Community Tree Management Plan and Key Policy Actions

The City of Milton, Georgia

May, 2012

Prepared for:
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Mission Statement
The City of Milton will provide opportunity and value in a responsive and responsible environment through active partnerships with the community and its stakeholders.

Vision Statement
Milton is a distinctive community embracing small-town life and heritage while preserving and enhancing our rural character.

Quality of Life
In 2011, the City of Milton was recognized as having the highest quality of life in the state of Georgia and ninth highest quality of life in the southern United States by the Business Journals' "On Numbers" survey.

Acknowledgements

City of Milton, Georgia

Georgia Forestry Commission

United States Department of Agricuture Forest Service

Georgia Urban Forest Council

Milton's comprehensive vision to preserve its rural character was a fundamental inspiration for this project. Limiting the loss of community forests and greenspace will reduce stormwater runoff and improve air quality, the health of people, and community aesthetics.

Milton is thankful for the grant funding they received from the Georgia Forestry Commission (GFC) in cooperation with the United States Department of Agriculture Forest Service (USDA Forest Service) and the Georgia Urban Forest Council (GUFC) through its Urban and Community Forestry (U&CF) Grant Program. The U&CF grant program is designed to encourage communities to create and support long-term and sustained urban and community forestry programs throughout Georgia.

The City also recognizes the support of its Mayor and City Council:

Joe Lockwood, Mayor
Burt Hewitt, Council Member
Matt Kunz, Council Member
Lance Large, Council Member
Joe Longoria, Council Member
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Karen Thurman, Council Member

The State of Georgia Forestry Commission Partnership Coordinator:

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Mark Law, Arborist
Michele McIntosh-Ross, Planner

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Executive Summary

Preserving the rural character and quality of the community is important to the City of Milton. Abundant trees and greenspaces, and the lack of impervious surfaces, help create that feeling of ruralness which is cherished by Milton's citizens and remembered by its visitors. In addition to creating a sense of place, the forests and greenspace improve the environmental health of the community. They cleanse air, reduce stormwater runoff, absorb and sequester carbon dioxide (CO_2), lower air temperatures, and generally make people feel more positive about the community in which they live and the goods and services it offers.

Rapid land-use change and urbanization represent the greatest threats to canopy cover and grass and pasture land cover because of the dramatic increases in impervious surfaces associated with them. These changes affect the feel of a community as well as its ecology. Unfortunately, the consequences of rapid land-use change and urbanization are not evident until after the trees and grasslands are gone (TreeLink, 2012). Because of the many benefits forests and greenspace provide to the community and the threats they face from land-use change and urbanization, a plan which addresses the management of them was commissioned. This plan developed for the City of Milton focuses on community trees and addresses short- and long-term maintenance and tree planting initiatives. Three studies were completed—a tree inventory, tree benefit analysis, and canopy assessment—to gain an understanding of the existing state of the community forest. Those studies, along with information about the City's existing program and visions for community forests and greenspace, were utilized to develop this Plan, *Community Tree Management Plan and Key Policy Actions*, that will guide future planning of City trees.

State of the Existing Community Forest

The inventory of community trees targeted high-use areas along public rights-of-way (ROW) and in parks. The City selected areas and parks for the inventory which included: Arnold Mill/State Route 140 Area; Crabapple Area; Highway 9/Cogburn Road Area; Bell Memorial Park; Bethwell House/Community Center; Birmingham Park; Crabapple House; Crabapple Park; and Hopewell House. A total of 3,598 sites were collected during the inventory. Two thousand five hundred fifteen (2,515) individual trees, 643 vacant planting sites, and 440 stands of trees which collectively represented over 10,000 trees were collected. Along ROWs, trees and vacant planting sites were collected. In parks, only individual trees or stands were collected. Analyses of the tree inventory data found:

- Overall, the tree population was in Fair condition.
- One species, loblolly pine (*Pinus taeda*), made up such a large percentage of the ROW (15%) and Parks (44%) that it threatens biodiversity and places the community forest at risk from southern pine beetle (SPB, *Dendroctonus frontalis* Zimmermann).
- On the ROW, crapemyrtle (*Lagerstromia indica*), in particular, was found in abundance (19%) and its presence was a concern to the streetscape's biodiversity.
- Overall, the diameter size class distribution trended towards the ideal for a tree population having a greater number of smaller trees (0- to 8-inch diameter at breast height [DBH]) than medium- and large-sized trees present (DBHs 9- to 17-inch, 18- to 24-inch, and greater than 24-inch).

The benefit analysis used the inventory data and the computer model, i-Tree Streets (USDA Forest Service, et al., 2012 (a)), to estimate the benefits ROW trees provide. Results indicated:

- The inventoried tree population provided $119,017 of annual environmental and economic benefits and, on average, one tree provided an annual benefit equal to $60.48. Simply stated that means the City did not have to spend $119,017 on heating and cooling, stormwater management, and air quality initiatives, and property values were higher because of the mere presence of trees on the ROW. If the City plants more trees, the amount of money saved to manage or create infrastructure will increase by $60.48 for each tree. It also means that if the City loses or removes trees, managing infrastructure will cost more.

- The most valuable tree in community forests was loblolly pine. It was found in high quantities along the ROW, and because of its number and function, it provided great environmental and economic benefits to the community. Willow oak (*Quercus phellos*) and tuliptree (*Liriodendron tulipifera*) were also important trees probably due to their size and leafy canopies.
- Crapemyrtle (*Lagerstroemia indica*), while dominant on the streets (19%), provided little environmental or economic value to the community. This is probably due to its small size and relatively small canopy.
- Consistently, large, leafy trees provided the most environmental and economic benefits to the community. These trees intercepted more gallons of rainfall, reduced energy usage through summer shade and diversion of winter winds, and rid the atmosphere of more CO_2 than smaller statured trees.

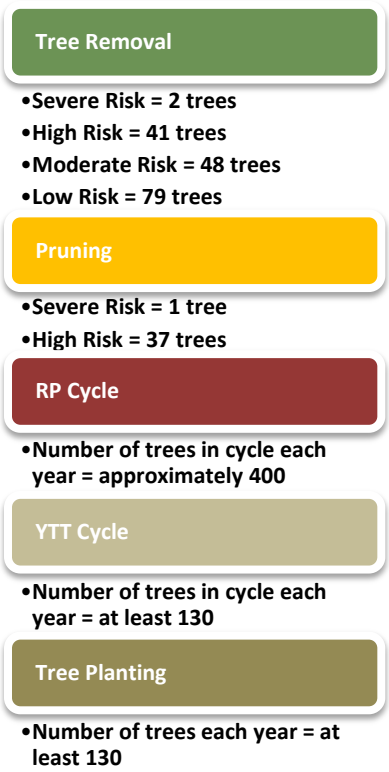
i-Tree Canopy (USDA Forest Service, et al., 2012 (b)) was utilized to assess land cover types citywide, including tree canopy. The assessment found:

- Tree canopy covers 58% of the land's surface.
- Grass and pasture land covers 24%.
- Impervious surfaces cover 13%; and all other land cover types comprise 5% of the land's surface.

Tree Maintenance and Planting Needs

The maintenance needs of community trees included planting, pruning, and removal. The maintenance need most recommended during the inventory was pruning (73%) followed by tree planting (18%) and then tree removal (9%). Reducing the risk associated with trees in the community forest was needed and should be prioritized and accomplished so that the trees with the highest risk are addressed first. During the inventory, less than 1% of the trees assessed had Severe Risk associated with them, 2% had High Risk, and the remainder of the trees (97%) presented Moderate or Low Risk to people and property. Even though only 3% of the inventoried trees had Severe and High Risk associated with them, these trees need removed or pruned immediately to benefit public safety. Moderate and Low Risk trees should be addressed after all elevated risk tree maintenance has been completed.

Based on conversations with City staff, Milton performs tree maintenance work mostly on demand; little proactive tree care is performed. However, Milton's community forest will benefit greatly from the inception and continuation of a five-year Routine Pruning Cycle (RP Cycle) and a three-year cycle, Young Tree Training Cycle (YTT Cycle). These proactive pruning cycles are critical to improving the health of trees and reducing program costs over time. In most cases, cyclic pruning will correct defects in trees before they escalate into urgent situations and, thus, avoid costly problems. Based on inventory data (excluding data from Birmingham Park), approximately 400 trees should be cleaned during the RP Cycle each year and at least 130 young or newly planted trees structurally pruned each year during the YTT Cycle.



Trees should be planted annually to replace removals and maintain tree canopy cover. Milton has 58% tree canopy cover and can expect 1% natural tree mortality per year. If natural tree mortality was the only threat, then the City should plant no less than 130 trees per year (based roughly on inventory data). However, natural mortality is not the only threat. Economic growth and development and SPB are impending threats to Milton's community forests. These threats warrant a more aggressive approach to tree planting. If budgets allow and follow-up maintenance is available, the City should increase the number of trees planted to exceed what is recommended in this Plan to be better prepared for impending threats.

Citywide tree planting should focus on creating canopy in areas that promote economic growth such as business districts, and fill in gaps in existing canopy. Increased public education, regulations that govern tree planting and preservation, and programs that promote land conservation could be implemented to augment tree planting efforts. The City should also focus its efforts on finding or creating the growspace needed to plant and sustain large-statured trees that have leafy canopies. Whenever growspace is not available or cannot be created, the use of an engineered system such as permeable pavement, structural soil, or structural cells/suspended pavement, smaller sized trees should be utilized. Trees of varying species should be planted. However, the planting of southern yellow pine for non-timber uses should be limited and other small-sized trees should be planted in lieu of crapemyrtle until the species distribution normalizes. The City's existing planting list offers smart choices for species selection. However, due to the species distribution and impending threats from SPB and emerald ash borer (EAB, *Agrilus planipennis* Fairmaire), crapemyrtle, all southern yellow pines, including loblolly pine, and all ash (*Fraxinus*) trees should be temporally removed from the planting list or planted only when a landscape plan is in place.

Photograph 1. The City of Milton recognizes that its community forests and greenspace, which include pasture and grasslands, are critical to ecosystem health, economic growth, and the rural character of the City. Planning and action is required now if trees and greenspace are to remain a part of the community's future.

Community Forest Program Needs

Having adequate funds to implement this Plan is important if the City is to have an effective community management forest program. Funding community forestry initiatives will benefit public safety for both the short and long term by allowing priority maintenance to be performed expediently and proactive maintenance cycles to commence and continue. The estimated cost for the first year of this five-year program is $85,000, but costs for continuation of the program the following four years decreases to approximately $65,000 per year. The majority of the costly priority tree removal and pruning work, which elevates the budget, is scheduled during the first year of the program. Following accomplishment of the priority work, proactive work becomes the bulk of the program. Proactive tree work is generally less costly to perform than priority work and, thus, projected budgets are less.

The budget recommended for the management of City trees is less than the annual environmental and economic benefits the City receives from only its street tree population as estimated by the i-Tree Streets computer model. The Streets analysis indicated that the ROW tree population saved the City $119,017 in infrastructure management costs while the cost to provide management of trees is projected to range from $65,000 to $85,000 a year. Supporting proactive management of trees through funding will over the long term reduce municipal tree care management costs and possibly the costs to build, manage, and support some City infrastructure.

Milton has many opportunities to improve its community forests. Continued tree planting and a systematic approach to tree maintenance will move the City from an "on-demand", priority-based program to a cost-savings, proactive program. The City's investment in trees will help preserve the rural character of the City and enhance public safety, improve program efficiency, and increase the environmental and economic benefits the community receives from trees.

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Introduction

Between 1995 and 2025, Georgia's population is projected to grow by 37%, adding 2.7 million people. Only California, Texas, and Florida are expected to add more people (Georgia Department of Natural Resources, 2012). These new Georgians will expect housing, employment, transportation, and recreational opportunity close to home. Unless urban ecosystems are protected now, the trees, greenspace, rivers, and streams that make neighborhoods liveable, walkable, and more desirable may become a causality of growth.

Milton recognizes that its community forests and greenspace are critical to ecosystem health, economic growth, and the rural character of the City, and that planning and action is required now if trees and greenspace are to be a part of the community's future.

Photograph 2. Community forests and greenspace are critical to ecosystem health, economic growth, and the rural character of Milton.

Approach for Community Forest Management

The best approach to managing a community forest is to have an organized, proactive management program that includes tools such as a tree inventory, benefit analysis, and canopy assessment from which goals are set and progress is measured. With these tools, the care of community trees can be prioritized, scheduled, and completed so that public safety is enhanced, canopy is created in strategic places, and budgets are effectively drafted based on need rather than reactive solutions to crises in the community forest.

In 2012, Milton worked with a consultant, Davey Resource Group, a Division of The Davey Tree Expert Company (Davey), to implement the above mentioned tools and develop a plan for the City's community forests. The plan considered the general condition, diversity, and distribution of public trees and ultimately provided a prioritized system for the management of ROW and park trees. In addition to the Plan, key policy actions focusing on limiting the loss of community forests and greenspace, augmenting stormwater management, and improving air quality, human health, and aesthetics were suggested.

Tasks Completed

For this Plan, the City of Milton staff:

- Specified protocols for the collection of tree stands.
- Assessed existing land cover types, including tree canopy, using i-Tree Canopy.
- Performed stakeholder outreach.
- Compiled information about City program costs, protocols, and policies.

A plan for community forests is important because the City government wishes to limit tree loss and is committed to preserving the rural character of the community.

Davey performed the following tasks:

- Inventoried trees, tree stands, and vacant planting sites within ROW and in community parks.
- Analyzed tree inventory data and land cover assessment findings.
- Estimated the environmental and economic benefits trees provide using the computer model, i-Tree Streets.
- Integrated all studies performed and information gathered into a management plan for the community forests.
- Developed key policy actions to improve the management and preservation of community forests and the rural character of the City.

The Plan is divided into five main sections: Benefits of Having a Community Forest; Existing Community Forest Program; Community Forest Assessment and Analyses; Tree Maintenance Program (ROW and Parks); and Key Policy Actions.

Section 1: Benefits of Having a Community Forest	Section 2: Existing Community Forest Program	Section 3: Community Forest Assessment and Analyses	Section 4: Tree Maintenance Program (ROW and Parks)	Section 5: Key Policy Actions
• Presents information about the benefits trees provide to communities	• Provides an overview of the existing tree management program and presents goals and objectives for the community forest	• Summarizes the three studies performed, inventory of trees and tree stands, i-Tree Streets benefit analysis, and i-Tree Canopy land cover assessment • Presents trends, results, and observations about the data	• Outlines a solid plan for the maintenance of ROW and park trees • Discusses tree planting and young tree care • Provides examples of how to use this Plan for educational outreach • Lists ideas for assessment and Plan updates	• Provides directives that integrate opportunities to increase tree cover, promote green infrastructure, and achieve a sustainable community forest

Section 1: Benefits of Having a Community Forest

There is a growing understanding and validation of the importance of trees to a community. Scientists and researchers study the effects of trees on human behavior, traffic patterns, crime rates, air quality, stormwater runoff, and property values…just to name a few. The relationship between trees and people and places is beneficial. Trees positively affect human and public health and are valuable assets to a community. The benefits trees provide are commonly divided into three categories—economic, social, and environmental.

Benefits Trees Provide People and Places

The environmental and economic benefits trees provide are well documented in the literature and showcased on the World Wide Web. Following is a summary of some of the benefits communities can gain from having a well-managed urban forest.

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 over those that were 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% when the property is next to natural open space, and 9% when adjacent to street trees. Commercial property rental rates were 7% greater when trees were present on the property (Wolf, 2009).

Photograph 3. The quality of landscaping along business routes affects the consumers' perceptions of the goods and services offered there. Well-landscaped business routes have a positive effect, making consumers more likely to spend time and money on goods and services.

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 also make our streets safer by reducing traffic speeds and the amount of stress drivers feel 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.

Environmental

Trees improve air quality. During photosynthesis, trees remove 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 by-product. 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 can reduce street level air pollution by 60%.

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 winter winds. 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).

In urban areas, trees are important for wildlife as well. Trees provide nesting sites for birds and support a wide range of insects which are important food sources for birds and other wildlife.

Photograph 4. Trees enhance parking lots via the shade they provide and reduce stormwater runoff through their ability to absorb and divert rainfall.

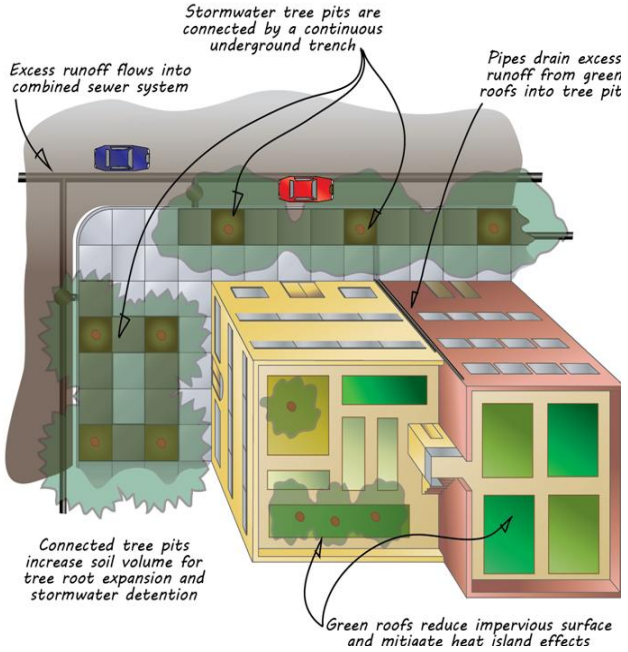
Trees Can Improve the Management of Stormwater

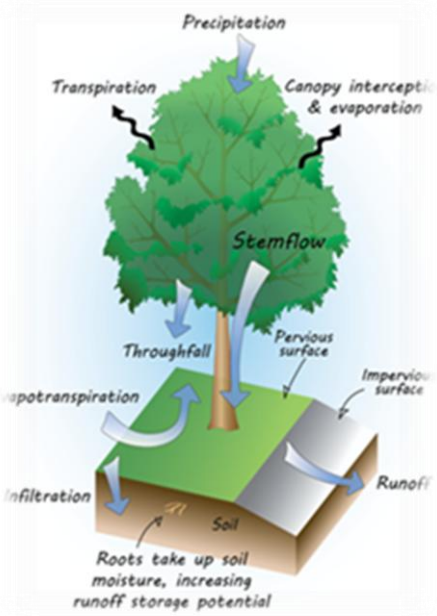
Trees are typically not considered part of either grey or green stormwater management systems; they are generally, and falsely, considered landscaping. Planting a tree as just landscaping is not taking advantage of the stormwater utility benefits it provides. Leafy tree canopies catch precipitation before 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 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 community forest of 10,000 trees will retain approximately 10 million gallons of rainwater per year (USDA Forest Service, 2003(b)).

