Downtown Tree Management Plan

City of Atlanta, Georgia

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Table of Contents

Figures

Tables

Appendices

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Executive Summary

This management plan was developed for the City of Atlanta by Davey Resource Group, a division of The Davey Tree Expert Company, (Davey) with a focus on addressing short- and long-term maintenance needs for inventoried public trees. Davey completed a tree inventory to gain an understanding of the needs of the existing urban forest and to project a maintenance schedule for tree care. To develop this plan, inventory data analysis was utilized along with information about the City's existing program and vision for the urban forest.

The 2011 inventory included trees, stumps, and planting sites along specified public street rights-of-way (ROWs) and trees and stumps in specified parks. The City's initial priority for the 2011 inventory was the Downtown area. After the Downtown area was inventoried, funds remained and the City increased the geographic boundary of the inventory to include streets and some parks surrounding the City's core, the Expanded area. The Atlanta Downtown Improvement District (ADID) was located within the inventory area; this business district was isolated by the City for analysis and budgeting since its funding comes from a community improvement district. The ADID included most of the sites in the Downtown area plus some sites in the Expanded Inventory area.

Davey recorded 9,004 sites during the inventory: 8,465 trees, 116 stumps, and 423 planting sites. There were 15 parks inventoried: 7 in the Downtown area and 8 in the Expanded area (Table 1).

Analysis of the 2011 tree population inventory data indicated:

- High proportions of oak (*Quercus* spp.), crapemyrtle *(Lagerstroemia indica),* red maple (*Acer rubrum*), Japanese zelkova (*Zelkova serrata*), and Chinese elm (*Ulmus parvifolia*).
- Relative age distribution trended toward the ideal, with generally low numbers of maturing (18–24 inches in diameter at 4.5 feet above ground [diameter at breast height, DBH]) and mature trees (>24 inches DBH).
- General tree condition rated to be good.

Potential threats to tree health were also noted during the 2011 inventory. Common issues included the presence of overhead utilities, tree grates, and growing space sizes with limited soil volume for roots. Over 2,400 trees were noted to be growing near overhead utilities; of these, 47% were not well suited to be placed by overhead wires because they are expected to be taller than 30 feet when mature. Grates were noted to be covering the entire growing space around 744 trees; some of the grates (98) were damaging trees because they did not accommodate tree trunk expansion or the height of surface roots. Many of Atlanta's trees are growing in locations where space is limited due to hardscape and soil volume. Of the top five species inventoried, 69% of these trees were located in growing spaces too small for their expected mature size. Of the 137 trees noted to be growing in raised planters, 80% were not suitable for that growing space.

No signs or symptoms of pests or diseases were observed during the inventory. However, the population contained many tree species that are targets for a variety of known pests and diseases. More than 76% of the species noted during the 2011 tree inventory are susceptible to granulate ambrosia beetle (*Xylosandrus crassiusculus*), Asian longhorned beetle (*Anoplophora glabripennis*), Xm ambrosia beetle (*Xylosandrus mutilates*), and oak wilt. The threats to City trees can be managed with tree management practices that include an integrated pest management plan and routine tree care to improve tree health.

Table 1. Summary of the 2011 Tree Inventory by Area

Inventory Populations		Number of Sites	Genera ≥20%	Species ≥10%	Relative Age	Condition
Overall	Streets and Parks	9,004	oak (*Quercus* spp.)	common crapemyrtle (*Lagerstroemia indica*) willow oak (*Quercus phellos*)	low number of maturing and mature trees	good
Downtown	Streets	3,364	oak (*Quercus* spp.) maple (*Acer* spp.)	willow oak (*Quercus phellos*) common crapemyrtle (*Lagerstroemia indica*) red maple (*Acer rubrum*) Chinese elm (*Ulmus parvifolia*)	low number of maturing and mature trees	good
	Parks	237	crapemyrtle (*Lagerstroemia* spp.)	common crapemyrtle (*Lagerstroemia indica*) Japanese zelkova (*Zelkova serrata*)	low number of maturing trees	good
Expanded	Streets	4,357	crapemyrtle (*Lagerstroemia* spp.)	common crapemyrtle (*Lagerstroemia indica*)	low number of maturing and mature trees	good
	Parks	1,046	oak (*Quercus* spp.)	red maple (*Acer rubrum*)	low number of young trees	good
ADID	Streets	3,149	oak (*Quercus* spp.)	willow oak (*Quercus phellos*) common crapemyrtle (*Lagerstroemia indica*) red maple (*Acer rubrum*)	low number of maturing and mature trees	good
	Parks	237	crapemyrtle (*Lagerstroemia* spp.)	willow oak (*Quercus phellos*) Japanese zelkova (*Zelkova serrata*)	low number of maturing trees	good

Tree Maintenance and Planting Needs

Trees provide many environmental and economic benefits that justify spending the time and money for planting and maintenance. Maintenance needs recommended during the inventory include tree pruning (88%), tree and stump removal (7%), and tree planting (5%). Reducing defects within trees should be prioritized so that the trees with the most critical defects are addressed first. The inventory noted several priority 1, 2, and 3 trees (2%, 3%, and 3% of trees assessed, respectively); these trees should be removed or pruned as soon as possible to promote public safety. After all of the higher priority tree maintenance has been completed, regular maintenance cycles should begin. These cycles include selective pruning for improving the structure of young trees (32% of trees assessed) every three years and for improved structure of more mature trees (60% of trees assessed) every five years. Tree planting should be performed annually to mitigate removals and create canopy.

Atlanta's urban forest will benefit greatly from a five-year routine pruning cycle (RP Cycle) and a three-year young tree training cycle (YTT Cycle). Proactive pruning cycles improve the general health of the tree population, eventually reducing program costs. In most cases, pruning cycles will correct defects in trees before they worsen, which will avoid costly problems. Based on the 2011 dataset, 1,022 of the inventoried trees should be cleaned during the RP Cycle each year, and 912 of the young inventoried trees should be structurally pruned during the YTT Cycle each year. Due to the number of young trees, Davey suggests that Atlanta begin the YTT Cycle as soon as possible to benefit the future health of its urban forest.

Planting trees is necessary to maintain canopy cover and to replace trees that have been removed or lost to natural mortality (expected to be 1% to 3% per year) or other threats (for example, construction, invasive pests and diseases, tree grates, overhead utilities, or severe weather).

Citywide tree planting should focus on creating canopy in areas that promote economic growth such as business districts, around parking lots and buildings needing more shade, and where there are gaps in the existing canopy along streetscapes and in parks. Large-growing trees provide the greatest benefit compared to small- and medium-growing trees and, therefore, should be planted where appropriate growing space is available.

Tree and Stump Removal

- **Priority 1= 103 trees**
- **Priority 2= 163 trees**
- **Priority 3= 229 trees**
- **Stumps= 116**

Pruning

- **Priority 1= 47 trees**
- **Priority 2= 74 trees**

RP Cycle

- **Number of total trees assessed= 5,112**
- **Number of trees in cycle each year = 1,022**

YTT Cycle

- **Number of total trees assessed= 2,737**
- **Number of trees in cycle each year = 912**

Tree Planting

- **Planting sites inventoried= 423**

Proper species selection should be a key aspect of Atlanta's future tree planting program. To help normalize the species distribution, the planting of Chinese elm, crapemyrtle, Japanese zelkova, red maple, and willow oak (*Quercus phellos*) should be limited. The City's planting species list has been revised as part of this plan and offers alternatives for species selection based on size and other tree attributes. Planting programs must consider site restrictions, species diversification, local climate, future maintenance needs, and mature tree characteristics to promote canopy cover and a healthy urban forest.

Urban Forest Program Needs

Adequate funding is needed to implement an effective tree management program that provides short- and long-term public benefit, to ensure that priority maintenance is performed expediently, and to establish proactive maintenance cycles. The estimated total cost for the first year of the recommended seven-year program is $115,451; this total will decrease by the third year to approximately $113,014 per year. Priority removal and pruning is costly; this work is scheduled during the first and second years of the program, which is why the budget is higher for those years. After this priority work has been completed, the urban forestry program will mostly involve proactive work, which is generally less costly, so budgets for later years are projected to be lower.

An urban forestry program budget has been created for only the ADID tree population. The estimated total cost for the first year of the recommended six-year program is $43,565; this total will decrease by the second year to approximately $42,640 per year. Maintenance prioritization is the same: all priority removal and pruning should be completed first followed by the YTT and RP Cycles.

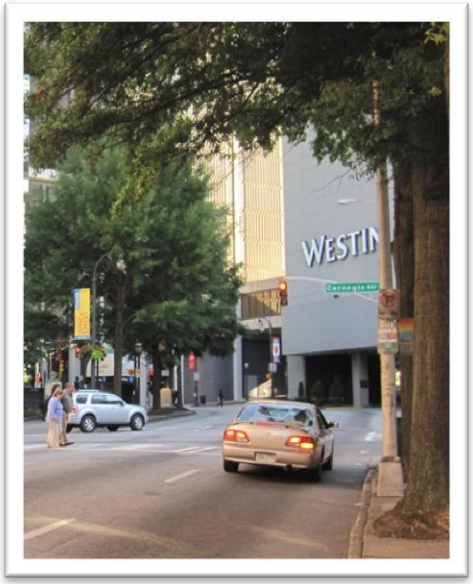
Supporting proactive management of trees through funding will over the long term reduces municipal tree care management costs and possibly the costs to build, manage, and support some city infrastructure. Investing in this tree management program will promote public safety, improve tree care efficiency, and increase the economic and environmental benefits the community receives from its trees.

Section 1: Urban Forest Overview

Introduction

Atlanta has a reputation as the "city in a forest" because of its abundance of lush tree canopy. While Atlanta does not have a harbor or an ocean front, or a visible river front, in many ways the tree cover is the City's signature environmental feature. The City's trees also work hard: they create shade that cools buildings and parking lots, mitigates the urban heat island effect, and reduces energy needs; they prevent soil erosion by slowing storm water; and they improve local air, soil, and water quality. Trees also provide shelter and food for birds and other wildlife, and, of course, they beautify the City's neighborhoods.

Atlanta's tree coverage does not go unnoticed—first-time visitors often marvel at the beautiful large trees that grace the City, and trees were the main feature cited by National Geographic in naming Atlanta a "Place of a Lifetime" in 2009. The City of Atlanta is home to more than 420,000 full-time residents and more than 5 million yearly visitors who enjoy the beauty and benefits of the urban forest.



Photograph 1. *With 24 years of Tree City USA status, the City of Atlanta takes great pride in their trees and makes great effort to keep them healthy and safe for City residents and visitors.*

Tree Ordinance

Because of the value of the tree canopy, Atlanta created an ordinance. The ordinance protects the urban forest by requiring that trees be preserved where possible. When healthy trees must be removed for construction or other purposes and there is not enough space to replant replacement trees, property owners contribute to a Trust Fund for planting additional trees throughout the City, ensuring a green legacy for the future.

Staff Vested in City Trees

The City's Parks Department (Department of Parks, Recreation, and Cultural Affairs) is responsible for regulating trees on public property and includes tree crews responsible for maintenance and care of trees located in the City's rights-of-way (ROWs), parks, and green spaces. The City's Arborist Division (Department of Planning and Community Development) is responsible for regulating trees on private property. The all-volunteer Tree Conservation Commission helps guide long-term planning, tree planting, and community outreach, and serves as an appeals board for citizen appeals related to administrative decisions regarding trees.

Tree City USA

The City of Atlanta has been recognized as a Tree City USA for the past 24 years through the Arbor Day Foundation certification program, and the forestry program is accredited by the Society of Municipal Arborists.

Need for a Tree Inventory

To enable those vested in the management of the City's trees to make more informed decisions about tree planting and maintenance, a tree inventory was needed. Tree inventories are utilized to assess the location, characteristics, and condition of individual trees within a well-defined group. Inventories help establish management priorities by identifying trees that need to be pruned or removed, revealing any systemic problems with pests or disease, identifying the distribution of tree species, and providing an up-to-date report on the general condition of the trees. This inventory also identified locations with sufficient space for planting trees, which will help make planting efforts more efficient.

Inventories of individual properties and parks have been conducted, but the 2011 inventory marks the first comprehensive inventory of the City's publicly owned Downtown trees. This inventory includes an assessment of the trees along streets, boulevards, parks, and public spaces in the Downtown area.

Downtown, as defined by Central Atlanta Progress, Inc., is an area of approximately four square miles bound by North Avenue to the north, Boulevard to the east, Interstate 20 to the south, and Northside Drive to the west. It includes central areas of Five Points, the Hotel District, and Fairlie-Poplar, as well as outlying inner-city neighborhoods such as SoNo and Castelberry Hill.

Based on initial estimates of the number of Downtown trees, the City contracted with Davey Resource Group, a division of The Davey Tree Expert Company (Davey), for the 2011 inventory of 9,000 trees. Soon after fieldwork began, contractors and City personnel learned that the contract to assess 9,000 trees and planting locations would cover a larger geographic area than originally anticipated. Even after making a careful estimate of the approximate number of trees in the Downtown area, the actual number of trees was significantly lower. This was an early indicator of the importance of the inventory project, which provided concrete data on the number of public trees and the condition of each tree. The positive implications for planning maintenance and planting projects based on actual data rather than approximations are apparent.

The Expanded area for the inventory covered Downtown as well as the areas east of downtown to Boulevard and south of downtown to Love Street between Boulevard on the east and Central Avenue on the west, including Fulton County stadium and parts of Summerhill and Grant Park. Oakland Cemetery and Grant Park were not included because they have been inventoried individually by other organizations.

Anticipated Benefits of the Inventory

- Data will be utilized to create a management tool for maintaining and planting trees in the central business area of Atlanta.
- Future tree planting initiatives will be focused on improving species diversity, planting the right trees in identified planting areas, based on information about species' success and failure.
- Contracts can be tailored to meet highest needs and establish economy of scale.
- The work order process for tree maintenance will be streamlined.

- Project accurate budget priorities for maintenance of the study area.
- Provide an opportunity to discuss and highlight the importance and value of trees in the urban environment.
- Work towards satisfying the Tree Ordinance, which calls for a Master Urban Forest Plan. Resources were limited for creating this plan; the 2011 inventory was the first step toward making data-driven decisions and formulating a management plan for tree care.
- Maximize public benefits from street trees and minimize public expense (Miller, 1997).
- Inspire the implementation of additional inventories in other parts of the City and possibly even for surrounding municipalities.

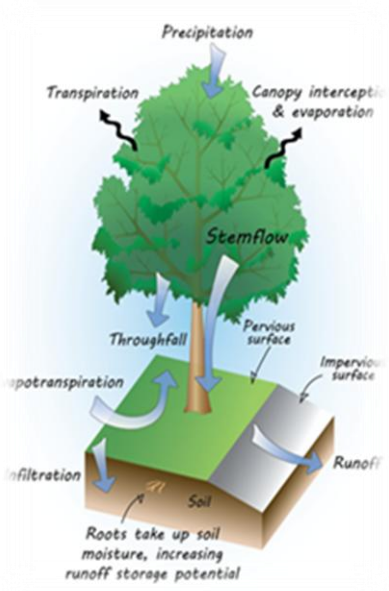
Benefits of the Urban Forest

There is a growing understanding and validation of the importance of trees to a community. Scientists and researchers have studied the effects of trees on human behavior, traffic patterns, crime rates, air quality, stormwater runoff, and property values. Trees are demonstrably beneficial and positively affect human and public health. The benefits trees provide are commonly divided into three categories—economic, environmental, and social.

Economic

Consumers are willing to pay more to park and shop in landscaped business districts. On average, consumers will pay about 11% more for goods in landscaped areas, with this figure being as high as 50% for convenience goods (Wolf, 1998(a); Wolf, 1999; and Wolf, 2003). Consumers also feel that the quality of the products is better in business districts having trees than in those that are considered barren (Wolf, 1998(a)). Additionally, the quality of landscaping along the routes leading to the business district had a positive influence on consumers' perceptions of the area (Wolf, 2000).

Several studies in the United States analyzed the effect of tree cover on the price of residential home sales, finding that values of properties in tree-lined areas may be 3% to 7% higher when trees are in the yard, 5% to 20% higher when the property is next to natural open space, and 9% higher when adjacent to street trees. Commercial property rental rates were 7% greater when trees were present on the property (Wolf, 2009).



Trees reduce stormwater runoff by capturing and storing rainfall in their canopy and releasing water into the atmosphere.

- *Tree roots and leaf litter create soil conditions that promote the infiltration of rainwater into the soil.*
- *Trees help slow down and temporarily store runoff and reduce pollutants by taking up nutrients and other pollutants from soils and water through their roots.*
- *Trees transform pollutants into less harmful substances.*

Environmental

Trees improve air quality. During photosynthesis, trees remove carbon dioxide (CO_2) from the atmosphere to form carbohydrates that are used in plant structure/function and return oxygen (O_2) back to the atmosphere as a byproduct. Trees, therefore, act as a carbon (C) sink. Urban forests cleanse the air by intercepting and slowing particulate materials and by absorbing pollutant gases on their leaf surfaces. Pollutants partially controlled by trees include nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), CO_2, ozone (O_3), and small particulates less than 10 microns in size (PM_{10}). Coder (1996) found that trees could reduce street-level air pollution by up to 60%. Lovasi et al., 2008 suggested that children who live on tree-lined streets have lower rates of asthma.

Trees reduce energy usage by lowering local air temperatures when they transpire water and shade surfaces. Urban trees shade buildings in the summer and block wind in the winter. The net cooling effect of a healthy tree is equivalent to 10 room-size air conditioners operating 20 hours a day (North Carolina State University, 2012). Trees placed properly around buildings as windbreaks can save up to 25% on winter heating costs (Heisler, 1986).

Planting trees in strategic areas can augment the function of existing stormwater infrastructure, increasing its capacity, delaying onsets of peak flows, and improving water quality. Because trees act as mini-reservoirs, planting trees can reduce the long-term costs incurred by the City to manage runoff. Leafy tree canopies catch precipitation before it reaches the ground, allowing some water to gently drip and the rest to evaporate. This lessens the initial impact of storms and reduces runoff and erosion. For every 5% of tree cover added to a community, stormwater runoff is reduced by approximately 2% (Coder, 1996). Research by the United States Department of Agriculture (USDA) Forest Service indicates that 100 mature tree crowns intercept about 100,000 gallons of rainfall per year, reducing runoff and providing cleaner water (USDA Forest Service, 2003(a)). A typical urban forest of 10,000 trees will retain approximately 10 million gallons of rainwater per year (USDA Forest Service, 2003(b)).

Social

In addition to increasing property values, research has shown that trees can lead to reduced crime rates, decreased amounts of human stress, and shorter lengths of hospital stays. Kuo and Sullivan (2001(a)) studied apartment buildings in Chicago and found that buildings with high levels of greenery had 52% fewer crimes than those without any trees, and buildings with medium amounts of greenery had 42% fewer crimes.

Tree-lined streets are safer; traffic speeds and the amount of stress drivers feel are reduced, which likely reduces “road rage” (Wolf, 1998(b); Kuo and Sullivan, 2001(b)). Ulrich (1984, 1986) found that hospital patients who were recovering from surgery and had a view of a grove of trees through their windows required fewer pain relievers, experienced fewer complications, and left the hospital sooner than similar patients who had a view of a brick wall.

Project Background

During July and August 2011, Davey inventoried 9,004 trees, stumps, and planting sites in the City of Atlanta's Downtown area and in neighborhoods east and south of Downtown. The inventory identified 7,199 ROW street trees, 1,266 trees in parks, 116 stumps, and 423 planting sites. Three arborists from Davey collected data during a three-week period; oversight was provided by a project manager who is an International Society of Arboriculture (ISA) Certified Arborist.

The inventory was funded with monies from the City and from a U&CF Grant from the Georgia Forestry Commission and the USDA Forest Service. The purpose and objectives of the inventory included creating an urban forestry management tool for characterizing public trees, identifying and setting priorities for tree maintenance, and identifying locations appropriate for additional plantings. The results of the inventory will be compared with analyses of a planned canopy study.

Prior to and during the data collection, Davey staff met with the City of Atlanta to verify protocols and procedures and to ensure the data collection methods would be congruent with City methodologies, the City's approach to urban forest management, and legal constraints. Davey's lead arborist met with the City at least weekly to discuss the project. And the City joined Davey in the field on more than one occasion to learn about the project and QA/QC work.

Data collected for the inventoried trees were specified by the City and included: species, diameter measured at 4.5 feet above ground (diameter at breast height, DBH), canopy size, canopy condition, trunk condition, root condition, size of planter, overhead utilities, maintenance need, and maintenance priority. Data collected for planting sites included the dimensions of the planting area and a recommendation for planting a small, medium, or large tree.

After data collection was complete, Davey attended a Tree Commission Meeting to present preliminary results and after the meeting forwarded a list of priority tree work to the City. The City obtained Davey's TreeKeeper® software and training on its use from Davey to manage the inventory database.

The final step in the process was for the City to commission the development of a tree management plan based on the inventory data. The City developed a scope of work and hired Davey to develop the plan for their Downtown urban forest.

The Importance of Atlanta's Urban Forest

The Comprehensive Development Plan (CDP) (City of Atlanta, 2011) is a guide to the growth and development of the City of Atlanta. It sets forth the development vision, policies, and an implementation plan for the City and its neighborhoods for the next 20 years. The City's CDP addresses all aspects of community and economic functions, including the urban forest, with the objective of sustaining and improving these functions in the future.

The 2011 CDP was adopted by the City of Atlanta in October 2011 per 11-O-1234. The following sections are adapted from the CDP, which defined the importance of the urban forest to the City of Atlanta.

Urban Design Elements

Urban design, the physical form and organization of elements in the urban environment, has wide implications beyond aesthetics. Atlanta's urban design policies embrace concepts of traditional urban development patterns, new urbanism, and smart growth with a focus on neighborhood cohesiveness, a healthy community, mixed-used centers, historic preservation, and environmental conservation. The goal for urban design in Atlanta is to improve the quality and productivity of the lives of all Atlantans by creating a more healthy, humane, and enjoyable place to live, work, and raise children.

Tree canopy, an essential physical element that characterizes Atlanta's urban form, is provided by Atlanta's urban forest, which is comprised of trees along the ROW, in community parks, and on City property as well as trees on private lands. These trees soften harsh building and pavement surfaces and make in-town living pleasant during the hot summer months by providing shade, reducing radiant heat, improving air quality, and enhancing the visual aesthetics of the urban landscape.

Development Patterns

The City of Atlanta recently adopted several mixed-use, smart-growth zoning districts known collectively as the Quality of Life districts that require development patterns compatible with the City's historic or traditional neighborhoods and that allow for a mix of uses built in a pedestrian-oriented manner. Historic and traditional neighborhoods typically have a connected street pattern, small blocks, tree-lined streets, sidewalks, and streets that promote walking, biking, and transit. These neighborhoods also contain small-scale commercial areas and community schools.

Tree-lined streets are integral to the character of many neighborhoods. Trees not only beautify streets, they also moderate temperature, absorb stormwater, clean pollutants from the air, provide habitat, provide shade, and buffer pedestrians from moving traffic. The Tree Protection Ordinance establishes standards to promote the City's policy that "there shall be no net loss of trees" and that Atlanta "will continue to enjoy the benefits provided by its urban forest." The ordinance establishes requirements for tree removal and replacement. In addition, planting street trees and trees in parking lots is a requirement for private development in all Quality of Life zoning districts.

The City of Atlanta Department of Parks, Recreation, and Cultural Affairs, has a tree planting program in partnership with Trees Atlanta. Founded in 1985, Trees Atlanta works to address Atlanta's tree loss, protect its forests, and create new green space by planting and maintaining trees in the public ROW. Some of the tree plantings are funded in part with the tree recompense fund. The City also has established partnerships in the higher density commercial areas with Community Improvement Districts that provide maintenance to the trees and streetscape.

Natural Resources

The City of Atlanta's vision is to balance growth and economic development with protection of the natural environment. Diverse natural resources exist within Atlanta's city limits, including the Chattahoochee River, numerous parks, scenic areas, agricultural and forested land, wetlands, protected mountains, and conservation areas.

The urban forest is a significant natural resource that is vulnerable to the impacts of development and that requires protection by government regulation and management. The City of Atlanta's Tree Ordinance protects the existing tree cover and requires replanting of trees.

Climate Protection and Sustainability

Sustainability is a concept that challenges everyone to consider the impact of their decisions on the economy, social equity, and the environment. It provides a framework to make decisions that will stimulate community development, promote fairness, and enhance quality of life for all. Sustainable communities use resources wisely, maintain healthy economies, and provide all citizens with equal access to environmental and economic benefits.

For the City of Atlanta, the goal of sustainability means building a community that lives within the self-perpetuating limits of its environment while maintaining high standards for economic development, environmental integrity, and social justice. Mayor Reed has set the goal for Atlanta to become one of the top ten sustainable cities in the United States. Achieving this goal will improve the quality of life of Atlanta's citizens by enhancing the quality of their environment while supporting jobs and long-term economic growth.

To become more sustainable and combat climate change, the City will commit to continual improvement and lead by example through policies and activities that support environmental sustainability. One of the City's benchmarks for sustainability directly impacts the management of the urban forest: "Provide a minimum of 10 acres of greenspace per 1,000 residents; create and maintain a park system that promotes and supports sustainable development; implement landscaping and facility renovations that reduce energy demand and maintenance costs" (City of Atlanta, 2011).

Section 2: Tree Inventory Assessment and Analysis

In July and August 2011, Davey arborists assessed and inventoried trees, stumps, and planting sites within the street ROW and trees and stumps in parks. The inventoried area included downtown Atlanta and selected neighborhoods just east and south of downtown (Appendix A). During the inventory 9,004 sites were collected: 8,465 trees, 116 stumps, and 423 vacant planting sites. Of the 9,004 sites recorded, 86% were located within the street ROW and 14% were located in parks (Table 2).

Table 2. Inventoried Sites (Overall)

Inventoried Sites	Streets	Parks	Total	Percent of Population
Trees	7,199	1,266	8,465	94%
Stumps	99	17	116	1%
Planting Sites	423	0	423	5%
Total	**7,721**	**1,283**	**9,004**	**100%**
Percent of Population	**86%**	**14%**	**100%**	

Data Collection Methods

Tree inventory data were collected using a system developed by Davey that utilizes a customized ArcPad program loaded onto pen-based field computers equipped with geographic information system (GIS) and global positioning system (GPS) receivers. The knowledge and professional judgment of Davey's arborists ensure the high quality of inventory data.

Data fields are defined in the glossary, and the site location method is provided in Appendix B. At each site, the following data fields were collected:

address number
area*
block side
canopy spread
CAP (Central Atlanta Progress, reported in this plan as ADID)
condition (evaluated by an assessment of roots, trunk, scaffold branches, twigs and branches, and foliage)
defects
further inspection
grate present
grow space length
grow space width
hardscape damage
inventory date
location
mapping coordinate
notes
overhead utilities
area 2 (park name listing)
primary maintenance
raised planter
side value
site number
stems
street name
tree height
tree size**

Davey has provided the collected data as an ESRI® shapefile, in a Microsoft Excel™ spreadsheet, and in an Access™ database. The City has subscribed to Davey's TreeKeeper® 7.7, a web-based tree management software that can be utilized to:

- View the inventory data through an integrated mapping system.
- Easily update and manage inventory data.
- Relate documents, photographs, and public requests regarding specific trees to that tree's inventory data.
- Create work orders and track expenses and vendors.
- Develop flexible reports.

Project Area

For management purposes, Atlanta's Arborist Division divided the project area into two geographic areas (Downtown and Expanded Inventory) and one management area (the ADID). The Downtown and Expanded Inventory areas divide the entire inventory dataset into two geographically based areas. The Downtown boundary was roughly North Avenue to the north, I-75 and Piedmont Avenue to the east, I-20 to the south, and Spring Street and Northside Drive to the west. The ADID was isolated by the City for analysis because of its funding through a community improvement district. The data set for the ADID is a subset that includes most of the Downtown and parts of the Expanded Inventory areas. The ADID area contains 220 blocks within an area generally bounded by: North Avenue to the north; I-75 and Piedmont Avenue (including part of Ralph McGill Boulevard and Central Park Place) to the east; Peachtree Street, Courtland Street, and Edgewood Avenue to the south; and the Norfolk-Southern rail line to the west.

Within the project area, the street ROW and 15 community parks were selected for inventory data collection: Central Park, Fire Station 5 Park, Freedom Park, Hardy Ivy Park, Hurt Park, John Calhoun Park, Mayors Park, Phoenix Park Number 2, Phoenix Park Number 3, Renaissance Park, Selena S. Butler Park, Stone Mountain Trail Area, Susan K. May Park, Walton Springs Triangle, and Woodruff Park. The Downtown area contained 40% of the inventoried sites, and 60% were located in the Expanded Inventory area (Table 3). The ADID management area contained 38% of the inventoried sites.

Table 3. Inventoried Sites by Area (Overall)

	Geographical Areas			Management Area
Inventoried Sites	**Downtown**	**Expanded Inventory**	**Total**	**ADID**
Trees	3,350	5,115	8,465	3,180
Stumps	35	81	116	37
Planting Sites	216	207	423	169
Total	**3,601**	**5,403**	**9,004**	**3,386**
Percent of Population	**40%**	**60%**	**100%**	**38%**

Davey inventoried 237 trees and stumps in the parks located within the Downtown and ADID areas, and 1,047 trees and stumps in the parks located within the Expanded Inventory area (Table 4). Of these, 64% were located within three parks: Phoenix Park (Numbers 2 and 3 combined), Central Park, and Renaissance Park, which are all within the Expanded Inventory area.

Table 4. Inventoried Trees and Stumps by Park (Overall)

Project Area	Park Name	Trees	Stumps	Sites Inventoried	Percent of Total
ADID and Downtown	Woodruff Park	112	0	112	9%
	Hurt Park	55	1	56	4%
	John Calhoun Park	23	0	23	2%
	Mayors Park	21	0	21	2%
	Hardy Ivy Park	16	0	16	1%
	Fire Station 5 Park	5	1	6	<1%
	Walton Springs Triangle	3	0	3	<1%
	Subtotal	**235**	**2**	**237**	**18%**
Expanded Inventory	Phoenix Park Number 2	242	1	243	19%
	Central Park	239	1	240	19%
	Renaissance Park	181	7	188	15%
	Phoenix Park Number 3	147	3	150	12%
	Stone Mt. Trail Area	85	0	85	7%
	Selena S. Butler Park	62	3	65	5%
	Freedom Park	56	0	56	4%
	Susan K. May Park	20	0	20	2%
	Subtotal	**1,032**	**15**	**1,047**	**82%**
Total Sites Inventoried	**All Parks**	**1,267**	**17**	**1,284**	**100%**

Urban Forest Assessment and Analyses

Data analysis and professional judgment are used to characterize the state of the inventoried tree population. Recognizing trends in the data can help guide short- and long-term management planning. In this Plan, Davey assessed diversity, size class distribution, general health, and potential threats within the Overall dataset and within the dataset of each area (Downtown, Expanded Inventory, and ADID).

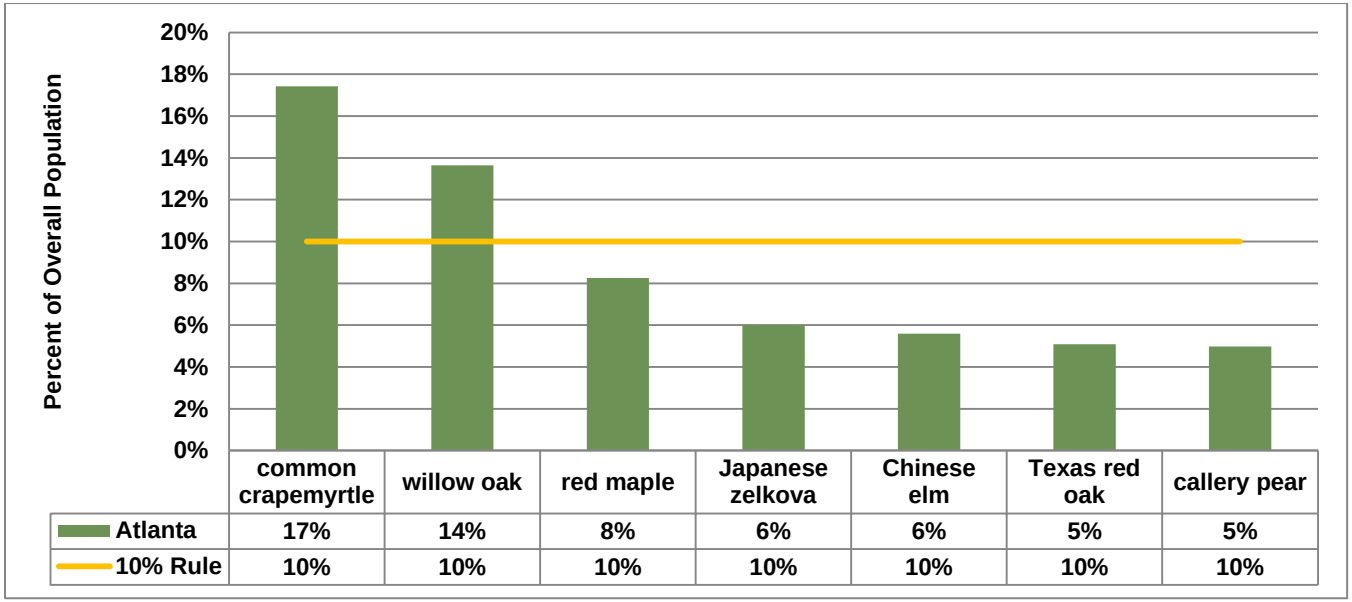
Overall Findings

The 2011 Overall inventory area map is provided in Appendix A. Davey inventoried 9,004 sites along street ROWs and within the parks.

