TALLAHASSEE URBAN FOREST MASTER PLAN

GROWING WITH TREES

City of Tallahassee, Florida

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EXECUTIVE SUMMARY

From Tallahassee's hundreds of large historic specimen trees to its signature canopy roads where huge moss-draped oaks and pines completely engulf the roads, tree canopy in Tallahassee is an iconic, defining symbol of the city.

The dedication of citizens and city leaders and staff over the years has resulted in a long history of care for trees. Much work has been done to-date to protect and care for these important city assets. Regulations have been in place for many years to preserve or replant trees in development—there are multiple professional arborists on staff within the city, a tree planting program is in place, and there are a variety of funding sources used for planting and care.

But there is more work to be done. This plan was developed as a long-range plan of action in support of the city commission's four priorities (public safety, economic development, infrastructure planning, and quality of life), and builds on the foundation of tree management efforts already established.

Having completed an extensive planning process (see inset) in 2018, Tallahassee now has a better understanding of its urban forest's distribution, composition, challenges, and opportunities.

During this process, a future vision (shown below) was developed based heavily on community input and city priorities, that serves as the guiding tenet for this long-term strategic plan.

Plan Development Process

This plan produced multiple data-driven, sustainable urban forest management recommendations through the following steps:

- Conducting the city's first high-resolution urban tree canopy (UTC) assessment and analyses.
- Collecting a sample inventory of public trees.
- Calculating the types and values of tree benefits.
- Obtaining public and stakeholder input to clarify both existing challenges and future priorities (2 public meetings, 3 stakeholder meetings, survey, presentation to multiple groups).
- Undergoing an internal review of operations and policies in place.
- Utilizing the national urban forestry expertise of Davey Resource Group.

Vision for Tallahassee's Urban Forest

Tallahassee values its extensive tree canopy and will strive to ensure that current and future actions result in improved quality canopy with no net loss of quantity. In response to current growth and future changes, the city and the community at-large will work together in partnership toward an urban tree canopy that will be a high-quality, sustainable, and safe asset providing benefits to all citizens

A highlighting of findings from this development process (value of the urban forest, existing conditions, challenges, and key points gained from stakeholders and data) and subsequent recommendations for next steps follow.

The Importance of Trees in Tallahassee

Knowledge on tree canopy and street trees is important for many reasons. Trees within cities are a community asset and a critical component of city infrastructure. They provide a tremendous quantity of ecological and economic services, such as improving air quality, improving public health (both physical and mental), improving water quality, increasing property values, absorbing carbon, reducing energy costs, and moderating hot temperatures in urbanized areas.

Additionally, Tallahassee's tree canopy was repeatedly cited as one of the city's most iconic identifiers, with many attributing this as a reason they made Tallahassee their home.

- **Tallahassee's current canopy provides over $15.4 million in benefits each year.** This includes annually intercepting over 550 million gallons of stormwater, and removing 44,000 lbs. of carbon monoxide, 1.7 million lbs. of ozone, 270,000 lbs. of nitrogen dioxide, 34,000 lbs. of sulfur dioxide, and 690,000 lbs. of soot, dust, and other particulates that pollute the air. The tree canopy also saves the city, businesses, and residents the cost in energy of over 32 million kilowatt hours every year.
- **It is estimated that the city's street trees produce $4.3 million in benefits every year.** Using the city budget allocated for street tree maintenance, planting, and administration, a cost-benefit analysis reveals that **for every $1 the city invests in public trees, $10 in benefits are returned to the community.**

Many communities, after learning about the breadth and value of all the important services trees provide, often want to start planting more trees right away. However, to effectively and efficiently make long-lasting improvements, it is important to first accurately assess the state of the existing urban forest, establish goals for the future, and use this information to map out the most effective ways to move forward.

Tallahassee's Urban Forest Today

Urban tree canopy (UTC) cover is high, covering 55% of the land within the City of Tallahassee. This UTC percentage is higher than most cities in Florida, and higher than most cities of similar size nationwide. Between the 1950s until the mid-1980s, tree canopy cover increased overall as the city population grew and more land converted from agriculture to residential land uses. However, since then as the city's population grew at an even faster rate, tree canopy dropped from 61% to 55%, and land covered by hard (impervious) surfaces like buildings and roads grew from 9% to 17% (Figure 1).