Engineered Systems for Trees

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, adding trees can reduce the long-term costs incurred by the City to manage runoff.

Tree-filled bioswales, linear, connected or stormwater tree pits, structural soils, suspended pavements and structural cells, rain gardens, green roofs, and green streets are just a few of the many options available that integrate trees into stormwater infrastructure.





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.

Section 2: Existing Community Forest Program

The current management of and future planning for trees and greenspace are critical to their long-term establishment in the community and the benefits they provide. Many departments have stake in community forests and greenspace and play important roles in accomplishing goals and objectives set for them. The following sections briefly describe the current management of trees and the goals and objectives of this Plan.

Management Overview

Currently, community forest management activities are performed on demand, meaning the City responds to calls about trees or acts in response to weather events that damage trees. Routine, proactive tree maintenance/pruning cycles which typically train young trees and clean and raise tree crowns are not performed.

When tree maintenance is needed, the Public Works Department routes staff or contracts vendors to perform the tree work. Typically, vendors used to perform tree pruning and removals are not Tree Care Industry Association (TCIA) accredited and often perform non-arboriculture work as their main line of business or product/service offered. The majority of tree planting is done by the Public Works Department; sometimes local citizen groups or not-for-profits participate in small-scale tree planting projects. Milton has a City Arborist who responds to calls about trees from citizens, inspects trees and tree save areas, reviews permits, and enforces the Tree Preservation Ordinance. The City Arborist also performs code review not related to the community forest.

Milton has been designated a Tree City USA by the Arbor Day Foundation since 2009.

TREE CITY USA
Arbor Day Foundation

To qualify as a Tree City USA community, a town or city must meet four standards established by The Arbor Day Foundation and the National Association of State Foresters.

These standards were established to ensure that every qualifying community would have a viable tree management plan and program, and that no community would be excluded because of size.

Standards:

1. A tree board or department
2. A tree care ordinance
3. A community forestry program with an annual budget of at least $2 per capita
4. An Arbor Day observance and proclamation

Goals and Objectives

The City government strives to preserve its rural character and understands that trees and greenspace are critical components of the community's rural feel.

Goals

- Enhance the rural character of Milton through community forestry initiatives.
- Direct growth with respect to natural resources.
- Provide professional and uniform maintenance of trees.

Objectives

- Evaluate existing community forest conditions.
- Establish an effective management program that provides long-term planning strategies to improve maintenance efficiency and tree health.
- Focus tree planting efforts to better opportunities for economic growth and enhance the rural character of the City.
- Formulate key policy actions for consideration that improve community forests and the benefits they provide for the long term.
- Educate Milton's residents about the value of community forests.

Section 3: Community Forest Assessments and Analyses

Three assessments were completed and utilized to analyze the current state of community forests and greenspace. A tree inventory, benefit analysis, and canopy assessment were performed. Each assessment is discussed separately in the sections that follow.

Tree Inventory

In March 2012, Davey arborists certified through the International Society of Arboriculture (ISA) assessed and inventoried ROW and park trees. A total of 3,598 sites were collected representing trees, vacant planting sites, or stands of trees. Of the 3,598 sites collected, 73% were collected along the ROW and the remaining 27% in parks. Table 1 provides a detailed breakdown of the number and type of sites inventoried.

The collection of vacant planting sites and stands of trees was specified by the City. Vacant planting sites were collected in areas where future tree planting was considered most desirable. Tree stands were collected in areas where tree density was great enough that more traditional stand analysis provided adequate information for assessment and management recommendations. The collection of tree stands also leveraged the site count. Birmingham Park was collected primarily using tree stand methodologies. However, some of the occurrences of Chinese privet (*Ligustrum sinense*) along ROWs were recorded as a stand. Most ROW trees and other parks were collected using standard tree inventory protocols.

Table 1. Number, Type, and Location of Sites Collected During the Inventory

Right-of-Way		Parks		Birmingham Park		Total
Total Sites	2,610	Total Sites	366	Total Sites	622	3,598
Number of Trees	1,967	Number of Trees	366	Number of Trees (individual sites)	182	2,955 ~10,000
				Number of Stands/Estimated Number of Trees	440/10,000	
Number of Vacant Planting Sites	643	Number of Vacant Planting Sites	0	Number of Vacant Planting Sites	0	643

Tree Inventory Data Collection Methods

Tree inventory data were collected using a system developed by Davey that utilizes Geographic Information System (GIS) and Global Positioning System (GPS) receivers, as well as arborists' knowledge and judgment. In the field, Davey arborists used pen-based field computers equipped with GIS along with GPS receivers. A customized ArcPad data collection program was loaded onto field computers for data collection. At each site, the following data fields were collected: aboveground utilities; blockside; clearance requirements; condition; growing space type; further inspection; hardscape damage; location; location rating; maintenance needs based on *American National Standards Institute (ANSI) A300 Standards (2001)*; mapping coordinate; observations; notes; risk rating; space size; species; stems; tree size or DBH; and vacant planting sites. These data fields are defined in Appendix A. The data collected were provided in shapefile and Microsoft Excel™ and Access™ formats on a CD-ROM accompanying this Plan.

Individual Trees

Data collection protocols for individual trees differed from the protocols used to collects stands of trees. Differing methods were utilized to minimize the use of sites but still capture the character of an area. During data collection, all significant or individual trees growing along ROWs and in parks were collected. For some trees along the ROW, particularly highways which ran parallel to forested areas, only trees greater than or equal to an 18-inch DBH or that were assessed as hazardous or invasive were inventoried. Park trees growing in manicured areas were inventoried individually along with any trees that appeared hazardous along the perimeter of a park. Vacant planting sites were collected along the ROW only and were based on growspace size, the presence of overhead utilities, and mature tree height.

Tree Stands

If a stand of like trees were found, it was typically recorded as one site and the data fields collected were used to ascertain a general idea of stand composition. Most stands were found in Birmingham Park; however, some patches or groups of Chinese privet were collected along the ROW. In the text of this Plan, all stands, groups, and patches of trees are referred to as stands.

Data recorded about stands were based on the most typical tree species present. When a forested stand was encountered, either "pine (*Pinus*) stand or group, mixed stand or group, or privet patch" and/or the estimated number of trunks were recorded in the notes data field for that specific site. If a site was recorded and noted as only a stand, then it is assumed that 50 trunks were present; if it was recorded as mixed, patch, or a group, then it is assumed that 10 trunks were present. If a number of trunks was recorded, then the number recorded the notes data field for the site represents the estimated number of trunks at that site. Other data, including DBH and condition, were collected and assigned to the site. The data used for analysis purposes were assumed to be representative of the entire stand.

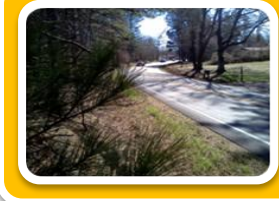
For example, Chinese privet has a dense, thicket-like growth pattern. This growth pattern makes its collection as an individual site difficult as well as not prudent because location information and measurements would be hard to obtain and its abundant occurrence would quickly deplete the site count. In the instance of multiple Chinese privets at one location, a single site was collected that represented multiple trees growing in that immediate area. The data collected and assigned to that site are representative of the majority of Chinese privet at that site.

Project Areas

Three project areas, Crabapple, Arnold Mill/State Route 140, and Highway 9/Cogburn Road, and 6 community parks were selected by Milton for the tree inventory. On the following page is the City of Milton's Future Development Map 2030, Map 1, which illustrates some of the inventory project areas.

Crabapple Area has 544 trees and 197 vacant planting sites.

- Crabapple Road
- Mayfield Road
- Charlotte Road
- Broadwell Road
- Mid Broadwell
- Birmingham Highway to northern City limits



Arnold Mill/State Route 140 has 46 trees and 61 vacant planting sites.

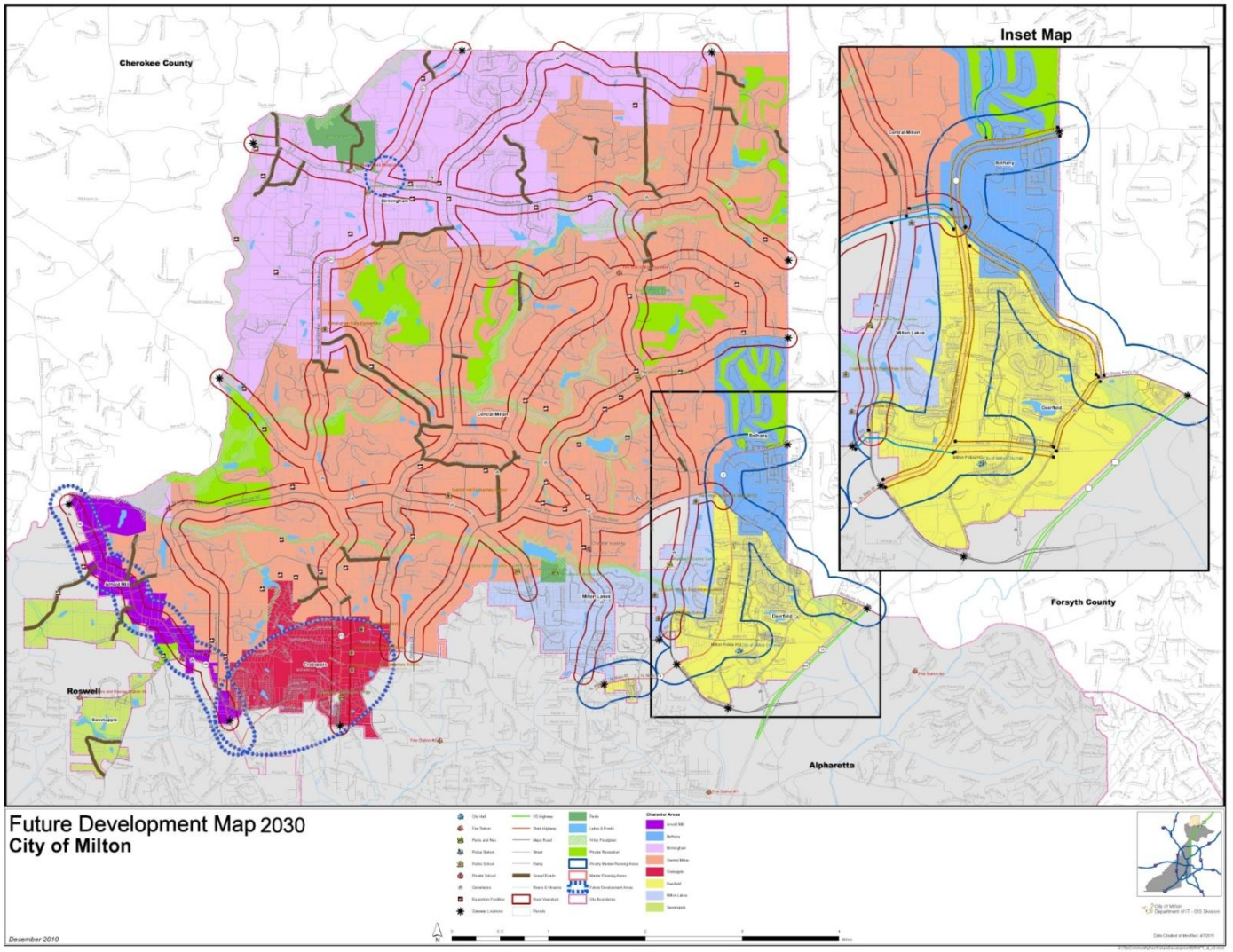
- Arnold Mill Road

Higway 9 Area has 1,378 trees and 385 vacant planting sites.

- Highway 9
- Deerfield Parkway
- Bethany Bend
- Morris Road
- Webb Road
- Cogburn Road/Hopewell Road to northern City limits

The Parks Inventory included the following:

- Bell Memorial Park which has 134 trees
- Bethwell House/Community Center which has 33 trees
- Birmingham Park which has 622 trees (440 stands with over 10,000 estimated trees)
- Crabapple House which has 10 trees
- Crabapple Park which has 66 trees
- Hopewell House which has 122 trees



Map 1. Future Development Map 2030, City of Milton

Tree Inventory Analysis

Recognizing trends within the tree population can help guide both short- and long-term management planning. Usually tree inventory data are examined to determine the diversity of species present, the distribution of size classes (with size being based on DBH), and the general health of the tree population. Those analyses, along with professional judgment, are used to make generalizations about the state of the inventoried tree population. In this Plan, the following population characteristics were assessed:

- **Species 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 as well as impact tree maintenance needs and costs, tree planting goals, and canopy continuity.

- **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.

- **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.

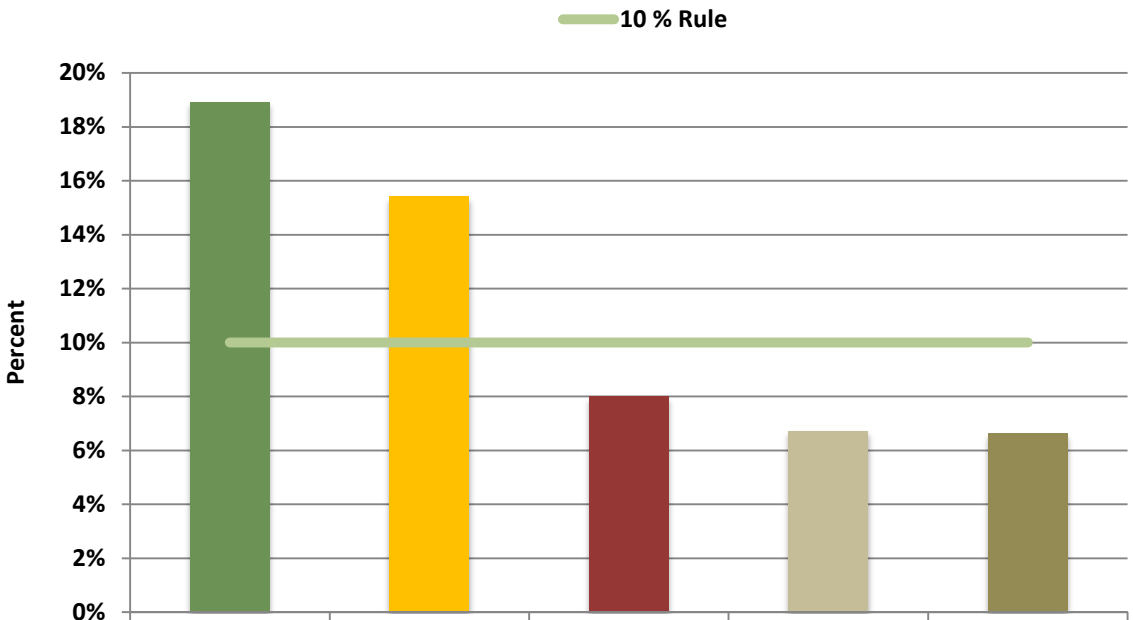
Photographs 5 and 6. Davey's ISA Certified Arborists inventoried trees along ROW and in community parks to collect information about trees that could be used to assess the state of community forests.

Species Diversity

Species diversity is an important consideration for the management of community trees. It affects maintenance costs and the ability of the population to resist and respond to threats from invasive pests and diseases. Having a low species diversity (large number of trees of the same species) can lead to catastrophic results in the event of species-specific epidemics (*i.e.,* DED, Dutch elm disease) and can increase program costs should a particularly high-maintenance tree dominate streets and/or parks.

The composition of a thriving tree population should adhere to the 10-20-30 Rule for species diversity rule (Ohio Department of Natural Resources Urban Forestry Program, 2012). This rule implies that no more than 10% of the community forest should be of the same species, while no more than 20% of the forest should be of the same genera, and a single family should not make up more than 30% of the community's forest.

In this Plan, the species distributions for inventoried ROW and park trees are analyzed using the principles of the 10-20-30 Rule.



	Crapemyrtle *Lagerstsromia indica*	Loblolly Pine *Pinus taeda*	Willow Oak *Quercus phellos*	Red Maple *Acer rubrum*	Holly spp. *Ilex* spp.
Milton	19%	15%	8%	7%	7%
10 % Rule	10%	10%	10%	10%	10%

Figure 1. Five most abundant species found on the ROW during the 2012 inventory.

Overall Findings

Analyses of Milton's complete tree inventory data found that the population had relatively good diversity having 48 genera and 78 species present.

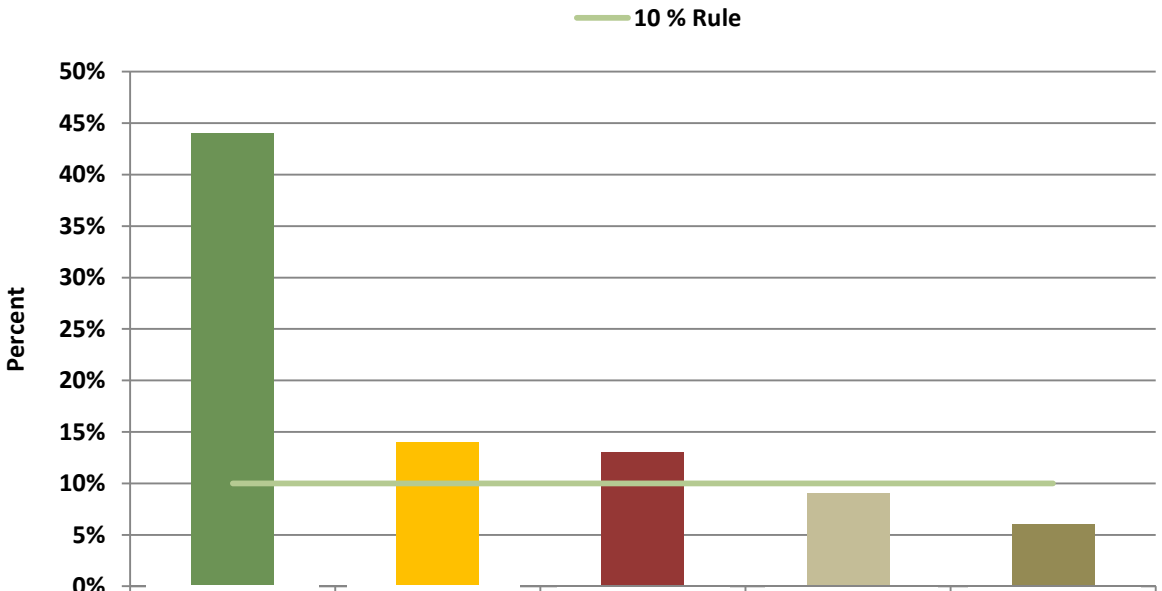
ROW Findings

Figure 1 compares the percentages of the most common species found on the ROW during the inventory to the 10% Rule. Crapemyrtle and loblolly pine far exceed the recommended 10% maximum for a single species in a population comprising 19% and 15% of the inventoried ROW tree population, respectively. Willow oak, red maple (*Acer rubrum*), and holly (*Ilex* spp.) are approaching the 10% threshold as well.