Diversity

The diversity of the Overall dataset was rated relatively good, with 56 genera and 112 species represented. Within the Overall inventoried tree population, 51 genera and 102 species were represented along the street ROW, and 35 genera and 69 species were represented in the parks.

The percentages of the most common species identified during the inventory were compared to the 10-20-30 rule (Figure 1). These species represented populations equal to or greater than 5% of the Overall population (8,465 trees). Common crapemyrtle (*Lagerstroemia indica*) and willow oak (*Quercus phellos*) far exceeded the recommended 10% threshold for a single species in a population, comprising 17% and 14%, respectively. Red maple (*Acer rubrum*), Japanese zelkova (*Zelkova serrata*), Chinese elm (*Ulmus parvifolia*), Texas red oak (*Quercus texana*), and Callery pear (*Pyrus calleryana*) were approaching the 10% threshold as well.



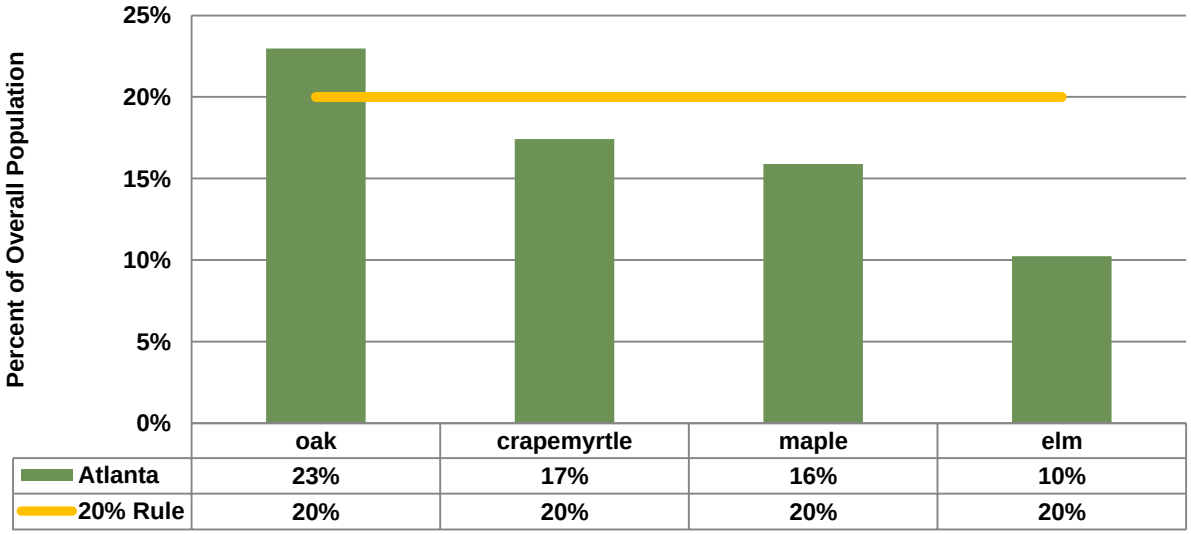
	common crapemyrtle	willow oak	red maple	Japanese zelkova	Chinese elm	Texas red oak	callery pear
Atlanta	17%	14%	8%	6%	6%	5%	5%
10% Rule	10%	10%	10%	10%	10%	10%	10%

Note: Only species populations ≥5% are illustrated in this figure.

Figure 1. Most Abundant Species (Overall)

The percentages of the most common genera identified during the inventory were compared to the 10-20-30 rule (Figure 2). The genera illustrated represented populations equal to or greater than 10% of the Overall population (8,465 trees). Oak (*Quercus* spp.) exceeded the recommended 20% threshold for a single genus in a population, comprising 23%. Crapemyrtle (*Lagerstroemia* spp.), maple (*Acer* spp.), and elm (*Ulmus* spp.) were approaching the 20% threshold as well.

Photographs 2 and 3. *Willow oak (*Quercus phellos*) and common crapemyrtle (*Lagerstroemia indica*) dominate Atlanta's public tree population. Having a greater variety of tree species of all ages will lead to a more sustainable urban forest.*

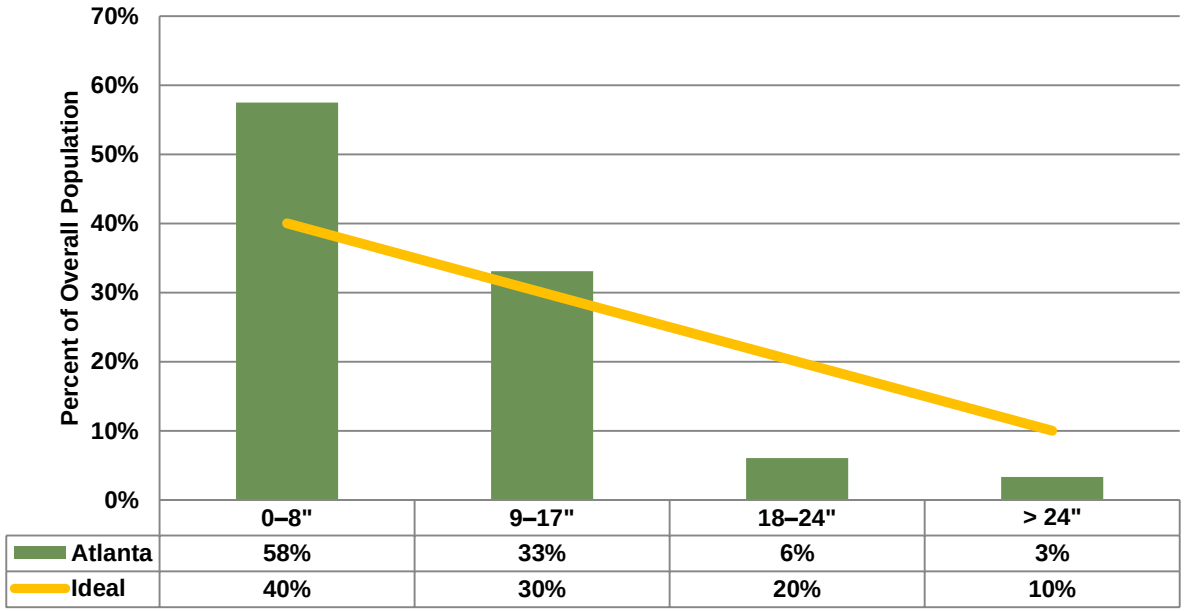


Note: Only genus populations ≥10% are illustrated in this figure.

Figure 2. Most Abundant Genera (Overall)

Size Class Distribution

The diameter size class distribution of the Overall inventoried tree population (street and park trees) was compared to the ideal proposed by Richards (1983) (Figure 3). Atlanta's distribution trended toward the ideal; however, larger diameter size classes fell short of the ideal. The number of trees in Atlanta's maturing tree population (18–24 inches DBH) was approximately 14% less than the ideal, and the mature tree population (>24 inches DBH) was 7% less than the ideal.



	0–8"	9–17"	18–24"	> 24"
Atlanta	58%	33%	6%	3%
Ideal	40%	30%	20%	10%

Figure 3. Diameter Size Class Distribution (Overall)

General Health

The Overall inventoried tree population was in good health: 7,075 trees (84%) were rated to be in good or excellent condition; 1,219 trees (14%) rated fair; and 171 trees (2%) rated poor, very poor, or dead (Figure 4).

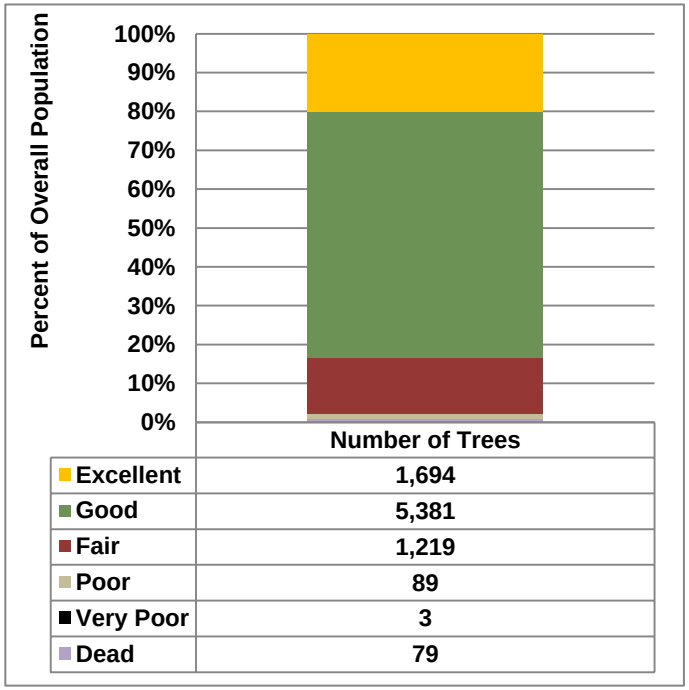


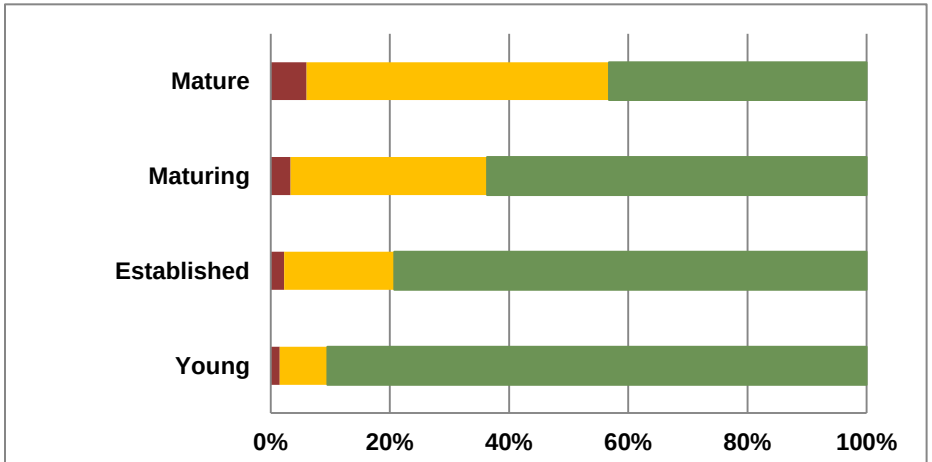
Figure 4. Tree Condition (Overall)

Trends of Species, Size, and Health

Comparing the health of a tree population to its relative age can provide some insight into the stability of the population. Figure 5 illustrates that as the relative age of the population matures, the general health declines. The number of trees rated fair, poor, very poor, or dead increases with increasing relative age; the number of trees rated good or excellent decreases as relative age increases.

The top five species in the Overall tree population were analyzed by relative age and condition (Table 5); data analysis indicated that the most abundant species in the Overall dataset were doing very well. More than 78% of the species populations were rated in good or better condition, and no more than 3% of the trees in each of the top five species were in poor or worse condition, regardless of relative age. Of the top five species in the Overall dataset, Japanese zelkova, red maple, and common crapemyrtle were most often noted to be in poor or worse health, and the relative ages of these trees were mostly young or established.

The species with the greatest percent in fair condition were Japanese zelkova and red maple. Most of the Japanese zelkova trees in fair health were at an established age and most of the red maples in fair health were at a young age, closely followed by the established age.



	Young	Established	Maturing	Mature
Poor to Dead	1%	2%	3%	6%
Fair	8%	18%	33%	51%
Excellent to Good	90%	79%	64%	43%

Figure 5. Tree Condition by Relative Age (Overall)

Table 5. Top Five Species by Size and Condition (Overall)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
common crapemyrtle (*Lagerstroemia indica*)	**1,197**	**265**	**10**	**3**	**1,475**	**100%**
Excellent	312	71	0	0	383	26%
Good	780	173	10	3	966	65%
Fair	96	20	0	0	116	8%
Poor	1	1	0	0	2	0%
Very Poor	2	0	0	0	2	0%
Dead	6	0	0	0	6	0%
willow oak (*Quercus phellos*)	**246**	**703**	**145**	**61**	**1,155**	**100%**
Excellent	58	100	4	0	162	14%
Good	167	551	115	34	867	75%
Fair	19	50	24	26	119	10%
Poor	1	2	2	1	6	1%
Dead	1	0	0	0	1	0%
red maple (*Acer rubrum*)	**422**	**232**	**36**	**8**	**698**	**100%**
Excellent	108	22	1	0	131	19%
Good	261	168	27	3	459	66%
Fair	48	39	6	4	97	14%
Poor	3	3	1	1	8	1%
Dead	2	0	1	0	3	0%
Japanese zelkova (*Zelkova serrata*)	**194**	**285**	**26**	**4**	**509**	**100%**
Excellent	25	20	0	0	45	9%
Good	149	199	7	2	357	70%
Fair	18	59	18	2	97	19%
Dead	2	7	1	0	10	2%
Chinese elm (*Ulmus parvifolia*)	**368**	**105**	**0**	**0**	**473**	**100%**
Excellent	136	35	0	0	171	36%
Good	210	63	0	0	273	58%
Fair	18	5	0	0	23	5%
Poor	1	1	0	0	2	0%
Dead	3	1	0	0	4	1%

Potential Threats to Trees

To promote the general health of a tree population, it is essential to monitor the various potential threats to trees in the urban environment. Planting a tree in a site that is not well suited for its species or that is too small may impede its health and affect its longevity. Installing hardware such as stakes, grates, or guards can injure trees and threaten their health and lifespan. Invasive pests or diseases can have a devastating effect on one or several species. Table 6 provides a summary of the noted threats to the Overall inventoried trees.

Overhead Utilities

During the inventory, Davey noted 2,431 trees in the Overall population with utility lines directly over or passing through the tree canopy. Large- or medium-growing trees that were noted to be located near overhead utilities accounted for 14% of the Overall inventoried trees.

The presence of overhead utilities was also noted for planting sites. Of the 423 planting sites inventoried along the street ROWs in the Overall dataset, 124 were noted to be located where overhead utilities were present; only small-growing tree species were recommended for these sites.

Tree Grates

Tree grates were noted for 9% of the Overall inventoried trees. Davey noted 98 trees with damage caused by a tree grate.

Pests and Diseases

There are many species of ambrosia beetle present in the United States and some are found in Georgia. Ambrosia beetles are often found on dying or recently dead trees; however, they can also be found in young or thin-barked trees. They bore into the heartwood of the tree and block xylem vessels with an ambrosia fungus. Most recent beetle concerns include the granulate ambrosia beetle (*Xylosandrus crassiusculus*) and Xm ambrosia beetle (*Xylosandrus mutilates*). These pests were not detected in Atlanta during the inventory, but if an infestation were to occur, the City could see severe changes in its tree population. A large percentage of the inventoried trees (76% and 18%, respectively) could become infested.

Other threats that were not identified during the inventory but that could cause major damage to the tree population if they had been are Asian longhorned beetle (ALB or *Anoplophora glabripennis*) and oak wilt (caused by the fungus *Ceratocystis fagacerum*). Davey inventoried 1,854 ALB host trees and 1,977 oak wilt host trees within the street ROW and in the parks (22% and 23% of the Overall population, respectively).

Table 6. Potential Threats to Trees (Overall)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present overhead	2,431	29%
	Potential problem (large- and medium-growing trees)	1,153	14%
Tree Grates	Total grates present	744	9%
	Current problem	98	1%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	6,394	76%
	Oak wilt (*Ceratocystis fagacerum*)	1,977	23%
	Asian longhorned beetle (*Anoplophora glabripennis*)	1,854	22%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	1,560	18%
	Sudden oak death (*Phytophthora ramorum*)	115	1%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	20	0%
	Thousand cankers disease (*Geosmithia morbida*)	1	0%

Growing Space Size

During the inventory, Davey noted that 40% of the Overall inventoried tree population was located in a growing space with the shortest dimension between 4 and 5 feet wide. This is considered a small growing space and is best suited only for species that are considered small at maturity. Sites best suited for medium-growing species (growing space between 6 and 7 feet wide) were noted for 4% of the population, and 28% of the population was in a growing space best suited for large-growing species (equal to or greater than 8 feet wide). The remaining 8% of the population was in a growing space considered to be too small and not suited for any tree.

Table 7 illustrates the distribution of common inventoried species by recorded growing space size. Willow oak, the first species listed, is a large-growing tree suited only for growing spaces equal to or greater than 8 feet wide. The inventory reports that 81% of the willow oak population was found in growing spaces too small for its size. Of the top five species in Atlanta, 69% were present in growing spaces that are too small for the mature tree size. A growing space too small for a tree's mature size may limit the ability of that tree to thrive.

Table 7. Tree Species Planted in Insufficient Growing Space (Overall)

Common Name	Botanical Name	Mature Tree Size	Tree Type for Smallest Dimension of Grow Space Size				Possible Threat	Total Species Population	Percent of Species Population	Percent of Total Population
			Not Suitable (0-3 Feet)	Small (4-5 Feet)	Medium (6-7 Feet)	Large (≥8 Feet)				
willow oak	*Quercus phellos*	Large	148	760	33	214	941	1,155	81%	11%
common crapemyrtle	*Lagerstroemia indica*	Small	757	232	20	466	757	1,475	51%	9%
Japanese zelkova	*Zelkova serrata*	Large	127	263	60	59	450	509	88%	5%
red maple	*Acer rubrum*	Medium	92	342	40	224	434	698	62%	5%
Chinese elm	*Ulmus parvifolia*	Medium	33	345	26	69	378	473	80%	4%
Texas red oak	*Quercus texana*	Large	40	325	10	56	375	431	87%	4%
Callery pear	*Pyrus calleryana*	Small	180	162	12	67	180	421	43%	2%
American elm	*Ulmus americana*	Large	18	130	29	50	177	227	78%	2%
Florida dogwood	*Cornus florida*	Small	153	20	0	35	153	208	74%	2%
winged elm	*Ulmus alata*	Large	71	64	4	16	139	155	90%	2%
eastern redbud	*Cercis canadensis*	Small	139	10	2	38	139	189	74%	2%
trident maple	*Acer buergerianum*	Small	134	168	1	11	134	314	43%	2%
sugar maple	*Acer saccharum*	Large	19	72	7	28	98	126	78%	1%
ginkgo	*Ginkgo biloba*	Medium	17	69	10	3	86	99	87%	1%
Freeman maple	*Acer x freemanii*	Medium	1	73	1	23	74	98	76%	1%
American sycamore	*Platanus occidentalis*	Large	9	47	2	28	58	86	67%	1%
water oak	*Quercus nigra*	Large	26	22	4	91	52	143	36%	1%
blackgum	*Nyssa sylvatica*	Medium	42	8	1	11	50	62	81%	1%

Raised Planter Growing Space Size

There were 137 trees growing in raised planters, which include moveable planters and attached planters. Table 8 lists the species that were located in raised planters and related growing space suitability. Of the 137 trees in raised planters, 79% were not suitable for that growing space size.

Table 8. Tree Species Planted in Raised Planters (Overall)

Species Present		Number Present	
Common Name	**Botanical Name**	**Good Location**	**Not Suitable Location**
Not Suitable Planter		**0**	**42**
Amur maple	*Acer tataricum ginnala*	0	5
Fosters holly	*Ilex x attenuata-Fosteri*	0	12
common crapemyrtle	*Lagerstroemia indica*	0	23
eastern arborvitae	*Thuja occidentalis*	0	1
Chinese elm	*Ulmus parvifolia*	0	1
Small Planter		**2**	**52**
red maple	*Acer rubrum*	0	5
saucer magnolia	*Magnolia x soulangiana*	2	0
Callery pear	*Pyrus calleryana*	0	2
willow oak	*Quercus phellos*	0	4
Chinese elm	*Ulmus parvifolia*	0	16
Japanese zelkova	*Zelkova serrata*	0	25
Medium Planter		**1**	**14**
willow oak	*Quercus phellos*	0	13
red maple	*Acer rubrum*	1	0
Japanese zelkova	*Zelkova serrata*	0	1
Large Planter		**26**	**0**
willow oak	*Quercus phellos*	16	0
Chinese elm	*Ulmus parvifolia*	10	0
Total		**29**	**108**
Percent		**21%**	**79%**

Downtown Area Findings

The 2011 Downtown inventory area map is provided in Appendix A. Davey inventoried 3,601 sites along street ROWs and in parks within the Downtown area.

Site Distribution

The Downtown inventory included 3,350 trees, 35 stumps, and 216 planting sites (40% of the Overall inventory). Most (93%) of the Downtown inventory was recorded along street ROWs: 3,115 trees, 33 stumps, and 216 planting sites. Within the seven Downtown parks, Davey inventoried 235 trees and 2 stumps.

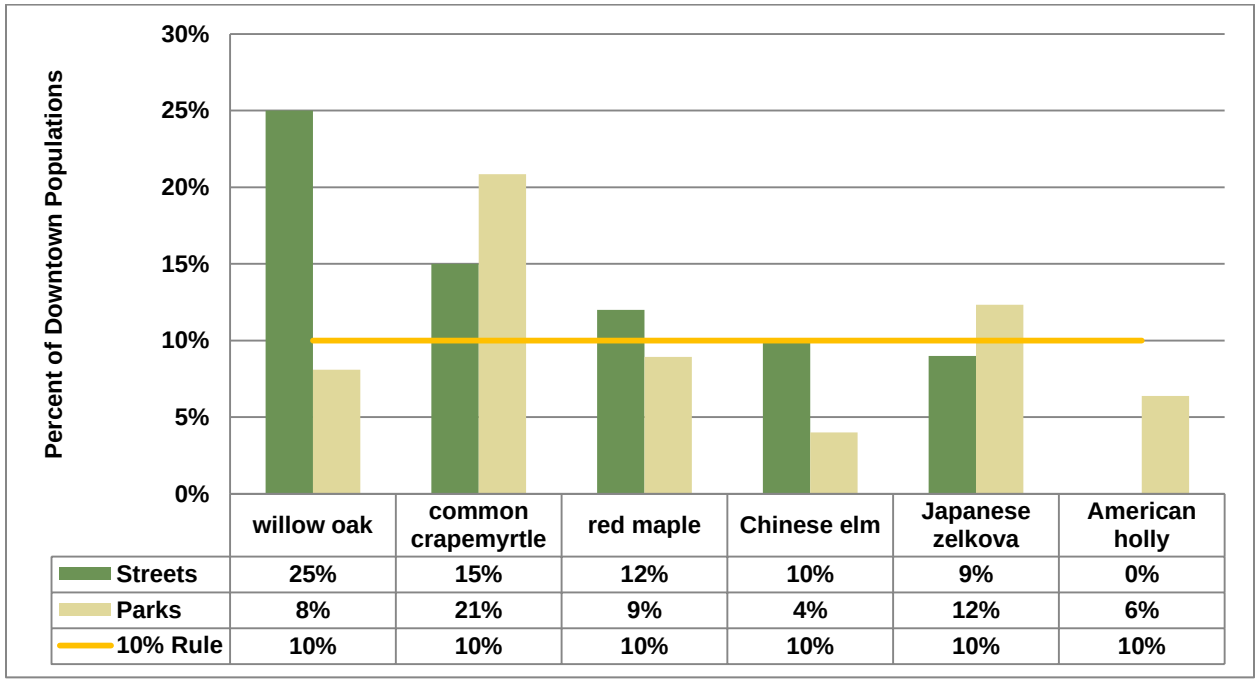
Table 9. Inventoried Sites (Downtown)

Inventoried Sites	Streets	Parks	Total	Percent of Population
Trees	3,115	235	3,350	93%
Stumps	33	2	35	1%
Planting Sites	216	0	216	6%
Total	**3,364**	**237**	**3,601**	**100%**
Percent of Population	**93%**	**7%**	**100%**	

Diversity

The diversity of the Downtown dataset was rated fair, with 32 genera and 62 species represented. There were 24 fewer genera and 50 fewer species found in the Downtown population than in the Overall population. Within the Downtown population, 25 genera and 51 species were represented along the street ROW, and 19 genera and 35 species were represented within the Downtown parks.

The percentages of the most common species identified during the inventory were compared to the 10-20-30 rule (Figure 6). These species represented populations equal to or greater than 5% of the Downtown population (3,115 street trees and 235 park trees). In the Downtown street ROW, willow oak, common crapemyrtle, and red maple far exceeded the recommended 10% threshold for a single species in a population, comprising 25%, 15%, and 12%, respectively. Chinese elm met the 10% threshold and Japanese zelkova was approaching the 10% threshold. In the Downtown parks, common crapemyrtle and Japanese zelkova far exceeded the recommended 10% threshold for a single species in a population, comprising 21% and 12%, respectively. Willow oak, red maple, American holly (*Ilex opaca*), and river birch (*Betula nigra*) were approaching the 10% threshold.

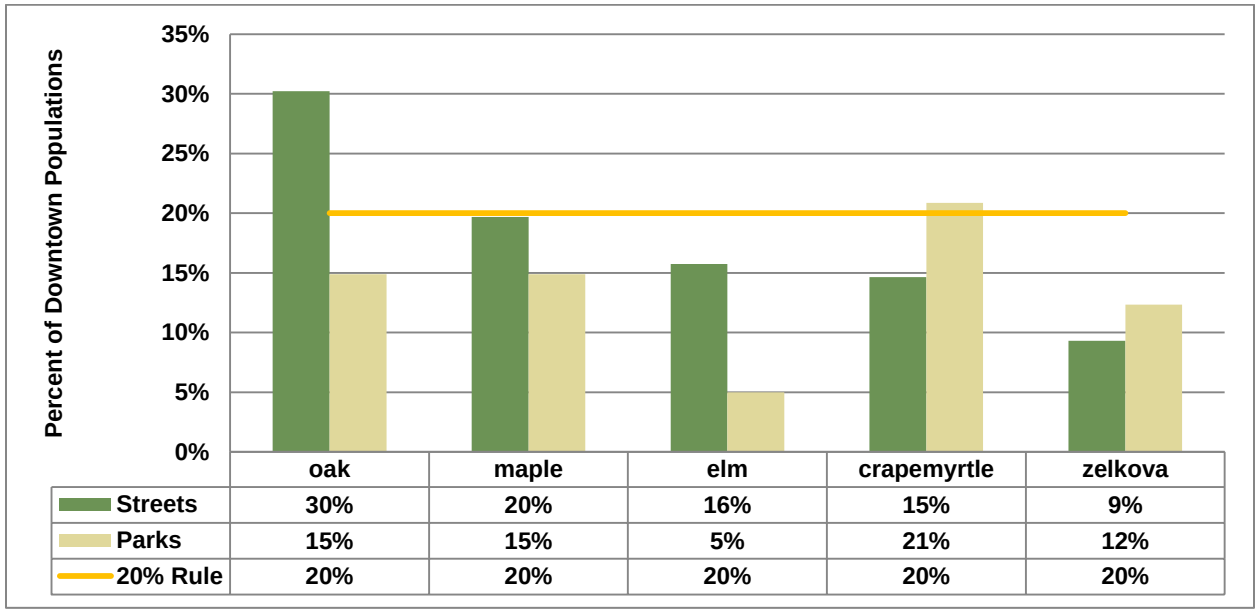


	willow oak	common crapemyrtle	red maple	Chinese elm	Japanese zelkova	American holly
Streets	25%	15%	12%	10%	9%	0%
Parks	8%	21%	9%	4%	12%	6%
10% Rule	10%	10%	10%	10%	10%	10%

Note: Only street and park species populations ≥5% are illustrated in this figure.

Figure 6. Most Abundant Species (Downtown)

The percentages of the most common genera identified during the inventory were compared to the 10-20-30 rule (Figure 7). The genera illustrated represented populations equal to or greater than 10% of the Downtown population (3,115 trees and 235 park trees). In the street ROW, oak exceeded the recommended 20% threshold for a single genus in a population, comprising 30% of the Downtown street ROW tree population. Maple met the 20% threshold and elm and crapemyrtle were approaching the 20% threshold. In the Downtown parks, crapemyrtle exceeded the recommended 20% threshold for a single genus in a population, comprising 21%. Oak, maple, and zelkova were approaching the 20% threshold.



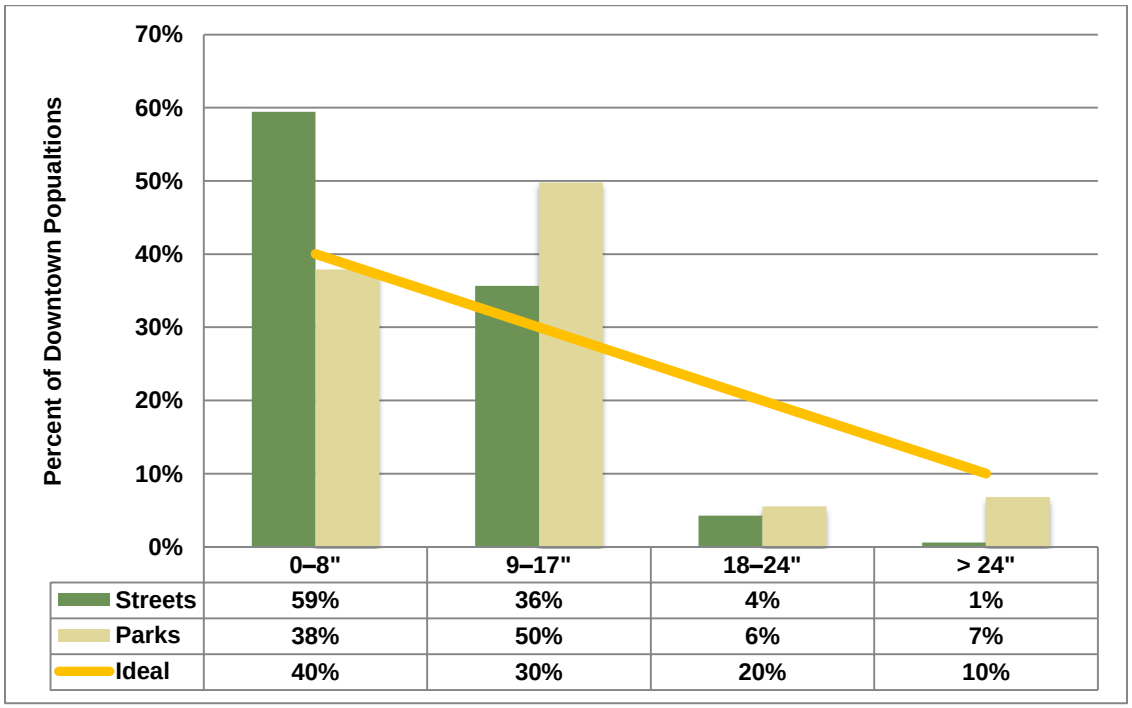
	oak	maple	elm	crapemyrtle	zelkova
Streets	30%	20%	16%	15%	9%
Parks	15%	15%	5%	21%	12%
20% Rule	20%	20%	20%	20%	20%

Note: Only street and park genus populations ≥10% are illustrated in this figure.

Figure 7. Most Abundant Genera (Downtown)

Size Class Distribution

The diameter size class distribution of the Downtown inventoried tree population (street and park trees separately) was compared to the ideal proposed by Richards (1983) (Figure 8). The distribution trended toward the ideal for both street ROW and park tree populations; however, larger diameter size classes fell short of the ideal. There were very few trees >17 inches DBH in the Downtown population.

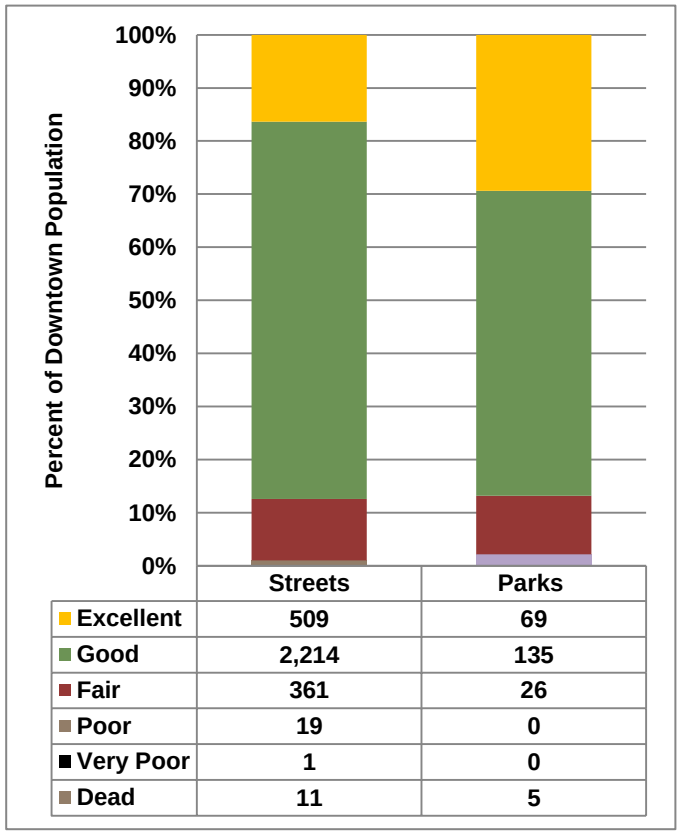


	0–8"	9–17"	18–24"	> 24"
Streets	59%	36%	4%	1%
Parks	38%	50%	6%	7%
Ideal	40%	30%	20%	10%

Figure 8. Diameter Size Class Distribution (Downtown)

General Health

The Downtown inventoried tree population was in good health (Figure 9). The Downtown street ROW had 2,723 trees (87%) rated to be in good or excellent condition; 361 trees (12%) rated fair; and 31 trees (1%) rated poor, very poor, or dead. The Downtown parks had 204 trees (87%) rated to be in good or excellent condition; 26 trees (11%) rated fair; and 5 trees (2%) rated poor, very poor, or dead.