Quality of canopy needs improvement. Despite the high quantity of trees and tree canopy in Tallahassee, a random sample inventory revealed that the majority of public trees are currently only in fair condition. Additionally, many of the tree species represented in the forest are short-lived, susceptible to storm damage, and/or invasive. Poor quality tree canopy equates to a short-lived canopy that is often costlier in the long run to care for. As the community works over the next few decades to improve the quality of tree canopy (and thus its longevity), Tallahassee may see a drop in overall canopy cover, but that is expected to correct itself over time.

Of the estimated 93,000 street trees under the city's care, only about 11% (downtown and along Canopy Roads) have been inventoried. This gap in data makes effective and proactive tree care difficult. Proactive care is crucial to longevity of existing tree canopy. Additionally, there are other trees under public care which have also not yet been inventoried, including trees in parks and on other public property.

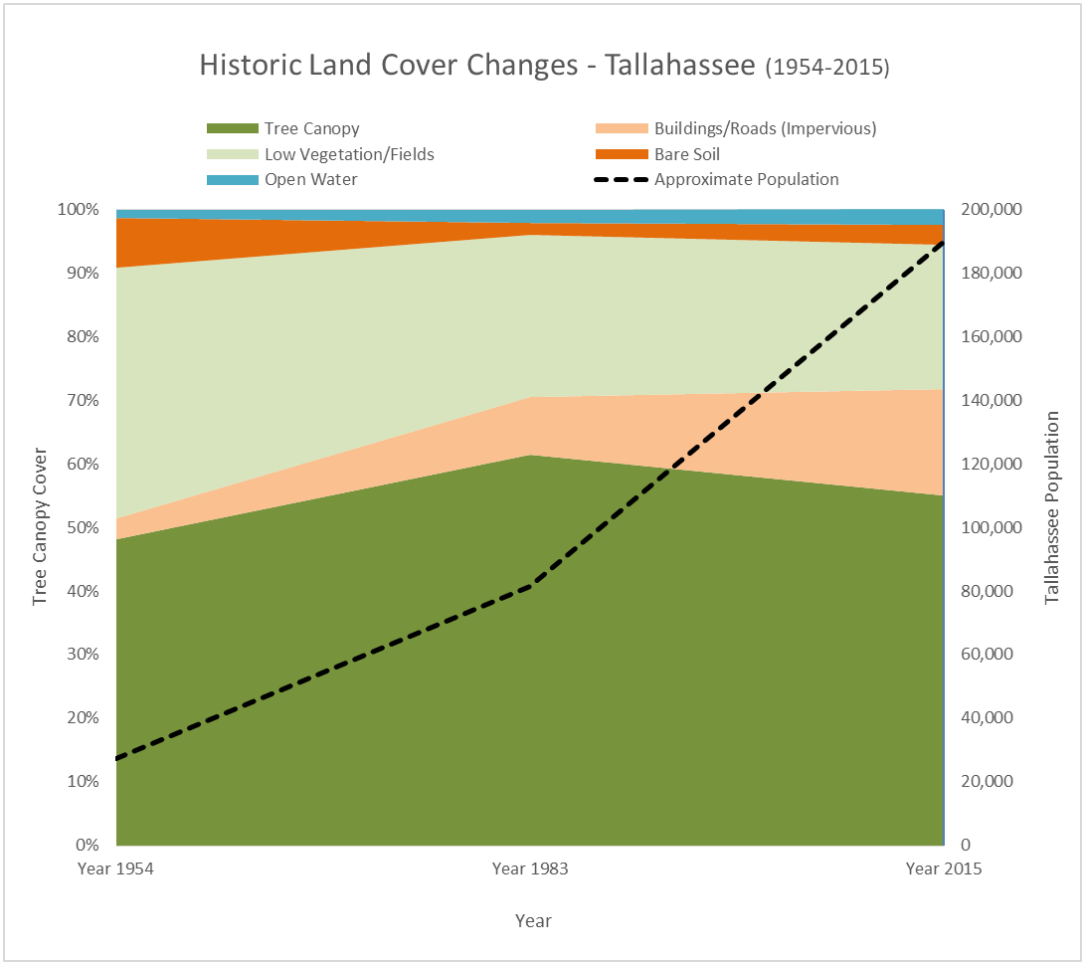

Figure 1. Historic land cover and population changes in Tallahassee.