Parks Findings

Figure 2 shows the estimated percentages of the most common species found in parks during the inventory. Tree stand data which represent approximately 10,000 trees from Birmingham Park are included in this study to provide a better look at the diversity found in parks.

After extrapolation of stand data, it was found that loblolly pine greatly exceeds the recommended 10% maximum for a single species in a population comprising almost half (44%) of the park tree composition. Chinese privet is also prevalent comprising 14% of the population. American sweetgum (*Liquidambar styraciflua*) and tuliptree also approach the 10% threshold.



	Pinus taeda	Ligustrum lucidum	Liquidambar styraciflua	Liriodendron tulipifera	Quercus alba
Milton	44%	14%	13%	9%	6%
10 % Rule	10%	10%	10%	10%	10%

Figure 2. Five most abundant species found in parks during the 2012 inventory. Data include estimation of species and counts from Birmingham Park stands. Total site count is estimated to exceed 10,000 trees based on stand collection protocols described in the Tree Inventory Data Collection Methods section of this Plan.

Discussion of Findings

Most loblolly pines on the ROW in parks are remnants of Milton's past agrarian use. The American sweetgums and tuliptrees are probably relics of past hardwood forests. The dominance of pines and Piedmont forest-type hardwoods in the landscape is no surprise. However, loblolly pine dominates the streets and park. Its abundance in the landscape make it a concern and a limiting species in terms of biodiversity. Also, it is southern yellow pine and a target of the SPB. Considering the large quantity of loblolly pine already present in the population and its susceptibility to SPB, the planting of loblolly pine for any purpose other than timber should be limited to minimize the potential for loss should SPB threaten Milton's community forests. American sweetgum or tuliptree can still be planted in a growspace that accommodates large-stature trees; however, other large-stature species should be planted whenever possible to increase species diversity. These trees should be used only when a landscape pattern specifies their use. See Appendix B for a recommended tree species list for planting.

While the dominance of loblolly pines may be considered historical and the presence of American sweetgum and tuliptree may be reminiscent of the Piedmont forest, the abundance of crapemyrtle on the ROW is most likely a product of landscape plantings. Because crapemyrtle comprised 19% of the inventoried ROW population, the City should limit the planting of it in favor of other small-sized trees until the distribution normalizes. Appendix B contains a list of tree species categorized by mature tree size, including smaller sized trees that can be planted in lieu of crapemyrtle, that are appropriate for the community.

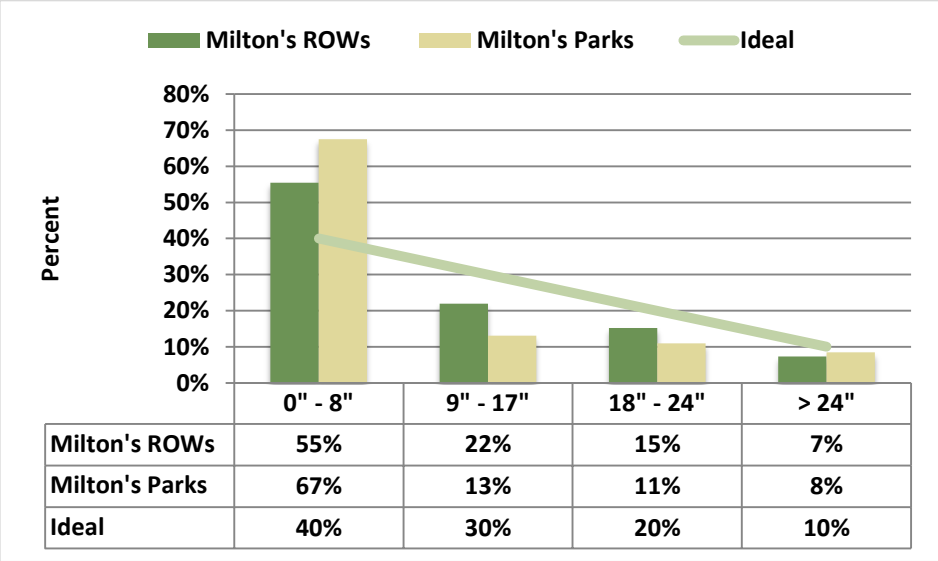
Chinese privet is prevalent in community parks and was found on some ROWs. It is an exotic, invasive pest that can overtake native habitats and oust desirable species. A plan of action should be in place to combat Chinese privet to ensure it does not disrupt the plant and animal communities present and change the character of the community.

Diameter Size Class Distribution

Traditionally a projection of forest stand condition through time, the distribution of diameter size classes can be used to assess the structure of the urban forest. Analyzing the diameter distribution of size classes within a managed population provides insight into the maturity of the population as well as maintenance practices and needs.

The following diameter size classes, based on measured DBH, were used: 0 to 8 inches, 9 to 17 inches, 18 to 24 inches, and greater than 24 inches. These categories were chosen because of their congruency with the work of Richards (1983). Richards proposed an ideal diameter size class distribution for street trees based on observations of well-adapted trees in Syracuse, New York. Richards' ideal distribution suggests that the largest fraction of trees (40% of the total) should be young with DBHs less than 8 inches, while only 10% should be in the large-diameter size class (>24 inches). A tree population with a trend like the ideal will have an abundance of newly planted and young trees. Established, mature, and overmature trees will be present but found in lesser quantities.

The presence of all sizes and thus ages of trees in a population is important because it ensures continual canopy, maximizes the environmental benefits provided by trees, and spreads out maintenance costs. Newly planted trees are especially important to the livelihood of tree population. They are the future of the community forest. They fill in gaps in existing canopy which may have been caused by past storm events and new development, or the lack of a formal tree planting program. New tree plantings are also the successors of the existing mature tree canopy.



	0" - 8"	9" - 17"	18" - 24"	> 24"
Milton's ROWs	55%	22%	15%	7%
Milton's Parks	67%	13%	11%	8%
Ideal	40%	30%	20%	10%

Figure 3. Comparison of Milton's diameter size class distribution for ROW and park trees to the ideal distribution. Data from Birmingham Park were not used because of collection protocols that included stands of trees.

Overall Findings

Figure 3 compares Milton's diameter size class distributions of ROW and park trees (excluding Birmingham Park) to the ideal proposed by Richards (1983). Milton's distribution for both populations trends toward the ideal; however, small trees (0- to 8-inch class) outweigh the ideal by over 10% for each population while larger diameter size classes fall short.

Discussion of Findings

Even though it may appear that Milton may have too many small-sized trees that is not the case. Actually, Milton has too few medium- and large-sized trees and, thus, the distribution is skewed.

Milton must continue to plant trees. They must enact a strong planting and maintenance program to ensure young, healthy trees are in place to fill in gaps in tree canopy and provide for gradual succession of older community trees. The City must encourage tree preservation and mature tree care to ensure mature trees survive as long as possible. Tree planting and tree care will allow the distribution to normalize over time.

It is a reality that trees will die naturally, fail due to difficult urban growing conditions, or be lost to natural and human-influenced events. Managers can expect 1% of the tree population to die from natural causes or natural or human-influenced events each year. Planning for the replacement of existing canopy and finding the best places to create new canopy is critical if tree cover is to be maintained or increase through time.

General Health

In this Plan, the general health of the tree population was characterized by the most prevalent condition assigned during the inventory. In some situations when no one condition dominates, the general health of the tree population may be described as a range such as "Fair to Good".

Davey assessed the condition of individual trees based on methods defined by ISA. Several factors were considered for each tree, including but not limited to: root characteristics; branch structure; trunk, canopy, and foliage condition; and the presence of pests. Conditions assigned included Excellent, Very Good, Good, Fair, Poor, Critical, and Dead. Due to collection procedures, Birmingham Park is excluded from the analysis.

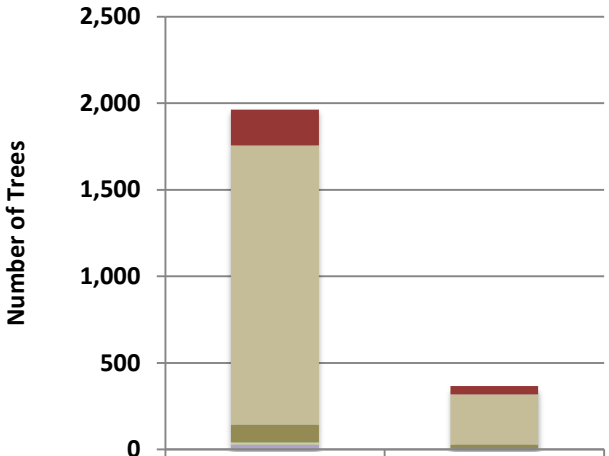
Overall Findings

For analyses, Figure 4 lists the number of trees in each condition class for the ROW and parks data separately (Birmingham Park is excluded). Although viewed separately, a similar trend is present for ROW and park trees. Fair was the most collected tree condition for both populations, making up approximately 80% of the condition ratings assigned to each population. Trees found to be in Good condition were the next most abundant, making up approximately 10% of each population. Based on the dominance of Fair trees on both the ROW and in parks, the general health of the overall community forest can be stated as Fair. A Fair community forest is a sign of normality.

Discussion of Findings

Even though the condition of Milton's urban forest is typical, the conditions found lent some insight into maintenance needs and historical maintenance practices. The following can generally be said of Milton's trees and other needs:

- The similar trend in tree condition across ROW and park trees reveals that growing conditions and/or past management of trees were consistent. Inventoried species exhibited conditions typical of trees growing in an urban setting.
- All Dead trees and trees in Critical condition should be removed because of their failed health. These trees most likely will not recover even if care is increased.



	ROW	Parks (Birmingham Park Excluded)
Excellent	0	0
Very Good	5	0
Good	205	47
Fair	1,614	291
Poor	102	23
Critical	13	3
Dead	28	2

Figure 4. Tree conditions found along the ROW and in Parks during the 2012 inventory. Data from Birmingham Park were not used because of collection protocols that included tree stands.

- Younger trees rated in Fair or Poor condition may benefit from improvements in structure which through time may improve their condition and general health. In most cases, pruning that follows current professional standards such as the *ANSI A300 Standards* can be employed.
- Poor condition ratings given to mature trees were generally due to visible signs of decline and stress, including, but not limited to, decay, dead limbs, sparse branching, or poor structure. These trees will require corrective pruning and regular inspections and possible intensive plant health care (PHC) to improve their condition and health.
- Related to the long-term general health of community forests is the need for proper tree care practices. Many of the newly planted trees were improperly mulched or had staking hardware attached to them long after it should have been removed. Using only TCIA accredited companies to perform tree maintenance and providing education to both City workers and the public will improve the general health of community forests.

Tree Benefit Analysis

Community forests play an important role in not only supporting the quality of life in urban areas, but also improving it. Trees filter air, water, and sunlight; they provide shelter to animals and recreational areas for people. Trees moderate local climate, slow wind and stormwater, and shade homes and businesses. To quantify these benefits, the USDA Forest Service developed a suite of software called i-Tree which estimates the value and benefits urban forests provide. The USDA Forest Service worked with a collaborative of partners, including Davey, to develop i-Tree software.

i-Tree Streets

The i-Tree application *Streets* was used for this project to assess the ROW trees inventoried. Streets is a management and analysis tool that uses tree inventory data to quantify the dollar value of annual environmental and aesthetic benefits provided by trees including energy conservation, air quality improvement, CO_2 reduction, stormwater control, and increases in property value. It estimates the costs and benefits of a street tree population and creates the following annual benefit reports that demonstrate the value street trees have and give to a community: Aesthetic/Other, Air Quality, Carbon Dioxide, Stored Carbon, Energy, Importance Values, Stormwater, Summary, and Total Annual Benefits, Net Benefits, and Cost for Public Trees. The following sections briefly discuss each report generated by Streets and the findings of this analysis.

Reports Generated

- **Aesthetic/Other Report**: The Aesthetic/Other Report shows the tangible and intangible benefits of trees reflected in increases in property values described in dollars ($).
- **Air Quality Report:** The Air Quality Report quantifies the air pollutants (O_3, Nitrogen Dioxide [NO_2], SO_2, PM_{10}) deposited on tree surfaces, and reduced emissions from power plants (NO_2, PM_{10}, Volatile Oxygen Compounds [VOCs], SO_2) due to reduced electricity use in pounds (lbs). Also reported are the potential negative effects of trees on air quality due to Biogenic Volatile Oxygen Compounds (BVOC) emissions.
- **Carbon Dioxide Report:** The Carbon Dioxide Report presents annual reductions in atmospheric CO_2 due to sequestration by trees and reduced emissions from power plants due to reductions in energy use measured in pounds. The model accounts for CO_2 released as trees die and decompose and CO_2 released during the care and maintenance of trees.
- **Stored Carbon Report:** Whereas, the Carbon Dioxide Report quantifies annual CO_2 reductions, the Stored Carbon Report tallies all of the carbon (C) stored in the community forest over the life of its trees as a result of sequestration. Carbon stored is measured in pounds as the CO_2 equivalent.
- **Energy Report:** The Energy Report presents the contribution of the community forest toward conserving energy in terms of reduced natural gas use in winter in therms (th) and reduced electricity use for air conditioning in summer measured in Megawatt-hours (MWh).

- **Importance Value:** Importance Values (IV) are calculated for species that make up more than 1% of the population. The Streets IV is the mean of three relative values (percentage of total trees, percentage of total leaf area, and percentage of canopy cover) and can range from 0 to 100 with an IV of 100 suggesting total reliance on one species. IVs offer valuable information about a community's reliance on certain species to provide functional benefits. For example, a species might represent 10% of a population, but have an IV of 25% because of its great size, indicating that the loss of those trees would be more significant than just their population percentage would suggest.
- **Stormwater Report:** The Stormwater Report presents reductions in annual stormwater runoff due to rainfall interception by trees measured in gallons (gal).
- **Summary Report:** The Summary Report presents the annual total of the Aesthetic/Other, Air Quality, Carbon Dioxide, Stored Carbon, Energy, and Stormwater Benefits. Results are presented in dollars per tree per year or annual total dollars.
- **Total Annual Benefits, Net Benefits, and Costs for Public Trees Report**: Total Annual Benefits are the citywide benefits and program costs summed according to category. If program costs are available, then net benefits are calculated as benefits minus costs. A benefit-cost ratio (BCR) (benefits divided by costs) can be calculated if program costs are submitted. The BCR lends insight into the effectiveness of an urban forestry program and demonstrates the value of that program to the community.

The Benefits of Milton's Community Forests

Davey used only ROW data for the Streets assessment. Park tree data were excluded from the assessment because of the data collection protocol which included stands and because Streets was developed primarily to assess street tree populations. Streets results are provided on a CD-ROM accompanying this Plan.

i-Tree Tools

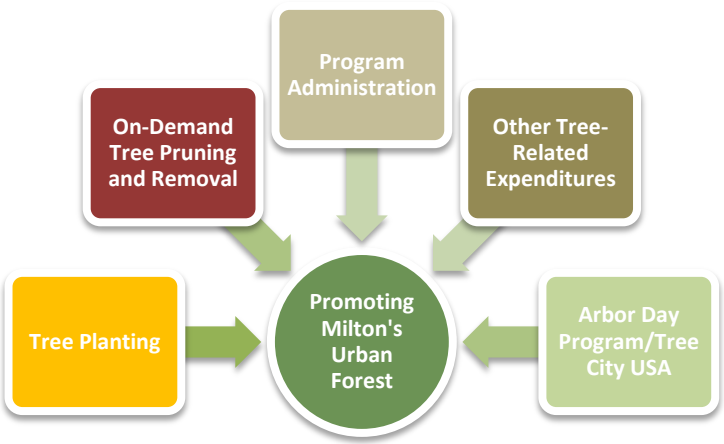
i-Tree Tools software was developed by the USDA Forest Service with the help of several industry partners including Davey. It provides tools that estimate the benefits and annual dollar values trees provide to a community. More information about i-Tree can be found at www.itreetools.org.

i-Tree Streets Inputs

In addition to tree inventory data, Streets requires information specific to the cost to run a community's tree management program. Costs incurred to perform tree pruning, removal, and planting; program administration; and data about the region in which the community is located including energy prices, property values, and stormwater costs are needed inputs to generate the environmental and economic benefits trees provide. If community program costs or local economic data are not available, then community program costs are not entered and Streets default economic inputs are used.

If community program costs are not available, then the reporting function of the Streets Model will be limited to the estimation of tree benefits and net benefits, and the BCR will not be calculated. If program default economic inputs are used, they will be based on prices from the Reference City selected by the USDA Forest Service for the climate zone in which Milton is located. Milton is located in the South Climate Zone (formerly the Piedmont Climate Zone). The Reference City for the South Climate Zone is Charlotte, North Carolina.

Streets' default economic analyses use regional energy prices, property values, water prices, and stormwater costs. Regional energy prices, typical energy use, and water prices are collected from utility companies in the Reference City. Property values and land-use distribution (single-family residence, multi-family residence, commercial, etc.) are determined from Reference City data. Air pollutant emissions are calculated based on the regional mix of fuels used to produce electricity, natural gas consumption, and hourly weather data in the Reference City. Stormwater costs are estimated with the help of local stormwater officials in the Reference City. Prices for trees and tree maintenance are determined from surveys of municipal foresters and local arborists in the Reference City. All this information is incorporated into Streets as default economic values. Any default value can be adjusted for local conditions. To find out more about the default costs for Charlotte, North Carolina, see the *Piedmont Community Tree Guide, Benefits, Costs, and Strategic Planting* (McPherson, *et al.,* 2006).



Milton's Inputs

Specific management costs for the City's community forestry program were not available at the time of this Plan and unadjusted program economic defaults were used. Because specific program costs were not known, the Net Annual Benefits, Cost for Public Trees, and BCR could not be calculated.

Figure 5 summarizes the annual benefits and results for conveyable reports for the street tree population. Table 2 presents results for individual tree species from the Streets analysis.