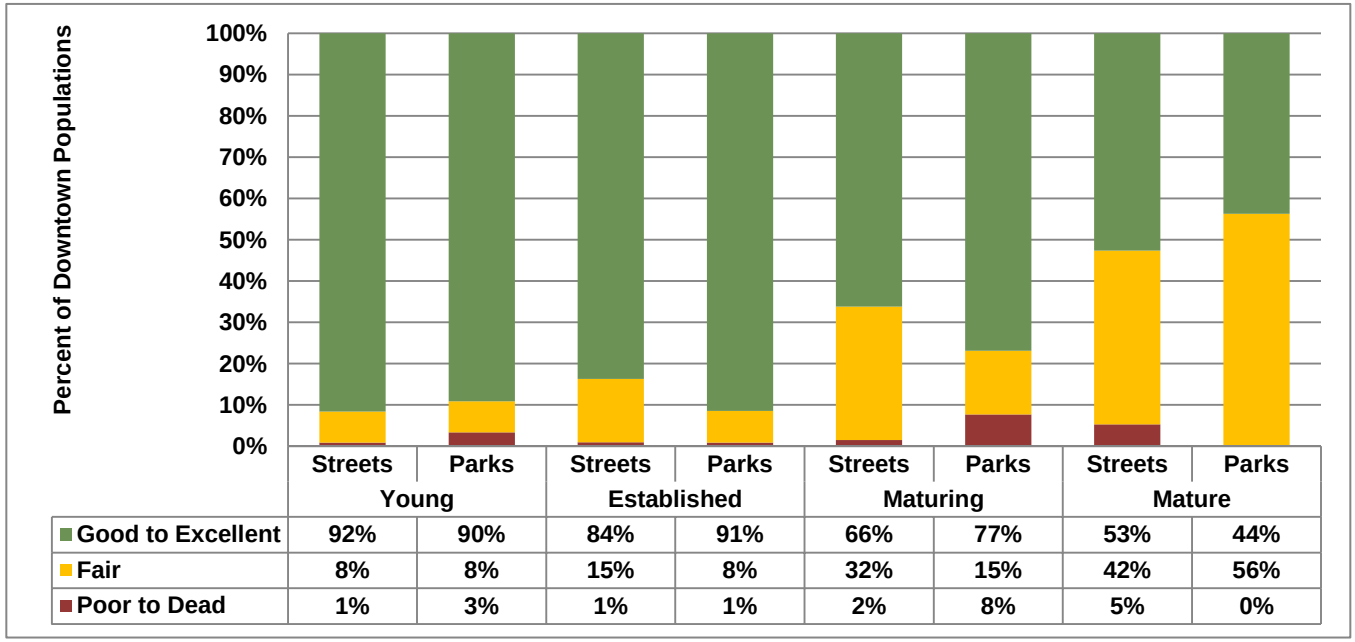


	Streets	Parks
Excellent	509	69
Good	2,214	135
Fair	361	26
Poor	19	0
Very Poor	1	0
Dead	11	5

Figure 9. Tree Condition (Downtown)

Trends of Species, Size, and Health

Comparing the health of a tree population to its relative age can provide some insight into the stability of the population. Figure 10 illustrates that as the relative age of the population matures, the general health declines. The number of trees rated fair, poor, very poor, or dead increases with increasing relative age; the number of trees rated good or excellent decreases as relative age increases.



	Streets	Parks	Streets	Parks	Streets	Parks	Streets	Parks
	Young		Established		Maturing		Mature	
Good to Excellent	92%	90%	84%	91%	66%	77%	53%	44%
Fair	8%	8%	15%	8%	32%	15%	42%	56%
Poor to Dead	1%	3%	1%	1%	2%	8%	5%	0%

Figure 10. Tree Condition by Relative Age (Downtown)

The top five species in the Downtown street ROW and park tree populations were analyzed by relative age and condition (Tables 10 and 11); data analysis indicated that the most abundant species in each dataset were doing very well. More than 76% of the species populations were in good or better condition, and no more than 2% of the street trees in each of the top five species were in poor or worse condition, regardless of relative age. Of the top five species in the Downtown street dataset, Japanese zelkova, red maple, common crapemyrtle, and willow oak were most often noted to be in poor or worse health, and the relative ages of these trees were mostly young or established. None of the top five species in the Downtown parks were in poor or worse condition.

In the Downtown street ROW population, the species with the greatest percent in fair condition were Japanese zelkova and red maple. Most of the Japanese zelkova trees in fair health were at an established age and most of the red maples in fair health were at a young age, closely followed by the established age. In the Downtown park tree population, the species with the greatest percent in fair condition was red maple. Most of the red maple trees in fair health were at an established age.

Table 10. Top Five Species by Size and Condition (Street ROWs, Downtown)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
red maple (*Acer rubrum*)	**264**	**96**	**5**	**0**	**365**	**100%**
Excellent	42	9	1	0	52	14%
Good	186	62	3	0	251	69%
Fair	33	23	1	0	57	16%
Poor	2	2	0	0	4	1%
Dead	1	0	0	0	1	0%
common crapemyrtle (*Lagerstroemia indica*)	**450**	**6**	**0**	**0**	**456**	**100%**
Excellent	39	0	0	0	39	9%
Good	383	6	0	0	389	85%
Fair	23	0	0	0	23	5%
Very Poor	1	0	0	0	1	0%
Dead	4	0	0	0	4	1%
willow oak (*Quercus phellos*)	**152**	**527**	**100**	**12**	**791**	**100%**
Excellent	41	68	4	0	113	14%
Good	96	414	72	7	589	74%
Fair	14	43	22	5	84	11%
Poor	1	2	2	0	5	1%

Table 10. Top Five Species by Size and Condition (Street ROWs, Downtown) (Continued)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
Chinese elm (*Ulmus parvifolia*)	**253**	**72**	**0**	**0**	**325**	**100%**
Excellent	85	23	0	0	108	33%
Good	151	43	0	0	194	60%
Fair	16	4	0	0	20	6%
Poor	1	1	0	0	2	1%
Dead	0	1	0	0	1	0%
Japanese zelkova (*Zelkova serrata*)	**103**	**179**	**6**	**2**	**290**	**100%**
Excellent	19	8	0	0	27	9%
Good	72	123	1	2	198	68%
Fair	11	44	5	0	60	21%
Dead	1	4	0	0	5	2%

Table 11. Top Five Species by Size and Condition (Parks, Downtown)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
common crapemyrtle (*Lagerstroemia indica*)	**28**	**21**	**0**	**0**	**49**	**100%**
Excellent	13	7	0	0	20	41%
Good	14	12	0	0	26	53%
Fair	1	2	0	0	3	6%
Japanese zelkova (*Zelkova serrata*)	**3**	**25**	**1**	**0**	**29**	**100%**
Excellent	0	8	0	0	8	28%
Good	3	17	1	0	21	72%
red maple (*Acer rubrum*)	**3**	**16**	**2**	**0**	**21**	**100%**
Excellent	1	2	0	0	3	14%
Good	1	11	1	0	13	62%
Fair	1	3	1	0	5	24%
willow oak (*Quercus phellos*)	**1**	**12**	**3**	**3**	**19**	**100%**
Excellent	0	4	0	0	4	21%
Good	1	8	3	2	14	74%
Fair	0	0	0	1	1	5%

Table 11. Top Five Species by Size and Condition (Parks, Downtown) (Continued)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
American holly (*Ilex opaca*)	**1**	**11**	**3**	**0**	**15**	**100%**
Excellent	0	5	0	0	5	33%
Good	1	5	3	0	9	60%
Fair	0	1	0	0	1	7%

Potential Threats to Trees

To promote the general health of a tree population, it is essential to monitor the various potential threats to trees in the urban environment. Planting a tree in a site that is not well suited for its species or that is too small may impede its health and affect its longevity. Installing hardware such as stakes, grates, or guards can injure trees and threaten their health and lifespan. Invasive pests or diseases can have a devastating effect on one or several species. Tables 12 and 13 provide summaries of the noted threats to the Downtown street ROW and park trees.

Overhead Utilities

During the inventory, Davey noted 458 street trees and 5 park trees (18% of the Downtown inventoried trees with overhead utilities) with utility lines directly over or passing through the tree canopy. Large- or medium-growing trees that were noted to be located near overhead utilities accounted for 10% of the inventoried Downtown trees.

The presence of overhead utilities was also noted for planting sites. Of the 216 planting sites inventoried along the street ROWs in the Downtown dataset, 19 (9%) were noted to be located where overhead utilities were present; only small-growing tree species were recommended for these sites.

Tree Grates

Tree grates were noted for 22% of the Downtown street ROW trees and for 3% of the inventoried park trees. Davey noted 92 trees with damage caused by a tree grate.

Pests and Diseases

There are many species of ambrosia beetle present in the United States and some are found in Georgia. Ambrosia beetles are often found on dying or recently dead trees; however, they can also be found in young or thin-barked trees. They bore into the heartwood of the tree and block xylem vessels with an ambrosia fungus. Most recent beetle concerns include the granulate ambrosia beetle and Xm ambrosia beetle. These pests were not detected in Atlanta during the inventory, but if an infestation were to occur, the City could see severe changes in its tree population. Large percentages of the Downtown street ROW and park trees (78% and 20%, respectively) could become infested.

Other threats that were not identified during the inventory but that could cause major damage to the tree population if they had been are ALB and oak wilt. Davey inventoried 993 ALB host trees and 979 oak wilt host trees within the Downtown street ROW and in the Downtown parks (30% and 29% of the Downtown population, respectively).

Table 12. Potential Threats to Trees (Street ROWs, Downtown)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	458	15%
	Potential problem (large- and medium-growing trees)	312	10%
Tree Grates	Total grates present	698	22%
	Current problem	85	3%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	2,449	79%
	Oak wilt (*Ceratocystis fagacerum*)	944	30%
	Asian longhorned beetle (*Anoplophora glabripennis*)	943	30%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	616	20%
	Sudden oak death (*Phytophthora ramorum*)	0	0%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	0	0%

Table 13. Potential Threats to Trees (Parks, Downtown)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	5	2%
	Potential problem (large- and medium-growing trees)	4	2%
Tree Grates	Total grates present	7	3%
	Current problem	7	3%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	159	68%
	Asian longhorned beetle (*Anoplophora glabripennis*)	50	21%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	42	18%
	Oak wilt (*Ceratocystis fagacerum*)	35	15%
	Sudden oak death (*Phytophthora ramorum*)	0	0%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	20	9%

Growing Space Size

During the inventory, Davey noted that 62% of the Downtown inventoried street tree population was located in a growing space with the shortest dimension between 4 and 5 feet wide. This is considered a small growing space and is best suited only for species that are considered small at maturity. Sites best suited for medium-growing species (growing space between 6 and 7 feet wide) were noted for 8% of the population, and 19% of the population was in a growing space best suited for large-growing species (equal to or greater than 8 feet wide). The remaining 10% of the population was in a growing space considered to be too small and not suited for any tree.

Parks generally have many open and unrestricted growing spaces ideal for large-growing trees. Most (82%) of the Downtown inventoried park tree population was located in a growing space with the shortest dimension equal to or greater than 8 feet wide. Sites best suited for medium-growing species were noted for 3% of the population, and 14% of the population was in a growing space best suited for small-growing species.

Table 14 illustrates the distribution of common inventoried species by recorded growing space size in the Downtown dataset. Of the top five species in the Downtown street ROW population, 73% were present in growing spaces that were too small for the mature tree size. Of the top five species in the Downtown parks, 19% were present in growing spaces that were too small for the mature tree size. A growing space too small for a tree's mature size may limit the ability of that tree to thrive.

Table 14: Tree Species Planted in Insufficient Growing Space (Parks, Downtown)

Area	Common Name	Botanical Name	Tree Size	Tree Type for Smallest Dimension of Grow Space Size				Possible Threat	Total Species Population	Percent of Species Population	Percent of Total Population
				Not Suitable (0-3 Feet)	Small (4-5 Feet)	Medium (6-7 Feet)	Large (≥8 Feet)				
Streets	willow oak	*Quercus phellos*	Large	92	588	49	62	729	791	92%	23%
	common crapemyrtle	*Lagerstroemia indica*	Small	48	64	0	344	48	456	11%	2%
	red maple	*Acer rubrum*	Medium	21	282	40	22	303	365	83%	10%
	Chinese elm	*Ulmus parvifolia*	Medium	10	253	18	44	263	325	81%	8%
	Japanese zelkova	*Zelkova serrata*	Large	32	192	58	8	282	290	97%	9%
Parks	common crapemyrtle	*Lagerstroemia indica*	Small	0	2	0	47	0	49	0%	21%
	Japanese zelkova	*Zelkova serrata*	Large	0	23	0	6	23	29	79%	12%
	red maple	*Acer rubrum*	Medium	0	0	0	21	0	21	0%	9%
	willow oak	*Quercus phellos*	Large	0	2	0	17	2	19	11%	8%
	American holly	*Ilex opaca*	Small	0	0	0	15	0	15	0%	6%

Raised Planter Growing Space Size

There were 137 street trees growing in raised planters, which include moveable planters and attached planters (4% of the Downtown street tree population). No park trees were noted to be growing in a raised planter. Table 15 lists the street tree species that were located in raised planters and related growing space suitability. Of the 137 trees in raised planters, 79% were not suitable for that growing space size.

Table 15. Tree Species Planted in Raised Planters (Street ROWs, Downtown)

Species Present		Number Present	
Common Name	**Botanical Name**	**Good Location**	**Not Suitable Location**
Not Suitable Planter		**0**	**42**
Amur maple	*Acer tataricum ginnala*	0	5
Fosters holly	*Ilex* x *attenuata-Fosteri*	0	12
common crapemyrtle	*Lagerstroemia indica*	0	23
eastern arborvitae	*Thuja occidentalis*	0	1
Chinese elm	*Ulmus parvifolia*	0	1
Small Planter		**2**	**52**
red maple	*Acer rubrum*	0	5
saucer magnolia	*Magnolia* x *soulangiana*	2	0
Callery pear	*Pyrus calleryana*	0	2
willow oak	*Quercus phellos*	0	4
Chinese elm	*Ulmus parvifolia*	0	16
Japanese zelkova	*Zelkova serrata*	0	25
Medium Planter		**1**	**14**
red maple	*Acer rubrum*	1	0
willow oak	*Quercus phellos*	0	13
Japanese zelkova	*Zelkova serrata*	0	1
Large Planter		**26**	**0**
willow oak	*Quercus phellos*	16	0
Chinese elm	*Ulmus parvifolia*	10	0
Total		**29**	**108**
Percent		**21%**	**79%**

Expanded Inventory Area Findings

The 2011 Expanded Inventory area map is provided in Appendix A. Davey inventoried 5,403 sites along City street ROWs and within City parks in the Expanded Area.

Site Distribution

The Expanded Inventory included 5,115 trees, 81 stumps, and 207 planting sites (60% of the Overall inventory). The street ROW contained most (81%) of the Expanded Inventory: 4,084 trees, 66 stumps, and 207 planting sites. Within the eight Expanded area parks, Davey inventoried 1,031 trees and 15 stumps.

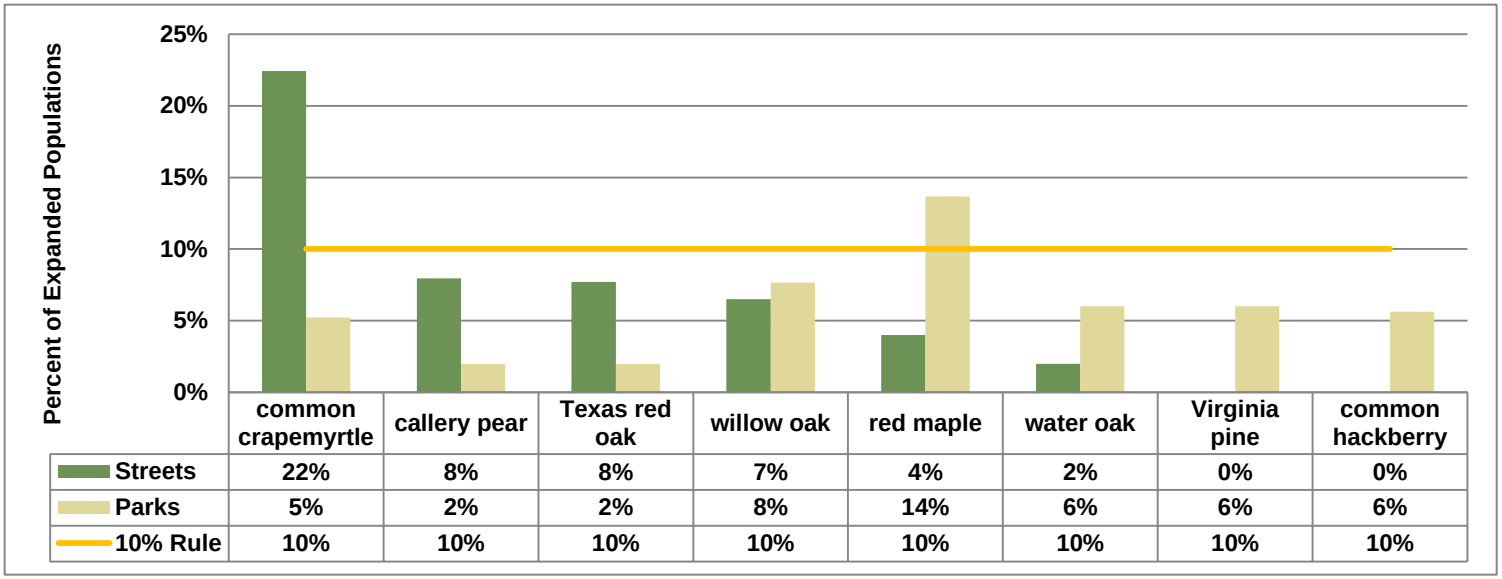
Table 16. Inventoried Sites (Expanded)

Inventoried Sites	Streets	Parks	Total	Percent of Population
Trees	4,084	1,031	5,115	95%
Stumps	66	15	81	1%
Planting Sites	207	0	207	4%
Total	**4,357**	**1,046**	**5,403**	**100%**
Percent of Population	**81%**	**19%**	**100%**	

Diversity

The diversity of the Expanded Inventory dataset was rated relatively good, with 52 genera and 100 species represented. There were 4 fewer genera and 12 fewer species found in the Expanded Inventory population than in the Overall population. Within the Expanded Inventory population, 44 genera and 93 species were represented along the street ROW, and 33 genera and 62 species were represented within the parks.

The percentages of the most common species identified during the inventory were compared to the 10-20-30 rule (Figure 11). These species represent populations equal to or greater than 5% of the Expanded Inventory area population (4,084 street trees and 1,031 park trees). In the street ROW, common crapemyrtle far exceeded the recommended 10% threshold for a single species in a population, comprising 22%. Callery pear, Texas red oak, and willow oak were approaching the 10% threshold. In the parks of the Expanded Inventory area, red maple far exceeded the recommended 10% threshold for a single species in a population, comprising 14%. Willow oak, water oak (*Quercus nigra*), Virginia pine (*Pinus virginiana*), common hackberry (*Celtis occidentalis*), and common crapemyrtle were approaching the 10% threshold.

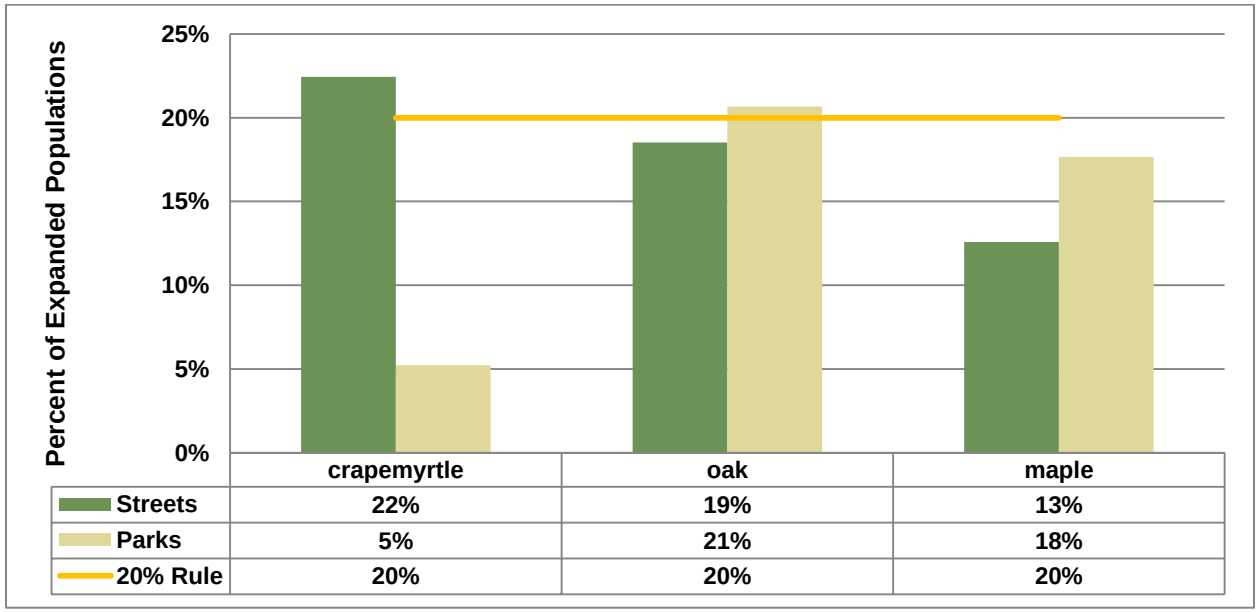


	common crapemyrtle	callery pear	Texas red oak	willow oak	red maple	water oak	Virginia pine	common hackberry
Streets	22%	8%	8%	7%	4%	2%	0%	0%
Parks	5%	2%	2%	8%	14%	6%	6%	6%
10% Rule	10%	10%	10%	10%	10%	10%	10%	10%

Note: Only street and park species populations ≥5% are illustrated in this figure.

Figure 11. Most Abundant Species (Expanded)

The percentages of the most common genera identified during the inventory were compared to the 10-20-30 rule (Figure 12). The genera illustrated represent populations equal to or greater than 10% of the Expanded Inventory area population (4,084 street trees and 1,031 park trees). In the street ROW, crapemyrtle exceeded the recommended 20% threshold for a single genus in a population, comprising 22%. Oak and maple were approaching the 20% threshold. In the parks Expanded Inventory area, oak exceeded the recommended 20% threshold for a single genus in a population, comprising 21%. Maple was approaching the 20% threshold.



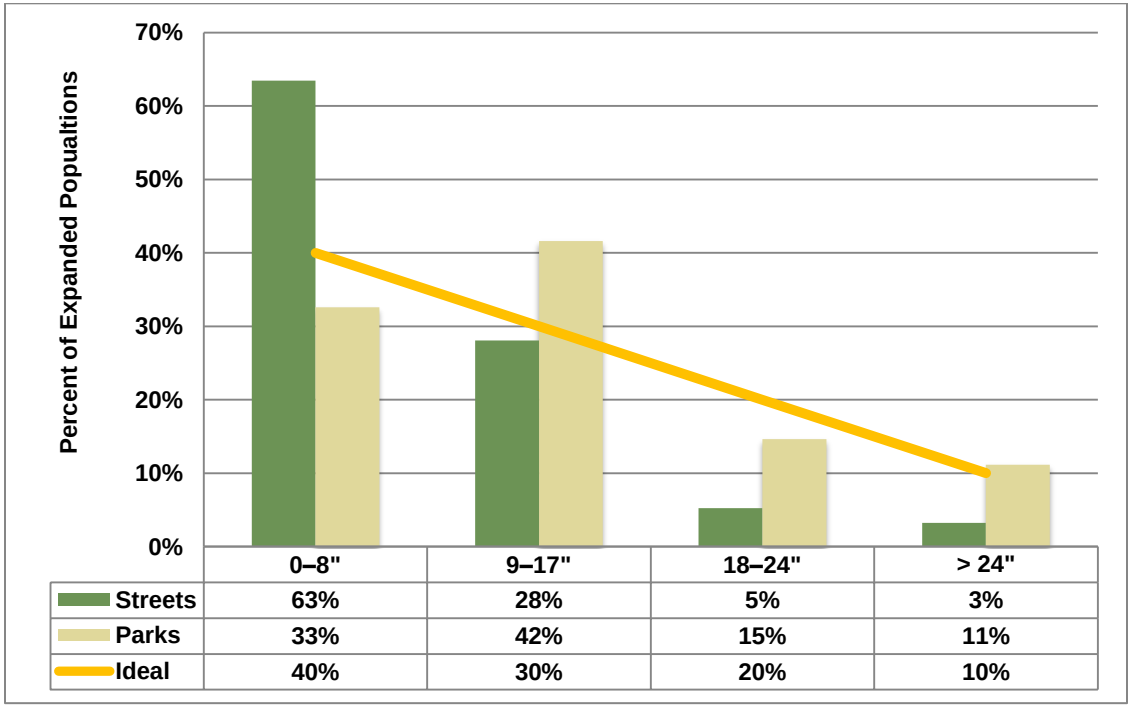
	crapemyrtle	oak	maple
Streets	22%	19%	13%
Parks	5%	21%	18%
20% Rule	20%	20%	20%

Note: Only street and park genus populations ≥10% are illustrated in this figure.

Figure 12. Most Abundant Genera (Expanded)

Size Class Distribution

The diameter size class distribution of the Expanded Inventory tree population (street and park trees separately) was compared to the ideal proposed by Richards (1983) (Figure 13). The distribution trended toward the ideal for both street ROW and park tree populations; however, larger diameter size classes of the street ROW trees and the young diameter size class of the park trees fell short of the ideal. In the street ROW, the number of trees in the maturing tree population was approximately 15% less than the ideal, and the mature tree population (>24 inches DBH) was 7% less than the ideal. In the parks, the number of trees in the young tree population was approximately 7% less than the ideal.



	0–8"	9–17"	18–24"	> 24"
Streets	63%	28%	5%	3%
Parks	33%	42%	15%	11%
Ideal	40%	30%	20%	10%

Figure 13. Diameter Size Class Distribution (Expanded)

General Health

The Expanded Inventory tree population was in good health (Figure 14). The Expanded street ROW had 3,310 trees (81%) rated to be in good or excellent condition; 664 trees (16%) rated fair; and 110 trees (3%) rated poor, very poor, or dead. The parks had 838 trees (81%) rated to be in good or excellent condition; 168 trees (16%) rated fair; and 25 trees (2%) rated poor, very poor, or dead.

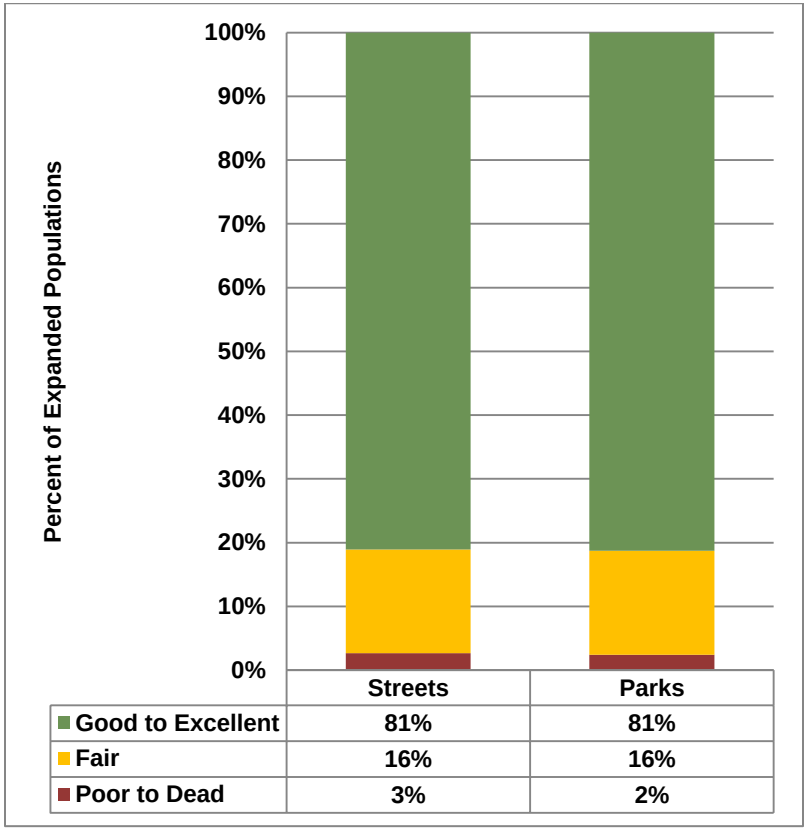
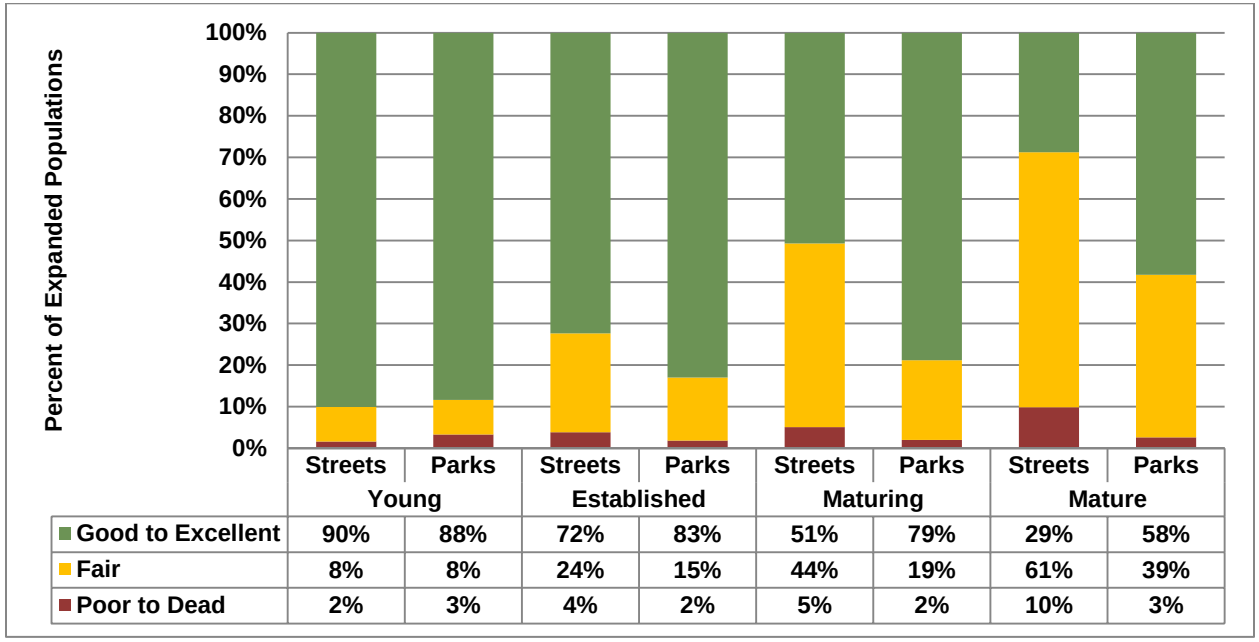


Figure 14. Tree Condition (Expanded)

Trends of Species, Size, and Health

Comparing the health of a tree population to its relative age can provide some insight into the stability of the population. Figure 15 illustrates that as the relative age of the population matures, the general health declines. The number of trees rated fair, poor, very poor, or dead increases with increasing relative age; the number of trees rated good or excellent decreases as relative age increases.



	Streets	Parks	Streets	Parks	Streets	Parks	Streets	Parks
	Young		Established		Maturing		Mature	
Good to Excellent	90%	88%	72%	83%	51%	79%	29%	58%
Fair	8%	8%	24%	15%	44%	19%	61%	39%
Poor to Dead	2%	3%	4%	2%	5%	2%	10%	3%

Figure 15. Tree Condition by Relative Age (Expanded)

The top five species in the Expanded Inventory street ROW and park tree populations were analyzed by relative age and condition (Tables 17 and 18); data analysis indicated that the most abundant species in each dataset were doing very well. More than 50% of the species populations were in good or better condition, and no more than 3% of each population were in poor or worse condition, regardless of relative age. Of the top five species in the Expanded Inventory street ROW dataset, Callery pear was most often noted to be in poor or worse health, and the relative ages of these trees were mostly established. Of the top five species in the Expanded Inventory park dataset, Virginia pine was most often noted to be in poor or worse health, and the relative ages of these trees were established or maturing.

In the Expanded Inventory street ROW tree population, the species with the greatest percent in fair condition was Callery pear. Most of the Callery pear trees in fair health were at an established age. In the Expanded Inventory park tree population, the species with the greatest percent in fair condition were Virginia pine and water oak; most of these trees were mature.