The city has a strong structure in place to manage its urban forest, but additional resources and systems are needed to implement the proactive ongoing care required for long-term sustainability. Despite the dedicated professional staff and tree protection regulations currently in place, there were a number of significant gaps identified in solid management. There is currently no proactive tree maintenance program in place. This is largely due to lack of inventory data on public trees, combined with inadequate resources (staff and funding) to implement such a program. In addition, there is no risk management program, strategic planting plan, or *public* tree ordinance.

Many citizens and stakeholders value the urban forest in Tallahassee. Green industry groups, non-profits, educational institutions, and citizens expressed concerned for Tallahassee's urban forest and are involved with projects and efforts to improve it. They are currently doing so without a common set of goals.

Challenges are on the horizon. Although 55% of Tallahassee is covered with trees now, in the last few decades there has been canopy loss. And these losses may continue in the future for a number of reasons.

- The high percentage of short-lived species in today's canopy will result in future loss of mature trees through natural aging out of these "pioneer species" trees (which includes water oak, among others).
- The high percentage of invasive species will result in future loss of mature trees overall as steps are taken to incrementally improve species quality by removals of invasives over time (including the Camphor tree and mimosa, among others).
- Denser development in the city's core (termed the Urban Service Area) as Tallahassee continues to grow will change the composition of tree canopy in this area over time.
- Proactive care has been proven to equate to longer-lived tree canopy. However, current resources (staffing and equipment) are inadequate for instituting this type of program. Additional resources will be needed to more effectively enforce existing development regulation and policies related to trees, as well as to move to a proactive public tree care program.
- The increase in storms and climate change pressures will likely result in unavoidable canopy loss, though proactive care (mentioned above) has shown to substantially reduce instance of storm damage.
- The general public is not fully engaged or educated about the value of trees and proper tree care. As over 70% of land in Tallahassee is privately owned, and private landowners control 74% of all tree canopy currently in Tallahassee, participation in tree preservation and planting from the private sector is critical for preservation and improvement in tree canopy.

The Way Forward

Based on the vision set forth, three goals emerged that drive the subsequent 13 recommendations for action. This Urban Forest Master Plan contains both short- and long-term recommendations and action steps that Tallahassee can implement incrementally. The full report provides details on each recommendation, along with a description of the resources needed.

Goals and action steps are listed below.

Goal 1: Improve Canopy Quality	Goal 2: Maintain Canopy Levels	Goal 3: Engage the Community
Recommendations:	**Recommendations:**	**Recommendations:**
- Complete an Inventory of Public Trees and Transition to Proactive Management	- Officially Adopt and Incorporate Community Goals	- Develop a Team for Plan Implementation
- Evaluate and Update Tree Preservation and Planting Regulations	- Plan for UTC Update in Ten Years	- Define and Implement a Roll Out Plan to Maintain Momentum
- Create a Purposed-Based Planting Plan that Reflects City Goals	- Add a Preservation-Focused Message to Existing Disaster Communications Plan	- Expand Overall Communications
- Address the Challenge of Tree Availability at Local Nurseries	- Encourage Voluntary Tree Planting and Preservation on Private Property	- Get the Public Engaged to Improve Their Own Communities
		- Incorporate Trees into Tallahassee's Think About Personal Pollution (TAPP) Curriculum

Timeline and Measuring Progress and Resources Required. Upon completing a master plan, the next concerns often include how to pay for the implementation, verifying the equipment/software/personnel needed to complete the plan, and which recommendations should be prioritized. Work from each recommended action step has been inserted into a suggested 20-year timeline, along with suggested benchmarks to use to measure progress along the way.

Resources Required for Implementation. Not surprisingly, many cities cite their biggest impediment to implementing an urban forest master plan and sustaining a proactive tree care and planting program is funding. The level of adequate funding is ultimately defined by the cost to implement and maintain a proactive tree care program for a particular city. In Tallahassee, the determination of an adequate annual budget is very difficult without an inventory in place (inventory defines the workload; workload defines the budget). The current average annual urban forest management budget is approximately $510,000 across four departments for tree maintenance, planting, and management. Given this lack of data, two estimation methods to determine an ideal budget can be used. The first is a comparison to the urban forestry budget of peer cities. The second is to estimate needs of full inventory based on the 3% sample inventory completed during this project.

Table 1. City Budget Estimations for Proactive Tree Care

Current Budget	Required Budget Estimations	
	Method 1: Peer City Comparison	Method 2: Based on 3% Sample Inventory Data
$500,000	$1,370,000–$3,960,000	$1,170,000–$2,350,000

Numbers are rounded. More detail on each method can be found in the full master plan.