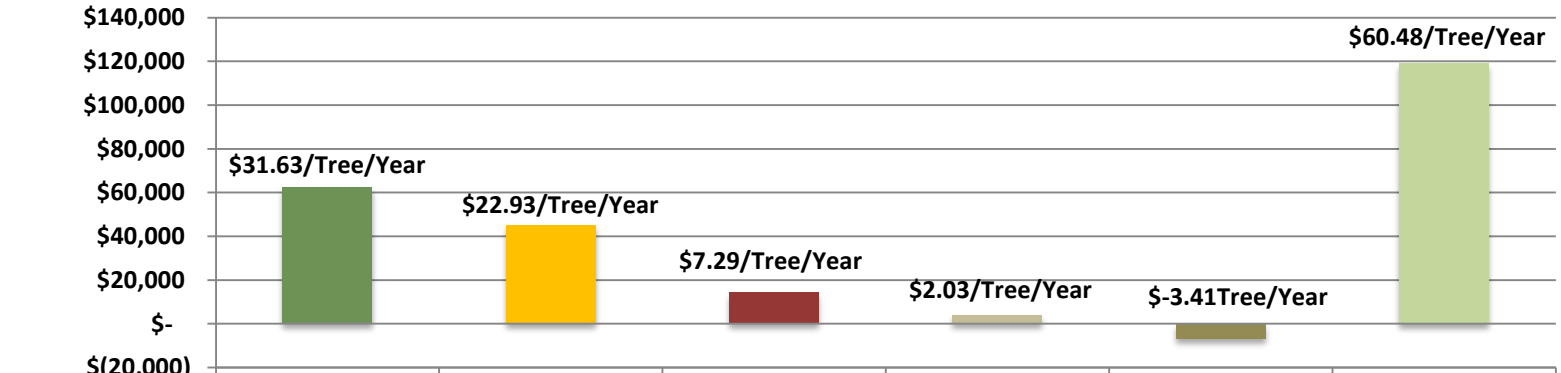
Table 2. Benefit Data for Common Street Trees by Species

Most Common Trees Collected During Inventory		Number Trees on the ROW	Percent of Total Trees	Canopy Cover	Benefit Provide By Street Trees						Importance Value (IV)
					Aesthetic/ Other	Stormwater	Carbon Dioxide Stored	Energy	Carbon Sequestered	Air Quality	
Common Name	Botanical Name		(%)	(ft^2)	Average/$/Tree						0 - 100 (higher IV = more important species)
crapemyrtle	*Lagerstroemia indica*	372	18.9	46,564	3.7	1.99	0.78	1.74	0.26	0.63	7.9
pine, loblolly	*Pinus taeda*	303	15.4	349,225	60.21	54.22	43.49	13.72	3.96	-15.05	24.9
oak, willow	*Quercus phellos*	157	8	117,911	59.25	29.87	30.6	10.54	3.38	-4.34	10.2
maple, red	*Acer rubrum*	133	6.8	68,176	44.63	17.33	14.3	7.13	1.94	2.04	6.1
holly	*Ilex* spp.	130	6.6	14,441	1.45	1.85	2.45	1.47	0.33	0.91	2.7
plum	*Prunus* spp.	94	4.8	27,598	13.85	5.86	2.25	4.09	0.65	1.52	2.7
cedar, northern white	*Thuja occidentalis*	94	4.8	19,526	5.47	5.39	4.31	2.62	0.64	1.56	2.4
tuliptree	*Liriodendron tulipifera*	68	3.5	109,663	87.63	76.91	98.42	20.35	6.07	-15.76	9.4
privet glossy	*Ligustrum sinense*	67	3.4	1,548	1.44	0.38	0.03	0.32	0.03	0.18	1.2
maple, sugar	*Acer saccharum*	56	2.8	32,831	44.36	13.54	9.25	8.33	2.13	2.49	2.4
cedar, eastern red	*Juniperus virginiana*	44	2.2	16,978	5.77	9.37	12.49	4.44	1.13	2.84	1.4
oak, water	*Quercus nigra*	39	2	70,666	85.11	85.59	115.71	21.82	6.71	-12.29	5.9
magnolia, southern	*Magnolia grandiflora*	36	1.8	8,893	10.66	7.06	3.13	2.99	0.44	1.11	1
dogwood, flowering	*Cornus florida*	35	1.8	9,167	6.67	4.9	8.17	3.64	1.02	1.45	0.9
American sweetgum	*Liquidambar styraciflua*	35	1.8	40,303	79.21	51.53	39.07	15.16	3.72	-15.79	3.4
cherry, black	*Prunus serotina*	21	1.1	12,128	48.67	21.93	21.28	8.22	2.65	-2.85	1.1
elm	*Ulmus* x hybrid	20	1	2,012	9.71	2.61	1.89	1.45	0.41	0	0.4
other street trees	~22 genera of varying species	263	13.3	174,826	32.84	27.16	35.69	8.43	2.49	-2.21	16
ROW Total	**~37 genera and ~61 species on the ROW**	**1,967**	**100**	**1,122,456**	**31.63**	**22.93**	**22.9**	**7.29**	**2.03**	**-3.41**	**100**

Annual Benefits

The Streets model estimated that the inventoried ROW trees provide annual benefits equal to $119,017. Simply stated, this means that because of street trees, $119,017 was not spent to cool buildings, manage stormwater, and clean the air. Additional, community aesthetics were improved and property values increased merely because of the presence of trees. On average, it can be said that one tree provides an annual benefit equal to $60.48. If the City plants more trees, the costs to heat and cool buildings, provide cleaner air, and manage stormwater should be reduced by $60.48 for each tree planted. Likewise, if trees are removed or lost, costs may increase by the same amount.

The assessment found that aesthetics and other tangible and intangible benefits trees provide were the greatest value to the community. Approximately half of the total annual net benefits were due to increases in property value because of the presence of trees. In addition to increasing property values, trees also augmented stormwater management. The ROW trees alone intercepted over 4.5 million gallons of rainfall which equates to a savings in City stormwater management costs of $45,135. Overall, 38% of the annual net benefits ROW trees provide augment stormwater management. Energy conservation and reductions in CO_2 are important but account for lesser amounts of work performed by community trees. Energy reductions accounted for 12% and CO_2 reductions for 3% of the total annual net benefits. The effect of community forests on air quality was negative due to the emission of natural BVOC from trees. This effect is discussed in detail in the Air Quality Benefit section.



	Aesthetic/Other Benefits	Stormwater Benefits	Energy Benefits	Carbon Dioxide Benefits	Air Quality Benefits	Total Annual Benefits
Total Dollars/Year	$62,249	$45,135	$14,343	$3,999	$(6,709)	$119,017

Figure 5. Annual per tree aesthetic/other, stormwater, energy, carbon dioxide, air quality and total annual benefits calculated using Streets.

Aesthetic/Other Benefits

The total annual benefit associated with property value increases and other tangible and intangible benefits because of the presence of street trees was $62,249. The average benefit per tree equaled $31.63 per year. The trees which made the biggest impact in the determination of aesthetic/other benefits were loblolly pine, willow oak, and tuliptree. Their values totaled 45% of the annual aesthetic/other benefit provided by the street tree population. Loblolly pine and willow oak were found in greater abundance than most species, except crapemyrtle, and their presence (23% of ROW population) along with their conditions and function account for their value. Tuliptree, water oak (*Quercus nigra*), and American sweetgum also greatly contribute to the aesthetic value of the community forest even though they are not as dominant on the streetscape (7% of ROW population). These trees have individual aesthetic and other annual values in excess of $79 per tree. Crapemyrtle, the most dominant species on the ROW (19%), has an aesthetic/other annual per tree value of only $3.70.

A common example of a natural BVOC is the gas emitted from pine trees, which creates the distinct smell of a pine forest.

Air Quality Benefits

The inventoried ROW tree population removes 829.8 lbs. of air pollutants through deposition and avoids 956 lbs. annually. Even with the removal of air pollutants, the ROW trees have a net negative impact (-48.1 lbs.) on community air quality. This somewhat surprising result is due to the abundance of trees in the community forest, such as pine, which naturally emit high quantities of BVOCs as gases. When the BVOC gases are emitted from trees and exposed to sunlight in the air, they react to form tropospheric ozone, a harmful gas that pollutes the air and damages vegetation. In Milton's inventoried tree population, the number of high BVOC-emitting trees outweighs the number of low emitters.

The current ROW trees emit -2,233 lbs. of BVOCs per year. Using the annual per tree values in Table 2, the individual tree species American sweetgum, tuliptree, loblolly pine, and water oak had the greatest adverse impact on air quality based on their annual per tree average values which ranged from $12.29 to $15.79. The trees which afforded the most benefits based on the annual per tree average value were eastern red cedar (*Juniperus virginiana*) and sugar maple (*Acer saccharum)* providing $2.84 to $2.49, respectively.

Stored Carbon and Annual Carbon Dioxide Benefits

Trees take in CO_2 that is emitted into the air and store some of it, keeping it from getting into the upper atmosphere where it can react with other compounds and form gases like ozone, which adversely affect air quality. The results below discuss the findings of the Stored Carbon Report which demonstrate the amount of C stored by the trees over their current lifespan and of the Carbon Dioxide Report which presents annual reductions in atmospheric CO_2 due to sequestration by trees and reduced emissions from power plants due to reduced energy use. When calculating annual reductions, the Streets model accounts for increases in CO_2 when it is released into the atmosphere as trees die and decompose and during the care and maintenance of trees.

The Streets analysis found that inventory ROW trees store 2,731 tons of C (measured in CO_2 equivalents). This amount is equal to the amount of C they have amassed during their lifetimes. On an annual basis, through sequestration and avoidance, 242.3 tons of CO_2 are removed each year. Water oak provided the most carbon storage and annual carbon benefits based on its annual per tree average value, storing $115.71 and sequestering $6.71.

Photograph 7. Trees help create and enhance the character of a community and also improve the quality of life there. Trees filter air, water, and sunlight, moderate local climate, slow wind and stormwater, shade homes, and provide shelter to animals and recreational areas for people.

Energy Benefits

The contribution of the ROW trees towards conserving energy is reflected in its ability to shade structures and surfaces, reduce electricity use for air conditioning in summer, and divert wind in the winter reducing natural gas use. Based on the inventoried ROW trees, the annual electric and natural gas savings are equivalent to 128.82MWh of electricity and 4,367th of natural gas. When converted into dollars and cents using Reference City default economic data, this accounts for a savings of $14,343 in energy consumption each year.

Loblolly pine contributed to the annual energy benefits ($13.72/tree) of the community forest, but its contribution was mostly due to its dominance on the streets. Fifteen percent (15%) of the ROW population was loblolly pine. Other tree species, specifically tuliptree and water oak, contributed more to reduce energy usage on a per tree basis. The value these trees provide exceeds $20 per tree annually although they comprise only 3.5% and 2% of the population, respectively. These large, leafy canopies provide shade which reduces energy usage and increases their value. Smaller trees inventoried, such as crapemyrtle, holly, and elm (*Ulmus* x hybrid.), were found to have smaller reductions in energy usage on a per tree basis. Crapemyrtle, the seemingly most planted tree on the ROW, is valued at only $1.74 per tree.

Crapemyrtle (*Lagerstromia indica*)	Loblolly Pine (*Pinus taeda*)	Tuliptree (*Liriodendron tulipifera*)	Water Oak (*Quercus nigra*)
19% of ROW	15% of ROW	3.5% of ROW	2% of ROW
5MWh Electricity	40MWh Electricity	13MWh Electricity	48MWh Electricity
272th Natural Gas	1,045th Natural Gas	416th Natural Gas	232th Natural Gas
$1.74Average $/tree	$13.72 Average $/tree	$20.35 Average $/tree	$21.82 Average $/tree

Stormwater Benefits

Rainfall interception by trees can help reduce the costs to manage stormwater runoff. The ROW trees alone intercept 4,558,806 gallons of rainfall annually (Table 3). The estimated average savings for the City in the management of stormwater runoff because of street trees is $45,135 annually.

Looking at the ROW population, loblolly pine contributed most of the annual stormwater benefits. The population of loblolly pines (15% of ROW) intercepted approximately 1.6 million gallons of rainfall. The most dominant species on the ROW, crapemyrtle (19% of ROW), only intercepted approximately 74,000 gallons of rainfall. On a per tree basis, large trees with leafy canopies provided the most value. Tuliptree and water oak comprised 3.5% and 2% of the ROW population, respectively. Tulip tree absorbed 7.5 times more gallons of rainfall than crapemyrtle and water oak, 4.5 times more gallons than crapemyrtle. Once again, large-statured trees with big canopies created the greatest benefits.

Table 3. Stormwater Benefits Provided by ROW Trees

Most Common Trees Collected During Inventory		Number Trees on the ROW	Percent of Total Trees	Total Rainfall Interception
Common Name	Botanical Name		(%)	(gal)
crapemyrtle	*Lagerstroemia indica*	372	18.9	74,661
pine, loblolly	*Pinus taeda*	303	15.4	1,659,312
oak, willow	*Quercus phellos*	157	8	473,614
maple, red	*Acer rubrum*	133	6.8	232,846
holly	*Ilex* spp.	130	6.6	24,271
plum	*Prunus* spp.	94	4.8	55,637
cedar, northern white	*Thuja occidentalis*	94	4.8	51.183
tuliptree	*Liriodendron tulipifera*	68	3.5	528,262
privet glossy	*Ligustrum sinense*	67	3.4	2.565
maple, sugar	*Acer saccharum*	56	2.8	76,562
cedar, eastern red	*Juniperus virginiana*	44	2.2	41,635
oak, water	*Quercus nigra*	39	2	337,154
magnolia, southern	*Magnolia grandiflora*	36	1.8	25,664
dogwood, flowering	*Cornus florida*	35	1.8	17,325
American sweetgum	*Liquidambar styraciflua*	35	1.8	182,180
cherry, black	*Prunus serotina*	21	1.1	46,509
elm	*Ulmus* x hybrid	20	1	5,279
other street trees	~22 genera of varying species	263	13.3	724,147
ROW Total	**~37 genera and ~61 species on the ROW**	**1,967**	**100**	**4,558,806**

Importance Value

Understanding how important a tree species is to the community is based not only on its presence on the ROW but also its ability to provide environmental and economic benefits to the community. The IV calculated by the Street computer model takes into account the total number of trees of a species, its percentage in the population, and its total leaf area and canopy cover. The IV can range from 0 to 100 with an IV of 100, suggesting total reliance on one species. If IV values are greater or less than the percentage of a species on the ROW, it indicates that the loss of that species may be more important or less important than its population percentage infers.

The Streets IV assessment found that loblolly pine has the greatest IV in the ROW population. Its IV is 24.9. Loblolly pine makes up 15% of the ROW. Its IV is greater than its percent and that indicates its loss would be more significant than its percentage indicates. The second highest IV was for willow oak (10.2) followed by tuliptree (IV, 9.4) and crapemyrtle (IV, 7.9). The abundances of willow oak (8%) and tuliptree (4%) on the ROW are not as great as crapemyrtle (19%), but their IVs are greater. This is likely because they are large-growing, broadleaf species by nature and their size and canopy provide more environmental benefits to the community. The IV for crapemyrtle is much less than its percentage of the population indicating that if it was lost, it would not be as significant as it appears to be.

Discussion of Findings

The Streets analysis found that ROW trees provide environmental and economic benefits to the community just by their mere presence on the streets. Currently, the aesthetic/other benefits provided by ROW trees were rated as having the greatest value to the community. Trees increase property values. In the growing community of Milton, that is very important because solid economic growth is desired. In addition to increasing aesthetics and property values, trees also help manage stormwater through rainfall interception, provide shade and windbreaks that reduce energy usage, and store and sequester CO_2. Even though these environmental benefits were not found to be as great as the aesthetic/other benefits, they are noteworthy, and especially the work trees do to intercept rainfall and reduce runoff. Over 4.5 million gallons of rainfall is absorbed by only 1,967 ROW trees. Air quality is impaired by the number of high BVOCs emitting trees; however, this effect can be offset by smart tree planting efforts.

The Streets study found that, currently, the most influential tree along Milton's ROWs is the loblolly pine. If it was lost to SPB or other threats, its loss would be felt more than the community may realize.

To increase the benefits community forests provide, the City should plant young, large-stature species that are low emitters of BVOCs wherever possible. Leafy, large-stature trees consistently created the most environmental and economic benefits. Following is a list of the tree species developed by David Nowak and the USDA Forest Service, Northeastern Research Station for improving air quality (ICLEI, 2006).

- *Betula nigra*, river birch
- *Celtis laevigata*, sugar hackberry
- *Fagus grandifolia*, American beech
- *Metasequoia glyptostroboides*, dawn redwood
- *Tilia cordata*, littleleaf linden
- *Tilia europea*, European linden
- *Tilia tomentosa*, silver linden
- *Ulmus americana*, American elm
- *Ulmus procera*, English elm

Canopy Assessment

i-Tree Canopy was used to conduct a land cover assessment for a project area which extended to the Milton city limits and included 25,039 acres. Ten land cover types, including tree cover, were assessed using Canopy. The City of Milton's Planning Department completed the study using protocols outlined in the *i-Tree Canopy Technical Notes* (USDA Forest Service and The Davey Tree Expert Company, 2011) during the period of March 5 through March 20, 2012. The imagery used for the study was 2012 Google Earth Terrametric aerial photography.

The following the steps were performed by the City:

1. Imported a GIS file that delineated the City limits.
2. Selected the following land cover classes from Canopy's default selections:
   - **Tree Forest**—Tree, non-shrub among other trees
   - **Impervious**—Pavement or building
   - **Grass/Pasture**—Grass, pasture, or golf course
   - **Shrub**—Shrub, non-tree
   - **Barren**—Exposed dirt area
   - **Gravel Road**—Linear gravel/dirt area
   - **Water**—Water bodies
   - **Tree Island**—Tree with two impervious sides
   - **Tree Single**—Tree not among other trees, surrounded by pervious
   - **Unknown**—Unable to categorize cover class
3. Allowed the Canopy software to randomly lay points onto Google Earth imagery within the boundary (the number of points generated was determined by the City).
4. Looked at 2,504 points and identified the land cover class each point fell upon.
5. Obtained results from the Canopy software reporting tool.

i-Tree Canopy

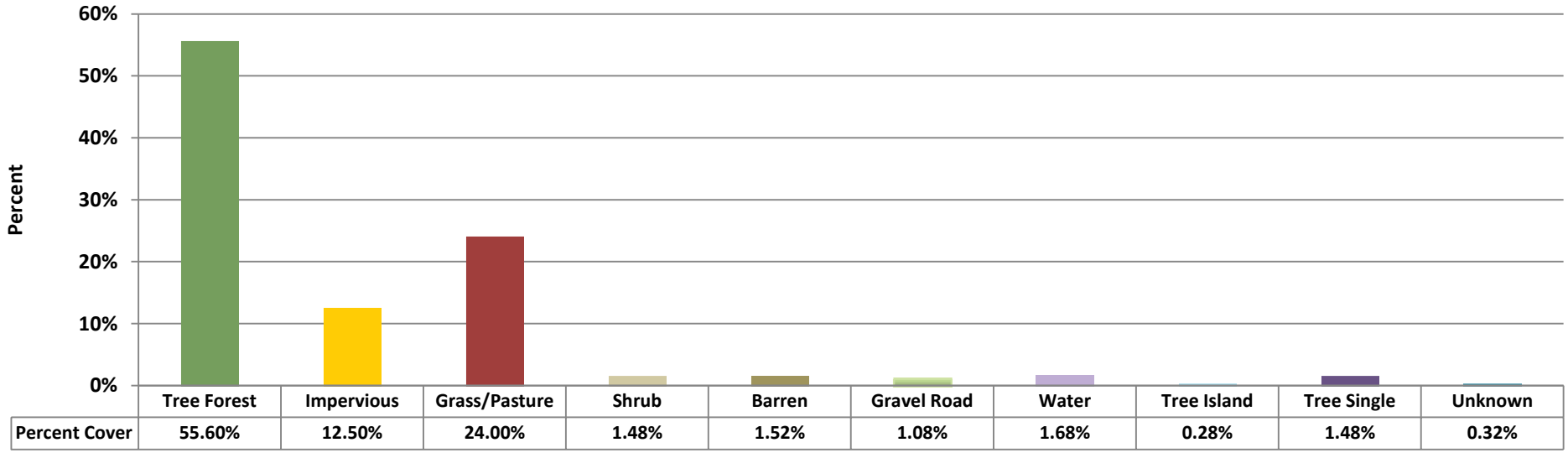
i-Tree Canopy is a software tool designed by USDA Forest Service in cooperation with The Davey Tree Expert Company. It allows easy and accurate estimation of tree and other land cover classes (*e.g.,* grass, building, roads, etc.) within a defined area, such as a city's limits.