Table 17. Top Five Species by Size and Condition (Street ROWs, Expanded)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
trident maple (*Acer buergerianum*)	**170**	**8**	**0**	**0**	**178**	**100%**
Excellent	45	0	0	0	45	25%
Good	117	7	0	0	124	70%
Fair	7	1	0	0	8	4%
Poor	1	0	0	0	1	1%
common crapemyrtle (*Lagerstroemia indica*)	**684**	**220**	**9**	**3**	**916**	**100%**
Excellent	250	64	0	0	314	34%
Good	363	138	9	3	513	56%
Fair	67	17	0	0	84	9%
Poor	1	1	0	0	2	0%
Very Poor	1	0	0	0	1	0%
Dead	2	0	0	0	2	0%
Callery pear (*Pyrus calleryana*)	**19**	**227**	**66**	**13**	**325**	**100%**
Excellent	7	0	0	0	7	2%
Good	10	126	23	1	160	49%
Fair	2	97	43	11	153	47%
Poor	0	2	0	1	3	1%
Dead	0	2	0	0	2	1%
willow oak (*Quercus phellos*)	**90**	**117**	**22**	**37**	**266**	**100%**
Excellent	17	27	0	0	44	17%
Good	67	84	20	16	187	70%
Fair	5	6	2	20	33	12%
Poor	0	0	0	1	1	0%
Dead	1	0	0	0	1	0%
Texas red oak (*Quercus texana*)	**246**	**68**	**1**	**0**	**315**	**100%**
Excellent	66	8	0	0	74	23%
Good	152	49	1	0	202	64%
Fair	26	11	0	0	37	12%
Poor	1	0	0	0	1	0%
Dead	1	0	0	0	1	0%

Table 18. Top Five Species by Size and Condition (Parks, Expanded)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
red maple (*Acer rubrum*)	**42**	**75**	**18**	**6**	**141**	**100%**
Excellent	20	6	0	0	26	18%
Good	18	63	15	2	98	70%
Fair	4	6	2	3	15	11%
Poor	0	0	0	1	1	1%
Dead	0	0	1	0	1	1%
common hackberry (*Celtis occidentalis*)	**12**	**29**	**10**	**7**	**58**	**100%**
Excellent	1	1	0	0	2	3%
Good	10	28	9	4	51	88%
Fair	1	0	1	3	5	9%
Virginia pine (*Pinus virginiana*)	**2**	**41**	**18**	**1**	**62**	**100%**
Excellent	1	0	0	0	1	2%
Good	1	26	11	1	39	63%
Fair	0	14	6	0	20	32%
Dead	0	1	1	0	2	3%
water oak (*Quercus nigra*)	**10**	**14**	**11**	**27**	**62**	**100%**
Excellent	1	0	0	0	1	2%
Good	9	14	9	15	47	76%
Fair	0	0	2	12	14	23%
willow oak (*Quercus phellos*)	**3**	**47**	**20**	**9**	**79**	**100%**
Excellent	0	1	0	0	1	1%
Good	3	45	20	9	77	97%
Fair	0	1	0	0	1	1%

Potential Threats to Trees

To promote the general health of a tree population, it is essential to monitor the various potential threats to trees in the urban environment. Planting a tree in a site that is not well suited for its species or that is too small may impede its health and affect its longevity. Installing hardware such as stakes, grates, or guards can injure trees and threaten their health and lifespan. Invasive pests or diseases can have a devastating effect on one or several species. Tables 19 and 20 summarize the noted threats to the Expanded Inventory trees.

Overhead Utilities

During the inventory, Davey noted 1,950 street trees and 60 park trees (39% of the Expanded Inventory trees with overhead utilities) with utility lines directly over or passing through the tree canopy. Large- or medium-growing trees that were noted to be located near overhead utilities accounted for 15% of the inventoried trees in the Expanded area.

The presence of overhead utilities was also noted for planting sites. Of the 207 planting sites inventoried along the street ROWs in the Expanded dataset, 105 (50%) were noted to be located where overhead utilities were present; only small-growing tree species were recommended for these sites.

Tree Grates

Tree grates were noted for 1% of the Expanded Inventory street ROW trees but for none of the park trees. Davey noted 6 trees with damage caused by a tree grate.

Pests and Diseases

There are many species of ambrosia beetle present in the United States and some are found in Georgia. Ambrosia beetles are often found on dying or recently dead trees; however, they can be found in young or thin-barked trees too. They bore into the heartwood of the tree and block xylem vessels with an ambrosia fungus. Most recent beetle concerns include the granulate ambrosia beetle and Xm ambrosia beetle. These pests were not detected in Atlanta during the inventory, but if an infestation were to occur, the City could see severe changes in its tree population. Large percentages of the street ROW and park trees (71% and 18%, respectively) in the Expanded area could become infested.

Table 19. Potential Threats to Trees (Street ROWs, Expanded)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	1,950	48%
	Potential problem (large- and medium-growing trees)	721	18%
Tree Grates	Total grates present	28	1%
	Current problem	6	0%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	3,006	74%
	Asian longhorned beetle (*Anoplophora glabripennis*)	1,353	33%
	Oak wilt (*Ceratocystis fagacerum*)	784	19%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	694	17%
	Sudden oak death (*Phytophthora ramorum*)	25	1%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	6	0%

Table 20. Potential Threats to Trees (Parks, Expanded)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	60	6%
	Potential problem (large- and medium-growing trees)	57	6%
Tree Grates	Total grates present	0	0%
	Current problem	0	0%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	623	60%
	Asian longhorned beetle (*Anoplophora glabripennis*)	478	46%
	Oak wilt (*Ceratocystis fagacerum*)	214	21%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	210	20%
	Sudden oak death (*Phytophthora ramorum*)	12	1%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	13	1%

Other threats that were not identified during the inventory but that could cause major damage to the tree population if they had been are ALB and oak wilt. Davey inventoried 1,831 ALB host trees and 998 oak wilt host trees within the Expanded Inventory area street ROW and in the Expanded Inventory area parks (36% and 20% of the Expanded Inventory population, respectively).

Growing Space Size

During the inventory, Davey noted that 50% of the Expanded Inventory street tree population was located in a growing space with the shortest dimension less than 4 feet wide. This is considered a growing space not suitable for any tree of any size. Sites best suited for small-growing species were noted for 34% of the population, sites best suited for medium-growing species were noted for 2% of the population, and 14% of the population was in a growing space best suited for large-growing species (equal to or greater than 8 feet wide).

Parks generally have many open and unrestricted growing spaces ideal for large-growing trees. Most (99%) of the Expanded Inventory park tree population was located in a growing space with the shortest dimension equal to or greater than 8 feet wide. Sites best suited for medium-growing species were noted for less than 1% of the population, and 1% of the population was in a growing space best suited for small-growing species.

Table 21 illustrates the distribution of common inventoried species by recorded growing space size in the Expanded Inventory street ROW and parks. Of the top five species in the Expanded Inventory street ROW, 76% were present in growing spaces that were too small for the mature tree size. Of the top five species in the Expanded Inventory parks, 1% were present in growing spaces that were too small for the mature tree size. A growing space too small for a tree's mature size may limit the ability of that tree to thrive.

Table 21. Tree Species Planted in Insufficient Growing Space (Expanded)

Area	Common Name	Botanical Name	Tree Size	Tree Type for Smallest Dimension of Grow Space Size				Possible Threat	Total Species Population	Percent of Species Population	Percent of Total Population
				Not Suitable (0-3 Feet)	Small (4-5 Feet)	Medium (6-7 Feet)	Large (≥8 Feet)				
Streets	common crapemyrtle	*Lagerstroemia indica*	Small	709	162	20	25	709	916	77%	29%
	Callery pear	*Pyrus calleryana*	Small	172	112	12	29	172	325	53%	10%
	Texas red oak	*Quercus texana*	Large	40	247	2	26	289	315	92%	10%
	willow oak	*Quercus phellos*	Large	55	143	12	56	210	266	79%	9%
	trident maple	*Acer buergerianum*	Small	134	44	0	0	134	178	75%	6%
Parks	red maple	*Acer rubrum*	Medium	0	4	0	137	4	141	3%	60%
	willow oak	*Quercus phellos*	Large	0	0	0	79	0	79	0%	34%
	Virginia pine	*Pinus virginiana*	Large	0	0	0	62	0	62	0%	26%
	water oak	*Quercus nigra*	Large	0	0	0	62	0	62	0%	26%
	common hackberry	*Celtis occidentalis*	Large	0	0	0	58	0	58	0%	25%

Raised Planter Growing Space Size

In the Expanded Inventory area, there were no trees growing in raised planters.

ADID Management Area Findings

The 2011 ADID inventory area map is provided in Appendix A. Davey inventoried 3,386 sites along City street ROWs and within City parks within the ADID area.

Site Distribution

The ADID inventory included 3,180 trees, 37 stumps, and 169 planting sites (38% of the Overall inventory). The street ROW contained most (93%) of the ADID inventory: 2,945 trees, 35 stumps, and 169 planting sites. Within the seven ADID parks, Davey inventoried 235 trees and 2 stumps. No planting sites were recorded for the parks.

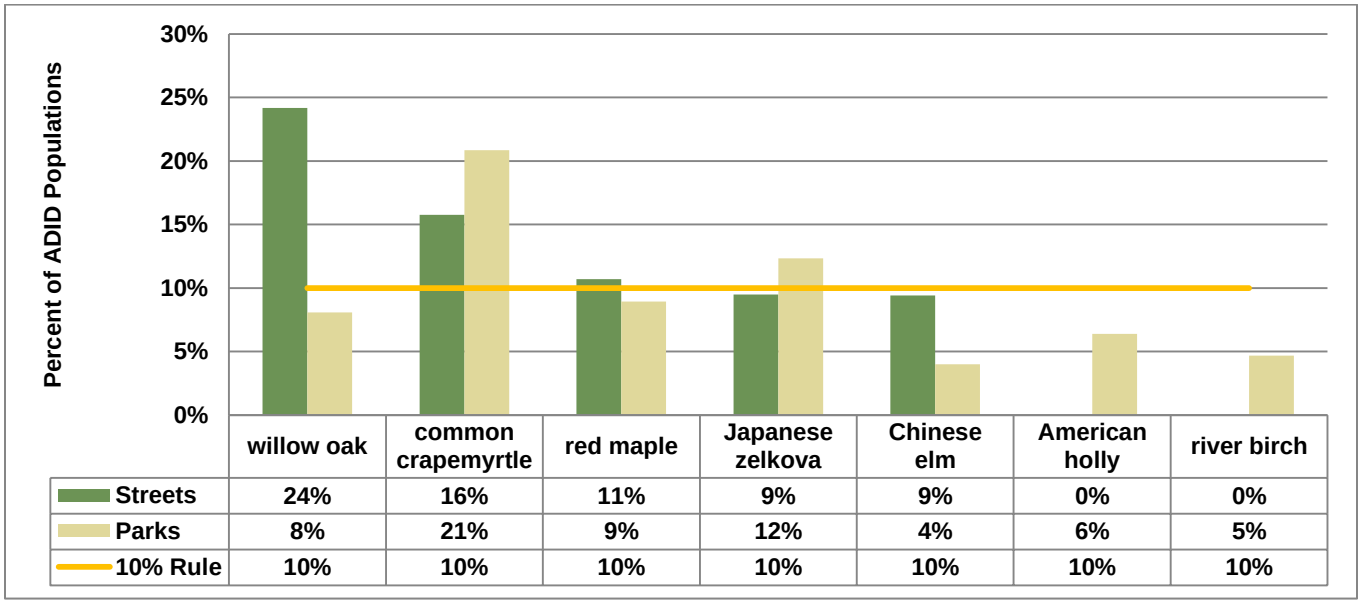
Table 22. Inventoried Sites (ADID)

Inventoried Sites	Streets	Parks	Total	Percent of Population
Trees	2,945	235	3,180	95%
Stumps	35	2	37	1%
Planting Sites	169	0	169	5%
Total	**3,149**	**237**	**3,386**	**100%**
Percent of Population	**93%**	**7%**	**100%**	

Diversity

The diversity of the ADID dataset was rated fair, with 29 genera and 58 species represented. There were 27 fewer genera and 54 fewer species found in the ADID population than in the Overall population. Within the ADID population, 22 genera and 48 species were represented along the street ROW, and 17 genera and 34 species were represented within the parks.

The percentages of the most common species identified during the inventory were compared to the 10-20-30 rule (Figure 16). These species represent populations equal to or greater than 5% of the ADID population (2,945 street trees and 235 park trees). In the street ROW, willow oak, common crapemyrtle, and red maple far exceeded the recommended 10% threshold for a single species in a population, comprising 24%, 16%, and 11%, respectively. Chinese elm and Japanese zelkova were approaching the 10% threshold. In the parks of the ADID, common crapemyrtle and Japanese zelkova far exceeded the recommended 10% threshold for a single species in a population, comprising 21% and 12%, respectively. Willow oak, red maple, American holly, and river birch were approaching the 10% threshold.

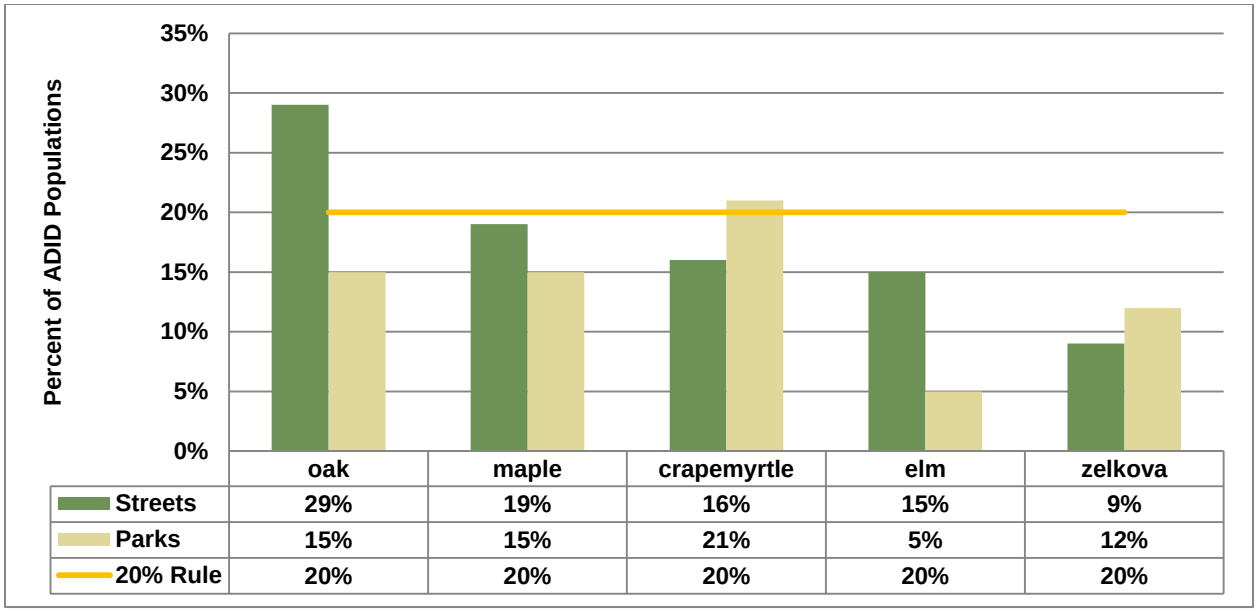


	willow oak	common crapemyrtle	red maple	Japanese zelkova	Chinese elm	American holly	river birch
Streets	24%	16%	11%	9%	9%	0%	0%
Parks	8%	21%	9%	12%	4%	6%	5%
10% Rule	10%	10%	10%	10%	10%	10%	10%

Note: Only street and park species populations ≥5% are illustrated in this figure.

Figure 16. Most Abundant Species (ADID)

The percentages of the most common genera identified during the inventory were compared to the 10-20-30 rule (Figure 17). The genera illustrated represent populations equal to or greater than 10% of the ADID population (2,945 trees and 235 park trees). In the street ROW, oak exceeded the recommended 20% threshold for a single genus in a population, comprising 29%. Maple, crapemyrtle, and elm were approaching the 20% threshold. In the parks of the ADID, crapemyrtle exceeded the recommended 20% threshold for a single genus in a population, comprising 21%. Oak, maple, and zelkova were approaching the 20% threshold.



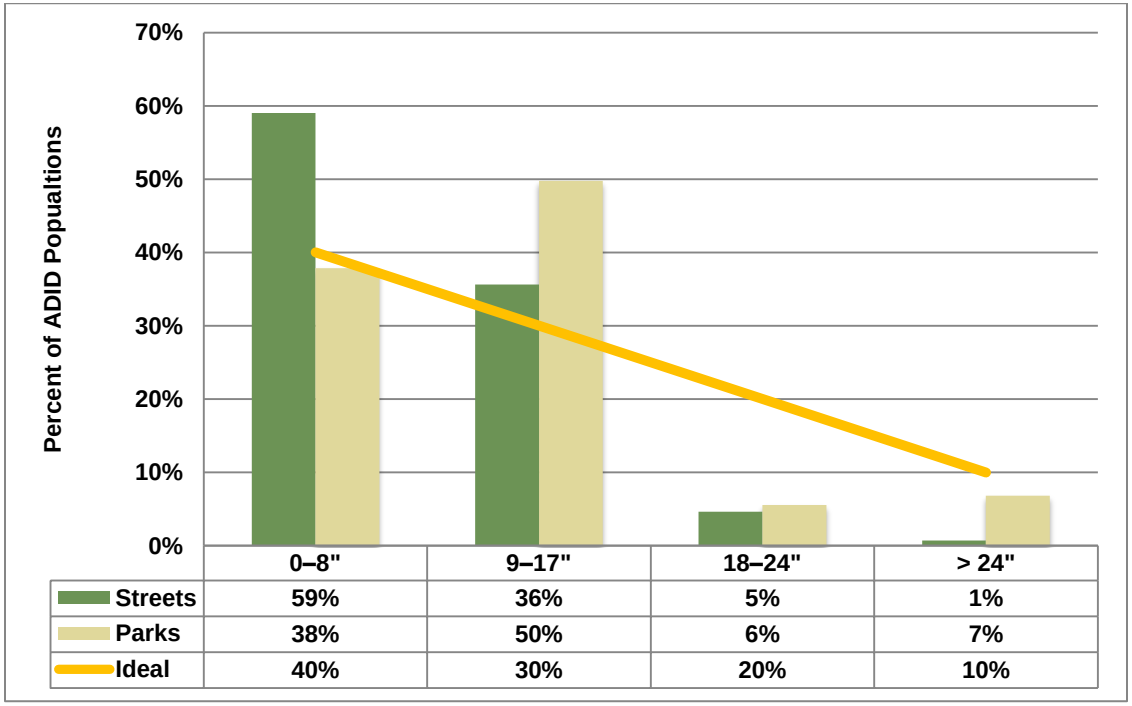
	oak	maple	crapemyrtle	elm	zelkova
Streets	29%	19%	16%	15%	9%
Parks	15%	15%	21%	5%	12%
20% Rule	20%	20%	20%	20%	20%

Note: Only street and park genus populations ≥10% are illustrated in this figure.

Figure 17. Most Abundant Genera (ADID)

Size Class Distribution

The diameter size class distribution of the ADID inventoried tree population (street and park trees separately) was compared to the ideal proposed by Richards (1983) (Figure 18). The distribution trended toward the ideal for both street and park tree populations; however, larger diameter size classes fell short of the ideal. There were very few trees >17 inches DBH in the ADID population.

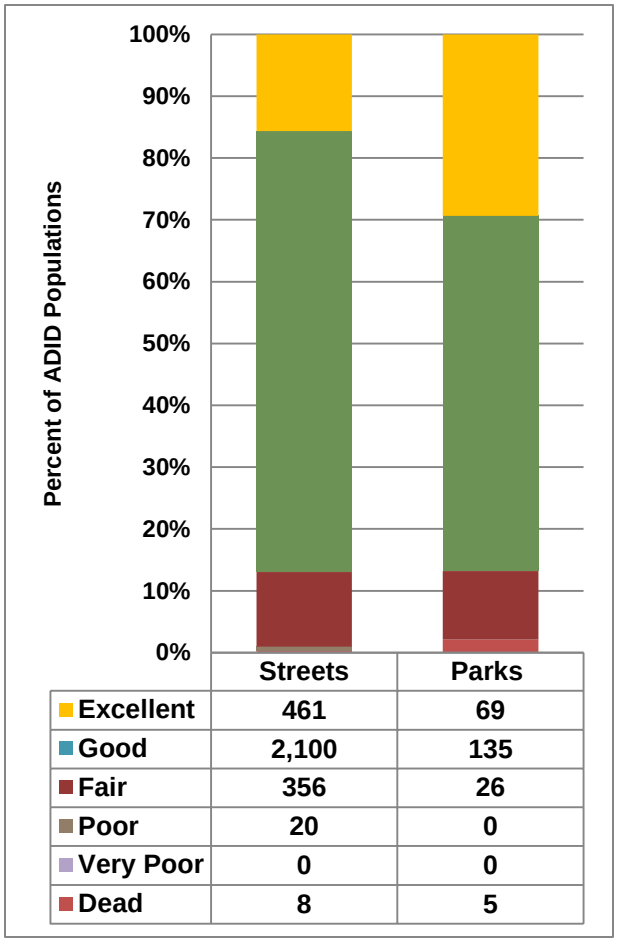


	0–8"	9–17"	18–24"	> 24"
Streets	59%	36%	5%	1%
Parks	38%	50%	6%	7%
Ideal	40%	30%	20%	10%

Figure 18. Diameter Size Class Distribution (ADID)

General Health

The ADID inventoried tree population was in good health (Figure 19). The ADID street ROW had 2,561 trees (87%) rated to be in good or excellent condition; 356 trees (12%) rated fair; and 28 trees (1%) rated poor, very poor, or dead. The ADID parks had 204 trees (87%) rated to be in good or excellent condition; 26 trees (11%) rated fair; and 5 trees (2%) rated poor, very poor, or dead.

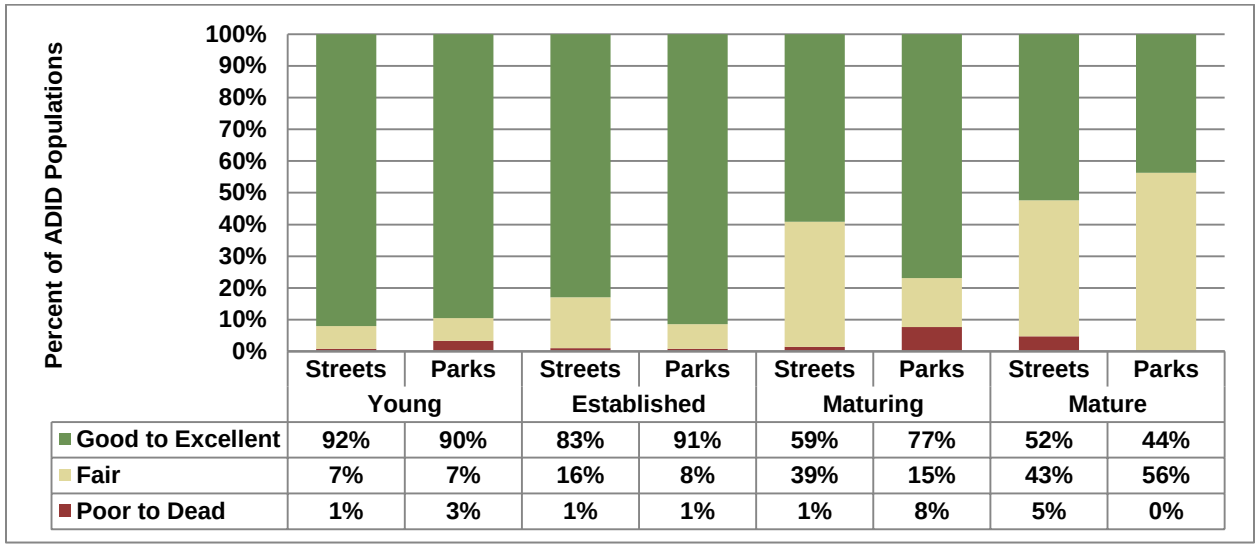


	Streets	Parks
Excellent	461	69
Good	2,100	135
Fair	356	26
Poor	20	0
Very Poor	0	0
Dead	8	5

Figure 19. Tree Condition (ADID)

Trends of Species, Size, and Health

Comparing the health of a tree population to its relative age can provide some insight into the stability of the population. Figure 20 illustrates that as the relative age of the population matures, the general health declines. The number of trees rated fair, poor, very poor, or dead increases with increasing relative age; the number of trees rated good or excellent decreases as relative age increases.



	Streets	Parks	Streets	Parks	Streets	Parks	Streets	Parks
	Young		Established		Maturing		Mature	
Good to Excellent	92%	90%	83%	91%	59%	77%	52%	44%
Fair	7%	7%	16%	8%	39%	15%	43%	56%
Poor to Dead	1%	3%	1%	1%	1%	8%	5%	0%

Figure 20. Tree Condition by Relative Age (ADID)

The top five species in the ADID street and park tree populations were analyzed by relative age and condition (Tables 23 and 24); data analysis indicated that the most abundant species in each dataset were doing very well. More than 76% of the species populations were in good or better condition, and no more than 1% of the street trees in each of the top five species were in poor or worse condition, regardless of relative age. Of the top five species in the ADID street dataset, red maple and willow oak were most often noted to be in poor or worse health, and the relative ages of these trees were mostly young or established. None of the top five species in the parks were in poor or worse condition.

In the street tree population, the species with the greatest percent in fair condition were Japanese zelkova and red maple. Most of the Japanese zelkova trees in fair health were at an established age and most of the red maples in fair health were at a young age, closely followed by the established age. In the park population, the species with the greatest percent in fair condition was red maple. Most of the red maple trees in fair health were at an established age.

Table 23. Top Five Species by Size and Condition (Street ROWs, ADID)

Species by Condition	0-8"	9-17"	18-24"	>24"	Grand Total	Percent of Species Population
red maple (*Acer rubrum*)	**228**	**84**	**3**	**0**	**315**	**100%**
Excellent	38	7	0	0	45	14%
Good	158	54	2	0	214	68%
Fair	29	21	1	0	51	16%
Poor	2	2	0	0	4	1%
Dead	1	0	0	0	1	0%
common crapemyrtle (*Lagerstroemia indica*)	**461**	**3**	**0**	**0**	**464**	**100%**
Excellent	59	0	0	0	59	13%
Good	376	3	0	0	379	82%
Fair	23	0	0	0	23	5%
Dead	3	0	0	0	3	1%
willow oak (*Quercus phellos*)	**137**	**472**	**88**	**15**	**712**	**100%**
Excellent	33	57	1	0	91	13%
Good	90	373	63	8	534	75%
Fair	13	40	22	7	82	12%
Poor	1	2	2	0	5	1%
Chinese elm (*Ulmus parvifolia*)	**210**	**67**	**0**	**0**	**277**	**100%**
Excellent	61	21	0	0	82	30%
Good	133	40	0	0	173	62%
Fair	15	4	0	0	19	7%
Poor	1	1	0	0	2	1%
Dead	0	1	0	0	1	0%
Japanese zelkova (*Zelkova serrata*)	**87**	**183**	**7**	**2**	**279**	**100%**
Excellent	8	7	0	0	15	5%
Good	68	128	2	2	200	72%
Fair	11	45	5	0	61	22%
Dead	0	3	0	0	3	1%

Table 24. Top Five Species by Size and Condition (Parks, ADID)

Species by Condition	0-8	9-17	18-24	>24	Grand Total	Percent of Species Population
red maple (*Acer rubrum*)	**3**	**16**	**2**	**0**	**21**	**100%**
Excellent	1	2	0	0	3	14%
Good	1	11	1	0	13	62%
Fair	1	3	1	0	5	24%
American holly (*Ilex opaca*)	**1**	**11**	**3**	**0**	**15**	**100%**
Excellent	0	5	0	0	5	33%
Good	1	5	3	0	9	60%
Fair	0	1	0	0	1	7%
common crapemyrtle (*Lagerstroemia indica*)	**28**	**21**	**0**	**0**	**49**	**100%**
Excellent	13	7	0	0	20	41%
Good	14	12	0	0	26	53%
Fair	1	2	0	0	3	6%
willow oak (*Quercus phellos*)	**1**	**12**	**3**	**3**	**19**	**100%**
Excellent	0	4	0	0	4	21%
Good	1	8	3	2	14	74%
Fair	0	0	0	1	1	5%
Japanese zelkova (*Zelkova serrata*)	**3**	**25**	**1**	**0**	**29**	**100%**
Excellent	0	8	0	0	8	28%
Good	3	17	1	0	21	72%

Potential Threats to Trees

To promote the general health of a tree population, it is essential to monitor the various potential threats to trees in the urban environment. Planting a tree in a site that is not well suited for its species or that is too small may impede its health and affect its longevity. Installing hardware such as stakes, grates, or guards can injure trees and threaten their health and lifespan. Invasive pests or diseases can have a devastating effect on one or several species. Tables 25 and 26 provide summaries of the noted threats to the ADID street ROW and park inventoried trees.

Overhead Utilities

During the inventory, Davey noted 400 street trees and 5 park trees (13% of the ADID inventoried trees with overhead utilities) with utility lines directly over or passing through the tree canopy. Large- or medium-growing trees that were noted to be located near overhead utilities accounted for 9% of the inventoried ADID trees.

The presence of overhead utilities was also noted for planting sites. Of the 169 planting sites inventoried along the street ROWs in the ADID dataset, 20 (12%) were noted to be located where overhead utilities were present; only small-growing tree species were recommended for these sites.

Tree Grates

Tree grates were noted for 23% of the ADID street ROW trees and for 8% of the park trees. Davey noted 90 trees with damage caused by a tree grate.

Pests and Diseases

There are many species of ambrosia beetle present in the United States and some are found in Georgia. Ambrosia beetles are often found on dying or recently dead trees; however, they can also be found in young or thin-barked trees. They bore into the heartwood of the tree and block xylem vessels with an ambrosia fungus. Most recent beetle concerns include the granulate ambrosia beetle and Xm ambrosia beetle. These pests were not detected in Atlanta during the inventory, but if an infestation were to occur, the City could see severe changes in its tree population. Large percentages of the ADID street ROW and park trees (77% and 19%, respectively) could become infested.

Other threats that were not identified during the inventory but that could cause major damage to the tree population if they had been are ALB and oak wilt. Davey inventoried 897 ALB host trees and 889 oak wilt host trees within the ADID street ROW and in the ADID parks (28% and 28% of the ADID population, respectively).

Table 25. Potential Threats to Trees (Street ROWs, ADID)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	400	14%
	Potential problem (large- and medium-growing trees)	268	9%
Tree Grates	Total grates present	670	23%
	Current problem	83	3%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	2,284	78%
	Oak wilt (*Ceratocystis fagacerum*)	854	29%
	Asian longhorned beetle (*Anoplophora glabripennis*)	847	29%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	571	19%
	Sudden oak death (*Phytophthora ramorum*)	0	0%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	0	0%

Table 26. Potential Threats to Trees (Parks, ADID)

Potential Threats to Trees		Number of Trees	Percent of Population
Overhead Utilities	Total present	5	2%
	Potential problem (large- and medium-growing trees)	4	2%
Tree Grates	Total grates present	18	8%
	Current problem	7	3%
Pests and Diseases	Granulate ambrosia beetle (*Xylosandrus crassiusculus*)	165	70%
	Asian longhorned beetle (*Anoplophora glabripennis*)	50	21%
	Xm ambrosia beetle (*Xylosandrus mutilatus*)	42	18%
	Oak wilt (*Ceratocystis fagacerum*)	35	15%
	Emerald ash borer (*Agrilus planipennis Fairmaire*)	1	0%
	Sudden oak death (*Phytophthora ramorum*)	0	0%

Growing Space Size

During the 2011 inventory, Davey noted that 58% of the ADID inventoried street tree population was located in a growing space with the shortest dimension between 4 and 5 feet wide. This is considered a small growing space and is best suited only for species that are considered small at maturity. Sites best suited for medium-growing species (growing space between 6 and 7 feet wide) were noted for 9% of the population, and 21% of the population was in a growing space best suited for large-growing species (equal to or greater than 8 feet wide). The remaining 12% of the population was in a growing space considered to be too small and not suited for any tree.

Parks generally have many open and unrestricted growing spaces ideal for large-growing trees. Most (83%) of the ADID inventoried park tree population was located in a growing space with the shortest dimension equal to or greater than 8 feet wide. Sites best suited for medium-growing species were noted for 3% of the population, and 14% of the population was in a growing space best suited for small-growing species.

Table 27 illustrates the distribution of common inventoried species by recorded growing space size in the ADID street ROW and parks. Of the top five species in the ADID street ROW, 71% were present in growing spaces that were too small for the mature tree size. Of the top five species in the ADID parks, 19% were present in growing spaces that were too small for the mature tree size. A growing space too small for a tree's mature size may limit the ability of that tree to thrive.