While both methods can only be viewed as rough estimates, the takeaway is that the current program is significantly underfunded. Additional funding sources are explored in the full plan, along with discussion of staffing and equipment needs.

Conclusion

Through the implementation of the action steps described in this urban forest master plan, the City of Tallahassee can continue to make progress toward improved management of the community forest, maintaining and improving the quality of the urban tree canopy both today and for future generations.

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CHAPTER I. INTRODUCTION

Tallahassee is known for its trees - from its hundreds of historic specimen trees to its nine signature canopy roads where the huge moss-draped oak, sweet gum, and pine fully engulf the roads. This iconic natural asset has given the city its green identity, and is a common reason cited for making Tallahassee a home.

Almost anywhere you travel in Tallahassee and Leon County, you will be in the presence of scenic trees. The community has long valued its tree canopy, dating back to a catastrophe in the 1840s when a fire destroyed over half the city, including most of the existing trees. Seeing the importance of this community asset, one of the first mandates city leaders issued in the aftermath of the fire was to replace the tree canopy. Now, almost 200 years later, residents and visitors alike are enjoying the rewards from their forward-thinking city leaders of the past (Hare 2002).

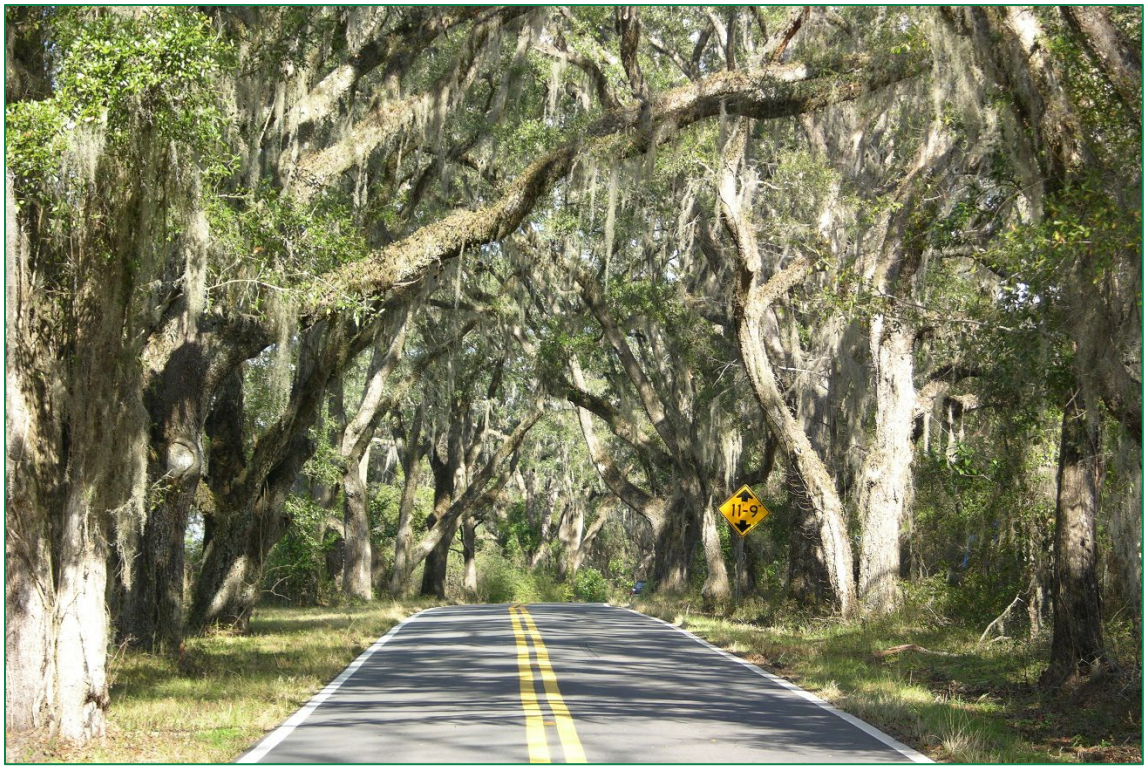
Today, over 55% of Tallahassee is covered by trees when viewed from aerial imagery. This tree canopy cover is considered city infrastructure and critical to the urban environment, as it is so closely linked to public health, neighborhood vitality, improvements in water/air quality, and keeping urban heat stress to a minimum, among many other benefits. In fact, Tallahassee's urban tree canopy provides an estimated $15.4 million in benefits every year - and these are just the benefits that can be currently quantified (benefits are detailed in *Chapter III: Why Trees*).