Limitations

Interpretation of land cover classes is performed from an aerial image and is limited by the ability of the user to classify each point into its correct class. Another limitation of this process is that the Google imagery may be difficult to interpret in all areas due to relatively poor image resolution (*e.g.,* image pixel size), environmental factors, or poor image quality.

Overall Findings

Ten different land cover classes ranging from forests with large trees to impervious surfaces made up of pavement and buildings were identified during the assessment. Tree canopy (sum of the land cover classes: Tree Forest, Tree Island, and Tree Single) covers approximately 58% of the City limits. Grass and Pasture land cover accounts for 24%, impervious land cover accounts for 13%, and all other land cover types make up 5% of the City (Figure 6).



	Tree Forest	Impervious	Grass/Pasture	Shrub	Barren	Gravel Road	Water	Tree Island	Tree Single	Unknown
Percent Cover	55.60%	12.50%	24.00%	1.48%	1.52%	1.08%	1.68%	0.28%	1.48%	0.32%

Figure 6. Canopy and land cover assessment results for the Milton city limits. Assessment performed using i-Tree Canopy.

The Standard Error ranged between ±.99% for Tree Forest to ±.11% for Tree Island and Unknown (Figure 7). For the methods used to calculate Standard Error and Confidence Intervals, see the i-Tree Canopy Technical Notes (USDA Forest Service and The Davey Tree Expert Company, 2011).

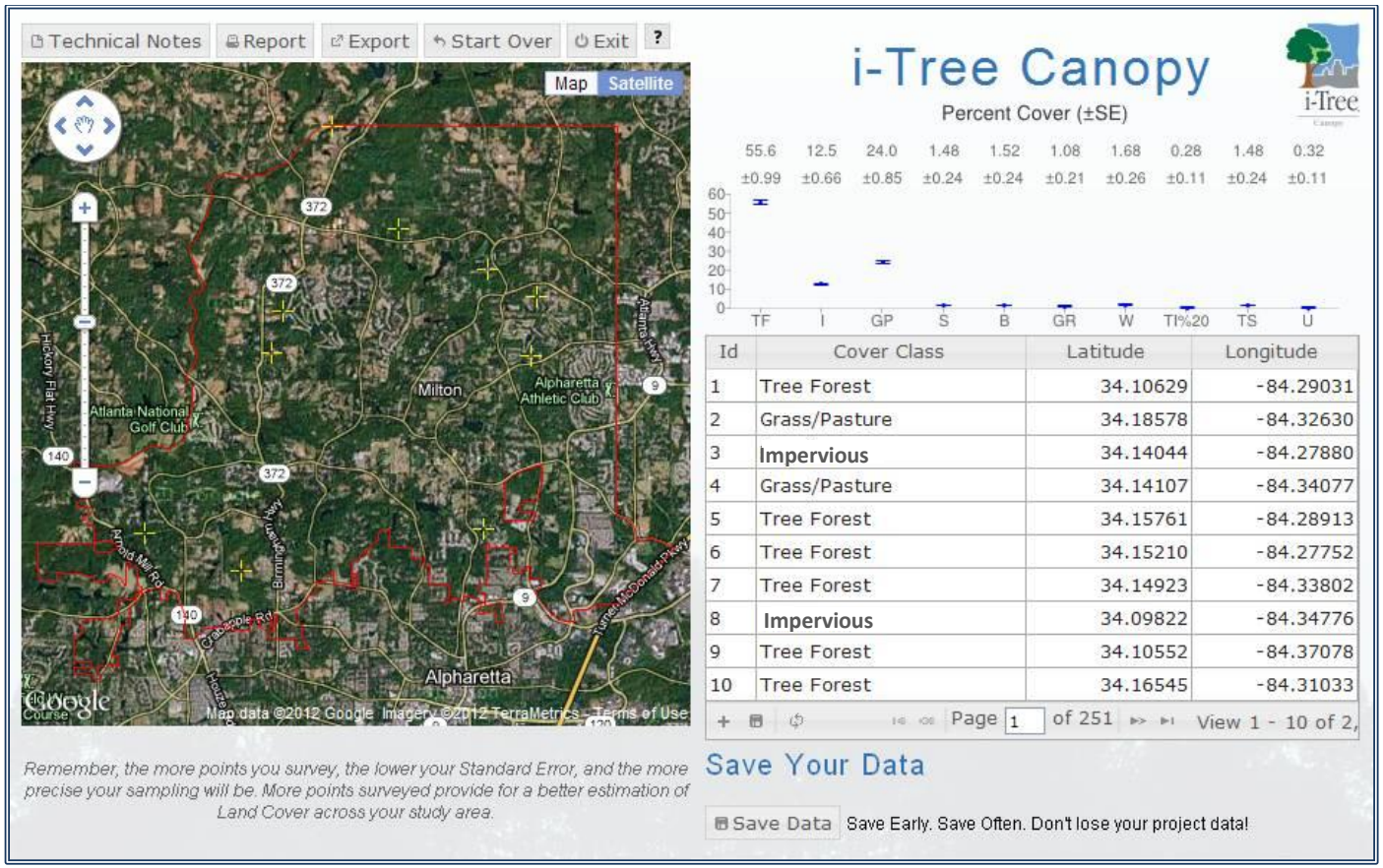


Figure 7. Percentage and standard error results for the land cover and canopy assessment.

Discussion of Findings

According to the *Georgia Model Urban Forest Book* (Georgia Forestry Commission, 2001), a rural area is characterized by forested areas, occasional fields, and scattered housing and commercial buildings associated with farming and forestry land uses. Based on Milton's land cover assessment, at this time, it is an ideal rural area characterized by ample tree cover and pasture and grass lands, limited impervious surfaces, and scattered development. To preserve its rural character, Milton should maintain its percentages of tree canopy and grass and pasture land covers, and limit the increase of the amount of impervious surfaces through smart growth and considering the use of technology like engineered systems designed to grow big trees while increasing infiltration at the site.

Models for Building the Urban Forest

The *Georgia Model Urban Forest Book* (Georgia Forestry Commission, 2001) suggests three models for building the urban forest: Public Education Model, Ownership Model, and the Regulation Model. The models focus on policy tools that communities can use to maintain and expand their tree canopy at differing levels of community structure and at different times during the development cycle. A successful program will pursue all three policy models. The following briefly describes each model:

Public Education Model

The Public Education Model involves the city in the education of citizens or groups who will set the vision for the future and support the planning, implementation, and maintenance of trees and forests. This model attempts to change attitudes towards trees and foster a larger acceptance of tree canopy. Tools within this model include developing programs to convince private owners of tree planting benefits, programs to stimulate and fund tree planting on private property, and organization and support of citizen action groups. These are groups who will become involved in or support tree planting and other urban forest issues such as increased spending on planting and maintenance and stronger tree ordinances.

Ownership Model

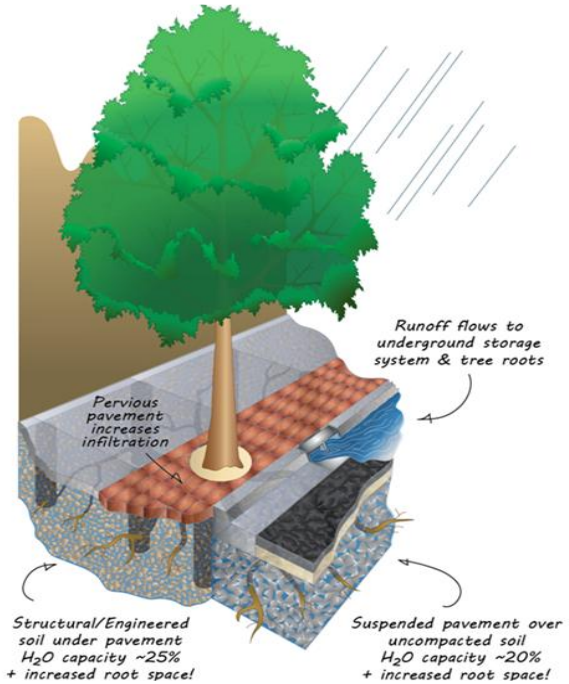
The ownership model involves the purchase of land or easements by public entities or private non-profit organizations for the establishment of trees and forests. Tools within the ownership model include public purchases of land, private land trust purchases of land, modification of existing public lands for tree planting, and design or redesign of transportation and utility ROWs to incorporate tree planting.

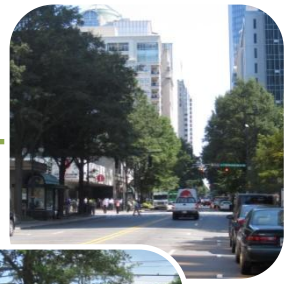
Regulation Model

The regulation model consists of developing legal tools for preserving and planting trees and forests on public and private lands. Tools within the regulation model include tree preservation and planting ordinances, modifications to development guidelines or regulations for the purpose of preserving and planting more trees, and use of environmental regulations that acknowledge the benefits of trees. The regulation model must begin by establishing a consensus within the community at large, on core issues of the importance of improving the urban forest canopy. The use of this model will have to overcome great political difficulty to write changes to existing laws acceptable to the public and the development community. While the effort will be challenging, the effectiveness of strong laws can be enormous. It will be impossible to achieve significant improvements in the urban forest canopy without finding successful ways to use this model.

Growing Trees and Limiting Impervious Surfaces

Creating functioning streetscapes with limited impervious surfaces and ample large-sized trees is not an easy task. However, the use of engineered systems designed to increase infiltration and grow trees may help. Parking lots, streetscapes, sidewalks, plazas, and other common areas can be designed to utilize permeable pavements, structural soil, suspended pavement or structural cells, and/or stormwater tree pits, to help limit the amount of impervious surface, increase infiltration, and maintain or grow canopy cover as the City develops. These systems can create space for trees to grow while protecting roots from compaction and allowing stormwater runoff and irrigation to infiltrate the ground surface. Innovative streetscapes that employ engineered systems are being achieved in urban environments including Charlotte, North Carolina; Key West, Florida; and Philadelphia, Pennsylvania,





Charlotte, North Carolina ultizes suspended pavement to grow big trees in their downtown business district

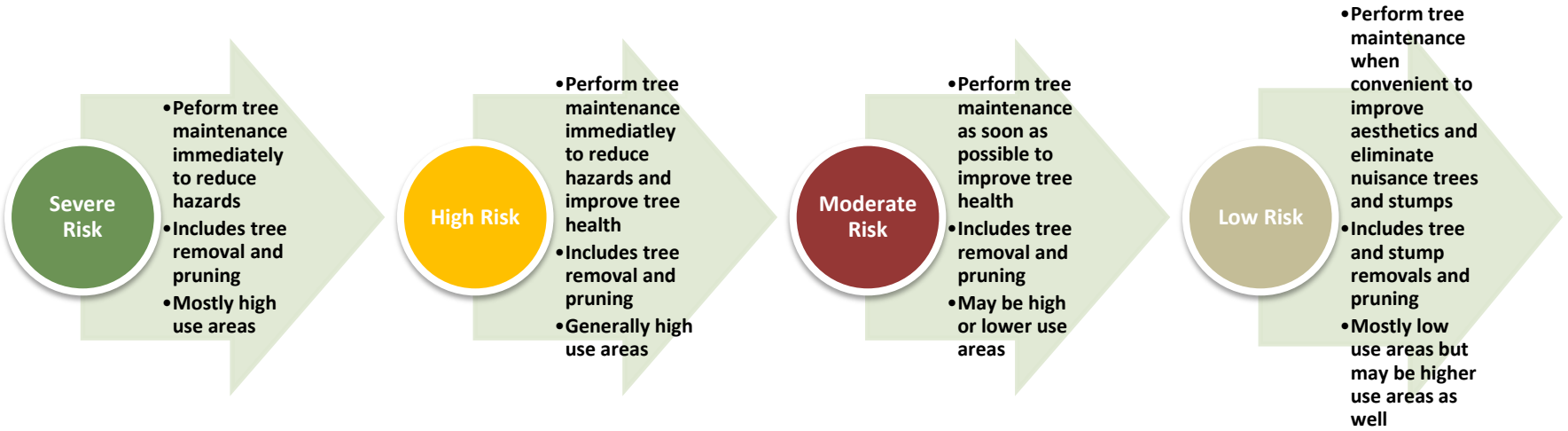
Key West, Florida uses permeable pavement as a surface over tree pits to protect tree roots from compaction while allowing for inflitration of water

Philladephia, Pennsylvania employs stormwater tree pits to capture runoff

Section 4: Tree Management Program (ROW and Parks)

This tree management program was developed to uphold Milton's comprehensive vision for preserving its rural character. It is a five-year program based on the tree inventory data, tree benefit analysis, and canopy assessment. The program was designed to reduce risk through prioritized tree removal and pruning and improve tree health and structure through cyclic pruning. Tree planting to mitigate removals and increase canopy cover and public outreach are important parts of the program as well. The management program addresses ROW trees separately from park trees.

The implementation of this program is and will always be an ongoing process. To accomplish this program, work must be done every year, every month of the year, and possibly every day of the month. However, tree work must always be prioritized to reduce the level of risk in the community forest. To reduce risk, Davey recommends completing the work found during the inventory based on the risk rating assigned AND routinely inspecting community trees so that any new higher-risk trees can be added to the list and be alleviated systematically. Cyclic pruning, tree planting, and public outreach should be done throughout the program; however, priority work (especially trees rated as having Severe and High Risk) may take precedence at times to ensure risk in the community forest is managed.



Priority Versus Proactive Maintenance

For many communities, a proactive tree management program is a luxury and "putting out fires" or an on-demand response to crisis situations in the community forest is the norm. However, research has shown that a proactive program which includes a routine pruning cycle improves tree health (Miller and Sylvester, 1981). In addition to improving tree health, proactive tree maintenance has many management advantages over priority tree maintenance. The biggest advantage is reduced risk. Since trees are assessed and pruned regularly, most defects are found and eliminated before they escalate into situations that have unacceptable levels of risk associated with them. 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.

Davey identified maintenance needs that are of importance to the management of the tree population. Maintenance recommendations were determined from visual observations made from the ground and based on *ANSI A300 Standards*. The structure and function of roots, trunk, scaffold branches, and canopy, as well as each tree's location relative to streets, sidewalks, utilities, signs, buildings, and traffic control devices, were taken into consideration during the assessment. Each tree inventoried was assigned a primary and secondary maintenance need.

The primary maintenance need focused on the type of tree work needed to reduce risk. The secondary maintenance need may be risk oriented, such as raising the crown for clearance, but generally it was geared toward improving the structure of the tree and enhancing aesthetics. Other maintenance oriented data fields were collected to help identify conflicts with infrastructure and the need for further inspection of individual trees with aerial lifts or differing technology than used during the inventory to identify concerns.

Why Prune Trees on a Cycle?

Miller and Sylvester (1981) examined the frequency of pruning for some 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 absent 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.

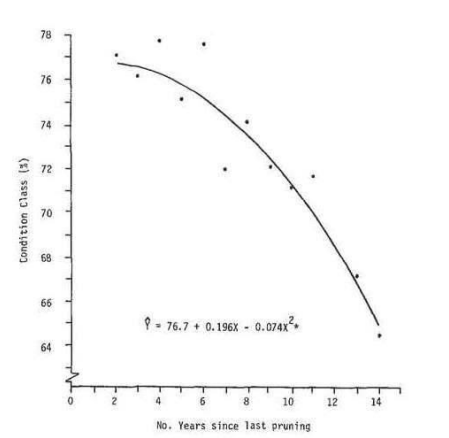


Fig. 1. Relationship between average tree condition class and number of years since last pruning.

Figure from Miller and Sylvester (1981)

Priority Maintenance

The purpose of identifying and ranking the priority maintenance needs of the community forest is to enable managers to prioritize tree work based on observed risk. Once tree work is prioritized, it can be accomplished systematically to eliminate the greatest risk and liability first (Stamen, 2011).

Risk is a graduated scale that measures the potential danger associated with a tree. A tree is considered hazardous when the potential danger associated with it exceeds the level of risk that is acceptable by the governing agency.

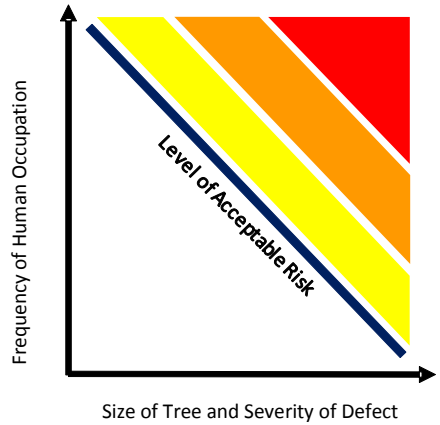
It is important to understand that managing trees for risk reduction can provide many benefits including:

- Lower frequency and severity of accidents, damage, and injury.
- Fewer expenditures for claims and legal expenses.
- Healthier, long-lived trees.
- Over time, fewer tree removals.
- Over time, lower tree maintenance costs.

Regular inspection of trees and performance of cyclic tree maintenance generally reduces the risk of failure as problems can be found and addressed before they escalate.

Acceptable Risk

The determination of acceptable risk ultimately lies with the City. Unfortunately, it is a reality that all trees have risks associated with them. The location of a tree is an important factor in the determination and the acceptability of risk for any given tree. The level of risk associated with a tree increases as the frequency of human occupation increases in the vicinity of the tree. Therefore, a tree located next to a heavily traveled street will have a higher level of risk than an identical tree in an open field.