Table 27. Tree Species Planted in Insufficient Growing Space (ADID)

Area	Common Name	Botanical Name	Tree Size	Tree Type for Smallest Dimension of Grow Space Size				Possible Threat	Total Species Population	Percent of Species Population	Percent of Total Population
				Not Suitable (0-3 Feet)	Small (4-5 Feet)	Medium (6-7 Feet)	Large (≥8 Feet)				
Streets	willow oak	*Quercus phellos*	Large	84	544	31	53	659	712	93%	24%
	common crapemyrtle	*Lagerstroemia indica*	Small	69	39	11	345	69	464	15%	16%
	red maple	*Acer rubrum*	Medium	34	212	30	39	246	315	78%	11%
	Japanese zelkova	*Zelkova serrata*	Large	46	165	58	10	269	279	96%	9%
	Chinese elm	*Ulmus parvifolia*	Medium	10	205	18	44	215	277	78%	9%
Parks	common crapemyrtle	*Lagerstroemia indica*	Small	0	2	0	47	0	49	0%	21%
	Japanese zelkova	*Zelkova serrata*	Large	0	23	0	6	23	29	79%	12%
	red maple	*Acer rubrum*	Medium	0	0	0	21	0	21	0%	9%
	willow oak	*Quercus phellos*	Large	0	2	0	17	2	19	11%	8%
	American holly	*Ilex opaca*	Medium	0	0	0	15	0	15	0%	6%

Raised Planter Growing Space Size

There were 137 street trees growing in raised planters, which include moveable planters and attached planters (5% of the ADID street tree population). No park trees were noted growing in a raised planter. Table 28 lists the street tree species that were located in raised planters and related growing space suitability. Of the 137 trees in raised planters, 79% were not suitable for that growing space size.

Table 28. Tree Species Planted in Raised Planters (ADID)

Species Present		Number Present	
Common Name	**Botanical Name**	**Good Location**	**Not Suitable Location**
Not Suitable Planter		**0**	**42**
Amur maple	*Acer tataricum ginnala*	0	5
Fosters holly	*Ilex x attenuata-Fosteri*	0	12
common crapemyrtle	*Lagerstroemia indica*	0	23
eastern arborvitae	*Thuja occidentalis*	0	1
Chinese elm	*Ulmus parvifolia*	0	1
Small Planter		**2**	**52**
red maple	*Acer rubrum*	0	5
saucer magnolia	*Magnolia x soulangiana*	2	0
Callery pear	*Pyrus calleryana*	0	2
willow oak	*Quercus phellos*	0	4
Chinese elm	*Ulmus parvifolia*	0	16
Japanese zelkova	*Zelkova serrata*	0	25
Medium Planter		**1**	**14**
red maple	*Acer rubrum*	1	0
willow oak	*Quercus phellos*	0	13
Japanese zelkova	*Zelkova serrata*	0	1
Large Planter		**26**	**0**
willow oak	*Quercus phellos*	16	0
Chinese elm	*Ulmus parvifolia*	10	0
Total		**29**	**108**
Percent of Total		**21%**	**79%**

Discussion and Management Recommendations

The discussion of Atlanta's tree inventory results and the management recommendations presented each consider the data analyses of the inventoried tree population in order to suggest a direction for the City to improve the sustainability of its urban forest. The findings for each of the data analyses are discussed, including diversity, relative age, general health, and possible threats from limited growing space and pests and diseases.

Diversity

Species diversity is the variety and abundance of trees in a specific population. It affects the population's ability to sustain threats from invasive pests and diseases. It also impacts tree maintenance needs and costs, tree planting goals, and canopy continuity. The composition of a tree population should follow the 10-20-30 Rule for species diversity: a single species should represent no more than 10% of the urban forest, a single genera no more than 20%, and a single family no more than 30%.

Of the three inventoried areas, the Expanded area has the greatest variety of species and genera present and the least number of species and genera that exceed the accepted rule. However, biodiversity concerns are present in this population as they are in the Downtown and ADID areas; thus, the City should limit planting tree species that are already overabundant. Table 29 provides a comparison of the four analyses. Several species exceed the 10% threshold. The City should carefully manage the number of oak species (specifically willow oak), crapemyrtle, red maple, and Japanese zelkova to avoid monocultures on street ROWs, in parks, or in neighborhoods. Tree planting efforts must consider existing diversity and should increase the number and abundance of different tree species so that Atlanta's urban forest will include a greater variety of species, and thus will become more sustainable and less vulnerable to threats.

Table 29. Comparing Species Distributions

Project Areas		Top Five Species Present				
Downtown	Streets	willow oak 25%	common crapemyrtle 15%	red maple 12%	Chinese elm 10%	Japanese zelkova 9%
	Parks	common crapemyrtle 21%	Japanese zelkova 12%	red maple 9%	willow oak 8%	American holly 6%
Expanded Inventory	Streets	common crapemyrtle 22%	Callery pear 8%	Texas red oak 8%	willow oak 7%	trident maple 6%
	Parks	red maple 14%	willow oak 8%	water oak 6%	Virginia pine 6%	common hackberry 6%
ADID	Streets	willow oak 24%	common crapemyrtle 16%	red maple 11%	Japanese zelkova 9%	Chinese elm 9%
	Parks	common crapemyrtle 21%	Japanese zelkova 12%	red maple 9%	willow oak 8%	American holly 6%
Overall	Streets and Parks	common crapemyrtle 17%	willow oak 14%	red maple 8%	Japanese zelkova 6%	Chinese elm 6%

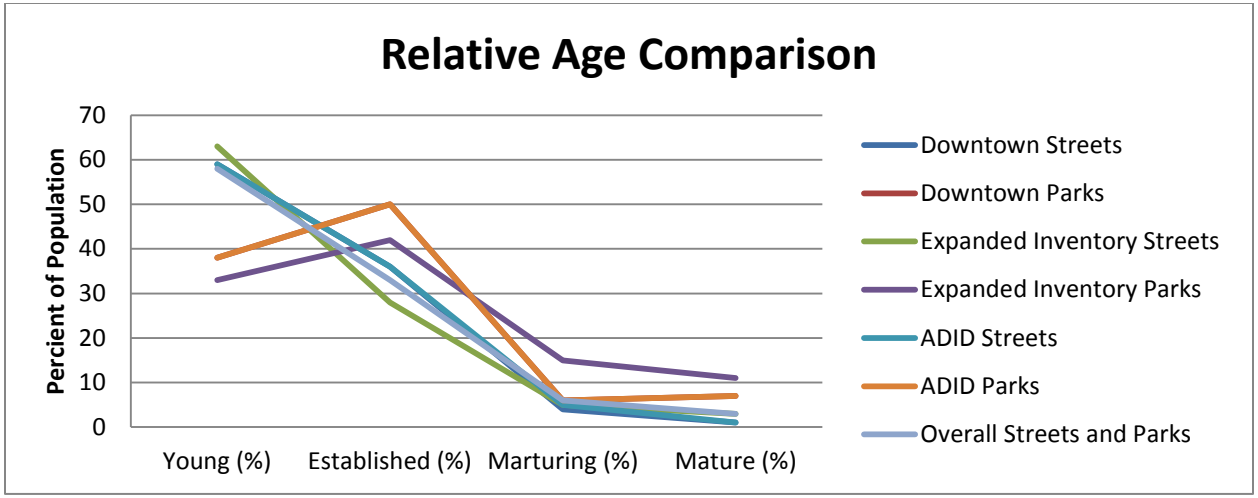


Figure 21. Relative Age Comparison

Relative Age

Diameter size class distribution is the proportion of trees by diameter size class in a specific population. This distribution is an indicator of the relative age of the population, which affects the environmental and economic benefits provided as well as tree maintenance needs and costs, tree planting goals, and canopy continuity. An ideal distribution is one where the largest fraction of trees should be young (approximately 40% of the population) with a smaller fraction of mature trees (approximately 10%). Table 29 provides a comparison of Atlanta's populations. All were trending toward the ideal, but the park population of the ADID inventory lacked young trees and most of the analyzed populations lacked maturing and mature trees.

To help normalize the distribution, increased tree care should be provided for the established, maturing, and mature trees to help ensure that trees survive as long as possible. This care includes pruning, watering, mulching, fertilizing, treating pests and diseases, and other standard tree health care practices. Ensuring mature trees are present in the population is important to Atlanta because they provide the greatest amount of canopy and, thus, are a greater benefit to the community.

Annual tree planting is necessary to sustain the population for the long term; to replace trees lost to natural mortality (expected to be 1% to 3% per year) and other threats (for example, invasive pests and diseases or impacts from severe weather); and to gradually increase the City's canopy cover. To maintain a stable urban forest, a systematic planting program must be developed to ensure that young, healthy trees are in place to provide for gradual succession of older trees. Newly planted trees are especially important—they are the future of Atlanta's urban forest.

General Health

The general health of a tree population indicates how well trees are performing given their site-specific conditions. General health affects short- and long-term maintenance needs and costs as well as canopy continuity. The inventory data analyses indicate that Atlanta has a well-developed tree population. However, maintaining the good general health of the City's tree population requires implementing a proactive maintenance and management program. Established, maturing, and mature trees need to be pruned to remove dead, dying, diseased, and broken branches. Corrective pruning of all trees and structural pruning, especially of young and establishing trees, following ANSI A300 Standards should improve tree conditions (American National Standards Institute, 2008). Proper installation of young trees, continual watering through summer months, and mulching to keep weeds out and to lessen mechanical damage will promote good health and encourage quick establishment of newly planted trees. Over time, routine proactive maintenance and management will promote the general health of Atlanta's urban forest.

All dead and very poor trees should be removed due to failed health. During the 2011 inventory, Davey recorded 171 trees rated poor, very poor, or dead. Trees in poor condition require removal or corrective pruning, regular inspection, and possible intensive plant health care (fertilization and/or pest and disease treatments) to improve their condition and health. Even with increased care, trees rated poor may not recover.

Pests and Diseases

An integrated pest management plan should be established that includes identifying and monitoring threats, understanding the economic threshold, selecting the correct treatment, properly timing management strategies, recordkeeping, and evaluating results.

The awareness of pests and diseases and early diagnosis of problems are crucial to ensuring the health and continuity of the street and park trees. Atlanta should be aware of the signs and symptoms of potential infestations and should be prepared to act if a significant threat is observed in their tree population or in a community nearby. All host trees susceptible to granulated ambrosia beetle, Xm ambrosia beetle, ALB, or oak wilt should be inspected annually, and removal or treatment should be scheduled quickly if pests appear. Following are host species that were found during Atlanta's tree inventory:

- **Granulate ambrosia beetle:** Known hosts include cherry species (*Prunus* spp.), Chinese elm, crapemyrtle, dogwood species (*Cornus* spp.), hickory species (*Carya* spp.), magnolia species (*Magnolia* spp.), maple, mimosa (*Albizia julibrissin*), oak species, persimmon (*Diospyros*), redbud (*Cercis Canadensis*), and walnut species (*Juglans* spp.). Bradford Callery pear (*Pyrus calleryana*) and pecan (*Carya illinoinensis*) are common hosts in the southeastern United States.
- **Asian longhorned beetle (ALB):** Prefers hardwoods, including several maple species (Norway [*Acer platanoides*], sugar maple [*Acer saccharum*], silver maple [*Acer saccharinum*], red maple, and box elder [*Acer negundo*]), London planetree (*Platanus* x *acerifolia*), birch species (*Betula* spp.), and elm species.

- **Xm ambrosia beetle:** Hosts in the southeastern United States, where this insect has become established, are presently unknown. Reported hosts in its natural range include: dogwood species and maple species.
- **Oak wilt:** Caused by the fungus *Ceratocystis fagacearum*, kills oak trees. All oak species are susceptible to this vascular disease. Oaks in the red oak group (including willow oak, Texas red oak, and water oak) are most susceptible and succumb more readily than oaks in the white oak (*Quercus alba*) group. Other vulnerable species include chestnut (*Castanea* spp.) and apple (*Malus* spp.).

These are not comprehensive lists of all potential hosts. Davey suggests that Atlanta routinely check the APHIS Plant Pest Program Information website for complete lists of potential hosts and current infestation data (USDA 2012).

Growing Limitations

The presence of overhead utility lines above a tree or vacant planting site affects pruning activities and tree species selection for planting efforts. During the 2011 inventory, Davey recorded 2,431 trees growing near overhead utilities; 47% of these trees were not well suited to their site because they are large- or medium-growing trees (most were found in the Expanded Inventory area). Only small-growing trees should be planted within 20 feet of overhead utilities and medium- to large-growing trees should be planted outside 20 feet in order to avoid future conflicts, improve future tree conditions, and lessen maintenance costs. Appendix C lists suggested species by mature-growing habit.

Trees can become injured by grates that are installed to cover planting pits. Damage is generally caused because the grate does not expand to accommodate the girth of a growing tree. During the 2011 inventory, Davey recorded 744 trees having grates (primarily in the Downtown area). Even though less than 10% of the population had grates, there could be significant losses to Atlanta's Downtown canopy cover if the tree grates were not maintained properly. Tree grates must be inspected annually and maintained to prevent damage to tree roots and trunks. Additionally, grates must remain free of debris to ensure water and nutrients can reach tree roots. If grates are not maintained, tree health will decline.

If proper maintenance cannot be provided to trees with grates, it is Davey's recommendation that the grates be removed and that the soil around the trees be covered with mulch, vegetation, or left alone. But if the City choses to continue using grates, Davey recommends that the trees and grates be inspected annually, routine plant health care be provided (adding nutrients and watering), and the grates be expanded as needed or removed when expansion of the grate's center ring is not possible. General guidelines for grates are: create the largest tree well opening possible, purchase the largest grate possible with the largest center opening, keep approximately 3 inches of open space between the tree trunk and the center ring of the grate, and if the tree begins to raise the grate, the grate should be removed.

Grow space size should guide species selection for future planting efforts. Most of the trees recorded during the 2011 inventory were in growing spaces too small for their expected mature tree size (69% of the top five species). Grow space sizes that were unsuitable for any tree of any size (0 to 3 feet wide) were recorded most often in the Expanded Inventory area. A growing space too small will interfere with a tree's ability to develop a natural trunk taper and root system and will ultimately limit its size and affect its stability (Figure 22). Future tree planting initiatives should place only small-growing tree species in growing spaces 4 to 5 feet wide, medium-growing tree species in growing spaces 6 to 7 feet wide, and large-growing tree species in growing spaces that are 8 feet or greater. Appendix C lists tree species appropriate for planting in parks and along the street ROW.

It is usually difficult for a tree to grow in a planter due to limited soil and space. Davey recorded 137 trees in raise

d planters during the 2011 inventory. If these planters do not have engineered systems designed to promote infiltration and increase soil volume, they may limit tree growth. For a containerized planting to be successful, soil volume must be adequately provided for the mature tree size of the species (Urban [2008] provides recommendations) and infiltration and drainage of water (so roots receive water but do not drown). Trees need soil and water to survive. If the City does not already employ engineered systems, some options to consider that make space for soil and roots are: root paths, soil trenches, soil vaults, structural soils, suspended sidewalks, and structural cells. Due to the small size of movable planters, Davey does not recommend planting trees in movable pots.

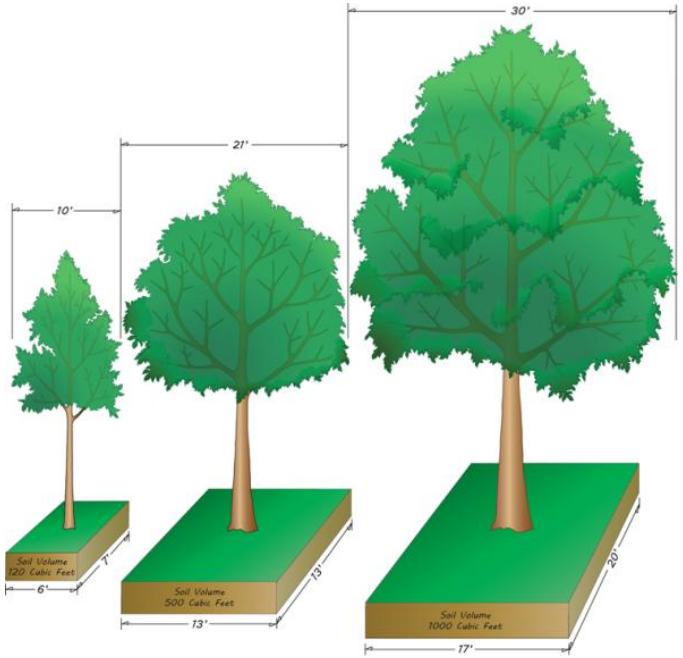
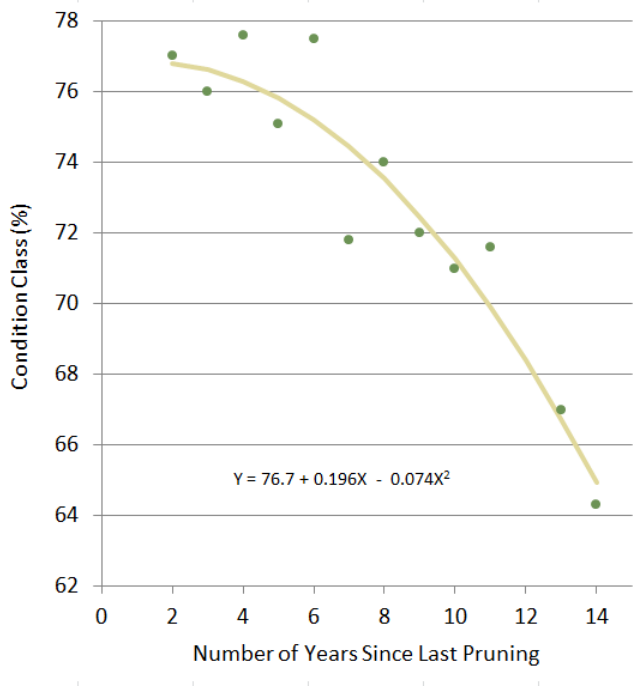


Illustration based on the work of Casey Trees, 2008.

Section 3: Program Maintenance Recommendations

This management program details the activities that constitute a seven-year work plan for Atlanta. Maintenance recommendations are based on 2011 tree inventory data and are guided by best management practices and arboricultural standards. The program was designed to promote public safety, to mitigate failure of trees or tree parts, and to improve tree health and structure by implementing pruning cycles. Tree planting to mitigate tree removal and to increase canopy cover is an important part of the program as well.

Regular Maintenance Cycle



Relationship between average tree condition class and number of years since last pruning (adapted from Miller and Sylvester, 1981).

For many communities, a proactive tree management program is considered to be unfeasible, and on-demand response to urgent situations is the norm. Research has shown that a proactive program that includes a routine pruning cycle will improve the general health of a tree population (Miller and Sylvester, 1981). Proactive tree maintenance has many advantages over reactive maintenance: the most significant advantages are increased safety and improved health. When trees are assessed and pruned regularly in a proactive program, most defects will be found and eliminated before they escalate to more serious situations. Other advantages of a proactive program are more predictable budgets and projectable workloads, reduced long-term tree maintenance costs, and increased environmental and economic benefits from trees.

Why Prune Trees on a Cycle?

Miller and Sylvester (1981) examined the frequency of pruning for 40,000 street and boulevard trees in Milwaukee, Wisconsin. They documented a decline in tree health as the length of the pruning cycle increased. When pruning was not completed for more than 10 years, average tree condition was rated 10% lower than when trees had been pruned within the last several years. Miller and Sylvester suggested that a pruning cycle of five years is optimal for urban trees.

Pruning Cycles

Most of the work recommended in the inventory was pruning (91%). The goals of pruning cycles are to visit, assess, and prune trees on a regular schedule to improve health and promote safety. To ensure all trees receive the type of pruning they need to mature with better structure and fewer hazards, two pruning cycles are recommended: the young tree training cycle (YTT Cycle) and the routine pruning cycle (RP Cycle). The cycles differ in the type of pruning, the general age of the tree they target, and the length of the cycle. Typically, Davey recommends that pruning cycles begin after all priority maintenance trees are corrected through removal or pruning. However, because of the long-term benefit that will come from implementing pruning cycles, Davey recommends that cycles be implemented sooner than later.

Young Tree Training Cycle

Trees included in the YTT Cycle are generally smaller than 6 inches DBH and 25 feet tall. These younger trees may have branch structures that can lead to potential problems as the tree ages: codominant leaders, many limbs attaching at the same point on the trunk, or crossing/interfering limbs are common problems. If these problems are not corrected, they may worsen as the tree grows, increasing the likelihood of failure.

The YTT Cycle differs from the RP Cycle in that these trees generally can be pruned from the ground with a pole pruner or pruning shear, with the objective to increase structural integrity by pruning for one dominant leader. Of course, this is species-specific since some trees, such as river birch, may naturally have more than one leader. For these trees, YTT pruning is used to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree.

YTT pruning improves tree form or structure; the recommended length of a YTT Cycle is three years because young trees tend to grow at faster rates (on average) than more mature trees. One-third of a young tree population would need training pruning each year.

Recommendations

During the inventory, Davey recorded 2,737 trees that needed training pruning. Since the number of young trees present was large (31% of trees with recommended maintenance) and the benefit of beginning the YTT Cycle is great, Davey recommends that Atlanta implement a three-year YTT Cycle to begin as soon as possible. Atlanta should begin by pruning approximately 912 young trees per year (Table 30).

Table 30. Young Tree Training Cycle by Diameter Class

Diameter Size Class (inches)	Young Tree Training (number inventoried)	YTT Cycle	Annual Cost Estimate
1 - 3	1,488	496	$9,920
4 - 6	1,249	416	$12,490
Total	**2,737**	**912**	**$22,410**

RP Cycle

The RP Cycle includes more established, maturing, and mature trees that need cleaning, crown raising, and reducing to remove deadwood and to improve structure. Over time, routine pruning generally improves health and reduces tree or tree part failures, as most problems can be corrected before they escalate into more costly high priority tree work. Dead, dying, diseased, or broken branches found within these trees can usually be remediated during the RP Cycle.

The length of the RP Cycle is based on the size of the tree population and what was assumed to be a reasonable number of trees for a program to prune per year. The RP Cycle recommended for a tree population is typically five years but may extend to seven years if the population is large. One-fifth to one-seventh of the more established to mature tree population would need to be pruned each year.

Recommendations

Davey recommends that Atlanta establish a five-year RP Cycle to commence after all priority tree maintenance identified during the inventory has been addressed. During the inventory, Davey recorded 3,495 trees as large tree routine prune and 1,617 trees as small tree routine prune (60% of trees with recommended maintenance). Based on the recommended five-year RP Cycle, approximately 1,022 established to mature trees should be pruned each year (Table 31).

Table 31. Routine Pruning Cycle by Diameter Class

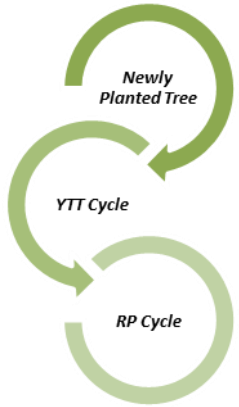
Diameter Size Class (inches)	Large Tree Routine Prune (number inventoried)	Small Tree Routine Prune (number inventoried)	Total Routine Prune	RP Cycle	Annual Cost Estimate
1 - 3	84	213	297	59	$1,188
4 - 6	241	482	723	145	$4,338
7 - 12	1,680	765	2,445	489	$36,675
13 – 18	1,020	147	1,167	233	$28,008
19 – 24	287	6	293	59	$9,962
25 – 30	103	4	107	21	$4,815
31 – 36	56	0	56	11	$3,416
37 – 42	15	0	15	3	$1,140
43+	9	0	9	2	$1,062
Total	**3,495**	**1,617**	**5,112**	**1,022**	**$90,604**

Pruning Cycle Progression

The recommended number of trees in each pruning cycle will need to be modified to reflect changes in the population as trees are planted, age, and die. As trees are planted, they will need to enter the YTT Cycle, two to three years after planting. As young trees mature, as trees grow greater than 25 feet tall, and as trees need to be pruned to provide pedestrian or vehicular clearance, those trees will need to enter the RP Cycle. When a tree reaches the end of its useful life, it should be removed and eliminated from the RP Cycle. Estimated costs for Atlanta's pruning cycle program equal $113,014 annually for the trees in the Overall dataset.

Routine Inspections

Inspections are essential to identify potential problems; trees along the street ROW and in parks should be inspected regularly and attended to as needed based on inspection findings. When trees need work, they should be added to the maintenance schedule and included in the budget as appropriate. Inspections are an opportunity to look for signs and symptoms of pests and diseases. Atlanta has a large population of tree species that are susceptible to pests and diseases. Even though they were not identified during the 2011 inventory, granulate ambrosia beetle, Xm ambrosia beetle, ALB, and oak wilt are considered potential threats to Atlanta's urban forest.



The City must continually update the number of trees in the YTT and RP Cycles as a result of planting programs and population dynamics. Cycles must be modified as trees are planted, mature, and removed.

Priority Maintenance

Priority maintenance needs are based on the primary maintenance recommendation made at the time of the 2011 inventory. Implementing Davey's prioritized maintenance recommendations will allow Atlanta to first address the highest priorities related to public safety. Priority tree maintenance needs are:

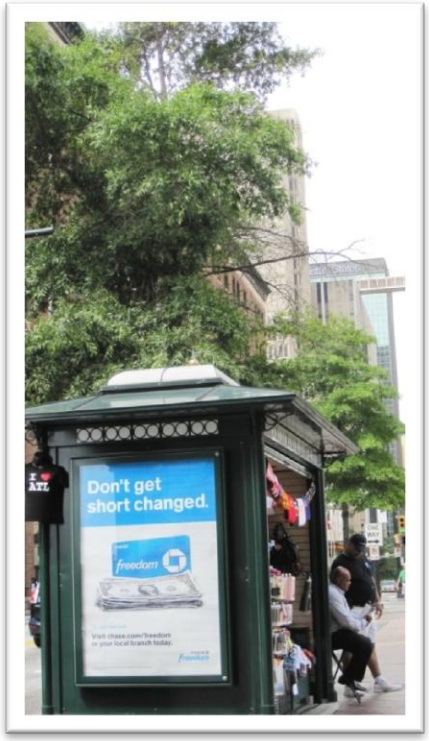
- Removal—Priority 1, Priority 2, Priority 3, and Stumps
- Pruning—Priority 1 and Priority 2

Davey strongly encourages the City to schedule all priority maintenance in as timely a manner as possible to reduce total tree or tree part failure. Even though large, short-term expenditures may be required, funding and expediently completing priority tree removals is important to promote public safety. Atlanta's street and park tree inventory database will prove to be a valuable tool in organizing, scheduling, and routing the needed work.

Tables 32 and 33 present the numbers for each priority removal classification and priority prune classification by diameter size class identified during the inventory. The following sections briefly summarize the recommended removal and pruning needs.

Table 32. Priority Removals by Diameter Class

Diameter Size Class (inches)	Removals				Total Cost Estimate
	Priority 1 (Number Inventoried)	Priority 2 (Number Inventoried)	Priority 3 (Number Inventoried)	Stump (Number Inventoried)	
1–3	0	0	68	0	$1,700
4–6	0	12	57	34	$7,755
7–12	25	63	66	30	$34,750
13–18	27	52	30	19	$39,588
19–24	26	20	5	16	$27,815
25–30	16	11	1	8	$24,324
31–36	5	4	0	0	$12,540
37–42	2	0	2	6	$3,654
43+	2	1	0	3	$6,030
Total	**103**	**163**	**229**	**116**	**$158,156**



Photograph 4. *The willow oak (*Quercus phellos*) pictured here is a Priority 2 Prune because of the 2-inch diameter dead branch over the sidewalk and near this bus stop.*

Table 33. Priority Prunes by Diameter Class

Diameter Size Class (Inches)	Prunes		Total Cost Estimate
	Priority 1 (Number Inventoried)	Priority 2 (Number Inventoried)	
1–3	0	0	$0
4–6	0	0	$0
7–12	4	9	$975
13–18	12	26	$4,560
19–24	7	12	$3,230
25–30	10	9	$4,275
31–36	3	9	$3,660
37–42	4	5	$3,420
43+	7	4	$6,490
Total	**47**	**74**	**$26,610**

Priority Tree Removal

Although tree removal is usually considered a last resort and may stir emotions from people in the community, there are circumstances when it is necessary. Trees fail from natural causes, such as diseases, insects, and weather conditions, and from physical injury due to vehicles, vandalism, and root disturbances. Davey recommends that trees be removed when corrective pruning will not adequately eliminate the defect or when it is cost-prohibitive to correct problems. Trees causing obstructions or interfering with power lines or other infrastructure should be removed when their defects cannot be corrected through pruning or other maintenance practices. Nuisance trees and diseased trees also merit removal. Nuisance trees in Atlanta may include Chinaberry (*Melia azedarach*), Chinese privet (*Ligustrum sinensis*), Chinese tallowtree (*Triadica sebifera*), Chinese parasoltree (*Firmiana simplex*), royal paulownia (*Paulownia tomentosa*), and tree of heaven (*Ailanthus altissima*).

Davey recorded 103 trees recommended for Priority 1 Removal. Most of these were found in the Expanded Inventory area along the street ROW and were identified to be Callery pear, American sycamore (*Platanus occidentalis*), and water oak. The defect recorded most with Priority 1 Removals was trunk decay, followed by major dieback and trunk cavity.

Davey recommended 163 trees for Priority 2 Removal. Most of these were found in the Expanded Inventory area along the street ROW and were identified to be Callery pear, American sycamore, and Japanese zelkova. The defect recorded most with Priority 2 Removals was trunk decay, followed by major dieback and trunk cavity.

Davey recommended 229 trees for Priority 3 Removal. Most of these were found in the Expanded Inventory area along the street ROW and were identified to be tree of heaven, Callery pear, and cherry species. Most of these trees are nuisance trees or young trees that did not survive establishment.

The inventory noted 116 stumps to be removed: 81 in the Expanded Inventory area and 35 in the Downtown area. Most were located along the street ROWs in both areas.

Priority Tree Pruning

Trees in these two pruning categories should be examined closely during pruning operations for severe internal decay or dieback. If, upon closer inspection, these trees are found to be severely decayed, they should be removed.

Davey recommended 47 trees for Priority 1 Prune work. Callery pear, water oak, and American elm (*Ulmus americana*) account for most of this maintenance type.

Davey recorded 74 trees recommended for Priority 2 Prune. Callery pear, willow oak, and water oak account for most of this maintenance type.

Work Plan Cost Projections

Utilizing data from the 2011 City of Atlanta tree inventory, an annual maintenance schedule was developed detailing the number and type of tasks recommended for completion each year. The schedule provides a framework for completing the priority maintenance recommendations in two years followed by a more proactive, cycled tree care program. Budget projections were made by Davey utilizing industry knowledge and public bid tabulations; actual costs were not specified by the City of Atlanta. A seven-year projected work plan for Atlanta's urban forestry program is presented in Table 34.