What is an Urban Forest?

All trees within a city or community comprise the urban forest. This includes trees on both public and private lands.

What is Urban Tree Canopy?

All land covered by trees (with leaves on) when viewed from above. Canopy cover levels are expressed in percentages, and is an important way of measuring the character, location, amount, and benefits of an urban forest.



Photograph 1. Canopy roads in Tallahassee.

Because of the high value of tree canopy as an urban asset, the city places a priority on caring for this resource - not just for today's residents, but for future generations as well. The City Commission's priorities call for focuses on Infrastructure Planning and Quality of Life and specifically cited the need for an urban forest master plan (City of Tallahassee 2018). This project is in response to the Commission's request. Work included the following:

- *Tree Canopy Cover Analysis/Sample Public Tree Inventory (Collection and Analysis).* This project includes Tallahassee's first ever high-resolution urban tree canopy assessment (UTC) which analyzed the amount of tree cover in the city based on 2016 aerial imagery. Canopy coverage was also determined for 1954 and 1983 to track overall historic trends. Additionally, a 3% sample inventory of public street trees was performed to provide preliminary information on the location, quantity, and condition of trees under the city's care.

- *Communitywide Input*. The community, including organizations, citizens, and city staff, were engaged in a number of ways to help assess the current local challenges and priorities, and to provide valuable opinions and insights about future management priorities and actions.
- *Review of Existing Policies & Programs.* All relevant policies, plans, programs, and regulations in place that impact, or are impacted by, the trees within Tallahassee were examined.
- *Industry Expertise.* This work was supported with urban forestry expertise provided by Davey Resource Group, Inc. "DRG" to ensure the community's current urban forest management program and its vision for the future will use the best practices available to manage this important asset.

The following seven chapters present and discuss the opportunities and challenges facing Tallahassee's urban forest, why trees are important, a community-driven vision, an assessment of the existing urban forest, and a list of 13 action steps recommended that the city and stakeholders take to work toward a managing a sustainable urban forest.

CHAPTER II. TALLAHASSEE'S URBAN FOREST TODAY

Tallahassee has a long history of valuing trees. Due to the past and current dedication and actions of Tallahassee citizens and city leadership, policies and programs to preserve and plant trees have been in place for many years and have contributed to one of the densest tree canopies in the nation. Clearly trees have been a priority in Tallahassee for generations, and a solid foundation has been laid for this plan to build on.

However, there are challenges that face our urban forest. Despite the current high quantity of tree canopy in Tallahassee (55%) and growth in past decades, a number of factors put the city at risk for future canopy loss, including the composition of the existing urban forest, a planning focus on denser urban development within the Urban Service Area, reactive management practices, increasing frequency of severe weather, and a public that may be less aware of the importance of this asset. The challenges to Tallahassee's urban tree canopy are discussed below in more detail.

Photograph 2. Water oak in Tallahassee.