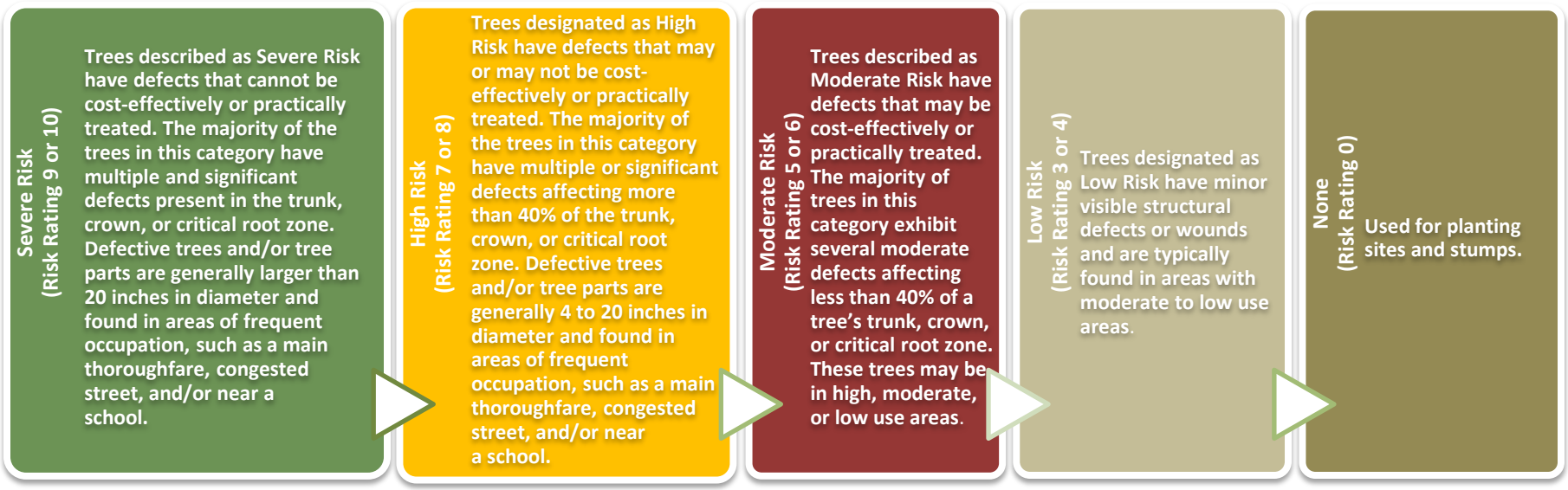
How Risk Was Assessed During the Inventory

All community forests have inherent risks of tree or tree part failure. During the inventory, Davey performed a risk assessment and that assessment was used to assign a risk rating to each tree. To rate each tree, Davey used a protocol based on the USDA Forest Service Community Tree Risk Rating System (Pokorny, *et.al,* 2003). The probability of failure, size of defective part, probability of target impact, and other risk factors were evaluated for each tree inventoried and assigned and independent point value (see below for description of the point system). The independent values are summed to generate the risk rating.

- Probability of Failure (1–4 points). Identifies the most likely failure and rates the likelihood that the structural defect(s) will result in failure based on observed, current conditions.
- Size of Defective Part (1–3 points). Rates the size of the part most likely to fail.
- Probability of Target Impact (1–3 points). Rates the use and occupancy of the area that would be struck by the defective part.
- Other Risk Factors (0–2 points). This category is used if professional judgment suggests the need to increase the risk rating. It is especially helpful when growth characteristics become a factor in risk rating. For example, some tree species have growth patterns that make them more vulnerable to certain defects such as weak branch unions and branching shedding.

Once the risk rating is calculated, a level of risk is assigned to each tree based on its risk rating. Severe Risk trees have a risk rating of 9 or 10; High Risk trees, 7 or 8; Moderate Risk trees, 5 or 6; and Low Risk trees have a risk rating of 3 or 4. A tree assigned a Risk of None has a risk rating equal to zero and is used for stumps or vacant planting sites only. Ultimately, the assigned risk rating allows for prioritization of tree maintenance work.

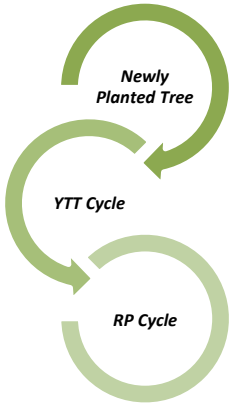
Usually trees with elevated levels of risk (Severe or High Risk) are removed or the defects that warranted their risk rating are eliminated via pruning. However, in some situations, risk can be reduced by adding support to the tree (cabling or bracing) or by moving the target away from the tree. Davey only recommends removal or pruning to alleviate risk. In special situations, such as significant or memorial tree or a tree in an historic area, Milton may decide that cabling. Bracing, or moving the target may be an option for alleviating risk.



Praoctive Maintenance

Proactive tree maintenance requires that trees are managed and maintained under the watchful eye of an individual, department, or agency. Typically, tree work is performed during a cycle. Individual tree health and form are addressed "routinely" during the cycle. When trees are planted, they are planted selectively and with purpose. Ultimately, proactive tree maintenance should reduce crisis situations in community forests as every tree in the managed population is visited, assessed, and maintained on a regular basis and tree planting is planned.

Davey's recommended proactive tree maintenance includes cyclic pruning, inspections, and tree planting.



The City must continually update the number of trees in the YTT and RP Cycles based on the City's tree planting program and population dynamics. As trees are planted, mature, and die, cycles must be modified.

Cyclic Pruning

The goal of cyclic pruning is to visit, assess, and prune trees on a regular schedule to improve health and reduce risk. Typically, Davey recommends that pruning cycles begin after all Severe and High Risk trees are corrected through priority removal or pruning. However, because of the long-term benefit that will come from the implementation of cyclic pruning, Davey may recommend it be implemented sooner. To ensure all trees receive the type of pruning they need to mature with better structure and fewer hazards, two pruning cycles, the Young Tree Training Cycle (YTT Cycle) and the Routine Pruning Cycle (RP Cycle), are recommended. The cycles differ in the type of pruning, the general age of the tree they target, and the length of the cycle.

YTT Cycle

Young trees generally have a DBH of six inches or less. Sometimes young trees 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 young trees can have. If these problems are not corrected, they can become worse as the tree grows older, and may increase risk and create potential liabilities.

During the YTT Cycle, pruning is performed to improve tree form or structure. The recommended length of the YTT Cycle is three years because young trees tend to grow at faster rates (on average) than more mature trees.

RP Cycle

The RP Cycle includes all small and large trees (most trees with a DBH greater than six inches) that need cleaning, crown raising, and reducing to remove deadwood and improve their structure. The length of the RP Cycle is based on the size of the tree population and what was determined by Davey to be a reasonable number of trees to prune per year. The RP Cycle recommended for Milton is five years.

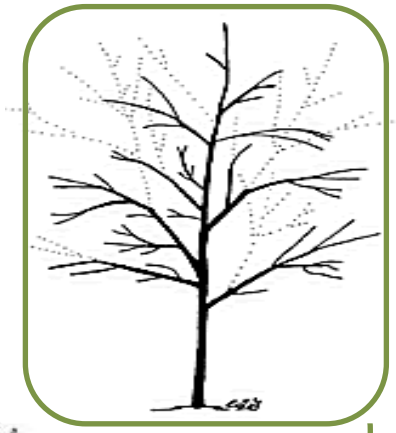
Pruning Cycle Progression

The recommended number of trees in the YTT Cycle and RP Cycle is constantly changing as trees are planted, age, and die. Newly planted trees will enter the YTT Cycle once they are established (generally one to two years after planting). Young trees will reach maturity and leave the YTT Cycle and enter the RP Cycle. And finally when a tree reaches the end of its useful life, it should be removed and, thus, be eliminated from the RP Cycle.

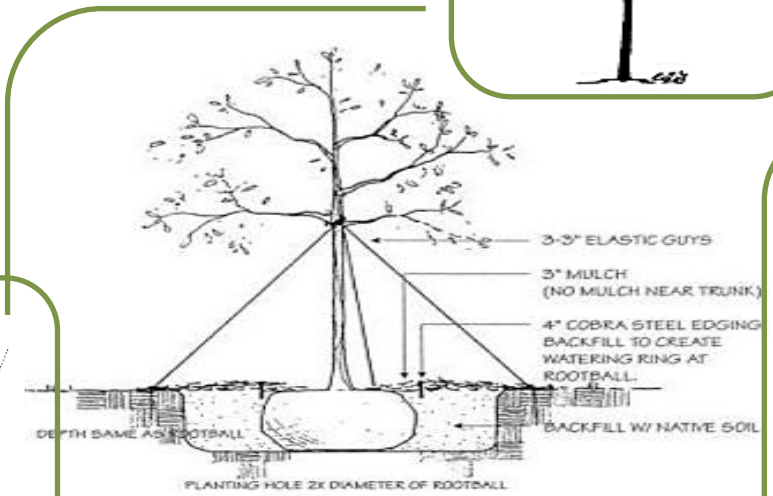
Proactive Tree Pruning and Planting

All figures are from the work of Dr. Ed Gilman, University of Florida. For more information, visit the University of Florida's Landscape Plants webpage at: http://hort.ufl.edu/woody/ (2012).

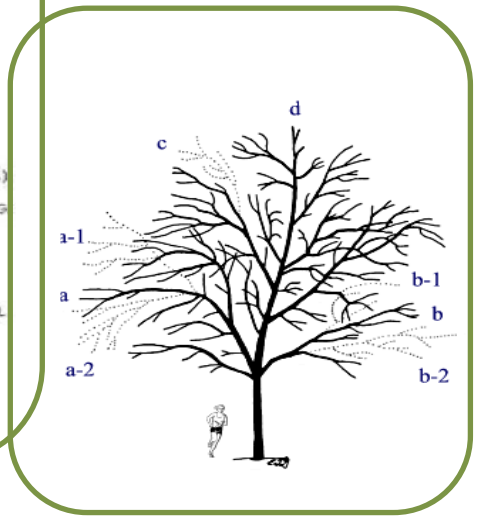
Structural Pruning



Planting



Raising



Reducing

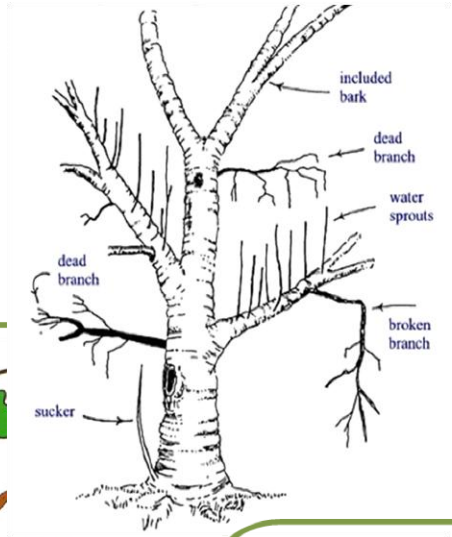
Thinning

Priority Tree Maintenance Work

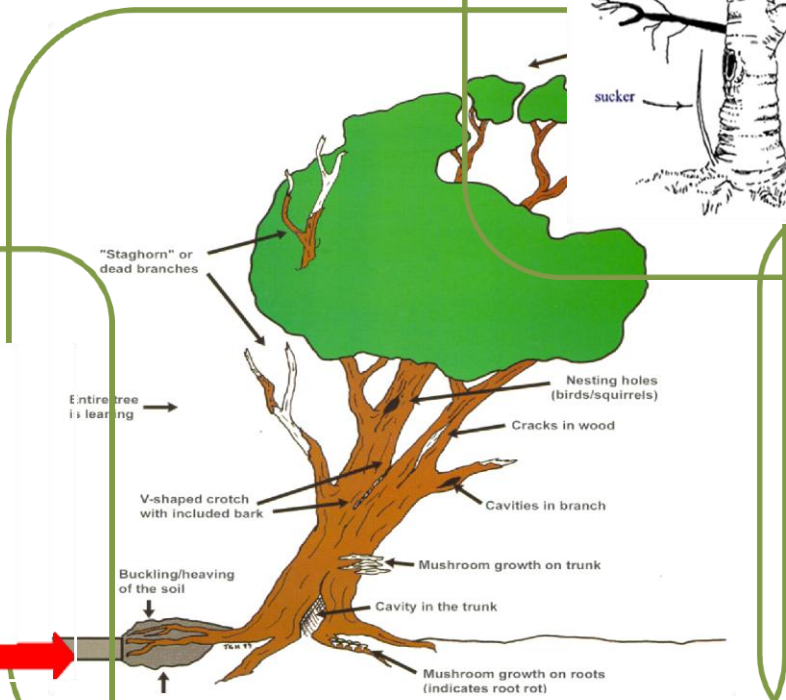
Cleaning figure is from the work of Dr. Ed Gilman, University of Florida. For more information, visit the University of Florida's Landscape Plants webpage at: http://hort.ufl.edu/woody/ (2012).

Cabling and bracing figure is from Trees and Landscaping, A *Guide to Trees and Landscaping for the Homeowner* (2006).

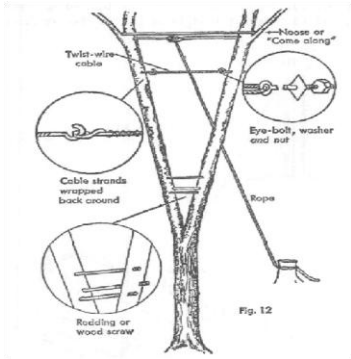
Cleaning



Removal



Move the Target



Cabling and Bracing

ROW Tree Maintenance Program

Tree maintenance along the ROW should focus on short- and long-term risk reduction through tree removal and proactive, routine pruning. Short-term risk reduction is the accomplishment of the Severe and High Risk tree removals and pruning. Clearing the street of a tree with an elevated failure potential is an example of short-term risk reduction through tree removal. Long-term risk reduction is the commitment to a RP Cycle and the performance or Moderate and Low Risk removals. The RP Cycle will help keep canopies free of hangers and dead branches, possibly reducing the number of branches that fall "without warning". The loblolly pines growing along heavily traveled roads like Birmingham Highway are an example of how routine pruning will reduce risk along the ROW. This species has a tendency to "self-prune", meaning branches naturally weaken and fall off; this process occurs even with healthy trees. Routine pruning of these pines should remove weakened branches before they fall on their own. Another example of long-term risk reduction is the performance of lower risk removals which will clear the street of nuisance plants and trees that because of species, size, or location are not of immediate concern, but if ignored may become more pressing problems. Failed transplants and Chinese privet are examples of lower risk removal.

The following listed streets were inventoried in each area of the community:

Crabapple Area

- Crabapple Road
- Mayfield Road
- Charlotte Road
- Broadwell Road
- Mid Broadwell Road
- Birmingham Highway to northern City limits

Arnold Mill Road/State Route 140 Area

- Arnold Mill Road/State Route 140

Highway 9 Area

- Highway 9
- Deerfield Parkway
- Bethany Bend
- Morris Road
- Webb Road
- Cogburn Road/Hopewell to northern City limits

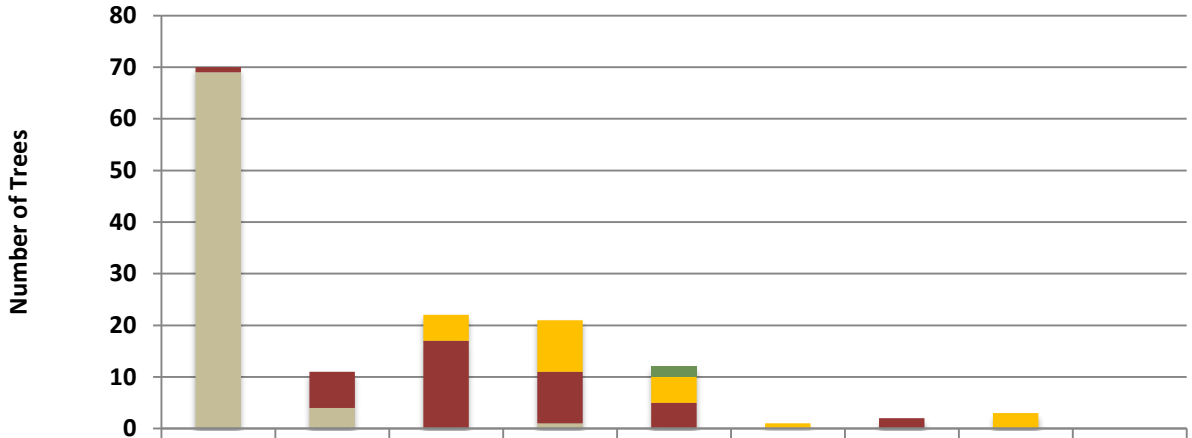
Photograph 8. Tree maintenance along the ROW should focus on short- and long-term risk reduction through tree removal and proactive, routine pruning.

Tree Removals

Although tree removal is usually considered a last resort and can stir emotions from 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 hazard or it is cost-prohibitive to correct the problems. Additionally, any trees that cause obstructions or interfere with power lines and 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.

Even though large, short-term expenditures are often required for tree removals, the funding and accomplishment of them in a reasonable amount of time is important if risk in community forests is to be reduced.

Figure 8 presents the Severe, High, Moderate, and Low Risk tree removals by diameter size class identified during the inventory. The following briefly summarizes the removals recommended.



	1" - 3"	4" - 6"	7" - 12"	13" - 18"	19" - 24"	25" - 30"	31" - 36"	37" - 42"	>43"
Severe	0	0	0	0	2	0	0	0	0
High	0	0	5	10	5	1	0	3	0
Moderate	1	7	17	10	5	0	2	0	0
Low	69	4	0	1	0	0	0	0	0

Figure 8. Severe, High, Moderate, and Low Risk tree removals identified by diameter size class.

Prioritized Removals

Severe Risk

Only two trees were found with Severe Risk on the ROW and recommended for removal. The combination of the size of the defect, the probability of failure, or the location of the tree in relation to its surroundings was the reason for their elevated risk rating and assignment of Severe Risk. These trees are medium to large in size based on their diameter size class (19 inches to 24 inches) and should be removed immediately to increase public safety. Severe Risk removals can be performed concurrently with Severe Risk prunings.

High Risk

High Risk removals have observed sizeable defects with elevated probabilities of failure. The location of these trees in relation to their surroundings also increases their risk. There were 24 trees identified as High Risk removals on the ROW. The diameter size classes for these trees ranged from 7 to 12 inches up to 37 to 42 inches. These trees should be removed immediately because of their assigned risk. Severe and High Risk removals and prunes can be performed concurrently because of their similar assigned risk.