Photographs 5 and 6. *Trees are an integral component of the City's infrastructure and urban environment. When properly maintained, trees return overall benefits and value to the community far in excess of the time and money invested in them for planting, pruning, protection, and removal.*

Table 34: Estimated Costs for Seven-Year Urban Forestry Management Program (Overall Dataset)

Estimated Costs for Each Activity			2013		2014		2015		2016		2017		2018		2019		Seven-Year
Activity	Diameter	Cost/Tree	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Cost
Priority 1	1–3"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Removal	4–6"	$105	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	7–12"	$220	25	$5,500	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$5,500
	13–18"	$355	27	$9,585	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$9,585
	19–24"	$525	26	$13,650	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$13,650
	25–30"	$845	16	$13,520	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$13,520
	31–36"	$1,140	5	$5,700	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$5,700
	37–42"	$1,470	2	$2,940	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$2,940
	43"+	$1,850	2	$3,700	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$3,700
Activity Total(s)			**103**	**$54,595**	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	**$54,595**
Priority 2	1–3"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Removal	4–6"	$105	0	$0	12	$1,260	0	$0	0	$0	0	$0	0	$0	0	$0	$1,260
	7–12"	$220	0	$0	63	$13,860	0	$0	0	$0	0	$0	0	$0	0	$0	$13,860
	13–18"	$355	0	$0	52	$18,460	0	$0	0	$0	0	$0	0	$0	0	$0	$18,460
	19–24"	$525	0	$0	20	$10,500	0	$0	0	$0	0	$0	0	$0	0	$0	$10,500
	25–30"	$845	6	$5,070	5	$4,225	0	$0	0	$0	0	$0	0	$0	0	$0	$9,295
	31–36"	$1,140	4	$4,560	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$4,560
	37–42"	$1,470	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	43"+	$1,850	1	$1,850	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$1,850
Activity Total(s)			**11**	**$11,480**	**152**	**$48,305**	0	$0	0	$0	0	$0	0	$0	0	$0	**$59,785**
Priority 3	1–3"	$25	0	$0	68	$1,700	0	$0	0	$0	0	$0	0	$0	0	$0	$1,700
Removal	4–6"	$105	0	$0	57	$5,985	0	$0	0	$0	0	$0	0	$0	0	$0	$5,985
	7–12"	$220	0	$0	66	$14,520	0	$0	0	$0	0	$0	0	$0	0	$0	$14,520
	13–18"	$355	0	$0	30	$10,650	0	$0	0	$0	0	$0	0	$0	0	$0	$10,650
	19–24"	$525	0	$0	5	$2,625	0	$0	0	$0	0	$0	0	$0	0	$0	$2,625
	25–30"	$845	0	$0	1	$845	0	$0	0	$0	0	$0	0	$0	0	$0	$845
	31–36"	$1,140	0	$0	2	$2,280	0	$0	0	$0	0	$0	0	$0	0	$0	$2,280
	37–42"	$1,470	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	43"+	$1,850	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Total(s)			0	$0	**229**	**$38,605**	0	$0	0	$0	0	$0	0	$0	0	$0	**$38,605**
Stump Removal	1–3"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	4–6"	$25	34	$850	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$850
	7–12"	$25	30	$750	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$750
	13–18"	$40	19	$760	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$760
	19–24"	$60	16	$960	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$960
	25–30"	$85	8	$680	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$680
	31–36"	$110	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	37–42"	$130	6	$780	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$780
	43"+	$160	3	$480	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$480
Activity Total(s)			**116**	**$5,260**	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	**$5,260**

Table 34: Estimated Costs for Seven-Year Urban Forestry Management Program (Overall Dataset)

Estimated Costs for Each Activity			2013		2014		2015		2016		2017		2018		2019		Seven-Year
Activity	Diameter	Cost/Tree	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Trees	Cost	Cost
Priority 1 Prune	1–3"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	4–6"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	7–12"	$75	4	$300	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$300
	13–18"	$120	12	$1,440	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$1,440
	19–24"	$170	7	$1,190	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$1,190
	25–30"	$225	10	$2,250	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$2,250
	31–36"	$305	3	$915	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$915
	37–42"	$380	4	$1,520	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$1,520
	43"+	$590	7	$4,130	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$4,130
Activity Total(s)			**47**	**$11,745**	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	**$11,745**
Priority 2 Prune	1–3"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	4–6"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	7–12"	$75	0	$0	9	$675	0	$0	0	$0	0	$0	0	$0	0	$0	$675
	13–18"	$120	0	$0	26	$3,120	0	$0	0	$0	0	$0	0	$0	0	$0	$3,120
	19–24"	$170	6	$1,020	6	$1,020	0	$0	0	$0	0	$0	0	$0	0	$0	$2,040
	25–30"	$225	9	$2,025	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$2,025
	31–36"	$305	9	$2,745	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$2,745
	37–42"	$380	5	$1,900	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$1,900
	43"+	$590	4	$2,360	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$2,360
Activity Total(s)			**33**	**$10,050**	**41**	**$4,815**	0	$0	0	$0	0	$0	0	$0	0	$0	**$14,865**
Routine Pruning	1–3"	$20	0	$0	0	$0	59	$1,188	59	$1,188	59	$1,188	59	$1,188	59	$1,188	$5,940
	4–6"	$30	0	$0	0	$0	145	$4,338	145	$4,338	145	$4,338	145	$4,338	145	$4,338	$21,690
	7–12"	$75	0	$0	0	$0	489	$36,675	489	$36,675	489	$36,675	489	$36,675	489	$36,675	$183,375
	13–18"	$120	0	$0	0	$0	233	$28,008	233	$28,008	233	$28,008	233	$28,008	233	$28,008	$140,040
	19–24"	$170	0	$0	0	$0	59	$9,962	59	$9,962	59	$9,962	59	$9,962	59	$9,962	$49,810
	25–30"	$225	0	$0	0	$0	21	$4,815	21	$4,815	21	$4,815	21	$4,815	21	$4,815	$24,075
	31–36"	$305	0	$0	0	$0	11	$3,416	11	$3,416	11	$3,416	11	$3,416	11	$3,416	$17,080
	37–42"	$380	0	$0	0	$0	3	$1,140	3	$1,140	3	$1,140	3	$1,140	3	$1,140	$5,700
	43"+	$590	0	$0	0	$0	2	$1,062	2	$1,062	2	$1,062	2	$1,062	2	$1,062	$5,310
Activity Total(s)			0	$0	0	$0	**1022**	**$90,604**	**1022**	**$90,604**	**1022**	**$90,604**	**1022**	**$90,604**	**1022**	**$90,604**	**$453,020**
Young Tree Training Pruning	1–3"	$20	496	$9,920	496	$9,920	496	$9,920	496	$9,920	496	$9,920	496	$9,920	496	$9,920	$69,440
	4–6"	$30	416	$12,490	416	$12,490	416	$12,490	416	$12,490	416	$12,490	416	$12,490	416	$12,490	$87,430
	7–12"	$75	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Total(s)			**912**	**$22,410**	**912**	**$22,410**	**912**	**$22,410**	**912**	**$22,410**	**912**	**$22,410**	**912**	**$22,410**	**912**	**$22,410**	**$156,870**
To Be Determined	TBD		0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	TBD		0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Total(s)			0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Grand Total			**1222**		**1334**		**1935**		**1935**		**1935**		**1935**		**1935**		**$12,230**
Cost Grand Total				**$115,540**		**$114,135**		**$113,014**		**$113,014**		**$113,014**		**$113,014**		**$113,014**	**$794,745**

Davey's recommendations for Atlanta include pruning approximately 912 young trees and 1,022 established, maturing, and mature trees each year. The YTT Cycle's annual cost estimate equals $22,410, and the RP Cycle's annual cost estimate equals $90,604.

Priority removal and pruning were recommended for 611 trees and stumps and 121 trees, respectively. Priority maintenance cost estimates equal $158,156 for removal and $26,610 for pruning. Atlanta should complete all priority work as soon as their resources allow; Davey recommends that this priority work be completed within two years.

To implement the maintenance schedule, the City's tree maintenance budget should be no less than $115,451 for the first year of implementation, $114,135 the second year, and $113,014 the following five years. Annual budget funds are needed to ensure that priority trees are remediated and that RP and YTT Cycles can commence. With routine and proper professional tree care, the safety, health, and beauty of the urban forest will improve.

If routing efficiencies and/or contract specifications allow for the accomplishment of more tree work, or if the schedule requires modification to meet budgetary or other needs, then it should be modified accordingly. Unforeseen situations, such as storms, may arise and change the maintenance needs of trees. Should conditions or maintenance needs change, budgets and equipment will need to be adjusted appropriately.

A summary of the projected work plan for only the ADID management area is presented to the right. The ADID was isolated by the City for analysis because of its potential funding through a community improvement district. The figure shows an expenditure of $43,565 for the first year and $42,640 the following five years.

FY 2013 **$43,565**

- **All 89 Priority Removals**
- **All 33 Stump Removals**
- **All 37 Priority Pruning**
- **YTT Cycle: 315 Trees**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2014 **$42,640**

- **RP Cycle: 1/5 of the established to mature tree population (approximately 424 trees)**
- **YTT Cycle: 315 Trees**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2015 **$42,640**

- **RP Cycle: 1/5 of the established to mature tree population (approximately 424 trees)**
- **YTT Cycle: 315 Trees**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2016 **$42,640**

- **RP Cycle: 1/5 of the established to mature tree population (approximately 424 trees)**
- **YTT Cycle: 1/3 of tree needing training pruning (approximately 315 trees)**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2017 **$42,640**

- **RP Cycle: 1/5 of the established to mature tree population (approximately 424 trees)**
- **YTT Cycle: 1/3 of tree needing training pruning (approximately 315 trees)**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2018 **$42,640**

- **RP Cycle: 1/5 of the established to mature tree population (approximately 424 trees)**
- **YTT Cycle: 1/3 of tree needing training pruning (approximately 315 trees)**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

As with the work plan for the Overall population, Davey recommends completing all priority maintenance in the ADID management area first, then establishing the RP Cycle. The YTT Cycle should begin in the first year due to the size of the population (29%) and the importance of structural pruning at a young age (two to three years after planting and before establishment).

Tree Grates

Covering a tree well with a grate does nothing for the tree and can lead to future problems that could have otherwise been avoided. The purpose of a tree grate is to provide a surface for pedestrians to walk on, but they can easily turn into a trip hazards due to various reasons, including the natural growth of the tree. In the future, the City should consider discontinuing the use of tree grates and focus on creating growing spaces that contain soil volumes and infiltration systems that would benefit tree growth rather than inhibiting it.

Photograph 7. *As this ginkgo (*Ginkgo biloba*) matures and the base of the tree widens, the tree grate will need removed.*

In most cases, tree grates that are already in place can be removed and replaced with ground covering. Mulch is most desirable due to its beneficial value to tree health. Mulch will help maintain soil moisture, control weeds, insulate soil temperatures, and improve soil aeration, soil structure, and soil fertility over time. Other ground cover options include vegetation or gravel. The positive side of added vegetation may invite more routine watering; however, the negative side is that vegetation will compete with the tree for soil nutrients. If vegetation is to be used, Davey recommends low-growing annuals or perennials, not shrubs. In various tree wells of the Downtown area, Davey noticed that river rock had been used when grates were removed. Davey does not recommend using river rock or other gravel because it provides little (or no) benefits and may affect soil moisture if it is laid too thick. Removing tree grates and covering exposed soil with mulch and/or vegetation can help existing trees live longer lives.

If a tree has already raised or grown into its grate, the grate should be carefully removed before the condition worsens. If the grate cannot be removed without damaging the tree, then the useful life of the tree is over and the tree and its grate should both be removed. Future planting to replace the tree, including improvement of the growing space to correctly accommodate a tree's needs should be planned. Many options are available, including developing internal standards for tree wells and implementing tree well designs suited for different situations. The 2008 book published by the ISA Press, *Up by Roots: healthy soils and trees in the built environment*, by Landscape Architect James Urban describes how soil and growing space conditions influence trees in urban landscapes; it is a good reference for the City to utilize when determining options for tree planting pits.

For the trees that have not raised or grown into their grate, the City should inspect those grates annually and widen the center hole as appropriate. However, some grates may not have the ability to be widened due to their structural integrity upon the center ring. In this case, the grate should be removed entirely. After the grate has been removed, a ground cover, such as mulch, should be used to cover the tree well; the mulch layer should be less than 3 inches deep and scattered around the base without touching the tree trunk. The top of the mulch should be slightly below the walkway as well.

Davey does not recommend adding soil to a tree well to change the grade, as this practice will eventually lead to the death of the tree. If it is not possible to lay mulch so that the top meets with the walkway level due to soil grade being too low or too high, then a decorative fence, curb, or railing can be installed to prevent entry of pedestrians and to prevent the mulch from spreading over the streetscape. Fencing or railing to be installed along the edge of a tree well should be a minimum of 18 to 24 inches high. If this is not an option, then the tree should be removed, the tree well covered, and adjustment plans for the tree well prepared. Trees should be reinstalled in well-executed sites that provide greater growing space with minimal restrictions.

Table 35. Comparison of Potential Benefits from Ground Cover for Tree Wells

Potential Benefits	Mulch	Vegetation	Gravel	Tree Grate
Soil Moisture	Yes	Yes	Yes	No
Weed Control	Yes	No	Yes	No
Soil Temperature	Yes	No	No	No
Soil Structure	Yes	No	No	No
Soil Fertility	Yes	Yes	No	Yes
Uniform Streetscape	Yes	Yes	Yes	Yes
Easy Maintenance	No	No	Yes	Yes
Inexpensive	Yes	Yes	Yes	No

Tree Planting

Planting trees is a worthwhile goal as long as tree species are carefully selected and correctly planted. Without upfront planning and follow-up tree care, a newly planted tree may become a future problem instead of a benefit to the community. When planting trees:

- Consider the specific purpose of the tree planting.
- Assess the site and know its limitations (for example, overhead wires, confined spaces, soil type).
- Select the species or cultivar that best matches site conditions.
- Examine trees before buying them, and buy for quality.

Plant with a Purpose

Trees support and improve the quality of life in urban areas—they filter pollutants from air and water, while providing shade from sunlight, providing shelter to wildlife, and enhancing our recreational areas. Trees moderate local climate, slow wind and stormwater, and shade homes and businesses. Trees provide important environmental and economic benefits to everyone who lives, works, and plays near them.

Atlanta's tree population should be fostered by implementing informed, well-planned management decisions derived from established goals for increased canopy cover with the objective to improve genus and species distributions, general tree condition, and diameter size class distribution. The correct placement of trees in the right locations will provide a return much larger than the time and money spent on planting and maintenance.

Inventoried Planting Sites

Proper site selection can minimize costs, ensuring the most productive use of Atlanta's resources. The relationship between species mature growth-habit and site restrictions should be carefully considered before planting. The size of each site is of great importance, including maximum desired height and spread due to overhead utilities, and proximity to buildings and infrastructure.

The inventory found 423 vacant planting spaces with 88% of those identified for small-growing trees, 8% for large-growing trees, and 4% for medium-growing trees. The Downtown area contained 216 planting sites, the Expanded Inventory area contained 207 planting sites, and the ADID management area contained 169 planting sites.

Table 36. Number of Vacant Planting Sites Identified by Mature Tree Size

Planting Sites	Geographical Areas			Management Area
	Downtown	Expanded Inventory	Total	ADID
Large Vacant	9	25	34	10
Medium Vacant	6	10	16	8
Small Vacant	201	172	373	151
Total	**216**	**207**	**423**	**169**
Percent of Population	**51%**	**49%**	**100%**	**40%**

Small Planting Sites

The minimum growing space requirement to allow a small-growing tree to grow into its mature form is 4 feet. When overhead utilities are present, only small-growing trees should be planted. To maximize plantable space, small-growing trees should be planted an average of 20 feet apart from each other.

Medium Planting Sites

The minimum growing space requirement to allow a medium-size tree to grow into its mature form is 6 feet. To maximize plantable space, medium-size trees should be planted an average of 30 feet apart from each other.

Large Planting Sites

The minimum growing space requirement to allow a large-growing tree to grow into its mature form is 8 feet. To maximize plantable space, large-growing trees should be planted an average of 40 feet apart from each other.

Planting Site Evaluations

Guidelines that provide consistent distances from other infrastructure will help ensure trees are planted in places that minimize future conflicts and costly maintenance. For aboveground infrastructure, some tree placement guidelines are:

- 35 feet from street corners
- 35 feet from front side of traffic signs and 10 feet from back side of traffic signs
- 10 to 15 feet from driveway cuts and alleys (depending on traffic speed)
- 15 feet from street lights and utility poles
- 15 feet from fire hydrants
- 10 feet from the edge of man-hole covers, storm drains, and all underground water or utility features

Species Diversification

Davey recommends the City increase diversity by planting more and different species and by limiting the planting of willow oak, crapemyrtle, red maple, Japanese zelkova, and Chinese elm until distributions of species and genera normalize. In the 2011 inventory, common crapemyrtle represented 17% of the Overall population and willow oak 14%, which well exceeded the recommended maximum for a species (10% of the population). Alternative species to common crapemyrtle and willow oak include:

Common crapemyrtle alternatives:

- fringetree (*Chionanthus virginicus*)
- kousa dogwood (*Cornus kousa*)
- Washington hawthorn (*Crataegus phaenopyrum*)
- red buckeye (*Aesculus pavia*)

Willow oak alternatives:

- common hackberry (*Celtis occidentalis*)
- hardy rubber tree (*Eucommia ulmoides*)
- London planetree (*Platanus* x *acerifolia*)
- American elm (*Ulmus americana*) – Dutch elm disease resistant varieties

Tree Species Selection

Selecting a limited number of species could simplify decision-making processes; however, careful deliberation and selection of a wide variety of species will increase benefits and save money. Planting a variety of species can decrease the impact of species-specific pests or diseases by limiting the number of susceptible trees in a population, which will reduce the time and money spent to mitigate problems if infestations were to occur. A wide variety of tree species may help to limit the impacts from physical events such as strong storms, wind, ice, flooding, or drought, as different tree species react differently to stress.

The City of Atlanta is located in USDA Hardiness Zone 7b, which identifies a climatic region where the average annual minimum temperature is between 5° and 10° F. Any tree species selected for planting in Atlanta should be appropriate for this zone.

Tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site characteristics below ground (soil texture, soil structure, drainage, soil pH, nutrients, and root spacing). Matching a species to its favored soil conditions is the most important task when planning for a low-maintenance landscape. Plants that are well matched to their environmental site conditions are much more likely to resist pathogens and insect pests and will, therefore, generally require less maintenance.

A major consideration for street trees is the amount of litter dropped by mature trees. Trees such as Callery pear have weak wood. Others, such as oaks, may drop high volumes of acorns. In certain species, such as ginkgo, female trees produce offensive/large fruit; male trees, however, produce no fruit. Furthermore, a few species of trees, including hawthorns (*Crataegus* spp.) and honeylocust (*Gleditsia triacanthos*) may have substantial thorns. These species should be avoided in high-traffic areas.

Seasonal color should also be considered when planning tree plantings. Flowering varieties are particularly welcome in the spring, and deciduous trees that display bright colors in autumn can add a great deal of interest to surrounding landscapes.

Appendix C lists recommended hardy native and non-native species for Atlanta's street ROWs and native species for park locations.

Quality Standards for New Trees

Establishing specifications for purchasing tree stock will help gauge the quality of trees that the City receives from nurseries. Poor quality trees can lead to future stability issues or poor establishment. Problems include circling roots, deep planting, codominant leaders, and leaning trees.

Having set City specifications will help to illuminate poor quality issues upon arrival to the planting site. Atlanta's standards should include much of the same language described by the ANSI Z60.1 nursery stock standard. Detailed specifications should be written using these standards to ensure quality is purchased and planted.

There is a downside to creating quality standards: a tree either meets the specifications or does not. It took the Florida Department of Agriculture and Consumer Services nine years to develop their Grades and Standards for Nursery Stock (Gilman, 2012). With many revisions and much compromise between stakeholders, four grades of tree quality were developed. Davey suggests Atlanta use these grades for quality standards or develop their own to drive future tree planting. The University of Florida, Landscape Plants, nursery tree production specifications and standards website has a listing for Florida's grades and standards and also has examples from California and Illinois (University of Florida, 2011).

Benefits of Large vs. Small Trees

Many considerations drive species choice, including planting site conditions, potential conflicts with infrastructure, maintenance concerns, and design considerations. In some cases, small- or medium-growing trees are the best (or only) option. Nonetheless, environmental and economic research shows that large-growing trees should be planted and replaced wherever possible to increase tree-related benefits and return on investment.

Large trees provide the most annual benefits, and benefits increase with tree size. Appendix D presents the total gross benefit estimates for a tree over a 40-year period:

- $1,931 for a small-growing tree
- $4,673 for a medium-growing tree
- $8,562 for a large-growing tree

Emphasis should be placed on replacing trees with large-growing trees wherever possible, identifying existing planting spaces suitable for large-growing trees, and designing planting areas within the streetscape suitable for root expansion and trunk taper. Table 37 shows most of Atlanta's inventoried street and park trees are large-growing (43%), followed by small-growing trees (36%), then medium-growing trees (22%). While large trees may be associated with higher maintenance costs over time compared to smaller trees, implementing a new tree establishment program and a proactive YTT Cycle pruning program can help distribute those costs more evenly and protect the initial investment of planting while ensuring maximum benefits.

Table 37. Number of Trees by Tree Type

Tree Type	Broadleaf Deciduous	Broadleaf Evergreen	Conifer	Total	Percent
Large	3,535	0	61	3,596	43%
Medium	1,621	98	123	1,842	22%
Small	2,860	167	0	3,027	36%
Total	**8,016**	**265**	**184**	**8,465**	**100%**
Percent	**95%**	**3%**	**2%**	**100%**	

Section 4: Updating the Inventory and Plan

To sustain the City's urban forest program and to ensure that program needs and budgets are accurately projected, this plan and the tree inventory database it is based on should be updated at various times. The inventory database is a tool that, if maintained properly through updates, will guide current and future decisions about tree planting and maintenance. It will also help the City to project equipment, staffing, and fiscal needs over the next five to seven years. Updates to the tree inventory database can spur changes to this Plan.

Photographs 8 and 9. *Atlanta's downtown tree inventory will to be a valuable tool in organizing, scheduling, and routing the work to be accomplished.*

The inventory should be updated *as needed* when events such as severe weather or human activity (such as construction or car accidents) affect trees. These updates typically focus on upholding public safety and generally require changing the maintenance needs and condition data fields in the database for the affected trees.

The inventory should be updated when planned work has been completed (such as pruning cycles or tree removals). The City should decide on a consistent protocol and interval for updating sites in the inventory database once work has been completed. Typically intervals for routine updates are *weekly* or *monthly*.

Plan updates should be done *annually* to account for tasks accomplished and to modify the remaining tasks to ensure they can be completed in a reasonable timeframe. Workload should be assessed (whether completed or remaining), and budgets should be projected and modified based on the work remaining.

After *five to seven years*, the tree inventory database and the Plan should be formally revised. The complete re-inventory should include collection of all data fields. The collection of all data fields will enable the City to:

- Identify changes in urban forest diversity, diameter size class distribution, and general health
- Develop new goals and objectives for the urban forest based on accurate data

As Needed

The database should be updated after all severe weather events and other incidents that impact trees, and the affected trees should be assessed. The maintenance needs, maintenance priorities, and condition data fields of the affected trees should be modified appropriately.

These as-needed updates will enable tree maintenance to be performed systematically.

Weekly or Monthly

After planned tree work has been completed, the maintenance needs data field of individual trees should be updated to ensure that tree work is prioritized accurately.

When trees are added to the database (whether from newly inventoried areas or from tree planting), all data fields for the new record should be completed. If data fields are left blank or incomplete, it will limit the City's ability to query data, which will ultimately limit database usage.

Annually

The maintenance schedule should be updated annually to record work completed and work required. Project budgets and equipment and staff needs should be based on the revised maintenance schedule.

At this time, priority removal and priority pruning needs should be reassessed and adjustments made to the database. The RP Cycle and YTT Cycle should be modified to include trees that are to be included or excluded from each cycle due to maturity or mortality.

Davey recommends that Atlanta continue to inventory sections of the City to develop a complete tree inventory database. The City should budget for annual data collection. The more complete the inventory database is, the better the foundation for making tree-related decisions.

Five to Seven Years

After five to seven years, this Plan should be formally revised. Either more complete inventory of the City or a re-inventory of areas collected for this Plan should be performed before the revision. Additional inventory or a re-inventory will capture the population characteristics and needs of the urban forest at that time.

During the re-inventory, all data fields should be updated (not just the maintenance and condition fields). The Plan revision should be based on the new data so that the existing needs of the urban forest are addressed in the plan.

Section 5: Conclusions

Managing trees in urban areas is often complicated. Dealing with the recommendations of experts, the needs of residents, the pressures of local economics and politics, the concerns for public safety and liability issues, the physical aspects of trees, the forces of nature and severe weather events, and the expectation for all of these issues to be met at the same time is a considerable challenge. The City of Atlanta must carefully consider each specific issue and balance these pressures with a knowledgeable understanding of trees and their needs. If balance is achieved, the City's beauty will flourish and the health and safety of its trees and citizens will be maintained.

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Glossary

10-20-30 rule: The composition of a thriving tree population should adhere to the 10-20-30 Rule for diversity: no more than 10% of the urban forest should be of the same species, no more than 20% should be of the same genera, and no more than 30% should be in a single family (Ohio Department of Natural Resources, 2012).

address number (data field): The address number was recorded based on the visual observation by the Davey arborist at the time of the inventory of the actual address number posted on a building at the inventoried site. In instances where there was no posted address number on a building, or where sites were located by vacant lots with no GIS parcel addressing data available, the address number assigned was matched as closely as possible to opposite or adjacent addresses by the arborist(s) in the field, and an "X" was added to the number in the database to indicate that the address number was assigned.

ADID (inventory area): Trees and sites collected in the area specifically identified as the Atlanta Downtown Improvement District. See map in Appendix A

American National Standards Institute (ANSI): ANSI is a private, nonprofit organization that facilitates the standardization work of its members in the United States. ANSI's goals are to promote and facilitate voluntary consensus standards and conformity assessment systems, and to maintain their integrity.

ANSI A300 Standards: Tree care performance parameters established by ANSI can be used to develop specifications for tree maintenance.

arboriculture: The art, science, technology, and business of commercial, public, and utility tree care.

area (data field): Locations within the City identified by subdivision, management area, park name, or other discrete location/property name. Areas include: Downtown, Expanded Inventory, and ADID.

Atlanta Downtown Improvement District (ADID): Founded in 1995 by Central Atlanta Progress, Inc. (CAP), the ADID is a public-private partnership that strives to create a livable environment for Downtown Atlanta. With a board of directors of nine private- and public-sector leaders, ADID is funded through a community improvement district. The District contained 220 blocks within an area generally bounded by North Avenue on the north, Memorial Drive on the south, Piedmont Avenue and the Downtown Connector on the east, and the Norfolk-Southern rail line on the west. ADID works side by side with CAP and together they are committed to creating a thriving downtown Atlanta community for all of its property owners, employees, residents, students, and visitors (Central Atlanta Progress, 2011).

block side (data field): Address information for a site that includes the *on street*, *from street*, and *to street*. The *on street* is the street that the site is actually located on. The *from street* is the cross street one is moving away from when moving in the direction of traffic flow. The *to street* is the cross street one is moving toward when moving in the direction of traffic flow.

canopy: Branches and foliage that make up a tree's crown.

canopy assessment: See urban tree canopy (UTC) assessment.

canopy cover: As seen from above, it is the area of land surface that is covered by tree canopy.

canopy spread (data field): Estimates the width of a tree's canopy in 5-foot increments.

Central Atlanta Progress, Inc. (CAP) (data field): Founded in 1941, CAP is a private nonprofit community development organization providing leadership, programs, and services to preserve and strengthen the economic vitality of downtown Atlanta. With a board of directors of downtown's top business leaders, CAP is funded through the investment of businesses and institutions. CAP works side by side with the ADID and together they are committed to creating a thriving downtown Atlanta community for all of its property owners, employees, residents, students, and visitors.

community forest: See urban forest.

condition (data field): The specific conditions of tree parts observed by the arborists were assigned a numeric value between 0 (dead) and 5 (no problem). Tree parts assessed include: trunk, scaffold branches, smaller branches, foliage, and roots. The cumulative condition of each tree was recorded as one of the following categories adapted from the rating system established by the ISA (Council of Tree and Landscape Architects, 2000; Matheny and Clark, 1994) and based on the total of specific condition ratings for a tree:

- excellent (90%): sum of specific condition ratings equals 23–25
- good (75%): sum of specific condition ratings equals 19–22
- fair (50%): sum of specific condition ratings equals 15–18
- poor (25%): sum of specific condition ratings equals 11–14
- very poor (10%): sum of specific condition ratings equals 5–10
- dead (0%): sum of specific condition ratings equals 0–4

cycle: Planned length of time between vegetation maintenance activities.

defects (data field): When the defects of a tree warrant recognition, it was described in this data field. Defects include anthracnose, ants, basal cavity, basal decay, basal scar, borer holes, canker, chlorotic, construction damage, crack, crown cavity, crown decay, dieback, Dutch elm disease, fireblight, frost crack, girdled roots, hanger, improperly mulched, improperly planted, improperly pruned, lean, lifted sidewalk, lightning strike, root rot, sap sucker damage, scorch, trunk cavity, trunk decay, trunk scar, utility damage, and verticillium wilt.

diameter: See tree size.

diameter at breast height (DBH): See tree size.

diameter size class distribution: Diameter size class distribution is the proportion of trees by diameter size class in a specific population. It affects the environmental and economic benefits provided by the population as well as tree maintenance needs and costs, tree planting goals, and canopy continuity. The diameter size class distribution can also be used to estimate relative age of a tree population. An ideal distribution is one where the largest fraction of trees (approximately 40% of the population) is young (<8 inches DBH) with a smaller fraction (approximately 10%) in the large-diameter size class (>24 inches DBH). A tree population with a trend like the ideal will have an abundance of newly planted and young trees. Established, maturing, and mature trees will be present but in lower numbers.

Downtown (inventory area): Trees and sites collected within the general geographic area of downtown Atlanta. See map in Appendix A.

Expanded Inventory (inventory area): Trees and sites collected to the east, south, and west of downtown Atlanta. See map in Appendix A.

failure: In terms of tree management, failure is the breakage of stems or branches, or loss of mechanical support of the tree's root system.

further inspection (data field): Notes that a specific tree may require an annual inspection for several years to make certain of its maintenance needs. A healthy tree obviously impacted by recent construction serves as a prime example. This tree will need annual evaluations to assess the impact of construction on its root system. Another example would be a tree with a defect requiring additional equipment for investigation.

general health: The general health of a tree population indicates how well trees are performing given their site-specific conditions. General health affects both short- and long-term tree maintenance needs and costs as well as canopy continuity.

genus: A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature, the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.

geographic information system (GIS): A technology that is used to view and analyze data from a geographic perspective. The technology is a piece of an organization's information system framework. GIS links location to information (such as people to addresses, buildings to parcels, or streets within a network) and layers that information to provide a better understanding of how they interrelate.

global positioning system (GPS): GPS is a system of earth-orbiting satellites that make it possible for people with ground receivers to pinpoint their geographic location.

grate present (data field): If a grate was present around the trunk of the tree it was noted.

grow space length (data field): Identifies the minimum length of the tree growspace for root development.

grow space width (data field): Identifies the minimum width of the tree growspace for root development.

hardscape damage (data field): Indicates trees damaged by hardscape or hardscape damaged by trees (for example, damage to curbs, cracking, lifting of sidewalk pavement one inch or more).

invasive, exotic tree: A tree species that is out of its original biological community. Its introduction into an area causes or is likely to cause economic or environmental harm, or harm to human health. An invasive, exotic tree species has the ability to thrive and spread aggressively outside its natural range. An invasive species that colonizes a new area may gain an ecological edge since the insects, diseases, and foraging animals that naturally keep its growth in check in its native range are not present in its new habitat.

inventory: See tree inventory.

inventory date (data field): Date inventory data were collected.

large tree routine prune: These trees require routine horticultural pruning to correct structural problems or growth patterns that could eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket truck access or manual climbing.

location (data fields): A collection of data fields collected during the inventory to aid in finding trees, including address number, street name, site number, side, and block side.

mapping coordinate (data field): Helps to locate a tree. X and Y coordinates were generated using GPS for each tree.

monoculture: A population dominated by one single species or very few species.

notes (data field): Describes additional pertinent information.

ordinance: See tree ordinance.

overhead utilities (data field): Indicates the presence or absence of overhead utilities at a site.

parcel address (data field): See address number.

parks inventoried: Central Park, Fire Station 5 Park, Freedom Park, Hardy Ivy Park, Hurt Park, John Calhoun Park, Mayors Park, Phoenix Park Number 2, Phoenix Park Number 3, Renaissance Park, Selena S. Butler Park, Stone Mountain Trail Area, Susan K. May Park, Walton Springs Triangle, and Woodruff Park.

plant tree: During the inventory, vacant planting sites were identified as small, medium, or large to indicate the appropriate size of tree species at maturity, depending on the growing space available and the presence of overhead wires. Planting sites were determined based on standard specifications set forth in accepted technical journals and by the arboriculture industry.

primary maintenance (data field). Trees were assigned a prioritized maintenance need to be used as a guideline to make safety-driven maintenance decisions and to direct normal tree maintenance programs efficiently. Maintenance needs were based on observable defects at the time of assessment; observations were made from the ground. Maintenance needs include: priority 1 removal, priority 2 removal, priority 3 removal, priority 1 prune, priority 2 prune, large tree routine prune, small tree routine prune, training/structural prune, and plant tree.

priority 1 prune: Trees categorized as priority 1 prune were recommended for pruning to remove deadwood, hangers, or broken branches. These trees have broken or hanging limbs, deadwood, or dead, dying, or diseased limbs or leaders greater than 4 inches in diameter.

priority 2 prune: Trees categorized as priority 2 prune were recommended for pruning to remove dead, dying, diseased, or weakened branches between 2 and 4 inches in diameter.

priority 1 removal: Trees designated for priority 1 removal have defects that cannot be cost-effectively or practically treated. Most of the trees in this category have a large percentage of dead crown and pose an elevated level of risk for failure. Large dead and dying trees that are high-liability risks are included in this category. These trees are the first ones that should be removed.

priority 2 removal: Trees that should be removed but are not as high a priority as the priority 1 removals. This category would need attention after priority 1 removal trees are removed.

priority 3 removal: Trees that should be removed but are not as high a priority as the priority 1 or priority 2 removals. This category would need attention after priority 1 and priority 2 trees are removed.

pruning: The selective removal of plant parts to meet specific goals and objectives.

raised planter (data field): Trees growing in a container rather than planted directly in the ground.

right-of-way (ROW): See street right-of-way.

side value (data field): Each site is assigned a side value to aid in locating the site. Side values include: *front*, *side to*, *side away*, *median* (includes islands), and *rear* based on the site's location in relation the lot's street frontage. The *front* side is the side that faces the address street. *Side to* is the name of the street the arborist is walking towards as data are collected. The *side from* is the name of the street the arborist is walking away from while collecting data. *Median* indicates a median or island. The *rear* is the side of the lot opposite the front.

site number (data field): All sites at an address are assigned a *site number*. Site numbers are not unique; they are sequential to the side of the address only (the only unique number is the tree identification number assigned to each site). Site numbers are collected in the direction of vehicular traffic flow. The only exception is a one-way street. Site numbers along a one-way street are collected as if the street were actually a two-way street, so some site numbers will oppose traffic.

size class distribution: See diameter size class distribution.

small tree routine prune: These trees require routine horticultural pruning to correct structural problems or growth patterns that could eventually obstruct traffic or interfere with utility wires or buildings. These trees are small-growing, mature trees that can be evaluated and pruned from the ground.

species: Fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of interbreeding. An organism belonging to such a category, represented in binomial nomenclature by an un-capitalized Latin adjective or noun following a capitalized genus name.

species diversity: Species diversity is the variety and abundance of trees, in this case, in a specific population. It affects the population's ability to sustain threats from invasive pests and diseases. It also impacts tree maintenance needs and costs, tree planting goals, and canopy continuity.

stem: A woody structure bearing buds and foliage, and giving rise to other stems.

stems (data field): Identifies the number of stems or trunks splitting less than one foot above ground level.

street name (data field): The name of a street right-of-way or road identified using posted signage or parcel information.

street right-of-way (ROW): A strip of land generally owned by a public entity over which facilities, such as highways, railroads, or power lines, are built.

street tree: A street tree is defined as a tree within the street ROW.

structural defect: A feature, condition, or deformity of a tree or tree part that indicates weak structure and contributes to the likelihood of failure.

topping: Reducing tree size using internodal cuts without regard to tree health or structural integrity. Topping is not an acceptable pruning practice.

training/structural prune: Young, large-growing trees that are still small must be pruned to correct or eliminate weak, interfering, or objectionable branches in order to minimize future maintenance requirements. These trees, up to 20 feet in height, can be worked with a pole pruner by a person standing on the ground.

tree: A tree is defined as a perennial woody plant that may grow more than 20 feet tall. Characteristically, it has one main stem, although many species may grow as multi-stemmed forms.

tree benefit: An economic, environmental, or social improvement that benefits the community and results mainly from the presence of a tree. The benefit received has real or intrinsic value associated with it.

tree defect: Any feature of a tree that is likely to make it less safe (in the case of a structural defect) or otherwise to reduce its health, longevity, landscape prominence or conservation value for any other reason.

tree height (data field): The height of the tree estimated by the arborist and recorded in 10-foot increments.

tree inventory: Comprehensive database containing information or records about individual trees typically collected by an arborist.

tree ordinance: Tree ordinances are policy tools used by communities striving to attain a healthy, vigorous, and well-managed urban forest. Tree ordinances provide the authorization and standards for management activities.

tree size (data field): A tree's diameter measured to the nearest inch at 4.5 feet above ground, also known as diameter at breast height (DBH) or diameter.

urban forest: All of the trees within a municipality or a community. This can include the trees along streets ROWs, in parks and greenspaces, and in forests.

