also guide long term treatment projects.

To help structure a comprehensive maintenance operation that is responsive to staff, budget, and maintenance priorities, the National Park Service has developed two computer-driven programs for its own landscape resources. A Maintenance Management Program (MM)is designed to assist maintenance managers in their efforts toplan, organize, and direct the park maintenance system. An Inventory and Condition Assessment Program (ICAP) is designed to complement MM by providing a system for inventorying, assessing conditions, and for providing corrective work recommendations for all site features.

Another approach to documenting maintenance and recording changes over time is to develop a manual or computerized graphic information system. Such a system should have the capability to include plans and photographs that would record a site's living collection of plant materials. (Also see discussion of the use of photography under Preparing Existing Conditions Plans) This may be achieved using a computer-aided drafting program along with an integrated database management system.

To guide immediate and ongoing maintenance, a systematic and flexible approach has been developed by the Olmsted Center for Landscape Preservation. Working with National Park Service landscape managers and maintenance specialists, staff assemble information

and make recommendations for the care of individual landscape features.

Each landscape feature is inspected in the field to document existing conditions and identify field work needed. Recommendations include maintenance procedures that are sensitive to the integrity of the landscape.

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## Summary

The planning, treatment, and maintenance of cultural landscapes requires a multi-disciplinary approach. In landscapes, such as parks and playgrounds, battlefields, cemeteries, village greens, and agricultural land preserves more than any other type of historic resource--communities rightly presume a sense of stewardship. It is often this grass roots commitment that has been a catalyst for current research and planning initiatives. Individual residential properties often do not require the same level of public outreach, yet a systematic planning process will assist in making educated treatment, management and maintenance decisions.

Wise stewardship protects the character, and or spirit of a place by recognizing history as change over time. Often, this also involves our own respectful changes through treatment. The potential benefits from the preservation of cultural landscapes are enormous. Landscapes provide scenic, economic, ecological, social, recreational and educational opportunities that help us understand ourselves as individuals, communities and as a nation. Their ongoing preservation can yield an improved quality of life for all, and, above all, a sense of place or identity for future generations.

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**Home page logo: Taro fields in Hanalei, Hawaii. Photo: NPS files.**

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