Lower Risk Removals

Moderate Risk

Tree removals in this category still pose some risk, but have a smaller size of defect and/or less potential for target impact associated with them. There were 42 trees recommended for removal with Moderate Risk. Most Moderate Risk trees had DBHs less than 24 inches. These trees should be removed as soon as possible and after all Severe and High Risk removals and pruning have been accomplished.

Low Risk

Low Risk removals pose little threat to the community. These trees are generally small, dead, invasive, or poorly formed trees that need to be removed. The elimination of these trees will minimize breeding site locations for insects and diseases and increase the aesthetics of the area in which they are found. Healthy trees growing in poor locations or undesirable species are also included in this category.

There were 74 trees recommended for Low Risk removal. Almost all of these trees had DBHs less than 3 inches. The majority of these trees were invasive Chinese privet that may be in Fair or Good condition but still should be eliminated due to its negative impact on desirable vegetation. All Low Risk trees should be removed when convenient and after all Severe, High, and Moderate Risk removals and pruning have been accomplished.

Prioritized Pruning

Priority pruning generally requires cleaning the canopy of both small and large trees to remove hazardous defects. A hazardous defect such as dead and/or broken branches can occur even when the rest of the tree is sound. In these cases, pruning the branch or branches can correct the problem and alleviate the risk associated with the tree. Priority pruning includes trees with Severe and High Risk.

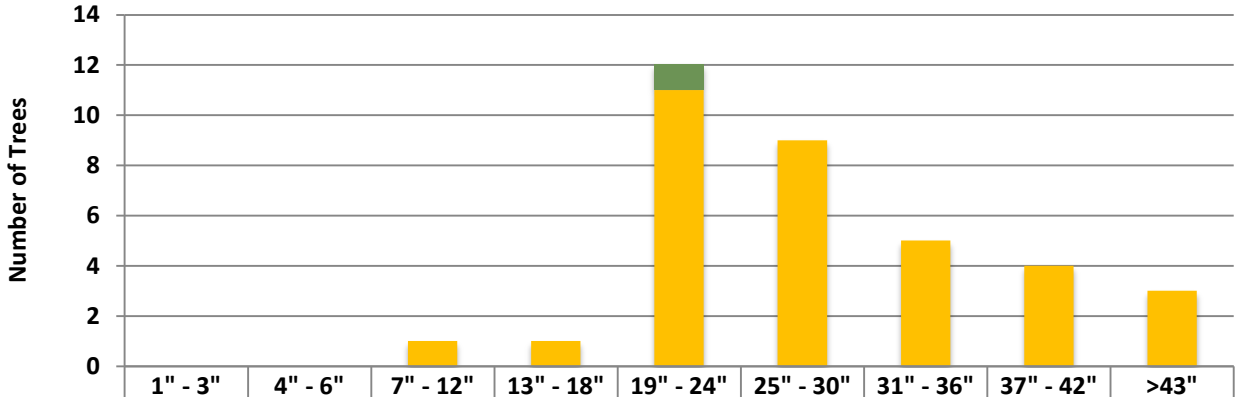
Figure 9 lists the priority pruning identified for ROW and the sections that follow briefly summarize the findings.

Severe Risk

Only one tree was categorized as having Severe Risk along the ROW and in need of pruning to correct the problem. The combination of the size of the defect, the probability of failure, or the location of the tree in relation to its surroundings was the reason for its elevated risk rating. This pruning should be performed immediately. This tree has the same diameter size class (19 inches to 24 inches) as the Severe Risk removals previously discussed and this pruning should be performed at the same time.

High Risk

High Risk prunes have observed sizeable defects with elevated probabilities of failure. The location of these trees in relation to their surroundings also increases their risk. There were 34 trees identified for High Risk pruning. The diameter size classes for these trees ranged from 7 to 12 inches to greater than 43 inches. This pruning should be performed immediately because of its assigned risk and can be done at the same time as other Severe and High Risk removals and prunes.



	1" - 3"	4" - 6"	7" - 12"	13" - 18"	19" - 24"	25" - 30"	31" - 36"	37" - 42"	>43"
Severe	0	0	0	0	1	0	0	0	0
High	0	0	1	1	11	9	5	4	3

Figure 9. Severe, High, Moderate, and Low Risk tree pruning identified by diameter size class.

RP Cycle for ROW Trees

It is important that the City commit and commence to proactive maintenance through the RP Cycle to improve overall community forest health. During the RP Cycle, trees are cleaned, raised, reduced, and thinned. Over time, routine pruning generally improves tree health and reduces risk as most problems with individual trees can be corrected before they escalate into more costly priority tree work. Included in this cycle are Moderate and Low Risk trees which require pruning. These trees still pose some risk, but have a smaller size of defect and/or less potential for target impact associated with them. The hazards found within these trees can usually be remediated during the RP Cycle.

The inventory found most trees (86%) on the ROW needed routine pruning (small and large tree cleaning). Figure 10 shows that a variety of tree sizes will require pruning; however, the majority of trees which require routine pruning had DBHs less than 24 inches.

Five-Year RP Cycle

For Milton, the RP Cycle recommended is five years in length. Approximately one-fifth of the City's streets should be pruned each year during the RP Cycle. Based only on the data collected during the inventory, approximately 340 trees will need visited and pruned each year. Davey recommended that the RP Cycle begin in Year 2 of this five-year plan and should commence after all Severe and High Risk trees are removed or pruned.

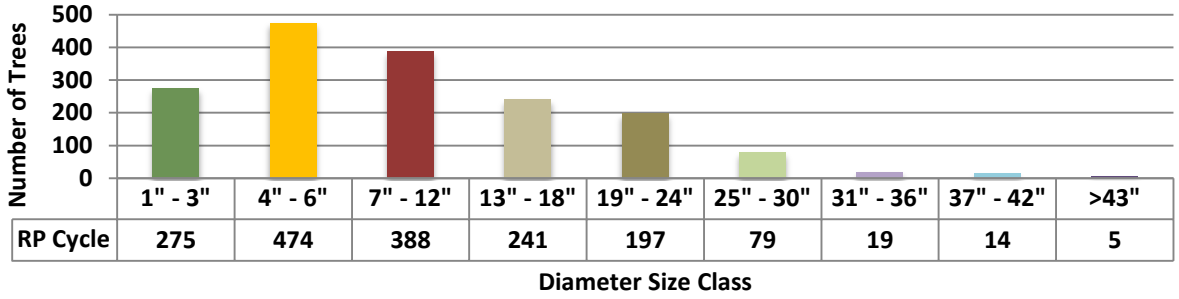


Figure 10. Number of trees by diameter size class in the ROW RP Cycle.

Inspections

Inspections are essential to unveiling potential problems with trees. Trees along the ROW should be inspected regularly and attended to as needed based on the inspection findings. When trees need additional or new work, trees should be added to the tree maintenance schedule and budgeted for as appropriate. In addition to locating new hazards, inspections are an opportunity to look for signs and symptoms of pests and diseases. Milton has a large population of trees susceptible to pests and diseases including southern yellow pines, a target for the SPB, southern red oaks which are susceptible to oak wilt, and species that fall prey to gypsy moth and hemlock woolly adelgid. A brief discussion and estimate of the percentage of inventoried ROW trees susceptible to key pests are found in Appendix C.

Park Tree Maintenance Program

Risk reduction is always the primary goal of public tree management. In community parks, addressing trees with elevated levels of risk is challenging because vast acreages of forested areas exist and usage varies. However, that challenge can be met through proactive management and expedient risk abatement. Proactive management includes routine inspections of community parks to locate trees in need of maintenance, routine and young tree training pruning to reduce the potential for higher risk situations in the future, public education, tree protection, and invasive, exotic plant management. Expedient abatement of risk is the swift performance of needed priority removals and prunes to eliminate hazards from parks.

Because of the varying nature of many of the parks, the park tree maintenance program places priorities on the maintenance of individual landscape trees in higher-use areas and tree stand management. For Birmingham Park, only High and Severe Risk removal and pruning needs found during the inventory are discussed.

Inventoried Parks

In Milton's parks, both individual trees and stands of trees were inventoried and recommendations were made for their maintenance. Individual trees were either landscape trees in higher-use areas of the park, or trees within the park, even in forested areas, with defects that may fail and cause damage to people or property. Most stands of trees were collected in Birmingham Park. Maintenance recommendations for tree stands were based on arborists' judgments of what task was most needed to improve the health and safety of the stand.

The following parks were inventoried:

- Bell Memorial Park
- Bethwell House/Community Center
- Birmingham Park (grouping inventoried)
- Crabapple House
- Crabapple Park
- Hopewell House

The following tables, Tables 4 and 5, illustrate the maintenance needs of Milton's parks. Table 4 illustrates the priority and proactive maintenance needs of Bell Memorial Park, Bethwell House/Community Center, Crabapple House, Crabapple Park, and Hopewell House. Table 5 provides information on the priority maintenance needs for Birmingham Park only. Discussion of park maintenance needs follow.

Table 4. Priority and Proactive Maintenance Needs for Parks By Diameter Size Class (Birmingham Park Excluded)

Diameter Size Class (Inches)	Removal			Prune		Inspections
	High Risk	Moderate Risk	Low Risk	High Risk	RP Cycle	
1" - 3"	0	0	1	0	69	Perform inspections of high use areas frequently and medium- and low-use areas as needed and not less than monthly
4" - 6"	0	2	3	0	104	
7" - 12"	2	3	1	0	49	
13" - 18"	0	0	0	0	36	
19" - 24"	0	0	0	1	30	
25" - 30"	1	0	0	1	15	
31" - 36"	1	0	0	1	6	
37" - 42"	0	0	0	0	4	
>43"	0	0	0	0	2	
Total	**4**	**5**	**5**	**3**	**315**	**City-Wide Parks**

Table 5. Severe and High Risk Tree Maintenance Needs for Birmingham Park

Tree Maintenance Recommendations	Estimated Count	Inspections
Severe and High Risk Removals	23	Perform inspections of high use areas frequently and medium and low use areas as needed and not less than monthly
Severe and High Risk Cleans	50	
Total	**73**	

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Park Tree Removals

During the inventory of parks, including Birmingham Park, trees were recommended for removal with Severe, High, Moderate, or Low Risk. In parks, most (98%) of the recommended removals had Moderate and Low Risk associated with them mostly because of the assumed infrequency of location. In some cases, the tree may be an invasive, exotic tree. For example, Chinese privet was prevalent in parks and a recommendation of removal, regardless of its condition, was made. Severe and High Risk removals accounted for only 2% of the recommended removals in parks. These 27 removals should be performed immediately as they are probably located in higher use areas of parks and impact public safety the most. The removal of Chinese privet and other trees identified for removal with Moderate and Low Risk is important but should commence after all elevated risks have been addressed. The development of a plan for the eradication of Chinese privet should be a priority for Milton so that it does not overtake desirable woodlots and change the character of community parks.

Priority Pruning in Parks

In all parks, including Birmingham Park, few Severe and High Risk trees (53) were found that required priority pruning to correct a defective part(s). These trees required cleaning of their crowns to remove deadwood and hangers and were mostly found in higher-use areas of the park.

RP Cycle for Park Trees

Routine pruning is a proactive strategy for reducing the number of hazards in the tree population over time. Trees in all parks except Birmingham Park were assessed for routine pruning needs and assigned to a RP Cycle. It was found that most trees in parks were in need of small or large tree cleaning to improve structure and health and would benefit from pruning at least once every five years. Excluding Birmingham Park, the inventory found 315 trees in parks in need of routine pruning making the RP cycle for Parks inclusive of about 60 trees per year.

Inspections

Inspections are essential to unveiling potential problems with trees. Park trees, like ROW trees, should be inspected regularly and attended to as needed based on the inspection findings. High use areas should be inspected frequently and lower use areas no less than monthly. Any new situations that arise with trees should be added to the tree maintenance workload as appropriate.

In addition to locating new hazards, inspections are an opportunity to look for signs and symptoms of pests and diseases. Milton has a large population of southern yellow pines, a target for the SPB, a significant number of southern red oaks which are susceptible to oak wilt, and species that fall prey to gypsy moth and hemlock woolly adelgid. A brief discussion and an estimate of the percentage of inventoried park trees susceptible to key pests are found in Appendix C.

Forested Area/Tree Stand Management

Many of Milton's parks, Birmingham Park in particular, have rows or patches of forested areas. These forested areas or tree stands offer practical benefits. Forested areas prevent soil erosion, cleanse the air, buffer noise, counter the heat-absorbing effects of impervious surfaces, provide homes for wildlife, and offer the kind of recreational opportunities that many new businesses and homeowners look for in a community. These areas are truly a community asset and one of the reasons Milton maintains its rural character.

Management of forested areas has many challenges including vast acreages that require maintenance and the threat of invasive, exotic vegetation. To better manage forested areas in parks, the City should educate the public about park needs, inspect park trees and areas on a regular basis to locate High Risk situations, remove and prune trees with Severe and High Risk associated with them, protect valuable resources, and combat invasive, exotic vegetation.

Public Education

Education is often the first requirement of forested area management. The community's support and understanding of forested areas are critical to implementing a successful management program.

Priority Tree Removal and Pruning

Trees are living organisms and can and will fail without warning. When a tree with elevated risk is found in a park, expedient removal or pruning of it to eliminate any hazards is necessary. Because people linger in parks, the City should strive to find and eliminate tree hazards within community parks.

Proactive Maintenance

Frequent inspections of higher use areas and routine inspection of all areas in parks are necessary to ensure public safety and welfare. Use qualified staff to perform inspections. During inspections, look for deadwood, hangers, cracks, dieback, discolored foliage, and other conditions that signal changes in tree condition. Also, look for poisonous plants and monitor the encroachment or retreat of invasive, exotic trees and plants. If changes are noted during inspections, send qualified staff to perform work and abate the situation.

Routine pruning and young tree training pruning of landscape trees and trees in forested areas that receive higher use should reduce the potential for higher risk situations in the future. After priority removals and prunings are complete, a RP Cycle of landscape trees and trees in areas that receive pedestrian or vehicle traffic should commence and continue.

Protection

Proper management of forested areas requires more than just tree maintenance and regular inspections. Because forested areas are generally in lower use areas of parks, they are often more vulnerable to compaction and erosion by vehicles and people. Park facilities should be designed to ensure that parking, trails, and enhancements respect the trees. Allowing the soil to become compacted near trees will impact their health and longevity and increase surface stormwater runoff. In forested areas, protect and manage forest resources by:

- Designing high-use facilities and roads or trails to avoid fragile areas.
- Using dense plantings to control erosion and direct foot travel.
- Moving picnic facilities away from significant trees.
- Prohibiting parking underneath tree canopies.
- Aerating and mulching around trees near heavy-use sites.
- Closing areas on a rotating basis for rest and restoration and using education/signage to explain the closed areas.
- As necessary and based on planning, prohibiting vehicles to protect tree resources.
- Planting trees to reduce erosion.

Photograph 9. Chinese privet is an invasive, exotic plant that can overtake native plant communities. The City should develop a plan to combat this pest plant.

Invasive, Exotic Plant Management

Forested areas, especially if left unmanaged, are ripe for the invasion of invasive, exotic plants. Chinese privet is an example of an invasive, exotic plant that is asserting itself into community parks. Left unmanaged, it may displace desirable plants and animal species and change the character of the City.

Milton should develop a plan to manage invasive, exotic plants on public properties and educate private property owners about the threat of these plants. At the same time, the City must develop a plan to reforest. Even though invasive, exotic plants are harmful to the ecology of an area, they do provide canopy cover. A plan for removal of invasive, exotic plants should include reforestation initiatives.

The Georgia Exotic Pest Plant Council (GA-EPPC) provides a current list of exotic, invasive plants in Georgia (Georgia Exotic Pest Plant Council, 2012) and information about the management of these plants. Visit their website at www.gaeppc.org for up-to-date information about invasive, exotic plants in the state of Georgia.

Tree Planting

Planting trees is a worthwhile goal, but it is only half the story. Whether planting two trees in a park or front yard or a million in one city, the effort will come to naught unless the trees are selected and planted correctly.

Tree planting is not to be taken casually. Tree planting requires upfront planning and follow-up maintenance of those trees for years to come. Without 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:

- Think clearly about the purpose of the tree planting.
- Assess the site and know its limitations such as overhead wires, confined spaces, soil type.
- Select the species or cultivar that best matches the site conditions.
- Examine the trees before buying them; buy for quality.

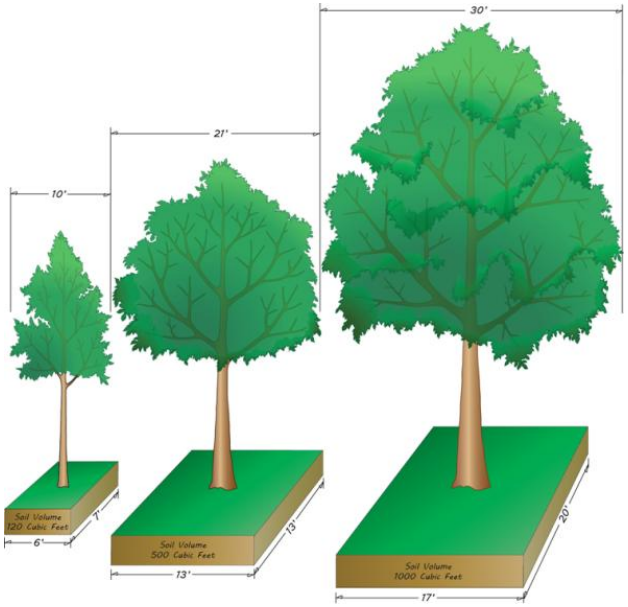


Illustration based on the work of Casey Trees, 2008.

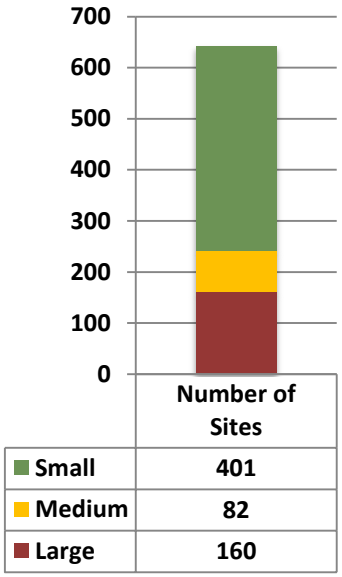


Figure 11. Number of vacant planting sites identified by mature tree size.

Inventoried ROW Planting Space

The goal of tree planting is to have a vigorous, healthy tree that lives to the limits of its natural longevity. That can be difficult to achieve in an urban growing environment because the soils there are typically poor and irrigation is limited. However, proper planning, planting, and follow-up tree maintenance will improve the chance of tree planting success.