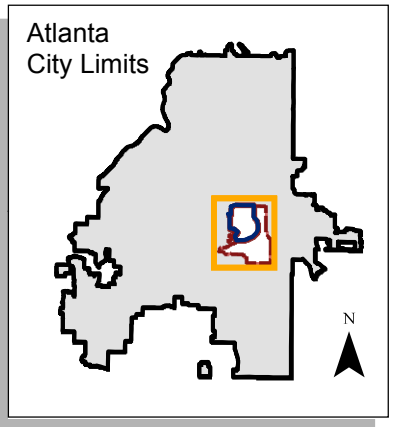
urban tree canopy (UTC) assessment: A study performed of land cover classes to gain an understanding of the tree canopy coverage, particularly as it relates to the amount of tree canopy that currently exists and the amount of tree canopy that could exist. Typically performed using aerial photographs, GIS data, or light detection and ranging (Lidar).

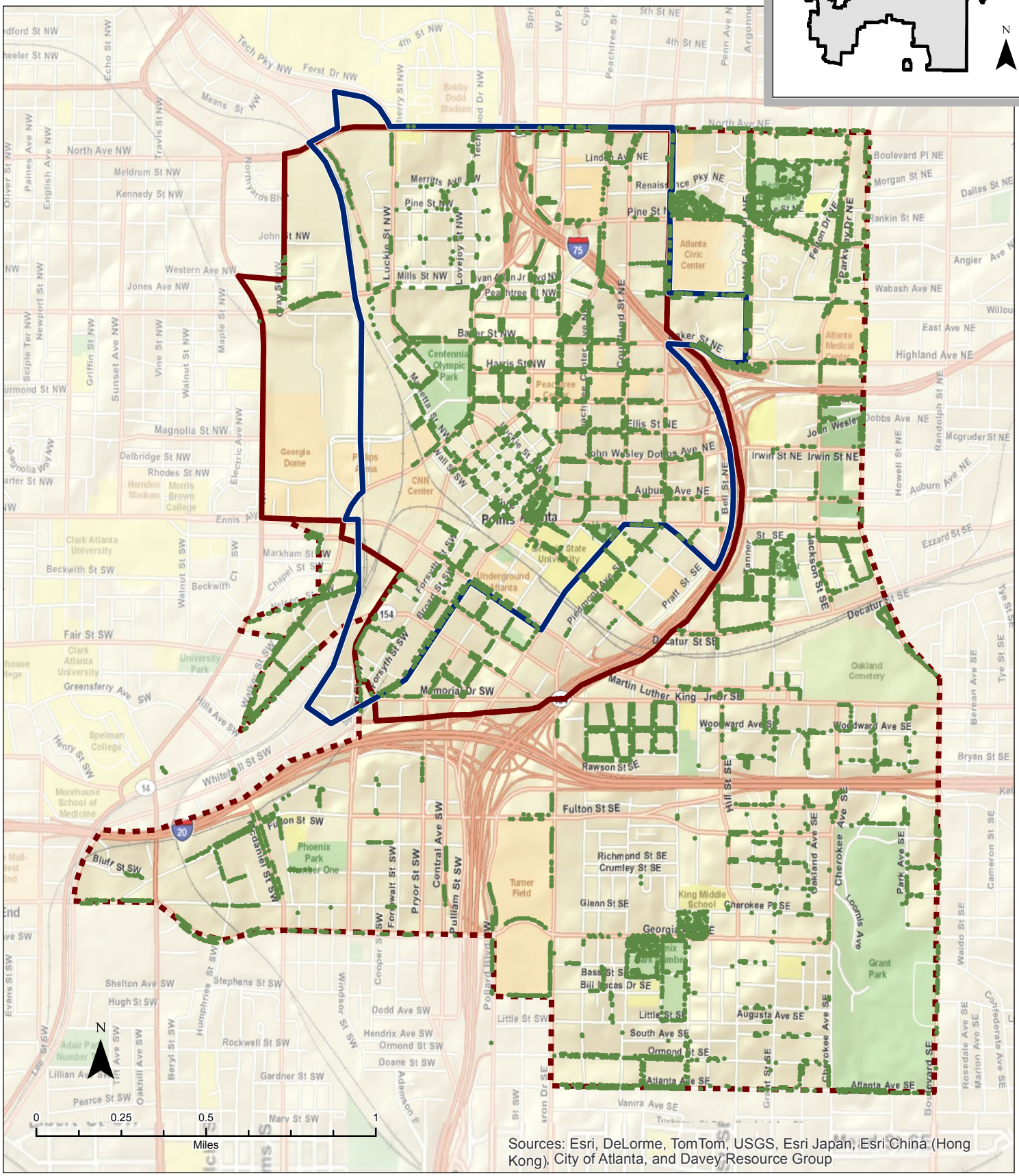
Appendix A. Maps of Inventoried Areas

Overall Tree Inventory Area

- Trees Inventoried
- Downtown Inventory Area
- ADID Area
- Expanded Inventory Area
- Atlanta City Limits

Inventory Date: July12 - August 4, 2011
* Outlying trees inlcuded in expanded area

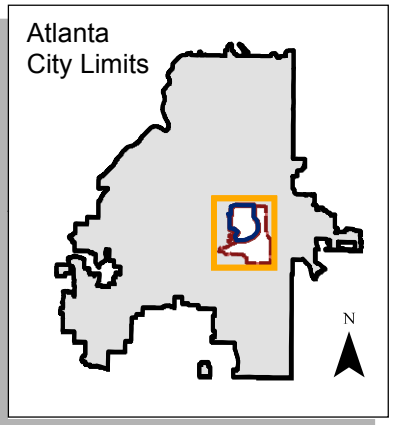


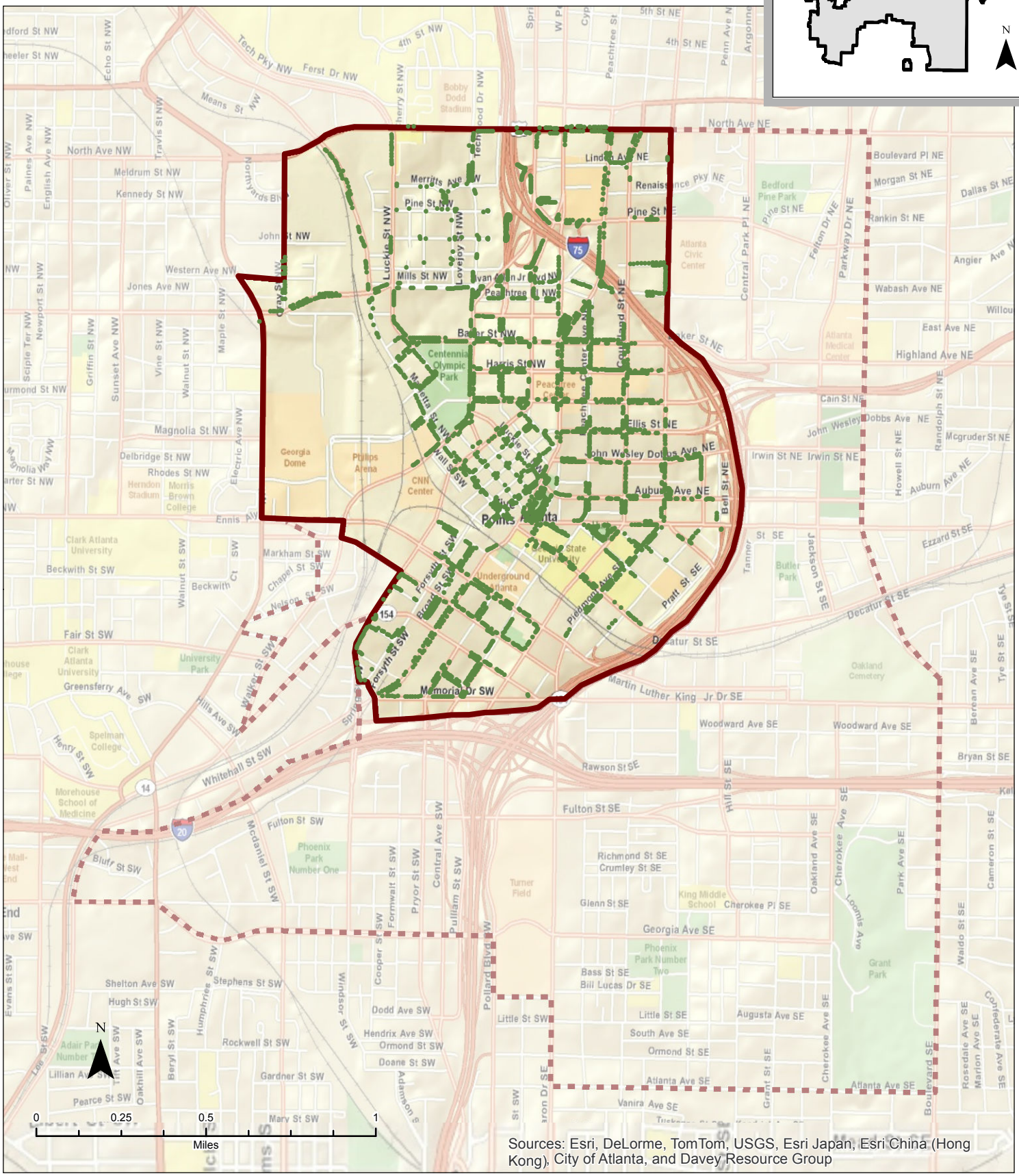


Downtown Tree Inventory Area

- Trees Inventoried
- Downtown Inventory Area
- ADID Area
- Expanded Inventory Area
- Atlanta City Limits

Inventory Date: July12 - August 4, 2011

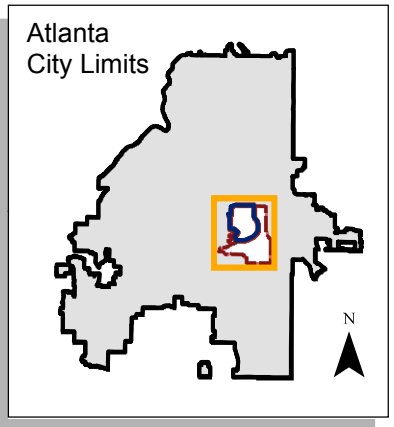


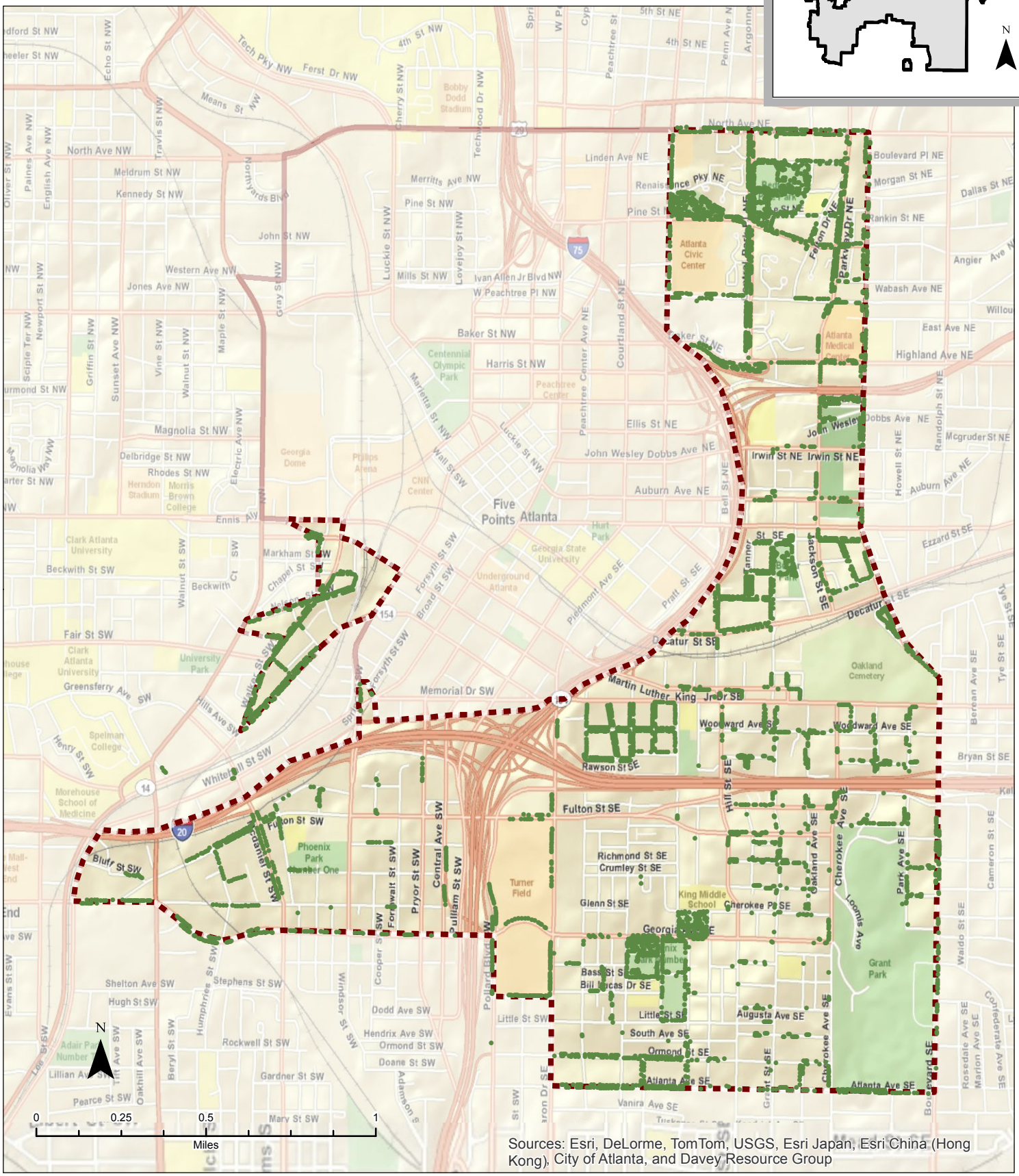


Expanded Tree Inventory Area

- Trees Inventoried
- Downtown Inventory Area
- ADID Area
- Expanded Inventory Area
- Atlanta City Limits

Inventory Date: July12 - August 4, 2011
* Outlying trees inlcuded in expanded area





Sources: Esri, DeLorme, TomTom, USGS, Esri Japan, Esri China (Hong Kong), City of Atlanta, and Davey Resource Group

ADID Management Area

- Trees Inventoried

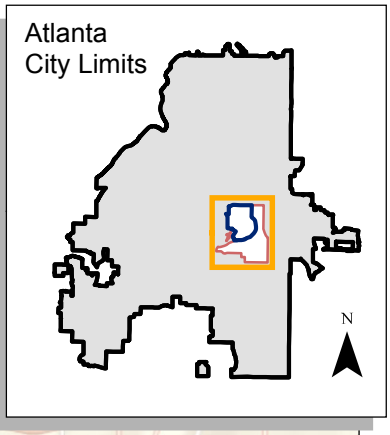
Inventory Date: July12 - August 4, 2011

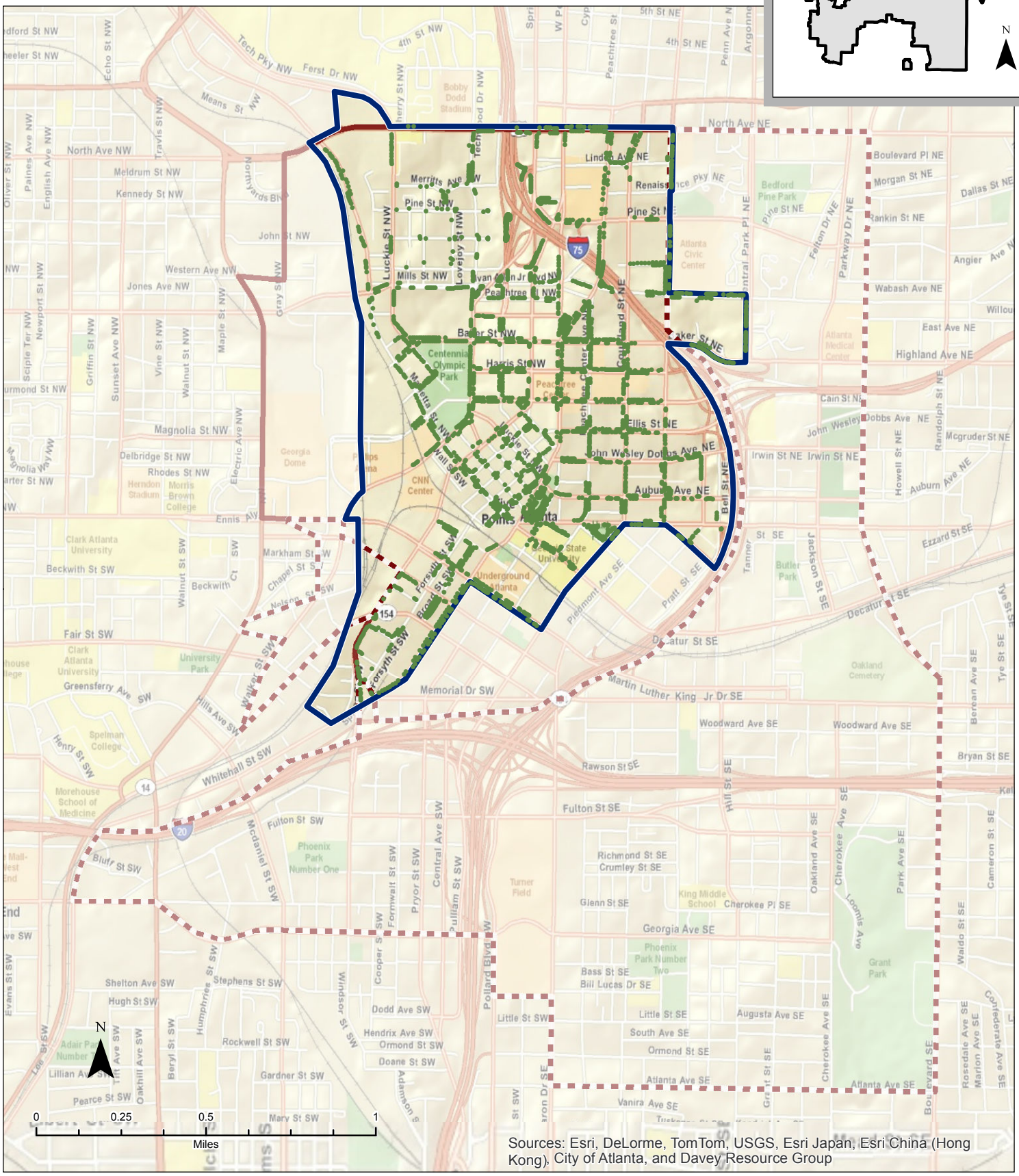
Downtown Inventory Area

Expanded Inventory Area

ADID Area

Atlanta City Limits





Appendix B. Site Location Method

Equipment and Base Maps

Inventory arborists use CF-19 Panasonic Toughbook® unit(s) and Trimble® global positioning system (GPS) Pathfinder® ProXH™ receiver(s).

Street ROW Site Location

Individual street ROW sites (trees, stumps, or vacant planting sites) were located using a methodology developed by Davey that identifies sites by *address number*, *street name, side, site number*, and *block side*. This methodology allows for consistent assignment of location.

Address Number and Street Name

The *address number* was recorded based on visual observation by the arborist at the time of the inventory (the address number posted on a building at the inventoried site). Where there was no posted address number on a building or where the site was located by a vacant lot with no GIS parcel addressing data available, the address number assigned was matched as closely as possible to opposite or adjacent addresses by the arborist and an "X" was added to the number in the database to indicate that it was assigned (for example, "37X Choice Avenue").

Sites in medians or islands were assigned an address number using the address on the right side of the street in the direction of collection closest to the site. Each segment was numbered with an assigned address that was interpolated from addresses facing that median/island. If there were multiple median/islands between cross streets, each segment was given its own assigned address.

The *street name* assigned to a site was determined by street ROW parcel information and posted street name signage.

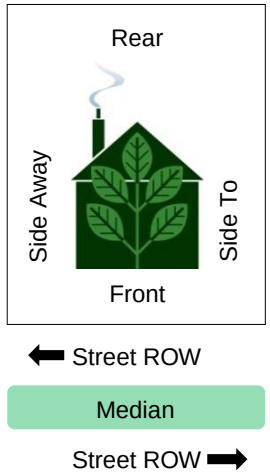


Figure 1. Side values for street ROW sites.

Side Value and Site Number

Each site was assigned a *side value* and *site number*. Side values include: *front*, *side to*, *side away*, *median* (includes islands), or *rear* based on the site's location in relation the lot's street frontage (Figure 1). The *front side* is the side that faces the address street. *Side to* is the name of the street the arborist is walking towards as data is being collected. The *side from* is the name of the street the arborist is walking away from while collecting data. *Median* indicates a median or island. The *rear* is the side of the lot opposite of the front.

All sites at an address are assigned a *site number*. Sites numbers are not unique; they are sequential to the side of the address only (the only unique number is the tree identification number assigned to each site). Site numbers are collected in the direction of vehicular traffic flow. The only exception is a one-way street. Site numbers along a one-way street are collected as if the street was a two-way street, thus some site numbers will oppose traffic.

A separate site number sequence is used for each side value of the address (front, side to, side away, median, or rear). For example, trees at the front of an address may have site numbers from 1 through 999 and, if trees are located on the side to, side away, median, or rear of that same address, each side will also be numbered consecutively beginning with the number 1.

Block Side

Block side information for a site includes the *on street*, *from street*, and *to street*.

- The *on street* is the street that the site is physically located on. (The *on street* may not match the address street. A site may be physically located on a street that is different from its street address, for example, a site located on a side street.)
- The *from street* is the first cross street encountered when proceeding along the street in the direction of traffic flow.
- The *to street* is the second cross street encountered when moving in the direction of traffic flow.

Park and/or Public Space Site Location

Park and/or public space site locations were collected using the same methodology as street ROW sites; however, the *on street*, *from street*, and *to street* would be the park and/or public space's name (not street names).

Site Location Examples

Figure 2. The tree trimming crew in the truck traveling westbound on E Mac Arthur Street is trying to locate an inventoried tree with the following location information:

Address/Street Name:	226 E. Mac Arthur Street
Side:	Side To
Site Number:	1
On Street:	Davis Street
From Street:	Taft Street
To Street:	E. Mac Arthur Street.

The tree site circled in red is the site the crew is looking for. Because the tree is located on the side of the lot, the on street is Davis Street even though it is addressed as 226 East Mac Arthur Street. Moving with the flow of traffic, the from street is Taft Street, and the to street is East Mac Arthur Street.

Figure 3. Location information collected for inventoried trees at Corner Lot A and Corner Lot B.

Corner Lot A

Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 1
On Street:	Taft St.
From Street:	E Mac Arthur St.
To Street:	Hoover St.

Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 2
On Street:	Taft St.
From Street:	E Mac Arthur St.
To Street:	Hoover St.

Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 3
On Street:	Taft St.
From Street:	19th St.
To Street:	Hoover St.

Address/Street Name:	205 Hoover St.
Side/Site Number:	Front / 1
On Street:	Hoover St.
From Street:	Taft St.
To Street:	Davis St.

Corner Lot B

Address/Street Name:	226 E Mac Arthur St.
Side/Site Number:	Side To / 1
On Street:	Davis St.
From Street:	Hoover St.
To Street:	E Mac Arthur St.

Address/Street Name:	226 E Mac Arthur St.
Side/Site Number:	Front / 1
On Street:	E Mac Arthur St.
From Street:	Davis St.

Appendix C. Recommended Tree Species for Planting

Appendix C: Recommended Tree Species for Planting

Key

Recommended Uses

Screen Trees
- "X" indicates that planting of species in a row would create a uniform barrier/division

Columnar Trees for Narrow Spaces
- "X" indicates that species has varieties that would adapt well to tight site locations

Trees Suitable for Detention Ponds and Wetlands
- "X" indicates that planting of species would adapt well to site conditions

Trees Suitable for Road Frontage and Parking Lots
- "X" indicates that planting of species would adapt well to site conditions

Physical Characteristics

Height Class in Urban Conditions
- Commonly achieved mature tree height classification
  - S = Small: 15 to 25 feet
  - M = Medium: 25 to 40 feet
  - L = Large: 40 feet and taller

Crown Class in Urban Conditions
- Commonly achieved mature tree crown width classification
  - VS = Very Small: 15 foot crown diameter
  - S = Small: 25 foot crown diameter
  - M = Medium: 35 foot crown diameter
  - L = Large: 45 foot crown diameter

Mature Crown Form
- General shape of mature tree
  - Columnar
  - Irregular
  - Multi-stemmed
  - Oval
  - Pyramidal
  - Rounded
  - Spreading
  - Upright
  - Vase

Leaf Type
- Leaf persistence and type
  - DB = Deciduous Broadleaf
  - DC = Deciduous Conifer
  - EB = Evergreen Broadleaf
  - EC = Evergreen Conifer

Physical Characteristics (continued)

Leaf Texture
- Relative size and appearance of leaves
  - F = Fine
  - M = Medium
  - C = Coarse

Fall Leaf Color
- Color of foliage in the season of fall
  - EV = Evergreen
  - BR = Bronze or brown
  - MA = Maroon
  - MU = Multi-colored: maroon, red, orange, yellow
  - OR = Orange
  - RE = Red
  - YE = Yellow
  - I = Insignificant color change

Flower Color
- Typical flower color of "showy" flowering trees
  - B = Blue
  - G = Green
  - L = Purple
  - M = Multiple colors: white, pink, purple, red, or others
  - P = Pink
  - R = Red
  - W = White
  - Y = Yellow
  - I = Insignificant flowers: small and/or unremarkable color

Flowering Time
- Season of bloom is indicated for "showy" flowering trees

Wildlife Value
- "X" indicates that species produces flowers or fruits that are consumed by insects, birds, or mammals

Excessive Litter
- "X" indicates that species would produce large or hazardous leaves, fruits, or other litter

Environmental Characteristics and Tolerances

Native Tree to Area
- Indication of species is found naturally growing in Georgia
  - Y = Yes
  - N = No

Growth Rate
- Typical rate of growth
  - S = Slow
  - M = Moderate
  - F = Fast

Average Life Span
- The average species life span
  - S = Short: less than 25 years
  - M = Moderate: 25 to 40 years
  - L = Large: 50 years or greater

Soil Moisture
- Species preferred soil moisture condition
  - H = Hydric: wet and may be occasionally flooded for short periods
  - M = Mesic: moist but moderately well-to well-drained
  - X = Xeric: dry and very well-drained

Drought Tolerance
- Tolerance level of species to infrequent or prolonged periods without rain
  - Low = not tolerant
  - Moderate = tolerant to moderately tolerant
  - High = very tolerant

Preferred Soil pH
- Soil acidity or alkalinity preferred by the species
  - AC = Acidic (5.0 to 6.0)
  - SLAC = Slightly acidic (6.0 to 7.0)
  - NU = Neutral (7.0)
  - SLAL = Slightly alkaline (7.0 to 8.0)
  - AL = Alkaline (8.0 to 8.5)
  - NIA = No information available

Light Requirement
- The amount of sunlight the species prefers or will tolerate
  - FS = Full sun
  - PS = Partial sun
  - SH = Shade

Urban Tolerant Tree
- "X" indicates that species would adapt to "tough" urban conditions

Street ROW: Overstory Trees (>1,600 Square Feet of Canopy at Maturity)																							
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Aesculus hippocastanum***	Horsechestnut				X	L	L	Oval/Rounded	DB	C	YE	W	Spring	X	X	N	M	M	M	AC to AL	FS	X
*Carya cordiformis**	Hickory, Bitternut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	F	M	L	AC to AL	FS	
*Carya glabra**	Hickory, Pignut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	M	M	H	SLAC TO AC	FS to PS	
*Carya illinoensis**	Pecan					L	L	Oval/Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	H	AC to AL	FS to PS	
*Carya ovata**	Hickory, Shagbark					L	M	Oval	DB	C	YE	GR	Spring	X	X	Y	S	M	M	SLAL to AC	FS to PS	
*Carya ovata var. australis**	Hickory, Southern Shagbark					L	M	Oval	DB	C	YE	I	Spring	X	X	Y	S	M	M	SLAL to AC	FS to PS	
*Carya tomentosa**	Hickory, Mockernut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	S	X	H	SLAC TO AC	FS	
*Castanea mollissima**	Chestnut, Chinese					L	L	Rounded	DB	M	BR	Y	Summer	X	X	N	M	X	M	AC to SLAL	FS	X
*Cedrus deodara***	Cedar, Deodar	X	X		X	L	S	Pyramidal	EC	F	EV	I	Spring			N	F	M	H	SLAL to AC	FS	
*Celtis laevigata**	Sugarberry			X	X	L	L	Spreading/Rounded	DB	M	YE	I	Spring	X		Y	F	M	H	AL to AC	FS to PS	X
*Celtis occidentalis**	Hackberry, Common				X	L	L	Spreading/Rounded	DB	M	YE	I	Spring	X		Y	F	M	H	AL to AC	FS to PS	X
*Celtis tenuifolia**	Hackberry, Georgia					S	S	Spreading	DB	M	YE	I	Spring	X		Y	S	D	H	AC to AL	FS	
*Corylus colurna***	Filbert, Turkish				X	L	M	Oval/Pyramidal	DB	M	YE	I	Spring	X	X	N	S	M	H	AC to AL	FS to PS	X
*Eucommia ulmoides***	Hardy Rubber Tree	X			X	L	M	Rounded/Spreading	DB	M	I	I	Spring			N	S	M	H	AC to AL	FS	X
*Fagus grandifolia**	Beech, American	X				L	L	Oval	DB	M	YE	I	Spring	X		Y	M	M	M	AC	FS to S	
*Ginkgo biloba**	Gingko (Male)		X		X	L	M to L	Pyramidal/Spreading	DB	M	YE	I	Spring			N	S	M	H	AL to AC	FS to S	X
*Gymnocladus dioicus***	Coffeetree, Kentucky				X	L	L	Oval	DB	M	YE	W	Spring		X	N	M	M	H	AC to AL	FS	X
*Juglans nigra**	Walnut, Black					L	L	Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	H	AC to AL	FS	
*Liquidambar styraciflua**	Sweetgum		X		X	L	L	Oval/Pyramidal	DB	M	MU	I	Spring	X	X	Y	M	M	L	SLAL to AC	FS to PS	X
*Liriodendron tulipifera**	Poplar, Yellow (Tuliptree)		X		X	L	L	Oval	DB	M	YE	G	Spring	X		Y	F	M	M	AC	FS	
*Magnolia acuminata***	Magnolia, Cucumbertree					L	L	Pyramidal	DB	C	I	Y	Spring	X		Y	F	M	M	SLAL to AC	FS to PS	
*Platanus occidentalis**	Sycamore, American				X	L	L	Rounded/Spreading	DB	C	BR	I	Spring		X	Y	F	M	H	AC to Al	FS	
*Platanus x acerifolia***	Planetree, London				X	L	L	Rounded/Spreading	DB	C	YE	RE	Spring		X	N	F	M	H	AC to AL	FS	X