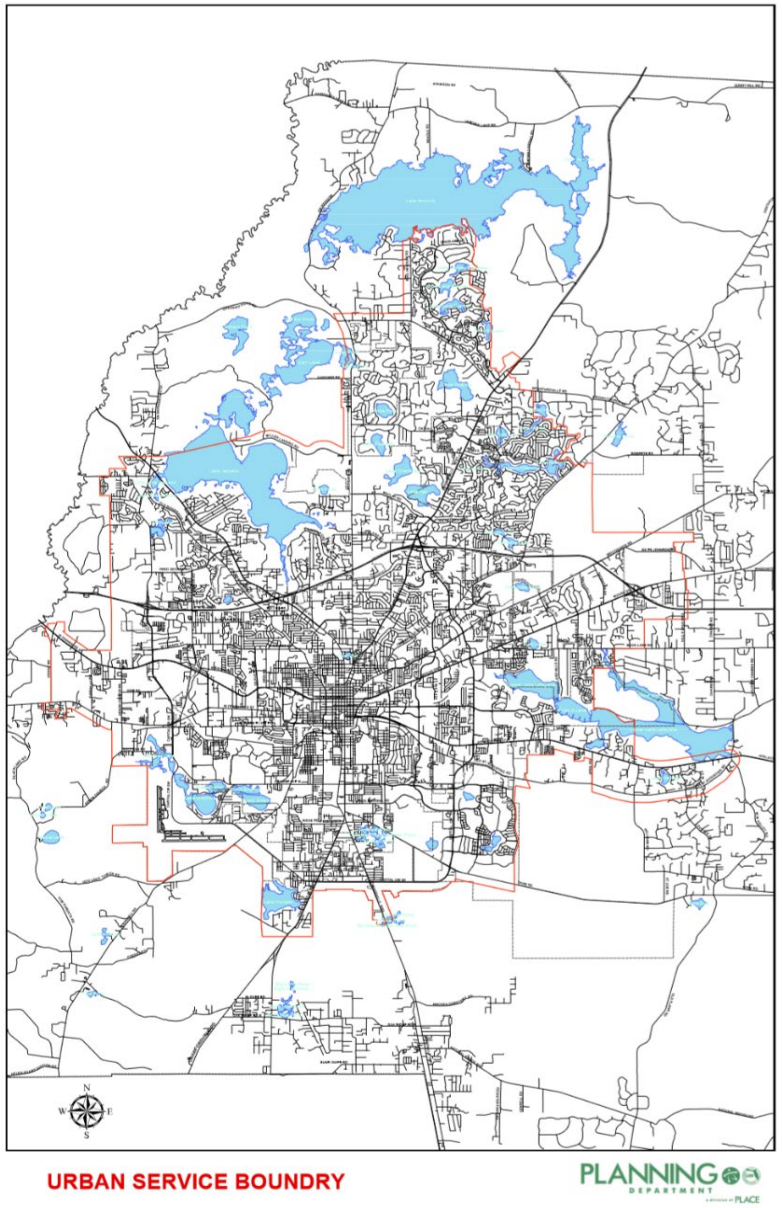
Tree Canopy Quality/Species Composition: *More recent areas of tree canopy growth consist primarily of short-lived "pioneer" and invasive species, both of which have undesirable characteristics and will require removal in the near future.*

Overall, canopy has increased over the years as land usage has changed from agricultural (which has very little canopy) to residential (where higher canopy is more typical). However, natural regeneration in these areas has not necessarily resulted in a sustainable urban forest. Many of the species that have appeared are "pioneer" species, like *Quercus nigra* (water oak, that grow quickly but often have weaker, more brittle wood and tend to be short-lived). Many of these trees in Tallahassee are now in the natural cycle of decline. This is often not apparent to the untrained eye and occurs due to decay of the interior of the tree.

Invasive species also take advantage of this new growth space (i.e., *Cinnamomum camphora,* the camphor tree). Because invasive, non-native species out-compete the more desirable native species, they are considered undesirable and should ideally be removed from the urban forest.

Urban Development: *Denser development is a focus for the more urban areas of Tallahassee.*

Tallahassee has experienced consistent population growth throughout its history, doubling in size from approximately 80,000 in 1980 to almost 190,000 today. Due to this growth, Tallahassee has focused on promoting denser development in the Urban Service Area to lessen excessive urban sprawl and the negative impacts sprawl brings to communities. This movement, defined in the Multimodal Transportation District plan, strives to improve quality of life in the long term by limiting urban sprawl which is considered one of the most inefficient uses of land (Tallahassee Comprehensive Plan Vision Statement). However, this focus on compact urban development will also mean changes to existing urban structure, including tree canopy. Pedestrian safety, bicycle access, and other amenities compete for space with trees. It is essential to maximize the benefits of trees through thoughtful tree placement and strategic preservation and removals. Ultimately, this will save more canopy in the city as a whole by reducing sprawl and the clear-cutting of large areas of trees that could occur in future suburban development.



Map 1. Tallahassee's Urban Service Area Boundary Map.

Management Approach and Available Resources: *Current management practices are largely reactive and inventory of public trees is lacking.*

City staff are very responsive to citizen requests and in emergency situations. However, insufficient staff and funding has led to a management approach that is primarily reactive. It has been shown in multiple studies that trees live longer and are healthier under a proactive management approach where care is provided before structural and disease issues become expensive and unmanageable (Miller and Sylvester 1981). Proactive care, however, requires information on all known public trees, and Tallahassee lacks a complete inventory. The lack of this data can lead directly to reduced longevity and quality of the existing and future canopy. Until the City of Tallahassee transitions to a more proactive management approach, trees are likely to continue to be shorter-lived then their potential and present a higher risk.