The inventory found 643 vacant planting spaces with 62% of those sites being for small-sized mature trees (Figure 11), 25% for large-sized trees, and 13% for medium-sized trees. Small-sized trees were recommended where the growspace was either too small for a medium- or large-sized species or where overhead utilities were present.

Tips for Planting Trees

When planting trees for success:

- Handle trees with care. Trees are living organisms and, thus, are perishable. During transport and when loading and unloading, protect trees from damage. Use care and don't break branches or lift by the trunk.
- If trees are stored prior to planting, keep the roots moist.
- Dig the planting hole according to your climate. Generally, the planting hole is wider (two to three times) than the root ball and not quite as deep as the root ball. The root flair is at or just above ground level.
- Fill the hole with native soil unless it is undesirable. In that case, mix in soil amendments according to local conditions. Gently tamp and add water during filling to reduce large air pockets to ensure a consistent medium of soil, oxygen, and water.
- Stake the tree as necessary to prevent it from shifting too much in the wind.
- Add a thin layer (1 to 2 inches) of mulch to help prevent weeds and keep the soil around the tree moist. Do not allow mulch to touch the trunk.

Tree Species Selection

While the use of a limited number of species can simplify the decision-making process for landscape managers, careful deliberation and selection of a wide palate of trees can benefit all and save money. Planting a variety of species can decrease the impact of species-specific pests and diseases by limiting the number of trees that are susceptible in a population. This, in turn, reduces the time and money spent on mitigating problems resulting from any such episodes. Also, a wide variety of tree species may help to limit the impacts from a number of physical events such as strong storms, wind, ice, flooding, drought, etc. because tree species react differently to stress.

Appendix B lists tree species by height at maturity recommended for planting in the community. The list is based on the City's current tree planting list, and species diversity and i-Tree Streets analyses findings.

Discussion of Tree Species Selection

Davey recommends limiting the planting of crapemyrtle until the species distribution normalizes. Crapemyrtle already occupies 19% of the ROW, which is well in excess of the recommended maximum for a species (10% of the population). Also, based on the Streets analysis, crapemyrtle provides lower environmental and economic benefits to the community. Planting of other small-sized trees will increase species diversity and provide more benefits to the community.

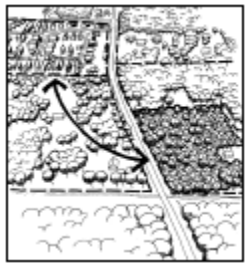
Planting of loblolly pine should be limited unless it is for timber farming. Like crapemyrtle, loblolly pine exceeds diversity standards comprising 15% of the ROW and 44% of the park tree populations. Also, it is a target of SPB. Adding more trees to the pine population will only make the potential for loss greater if SPB invades Milton's community forests. Planting a wide variety of hardwoods will help reduce the threat of SPB as the community forests will be more diverse.

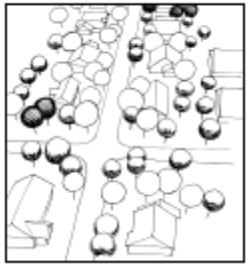
Strategic Planting for Milton's Community Forests

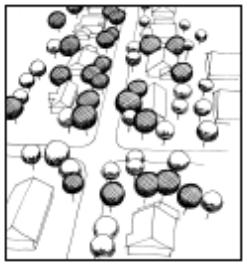
Through strategic tree planting, the rural character of the City can be preserved even with economic growth. The *Georgia Model Urban Forest Book* (Georgia Forestry Commission, 2001) suggests models for tree planting that apply to the community structure of the City of Milton including rural area, older suburb residential, and urban core. Diagrams on this page are from the *Georgia Model Urban Forest Book* (Georgia Forestry Commission, 2001).

Rural Areas

- Plant trees on public property to infill gaps in canopy.
- Encourage shade trees.
- Encourage landowners to plant trees in clusters, rows, or along fence lines to create windbreaks and maintain an agrarian feel.





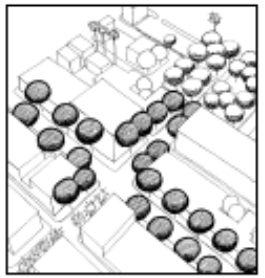


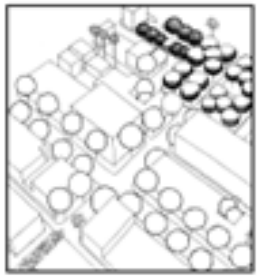
Older Suburb Residential

- Encourage homeowners to plant trees on private property.
- Require redevelopment/remodeling applicants to plant a minimum number of shade trees per lot.
- Infill gaps on public tree lawns with the largest sized tree possible for the growspace available.

Urban Core

- Plant street trees; provide large tree lawns to accommodate large-sized shade trees.
- Improve parking lots by planting shade trees.
- Require commercial development to plant a minimum number of shade trees.





Newly Planted and Young Tree Maintenance

Equal in importance to planting trees is caring for them after they are planted. After planting a tree, it must receive maintenance for years to come.

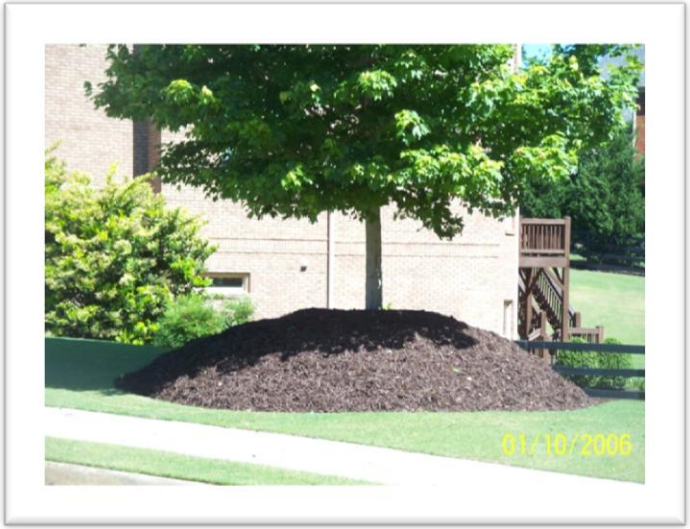
Watering

Initially, watering is a key to survival. New trees require water to establish. Determine how often to irrigate trees based on time of planting, drought status, species selection, and site condition. New trees typically require at least 60 days of cyclic irrigation to establish.

Mulching

Mulch can be applied to the growspace around a newly planted tree, or even a more mature tree, to ensure that no weeds grow, the tree is protected from mechanical damage, and the growspace is moist. Mulch should be applied in a thin layer, generally one to two inches, and the growing area covered. Mulch should not touch the tree trunk or be piled up around the tree.

During the inventory, it was noted that several trees were improperly mulched. Almost all of the willow oaks planted along Deerfield Parkway had excessive amounts of mulch mounded around their trunks. In some cases, the mulch had decayed into an organic soil, promoting conditions for the formation of girdling roots. Davey suggests that any mulch piled up around a tree should be spread out into a thin layer over the growspace and moved away from the trunk.



Photograph 10. Mulch piled too deep and touching the trunk of the tree will harm and may eventually kill the tree. Davey suggests that any mulch piled up around a tree should be spread out into a thin layer over the growspace and moved away from the trunk.

Young Tree Training Pruning

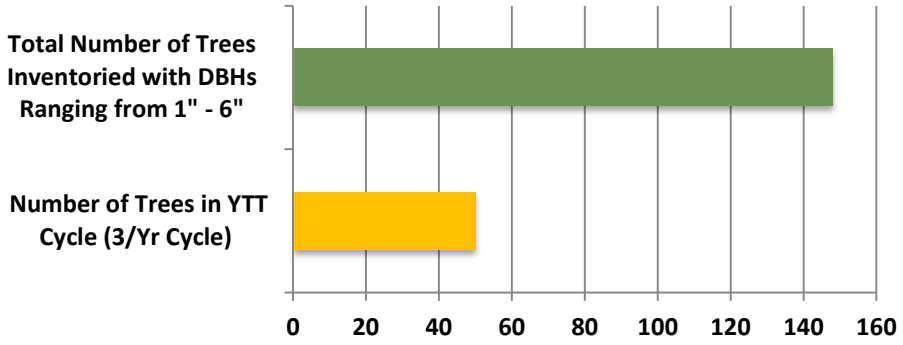
After the tree is established (generally one or two years), young tree training pruning (structural pruning) should begin to improve form and remove codominant stems and diseased or crossing branches. Davey recommends that the YTT Cycle includes all young or newly planted trees with canopy heights less than 25 feet.

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 and the objective of pruning is to increase structural integrity by pruning for one dominant leader. Of course, this is species-specific since many trees such as river birch (*Betula nigra*) often have more than one leader. For these trees, young tree training pruning is used to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree.

Three-Year City-Wide YTT Cycle

For Milton, the YTT Cycle recommended is three years in length. It should commence after all Severe and High Risk trees are removed or pruned. The YTT Cycle will include existing young trees and newly planted trees. During the inventory, 148 trees less than 6-inch DBH were inventoried and 129 trees were recommended for planting each year. Since the number of young trees present is relatively few and the benefit of beginning the YYT Cycle is great, Davey recommends that all 148 trees be structurally pruned during the second year of the program. Also during Year 1 of the program, 129 trees were recommended for planting. If accomplished, these newly planted trees will enter the YTT Cycle in Year 3 and, thus, the projected structural pruning needs for Year 3 will equal the number of trees planted in Year 1. During Year 3 of the program, no trees were scheduled for young tree training prune. The number of trees in the YTT Cycle during Year 4 will increase as annual new tree plantings and any trees from the first year of the Cycle that have not matured enough to leave this cycle and enter the RP Cycle will need to be pruned again.

In future years, the number of trees in the YTT Cycle will be based on tree planting efforts and growth rates of young trees. The City should strive to prune approximately one-third of the City's young and newly planted trees each year.



	Number of Trees in YTT Cycle (3/Yr Cycle)	Total Number of Trees Inventoried with DBHs Ranging from 1" - 6"
Number of YoungTrees	50	148

Figure 12. Trees included in the YTT Cycle.

Community Outreach

Much data about the community's trees and greenspace have been collected and analyzed for the development of this Plan. That data provides important information to the City about its tree resource and the proactive management of that resource. However, in addition to aiding in City tree management initiatives that data can also be utilized to promote the value of community forests. Milton can utilize:

- Tree inventory data to justify needed priority and proactive tree maintenance activities as well as tree planting and preservation initiatives.
- Tree benefit analysis results to convey the environmental and economic benefits of community forests in dollars and cents. The results can also be used to demonstrate how trees impact the ecology of the community.
- Tree planting list to guide species selections and hopefully improve species diversity and limit the introduction of invasive species.
- Information in this Plan to advise citizens about the presence of threats to community trees such as SPB and EAB.
- Land cover assessment to show how the current composition of land cover types creates the rural feel the community enjoys and to encourage smart growth.

Various avenues for outreach exist. Maps can be created and posted on websites, in parks, or in business areas. Public service announcements can be developed. Articles can be written and programs developed about trees and the benefits they provide. Arbor Day or Earth Day celebrations can be magnified and signs can be hung from trees to show the contributions trees make to the community. Even contests can be created to make people aware that trees are important. It is a fact that because of trees we have the oxygen we need to breathe, shade to cool our neighborhoods, and canopies to stand under to get out of the rain.

Milton has the data to provide solid, meaning outreach about community forests.

Photographs 11 and 12. A community in Missouri uses tree tags along a park trail to communicate annual benefits trees provide to the community.

Inventory and Plan Updates

Davey recommends the inventory and Plan be updated so that the City can sustain its program and accurately project future program and budget needs. Davey suggests the following to update the inventory and this Plan:

- Conduct inspections of trees after all storm events. Record changes in tree condition, maintenance needs, and risk rating/risk in the inventory database. Update the tree maintenance schedule and acquire the funds needed to restore safety in the community forest. Schedule work based on risk.
- Perform routine inspections of public trees as needed. “Windshield surveys” of ROW and parks will help City staff stay on top of changing conditions in the community forest. Update the tree maintenance schedule and the budget as needed to efficiently perform any identified tree work. Schedule work based on risk.
- If the recommended work cannot be completed as suggested in the Plan, modify maintenance schedules and budgets accordingly.
- Update the inventory database as work is performed. Add new tree work to the schedule when work is identified through inspections or a citizen call process.
- Re-inventory the ROWs and parks in five to seven years. At this time, all data fields should be updated.
- Revise the Community Tree Management Plan and Key Policy Actions after five or seven years when the re-inventory has been completed.

Maintenance Schedule

Utilizing data from the 2012 City of Milton tree inventory, an annual maintenance schedule detailing the number and type of tasks recommended for completion each year was drafted. Budget projections were made by Davey using industry knowledge and public bid tabulations; actual costs were not specified by the City of Milton. A summary of the maintenance schedule is presented here and the complete table, Estimated Costs for Milton's Five-Year Community Forest Management Program: Park and Street Trees, can be found in Appendix D.

The schedule provides a framework for completing the inventory maintenance recommendations in five years. Use of this schedule can shift tree care methods from an on-demand system to a more proactive method of tree work.

The schedule of tasks and budget includes the ROW and Park inventory data and the priority maintenance tasks from Birmingham Park (stands data was not extrapolated and Moderate and Low Risk removals and pruning were not accounted for in the schedule or budget).

To implement the maintenance schedule, the City's tree maintenance budget should be no less than $85,000 for the first year of implementation and $65,000 the following four years. Annual budget funds are needed to make certain hazard trees are remediated and critical RP and YTT Cycles can commence. With proper professional tree care, the safety, health, and beauty of the community forest will be improved.

If routing efficiencies and/or contract specifications allow for the accomplishment of more tree work, or the schedule requires modification to meet budget or other needs, then it should be modified accordingly. Additionally, 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 to meet the new demands.

FY 2013 **$84,165**

- **43 Priority Removals**
- **38 Priority Prunes**
- **127 Moderate or Low Risk Removals**
- **YTT Cycle; 148 Trees**
- **129 Trees Recommended for Planting**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs TBD**

FY 2014 **$64,045**

- **RP Cycle 1/5 of Public Trees Cleaned**
- **4 Palm Prunes**
- **129 Trees Recommended for Planting**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2015 **$65,600**

- **RP Cycle 1/5 of Public Trees Cleaned**
- **129 Trees Recommended for Planting**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY 2016 **$65,505**

- **RP Cycle 1/5 of Public Trees Cleaned**
- **YTT Cycle 1/3 of Young Trees Structurally Pruned**
- **130 Trees Recommended for Planting**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

FY2017 $**64,725**

- **RP Cycle 1/5 of Public Trees Cleaned**
- **YTT Cycle 1/3 of Young Trees Structurally Pruned**
- **130 Trees Recommended for Planting**
- **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**

Conclusions

Milton is a mosaic of rural, agricultural, and residential uses with small pockets of commercial development. As a community on the outer bounds of urban sprawl, its rural character is unique. Past community planning and visioning have helped Milton maintain its character. In the future, the same approach must be taken.

The land cover types present and the pattern of community forests help define Milton as a rural community. Maintaining current land cover percentages through growth will be important to the preservation of the City's rural character. Policies that preserve existing forested areas and encourage tree planting that mimics forested settings and agrarian windbreaks and fills in gaps in existing canopy will help preserve Milton's character. The preservation of agricultural land uses and pasture land, especially for equestrian ventures, should be a priority as well.

If Milton chooses to develop an urban core, policy should require new and in-fill tree plantings to use soil amendments when needed and possibly utilize engineered systems, such as permeable pavement, structural soil, and suspended pavement and structural cells to advance tree growth and help manage stormwater runoff—an ever-growing problem in urbanizing areas. Redevelopment of older, suburban, residential areas could encourage in-fill tree planting through increased regulations on private properties and during redevelopment. City planning will need to keep an eye on Planned Unit Developments (PUD) as well and encourage them to preserve larger tracts of forest land.

Public education that promotes preservation and reforestation of forests will be important and, in fact, may be the most important part of Milton's effort to maintain its rural character. Only if an understanding of why trees and greenspace are important to the community, will they exist into the future.

For any community, a successful community tree management program assures that:

- Public safety is upheld through prioritized actions to reduce risk in the community forest.
- New trees are planted with a purpose, not as a stem count.
- All trees receive continued pruning, maintenance, and PHC so they have long, useful lives in which to provide plentiful environmental, economic, and social benefits to the community.
- Trees are treated and managed as assets, not landscaping.
- Quality, not quantity, is the goal of planning and implementation.

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Section 5: Key Policy Action

Tree Maintenance

- Provide for and/or increase the City's tree maintenance budget to no less than $85,000 for the first year of Plan implementation and no less than $65,000 for the following four years to ensure tree maintenance work identified during the 2012 tree inventory can be completed as planned.
- Provide extra budget funds for storms and emergency tree maintenance situations not identified during the inventory.
- Prioritize all tree maintenance based on assessed risk to increase public safety and reduce liability.
- Implement a routine pruning cycle to improve the safety and health of the urban forest for the long term.
- Outsource tree maintenance, including routine and structural pruning, tree and stump removal, and tree planting, to only TCIA accredited companies.
- Develop a management plan to combat Chinese privet, a Category 1 exotic pest plant ranked by the Georgia Exotic Pest Plant Council.
- Remove ash trees(*Faxinus*) from the tree planting list because EAB is an impending threat to the area.

Green Infrastructure

- Maintain at least 58% tree canopy to absorb rainfall and prevent erosion.
- Maintain at least 24% pasture and grass land cover types to promote stormwater infiltration and preserve the rural character of the City.
- Manage the creation of impervious land cover types so that the existing percentage of impervious surface, 13%, is not exceeded.
- Incorporate engineered systems designed to promote tree growth and manage stormwater into development codes.
- Encourage tree planting citywide. Advise planting trees in rows or clusters using large-growing species.
- Increase the minimum width of medians and tree lawns so that large-growing tree species and clusters or rows of trees can be planted more successfully.

Growth and Development

- Create a Tree Board that focuses on preserving the rural character of the City through urban forestry and land use considerations.
- Perform an urban tree canopy assessment using GIS, zoning, and land use data to increase the understanding of and planning for trees during growth.
- Create designs standards for street trees based on road type.
- Modify the Tree Protection Ordinance to encourage/reward well-planned growth as well as punitive fines for careless development.
- Consider a "no net loss" policy for trees for development.
- Revise codes to increase the minimum space allotted for tree planting pits/areas to contain at least 1,000 cubic feet of good soil.
- Develop tree mitigation areas and/or a tree mitigation fund to help plant trees during growth.
- Enhance public outreach programs to emphasize Best Management Practices (BMPs) such as proper pruning and mulching of trees.

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