Street ROW: Overstory Trees (>1,600 Square Feet of Canopy at Maturity)																							
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Quercus alba**	Oak, White				X	L	L	Rounded/Pyramidal	DB	M	RE	I	Spring	X	X	Y	S	M	M	AC	FS to PS	
*Quercus bicolor**	Oak, Swamp White			X	X	L	L	Oval/Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	M	SLAL to AC	FS to PS	X
*Quercus coccinea**	Oak, Scarlet				X	L	L	Rounded	DB	M	RE	I	Spring	X	X	Y	M	X	M	AC	FS	
*Quercus falcata**	Oak, Southern Red				X	L	L	Oval/Rounded	DB	M	BR	I	Spring	X	X	Y	M	M	H	AC	FS	
*Quercus lyrata**	Oak, Overcup			X	X	L	L	Oval/Rounded	DB	M	BR	I	Spring	X	X	Y	M	H	M	SLAL to AC	FS to PS	X
*Quercus michauxii**	Oak, Swamp Chestnut			X		L	L	Oval	DB	M	BR	I	Spring	X	X	Y	M	M	M	na	FS	
*Quercus nuttalli**	Oak, Nuttail			X	X	L	L	Rounded	DB	M	RE	I	Spring	X	X	N	M	M	M	AC	FS	
*Quercus oglethorpensis**	Oak, Oglethorpe			X		M	M	Rounded	DB	M	RE	I	Spring	X	X	Y	S	H	M	na	FS	
*Quercus palustris**	Oak, Pin	X			X	L	L	Pyramidal	DB	M	RE	I	Spring	X	X	N	M	M	M	AC	FS	X
*Quercus phellos**	Oak, Willow	X		X	X	L	L	Rounded/Pyramidal	DB	F	YE	I	Spring	X	X	Y	F	M	H	AC	FS	X
*Quercus prinus**	Oak, Chestnut					L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	M	X	H	AC	FS	
*Quercus rubra**	Oak, Northern Red				X	L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	F	M	H	SLAL to AC	FS	X
*Quercus shumardii**	Oak, Shumard				X	L	L	Oval/Rounded	DB	C	RE	I	Spring	X	X	Y	F	M	H	AC to AL	FS	X
*Quercus stellata**	Oak, Post					L	L	Rounded	DB	C	BR	I	Spring	X	X	Y	M	X	H	SLAL to AC	FS	
*Quercus velutina**	Oak, Black				X	L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	M	X	H	AC	FS to PS	
*Tilia americana***	Linden, American				X	L	L	Oval/Pyramidal	DB	C	YE	G	Summer			N	M	M	M	AC to AL	FS to PS	
*Tilia tomentosa***	Linden, Silver				X	L	L	Oval/Rounded	DB	C	YE	Y	Summer			N	F	M	M	AC to AL	FS to PS	X
*Ulmus americana**	Elm, American		X	X	X	L	L	Vase	DB	M	YE	I	Spring	X		Y	F	H	H	AL to AC	FS to PS	X
*Ulmus rubra**	Elm, Slippery					L	L	Vase	DB	M	YE	I	Spring	X		Y	F	M	M	SLAC TO SLAL	FS to PS	

**Atlanta assigned species to size category by approximation of canopy cover size.*
***Species canopy cover category were assigned by estimation. References for canopy cover size were not found.*

Street ROW: Mid-Story/Mid-Canopy Trees (Approx. 900 Square Feet of Canopy at Maturity)																						
		Recommended Uses				Physical Characteristics									Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Acer barbatum**	Maple, Southern Sugar				X	L	M	Oval/Rounded	DB	M	OR	RE	Spring			Y	M	M	H	AC	FS to PS	X
*Acer campestre***	Maple, Hedge	X	X		X	M	M	Rounded	DB	F	YE	G	Spring			N	S	M	H	AC to AL	FS to PS	X
*Acer leucoderme**	Maple, Chalk				X	M	S	Oval	DB	M	MU	G	Spring			Y	S	M	H	SLAL to AC	FS to PS	X
*Aesculus pavia**	Buckeye, Red				X	S	S	Rounded/Pyramidal	DB	C	I	R	Spring	X	X	N	M	M	M	AC	PS to S	
*Alnus glutinosa***	Alder, European	X	X		X	L	M	Oval/Pyramidal	DB	C	I	RE	Spring			N	M	M	M	AC to AL	FS to PS	X
*Betula nigra**	Birch, River	X		X	X	L	M	Oval/Pyramidal	DB	M	YE	I	Winter/Spring			Y	F	M	M	AC	FS to PS	X
*Carpinus betulus**	Hornbeam, European	X	X		X	M	M	Oval/Vase	DB	F	YE	W	Spring	X		N	S	M	H	AC to AL	FS to SH	X
*Carpinus caroliniana**	Hornbeam, American	X	X		X	M	S	Oval	DB	M	YE	O	Spring	X		Y	S	M	M	SLAL to AC	FS to SH	
*Carya aquatica**	Hickory, Water			X		L	M	Oval	DB	M	YE	I	Spring	Y	Y	Y	S	H	na	na	FS to PS	
*Catalpa bignonioides***	Catalpa, Southern					M	M	Oval	DB	M	I	W	Spring		X	Y	M	M	H	AC to AL	FS to PS	
*Cladrastis kentukea**	Yellowwood, American				X	M	M	Rounded/Vase	DB	M	YE	W	Summer			Y	M	M	M	AC to AL	FS to PS	
*Cryptomeria japonica***	Cryptomeria, Japanese	X			X	L	S	Oval/Pyramidal	EC	F	BR	I	Spring			N	S	M	H	AC	FS	X
*Diospyros virginiana**	Persimmon, Common					L	M	Oval/Pyramidal	DB	M	RE	W	Spring	X	X	Y	M	M	H	AC to AL	FS	X
*Juniperus virginiana***	Redcedar, Eastern	X	X		X	L	S	Pyramidal	EC	F	EV	I	Late Winter	X		Y	F	M	H	AC to AL	FS to PS	X
*Koelreuteria paniculata***	Goldenraintree		X		X	M	M	Rounded/Spreading	DB	M	YE	Y	Summer			N	M	M	H	Ac to Al	FS	X
*Maclura pomifera**	Orange, Osage	X				M	M	Round/Spreading	DB	C	YE	W	Spring	X	X	N	F	X	H	AC to AL	FS	X
*Magnolia grandiflora***	Magnolia, Southern	X	X		X	L	M	Oval/Pyramidal	EB	C	EV	W	Spring/Summer	X	X	Y	M	M	M	SLAL to AC	FS to PS	
*Metasequoia glyptostroboides**	Redwood, Dawn	X	X	X	X	L	S	Pyramidal	DC	F	OR	I	Spring			N	F	M	M	AC	FS	X
*Morus rubra**	Mulberry, Red	X		X		L	L	Rounded/Spreading	DB	C	YE	I	Spring	X	X	Y	F	M	H	AC to AL	FS	X
*Nyssa sylvatica**	Blackgum (Tupleo)				X	L	S	Oval/Pyramidal	DB	M	RE	W	Spring	X	X	Y	M	M	H	AC	FS or PS	
*Ostrya virginiana**	Hophornbeam, American				X	M	M	Oval/Rounded	DB	F	YE	G	Summer	X		Y	S	M	H	AC to AL	FS to SH	X
*Parrotia persica***	Parrotia		X		X	M	M	Rounded/Vase	DB	F	MU	R	Spring			N	S	M	H	SLAL to AC	FS to PS	
*Phellodendron amurense***	Corktree, Amur				X	M	L	Rounded/Spreading	DB	M	BR	G	Spring			N	M	M	H	AC to AL	FS	X

Street ROW: Mid-Story/Mid-Canopy Trees (Approx. 900 Square Feet of Canopy at Maturity)																						
		Recommended Uses				Physical Characteristics									Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Pinus echinata**	Pine, Shortleaf					L	M	Rounded/Pyramidal	EC	F	EV	Y	Spring	X		Y	F	M	H	AC	PS	
*Pinus taeda**	Pine, Loblolly	X				L	M	Oval/Pyramidal	EC	F	EV	Y	Spring	X	X	Y	F	M	M	AC	FS	
*Pinus virginiana**	Pine, Virginia	X				M	M	Rounded/Pyramidal	EC	F	EV	Y	Spring	X	X	Y	M	M	H	AC	FS	
*Quercus georgiana**	Oak, Georgia				X	M	M	Rounded	DB	M	RE	I	Spring	X	X	Y	M	X	H	AC to AL	FS	
*Quercus hemisphaerica (Q. laurifolia)**	Oak, Laurel			X	X	L	L	Oval/Rounded	DB	F	YE	I	Spring	X	X	Y	F	M	M	SLAL to AC	FS to PS	
*Quercus muehlenbergii**	Oak, Chinkapin				X	L	L	Rounded/Spreading	DB	M	YE	I	Spring	X	X	N	F	M	H	AC to AL	FS	
*Quercus robur**	Oak, English		X		X	L	L	Oval/Rounded	DB	C	BR	I	Spring	X	X	N	M	M	H	AC to AL	FS	
*Salix nigra**	Willow, Black			X		M	M	Irregular	DB	F	YE	I	Summer		X	Y	F	H	L	na	FS	
*Sophora japonica**	Japanese Pagodatree		X		X	L	L	Rounded	DB	F	YE	W	Summer		X	N	M	M	H	AC to AL	FS	X
*Taxodium distichum**	Baldcypress	X	X	X	X	L	M	Pyramidal	DC	F	BR	I	Spring	X		Y	F	M	H	SLAL to AC	FS	X
*Ulmus alata**	Elm, Winged			X	X	L	M	Oval/Pyramidal	DB	F	YE	G	Fall			Y	F	M	H	AC to AL	FS to PS	X

**Atlanta asigned species to size category by approximation of canopy cover size.*

***Species canopy cover category were assigned by estimation. References for canopy cover size were not found.*

Street ROW: Understory and Ornamental Trees (Approx. 400 Square Feet of Canopy at Maturity)																							
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Acer buergeranum**	Maple, Trident				X	M	M	Oval/Rounded	DB	M	MU	Y	Spring			N	M	M	M	AC to AL	FS to PS	X
*Acer ginnala**	Maple, Amur				X	S	S	Rounded/Spreading	DB	F	RE	W	Spring			N	M	M	M	AC to AL	FS to SH	
*Acer palmatum**	Maple, Japanese					S	S	Rounded/Vase	DB	M	RE	R	Spring			N	S	M	M	SLAL to AC	PS to SH	
*Amelanchier arborea**	Serviceberry, Downy				X	S	S	Rounded/Upright/Vase	DB	F	MU	W	Spring	X		Y	S	M	M	AC	FS to PS	
*Asimina triloba**	Paw Paw					S	S	Rounded/Upright	DB	C	YE	L	Spring	X	X	Y	M	M	M	SLAL to AC	FS to SH	
*Cercis canadensis**	Redbud, Eastern				X	S	S	Rounded/Vase	DB	C	YE	L	Spring	X		Y	F	M	H	AC to AL	FS to PS	
*Chionanthus retusus**	Fringetree, Chinese				X	S	VS	Rounded/Vase	DB	M	YE	W	Spring	X	X	N	S	M	M	AC to AL	FS to SH	
*Chionanthus virginicus**	Fringetree				X	S	VS	Oval/Rounded	DB	M	YE	W	Spring	X		Y	S	M	M	AC	FS to SH	
*Cornus florida**	Dogwood, Flowering		X		X	S	S	Rounded	DB	M	RE	W	Spring	X		Y	M	M	M	SLAL to AC	FS to SH	
*Cornus kousa**	Dogwood, Kousa					S	S	Rounded	DB	M	RE	W	Spring	X		N	S	M	M	AC	FS to PS	
*Cotinus obovatus***	Smoketree, American				X	S	S	Rounded	DB	M	MU	P	Spring			N	S	M	H	AC to AL	FS to PS	X
*Crataegus phaenopyrum***	Hawthorn, Washington	X	X		X	S	S	Pyramidal	DB	M	BR	W	Spring	X		Y	M	M	H	AC to AL	FS	X
*Crataegus viridis***	Hawthorn, Green	X			X	S	M	Rounded/Vase	DB	F	I	W	Spring	X		Y	M	M	H	AC to AL	FS	X
*Halesia carolina**	Silverbell, Carolina				X	M	S	Rounded/ Upright/Vase	DB	F	YE	W	Spring			Y	M	M	M	SLAL to AC	FS to PS	
*Ilex opaca***	Holly, American	X			X	M	S	Pyramidal	EB	M	EV	W	Spring	X		Y	S	M	H	SLAL to AC	FS to SH	X
*Ilex vomitoria***	Holly, Yaupon	X		X	X	S	VS	Rounded/Vase	EB	F	EV	W	Spring	X		Y	M	M	H	AC to AL	FS to SH	X
Ilex x *attenuata* 'Fosteri'**	Holly, Fosters	X	X		X	S	VS	Columnar/Pyramidal	EB	F	EV	W	Spring	X		N	S	M	H	SLAL to AC	FS to PS	X
Ilex x *attenuata* 'Savannah'**	Holly, Savannah	X	X			M	VS	Columnar	EB	M	EV	W	Spring	X		N	M	M	H	SLAL to AC	FS to PS	
*Magnolia macrophylla**	Magnolia, Bigleaf					M	M	Oval	DB	C	I	W	Summer	X	X	N	M	M	na	SLAL to AC	FS to PS	
*Magnolia virginiana***	Magnolia, Sweetbay		X	X		L	S	Columnar/vase	EB	M	EV	W	Summer	X		Y	M	H	na	AC	FS to PS	
Magnolia x *soulangiana**	Magnolia, Saucer					M	M	Rounded/Upright	DB	C	YE	P/W	Late Winter			N	M	M	M	AC	FS to PS	
*Malus angustifolia**	Crabapple, Southern					S	S	Spreading	DB	M	YE	P	Spring	X	X	Y	M	M	L	AC to AL	FS to PS	
*Oxydendrum arboreum**	Sourwood					M	S	Oval/Pyramidal	DB	M	RE	W	Summer			Y	S	M	M	AC	FS to PS	

Street ROW: Understory and Ornamental Trees (Approx. 400 Square Feet of Canopy at Maturity)																						
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances						
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Pistacia chinensis**	Pistache, Chinese				X	M	M	Oval/Rounded/Vase	DB	M	OR	R	Spring		X	N	M	M	H	AC to AL	FS to PS	X
*Prunus sargentii***	Cherry, Sargent		X		X	M	M	Rounded/Vase	DB	M	BR	P	Spring	X		N	F	M	H	SLAL to AC	FS	X
*Rhamnus caroliniana***	Buckthorn, Carolina					S	S	Spreading	DB	M	YE	W	Spring	X		Y	M	M	M	AC to AL	FS to PS	
*Sassafras albidum**	Sassafras				X	L	M	Rounded/Pyramidal	DB	M	MU	Y	Spring	X	X	Y	M	M	H	AC	FS to PS	

**Atlanta asigned species to size category by approximation of canopy cover size.*
***Species canopy cover category were assigned by estimation. References for canopy cover size were not found.*

Parks: Overstory Trees (>1,600 Square Feet of Canopy at Maturity)																								
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances								
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Carya cordiformis**	Hickory, Bitternut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	F	M	L	AC to AL	FS	
*Carya glabra**	Hickory, Pignut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	M	M	H	SLAC TO AC	FS to PS	
*Carya illinoensis**	Pecan					L	L	Oval/Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	H	AC to AL	FS to PS	
*Carya ovata**	Hickory, Shagbark					L	M	Oval	DB	C	YE	GR	Spring	X	X	Y	S	M	M	SLAL to AC	FS to PS	
*Carya ovata var. australis**	Hickory, Southern Shagbark					L	M	Oval	DB	C	YE	I	Spring	X	X	Y	S	M	M	SLAL to AC	FS to PS	
*Carya tomentosa**	Hickory, Mockernut					L	M	Oval	DB	M	YE	I	Spring	X	X	Y	S	X	H	SLAC TO AC	FS	
*Celtis laevigata**	Sugarberry			X	X	L	L	Spreading/Rounded	DB	M	YE	I	Spring	X		Y	F	M	H	AL to AC	FS to PS	X
*Celtis occidentalis**	Hackberry, Common				X	L	L	Spreading/Rounded	DB	M	YE	I	Spring	X		Y	F	M	H	AL to AC	FS to PS	X
*Celtis tenuifolia**	Hackberry, Georgia					S	S	Spreading	DB	M	YE	I	Spring	X		Y	S	D	H	AC to AL	FS	
*Fagus grandifolia**	Beech, American	X				L	L	Oval	DB	M	YE	I	Spring	X		Y	M	M	M	AC	FS to S	
*Juglans nigra**	Walnut, Black					L	L	Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	H	AC to AL	FS	
*Liquidambar styraciflua**	Sweetgum		X		X	L	L	Oval/Pyramidal	DB	M	MU	I	Spring	X	X	Y	M	M	L	SLAL to AC	FS to PS	X
*Liriodendron tulipifera**	Poplar, Yellow (Tuliptree)		X		X	L	L	Oval	DB	M	YE	G	Spring	X		Y	F	M	M	AC	FS	
*Magnolia acuminata***	Magnolia, Cucumbertree					L	L	Pyramidal	DB	C	I	Y	Spring	X		Y	F	M	M	SLAL to AC	FS to PS	
*Platanus occidentalis**	Sycamore, American				X	L	L	Rounded/Spreading	DB	C	BR	I	Spring		X	Y	F	M	H	AC to Al	FS	
*Quercus alba**	Oak, White				X	L	L	Rounded/Pyramidal	DB	M	RE	I	Spring	X	X	Y	S	M	M	AC	FS to PS	
*Quercus bicolor**	Oak, Swamp White			X	X	L	L	Oval/Rounded	DB	C	YE	I	Spring	X	X	Y	M	M	M	SLAL to AC	FS to PS	X
*Quercus coccinea**	Oak, Scarlet				X	L	L	Rounded	DB	M	RE	I	Spring	X	X	Y	M	X	M	AC	FS	
*Quercus falcata**	Oak, Southern Red				X	L	L	Oval/Rounded	DB	M	BR	I	Spring	X	X	Y	M	M	H	AC	FS	
*Quercus lyrata**	Oak, Overcup			X	X	L	L	Oval/Rounded	DB	M	BR	I	Spring	X	X	Y	M	H	M	SLAL to AC	FS to PS	X
*Quercus michauxii**	Oak, Swamp Chestnut			X		L	L	Oval	DB	M	BR	I	Spring	X	X	Y	M	M	M	na	FS	
*Quercus oglethorpensis**	Oak, Oglethorpe			X		M	M	Rounded	DB	M	RE	I	Spring	X	X	Y	S	H	M	na	FS	
*Quercus phellos**	Oak, Willow	X		X	X	L	L	Rounded/Pyramidal	DB	F	YE	I	Spring	X	X	Y	F	M	H	AC	FS	X

Parks: Overstory Trees (>1,600 Square Feet of Canopy at Maturity)																							
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Quercus prinus**	Oak, Chestnut					L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	M	X	H	AC	FS	
*Quercus rubra**	Oak, Northern Red				X	L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	F	M	H	SLAL to AC	FS	X
*Quercus shumardii**	Oak, Shumard				X	L	L	Oval/Rounded	DB	C	RE	I	Spring	X	X	Y	F	M	H	AC to AL	FS	X
*Quercus stellata**	Oak, Post					L	L	Rounded	DB	C	BR	I	Spring	X	X	Y	M	X	H	SLAL to AC	FS	
*Quercus velutina**	Oak, Black				X	L	L	Rounded	DB	C	RE	I	Spring	X	X	Y	M	X	H	AC	FS to PS	
*Ulmus americana**	Elm, American		X	X	X	L	L	Vase	DB	M	YE	I	Spring	X		Y	F	H	H	AL to AC	FS to PS	X
*Ulmus rubra**	Elm, Slippery					L	L	Vase	DB	M	YE	I	Spring	X		Y	F	M	M	SLAC TO SLAL	FS to PS	

**Atlanta asigned species to size category by approximation of canopy cover size.*
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Parks: Mid-Story/Mid-Canopy Trees (Approx. 900 Square Feet of Canopy at Maturity)																						
		Recommended Uses				Physical Characteristics									Environmental Characteristics and Tolerances							
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Acer barbatum**	Maple, Southern Sugar				X	L	M	Oval/Rounded	DB	M	OR	RE	Spring			Y	M	M	H	AC	FS to PS	X
*Acer leucoderme**	Maple, Chalk				X	M	S	Oval	DB	M	MU	G	Spring			Y	S	M	H	SLAL to AC	FS to PS	X
*Betula nigra**	Birch, River	X		X	X	L	M	Oval/Pyramidal	DB	M	YE	I	Winter/Spring			Y	F	M	M	AC	FS to PS	X
*Carpinus caroliniana**	Hornbeam, American	X	X		X	M	S	Oval	DB	M	YE	O	Spring	X		Y	S	M	M	SLAL to AC	FS to SH	
*Carya aquatica**	Hickory, Water			X		L	M	Oval	DB	M	YE	I	Spring	Y	Y	Y	S	H	na	na	FS to PS	
*Catalpa bignonioides***	Catalpa, Southern					M	M	Oval	DB	M	I	W	Spring		X	Y	M	M	H	AC to AL	FS to PS	
*Cladrastis kentukea**	Yellowwood, American				X	M	M	Rounded/Vase	DB	M	YE	W	Summer			Y	M	M	M	AC to AL	FS to PS	
*Diospyros virginiana**	Persimmon, Common					L	M	Oval/Pyramidal	DB	M	RE	W	Spring	X	X	Y	M	M	H	AC to AL	FS	X
*Juniperus virginiana***	Redcedar, Eastern	X	X		X	L	S	Pyramidal	EC	F	EV	I	Late Winter	X		Y	F	M	H	AC to AL	FS to PS	X
*Magnolia grandiflora***	Magnolia, Southern	X	X		X	L	M	Oval/Pyramidal	EB	C	EV	W	Spring/Summer	X	X	Y	M	M	M	SLAL to AC	FS to PS	
*Morus rubra**	Mulberry, Red	X		X		L	L	Rounded/Spreading	DB	C	YE	I	Spring	X	X	Y	F	M	H	AC to AL	FS	X
*Nyssa sylvatica**	Blackgum (Tupleo)				X	L	S	Oval/Pyramidal	DB	M	RE	W	Spring	X	X	Y	M	M	H	AC	FS or PS	
*Ostrya virginiana**	Hophornbeam, American				X	M	M	Oval/Rounded	DB	F	YE	G	Summer	X		Y	S	M	H	AC to AL	FS to SH	X
*Pinus echinata**	Pine, Shortleaf					L	M	Rounded/Pyramidal	EC	F	EV	Y	Spring	X		Y	F	M	H	AC	PS	
*Pinus taeda**	Pine, Loblolly	X				L	M	Oval/Pyramidal	EC	F	EV	Y	Spring	X	X	Y	F	M	M	AC	FS	
*Pinus virginiana**	Pine, Virginia	X				M	M	Rounded/Pyramidal	EC	F	EV	Y	Spring	X	X	Y	M	M	H	AC	FS	
*Quercus georgiana**	Oak, Georgia				X	M	M	Rounded	DB	M	RE	I	Spring	X	X	Y	M	X	H	AC to AL	FS	
*Quercus hemisphaerica (Q. laurifolia)**	Oak, Laurel			X	X	L	L	Oval/Rounded	DB	F	YE	I	Spring	X	X	Y	F	M	M	SLAL to AC	FS to PS	
*Salix nigra**	Willow, Black			X		M	M	Irregular	DB	F	YE	I	Summer		X	Y	F	H	L	na	FS	
*Taxodium distichum**	Baldcypress	X	X	X	X	L	M	Pyramidal	DC	F	BR	I	Spring	X		Y	F	M	H	SLAL to AC	FS	X
*Ulmus alata**	Elm, Winged			X	X	L	M	Oval/Pyramidal	DB	F	YE	G	Fall			Y	F	M	H	AC to AL	FS to PS	X

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Parks: Understory and Ornamental Trees (Approx. 400 Square Feet of Canopy at Maturity)																						
		Recommended Uses				Physical Characteristics										Environmental Characteristics and Tolerances						
Latin Name	Species Common Name	Screen Trees	Colmnar Trees for Narrow Spaces	Trees Suitable for Detention Ponds and Wetlands	Trees Suitable for Road Frontage and Parking Lots	Height Class in Urban Conditions	Crown Class in Urban Conditions	Mature Crown Form	Leaf Type	Leaf Texture	Fall Leaf Color	Flower Color	Flowering Time	Wildlife Value	Excessive Litter	Native Tree to Area	Growth Rate	Soil Moisture	Drought Tolerance	Preferred Soil pH	Light Requirement	Urban Tolerant Tree
*Amelanchier arborea**	Serviceberry, Downy				X	S	S	Rounded/Upright/Vase	DB	F	MU	W	Spring	X		Y	S	M	M	AC	FS to PS	
*Asimina triloba**	Paw Paw					S	S	Rounded/Upright	DB	C	YE	L	Spring	X	X	Y	M	M	M	SLAL to AC	FS to SH	
*Cercis canadensis**	Redbud, Eastern				X	S	S	Rounded/Vase	DB	C	YE	L	Spring	X		Y	F	M	H	AC to AL	FS to PS	
*Chionanthus virginicus**	Fringetree				X	S	VS	Oval/Rounded	DB	M	YE	W	Spring	X		Y	S	M	M	AC	FS to SH	
*Cornus florida**	Dogwood, Flowering		X		X	S	S	Rounded	DB	M	RE	W	Spring	X		Y	M	M	M	SLAL to AC	FS to SH	
*Crataegus phaenopyrum***	Hawthorn, Washington	X	X		X	S	S	Pyramidal	DB	M	BR	W	Spring	X		Y	M	M	H	AC to AL	FS	X
*Crataegus viridis***	Hawthorn, Green	X			X	S	M	Rounded/Vase	DB	F	I	W	Spring	X		Y	M	M	H	AC to AL	FS	X
*Halesia carolina**	Silverbell, Carolina				X	M	S	Rounded/ Upright/Vase	DB	F	YE	W	Spring			Y	M	M	M	SLAL to AC	FS to PS	
*Ilex opaca***	Holly, American	X			X	M	S	Pyramidal	EB	M	EV	W	Spring	X		Y	S	M	H	SLAL to AC	FS to SH	X
*Ilex vomitoria***	Holly, Yaupon	X		X	X	S	VS	Rounded/Vase	EB	F	EV	W	Spring	X		Y	M	M	H	AC to AL	FS to SH	X
*Magnolia virginiana***	Magnolia, Sweetbay		X	X		L	S	Columnar/vase	EB	M	EV	W	Summer	X		Y	M	H	na	AC	FS to PS	
*Malus angustifolia**	Crabapple, Southern					S	S	Spreading	DB	M	YE	P	Spring	X	X	Y	M	M	L	AC to AL	FS to PS	
*Oxydendrum arboreum**	Sourwood					M	S	Oval/Pyramidal	DB	M	RE	W	Summer			Y	S	M	M	AC	FS to PS	
*Rhamnus caroliniana***	Buckthorn, Carolina					S	S	Spreading	DB	M	YE	W	Spring	X		Y	M	M	M	AC to AL	FS to PS	
*Sassafras albidum**	Sassafras				X	L	M	Rounded/Pyramidal	DB	M	MU	Y	Spring	X	X	Y	M	M	H	AC	FS to PS	

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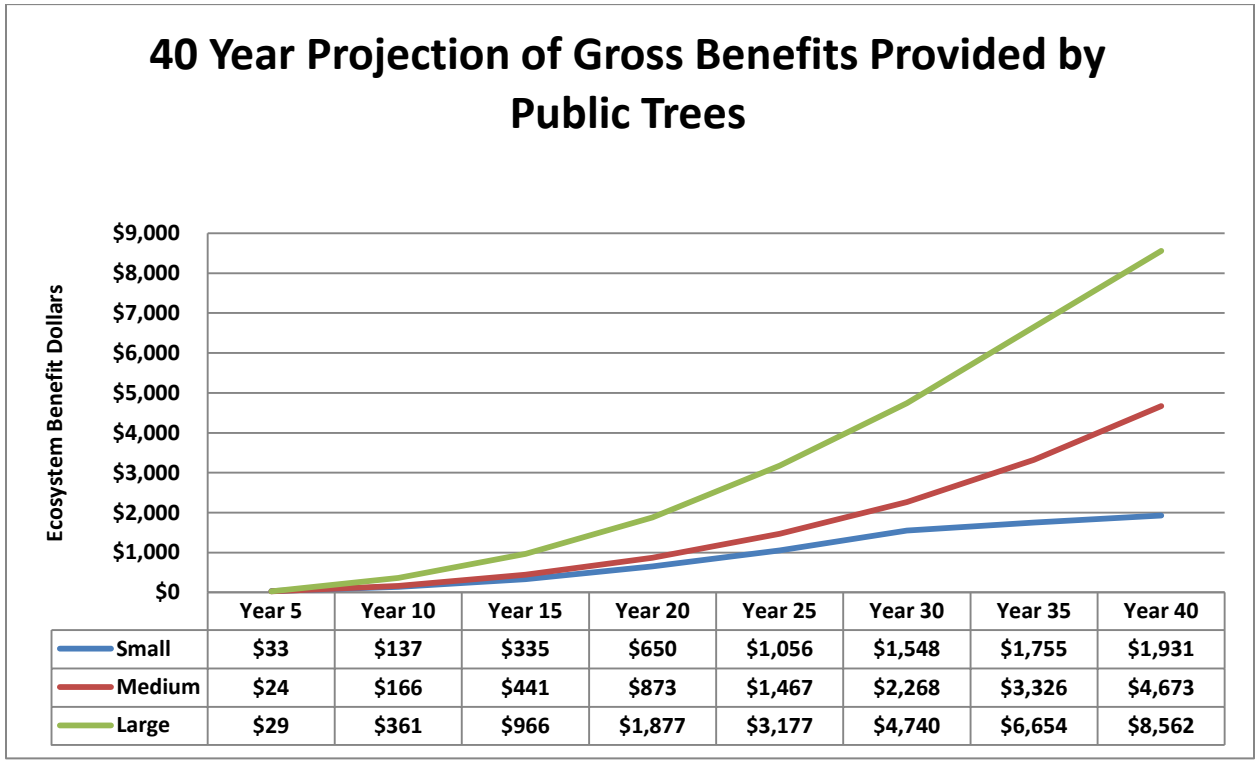
Undesirable Trees		
Latin Name	**Species Common Name**	**Reason**
Pyrus calleryana	Pear, Bradford	Category 3 Exotic Invasive Plant (GA-EPPC Sep-2012)
Prunus caroliniana	Cherrylaurel, Carolina	Included on Atlanta's Do Not Plant List
Meliaazederach	Chinaberry	Category 1 Exotic Invasive Plant (GA-EPPC Sep-2012)
Thuja occidentalis	Arborvitae, Eastern	Included on Atlanta's Do Not Plant List
Gleditsia triacanthos	Honeylocust	Included on Atlanta's Do Not Plant List
x Cupressocyparis leylandii	Leyland cypress	Included on Atlanta's Do Not Plant List
Albizia julibrissin	Mimosa	Category 1 Exotic Invasive Plant (GA-EPPC Sep-2012)
Broussonetia papyrifera	Paper mulberry	Category 3 Exotic Invasive Plant (GA-EPPC Sep-2012)
Paulownia tomentosa	Princess tree	Category 1 Exotic Invasive Plant (GA-EPPC Sep-2012)
Ligustrum vulgare	Privet	Category 2 Exotic Invasive Plant (GA-EPPC Sep-2012)
Photinia x *fraseri*	Red tip	Included on Atlanta's Do Not Plant List
Ailanthus altissima	Tree of heaven	Category 1 Exotic Invasive Plant (GA-EPPC Sep-2012)
Morus alba	Mulberry, White	Category 3 Exotic Invasive Plant (GA-EPPC Sep-2012)
Limited Use		
Latin Name	**Species Common Name**	**Reason**
Quercus phellos	Oak, Willow	Exceeds Diveristy Threshold
Lagerstroemia indica	Crapemyrtle, Common	Exceeds Diveristy Threshold
Fraxinus pennsylvanica	Ash, Green	EAB Host
Fraxinus americana	Ash, White	EAB Host
Fraxinus caroliniana	Ash, Carolina	EAB Host
Zelkova serrata	Zelkova, Japanese	Exceeds Diveristy Threshold
Acer rubrum	Maple, Red	Exceeds Diveristy Threshold
Ulmus parvifolia	Elm, Chinese	Exceeds Diveristy Threshold

Appendix D. Public Tree Benefit Projections

Davey developed an ecosystem benefit calculator that can be used to project the gross annual benefits trees provide from planting to 40 years of age. The Piedmont Community Tree Guide: Benefits, Costs and Strategic Planting report prepared and published by the USDA Forest Service, Pacific Southwest Research Station, Center for Urban Forest Research (McPherson et al., 2006) was used as the basis for the calculator and the projected benefits.

The benefits for large-, medium- and small-growing public trees are presented in the figure below. The tree benefits projected reflect savings from reductions in use of air conditioning and heating (energy saved), carbon dioxide avoided and removed (carbon dioxide reduced), air pollutants absorbed, rainfall intercepted, and aesthetic value added. The figure shows that large-sized trees provide the most benefit to the community and, thus, should be chosen for planting if growing spaces can accommodate them.



	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30	Year 35	Year 40
Small	$33	$137	$335	$650	$1,056	$1,548	$1,755	$1,931
Medium	$24	$166	$441	$873	$1,467	$2,268	$3,326	$4,673
Large	$29	$361	$966	$1,877	$3,177	$4,740	$6,654	$8,562