Photograph 3. Storm damaged tree after Hurricane Hermine.

Severe Weather: *There is a trend of increasing frequency of severe weather events.*

Because of the location near the coast, Tallahassee trees are especially vulnerable to severe weather events like storms, hurricanes, and drought. Over half of the population of public trees in the city are estimated to have either low or medium-low wind resistance, making them especially susceptible to damage in storm events. In the upcoming years, severe weather events are only expected to increase in frequency (National Climate Assessment 2014).

Regulations: *Though Tallahassee has been regulating tree protection and planting for many years, improvements can enhance the outcomes*.

One factor that has contributed to Tallahassee's extensive tree canopy is that a variety of regulations are in place for tree preservation, removal and replanting in development projects. Although tree protection and planting are addressed in the Land Development Code, the Code may not be producing the desired end results in some situations. Aspects of code would benefit from updates and adjustments to make the regulations a much more effective tool for protecting the city's urban forest resource.

Public Engagement: *The public is not fully aware or engaged in urban forest efforts.*

In terms of understanding both the value and benefits trees provide to the community and the care trees need (maintenance, planting, protection, removal), the public is not as aware or engaged as they could be. As 71% of land in Tallahassee is privately owned (estimated by land use types), and private landowners control 74% of all tree canopy currently in Tallahassee, participation in tree preservation and planting from the private sector is critical for realizing positive changes in the city's overall urban canopy. A public more aware of trees and tree care practices could then help ensure species diversity, connect urban forest corridors, and contribute to a stronger, more resilient overall forest able to withstand upcoming challenges, whether due to development growth or natural processes.

The multiple challenges described above require thoughtful action to prevent decreases and degradation of Tallahassee's valuable urban forest. Trees in Tallahassee support the quality of life and lessen city challenges and urban issues, such as managing stormwater, air quality, and decreasing urban heat. In fact, Tallahassee's tree canopy has been shown to provide over $15.4 million in ecosystem services and solutions to the city annually (detailed in the next *Chapter II: Why Trees*).

Should canopy losses occur, the environmental services tree provide to the community will decrease, and costs to the community to make up for those lost services will rise. Without trees and their ability to naturally provide solutions to urban issues, the costs to the city and residents will rise as additional, man-made replacement systems will need to be built to address worsening water and air quality, higher urban heat island fluctuations, drops in property value, deteriorating community structures, and more.

The City of Tallahassee recognizes these challenges and the importance of the urban forest to the community and is working toward a plan for its future. The following chapter details exactly why Tallahassee's urban forest is so valuable.

CHAPTER III. THE VALUE OF TREES IN TALLAHASSEE

Many cities are facing tight budgets, aging infrastructure, greater demand for social services, and increasing competition for limited city resources. So why should Tallahassee focus attention on trees?

First, trees can be directly and indirectly linked to projects and initiatives that achieve all of the Commission's Priorities of public safety, economic development, infrastructure planning, and quality of life in the city. Properly planted and maintained trees have been shown to reduce crime, improve employee relocation and retention, provide valuable stormwater mitigation services, and strengthen neighborhood and community identity (NRDC 2013, EPA 2014).

Second, due in large part to new technologies and scientific modeling in recent decades, the role of trees in cities is finally starting to be seen for all the critical services they provide—beyond simply aesthetics. By incorporating the results of the most recent urban tree canopy assessment into the i-Tree modeling tools, it has been shown that Tallahassee's urban tree canopy provides $15.4 million in benefits every year (Table 2).

Table 2. Annual Benefits from Tallahassee's Citywide Urban Forest

Benefits of Existing Urban Forest in Tallahassee			
Benefit	Quantity	Unit	Value
STORMWATER: Reduction of runoff	549,761,652	gallons	$1,266,651
AIR: Carbon monoxide removed	43,805	pounds	$29,104
AIR: Nitrogen dioxide removed	271,563	pounds	$27,733
AIR: Ozone removed	1,718,752	pounds	$1,332,376
AIR: Sulfur dioxide removed	33,820	pounds	$1,480
AIR: Particulate matter removed	688,235	pounds	$2,149,489
ENERGY: Electricity savings	31,857,720	kilowatt hours	$1,115,022
CARBON: Sequestration	270,173	tons	$9,525,055
		Total Annual Benefits	**$15,446,910**
CARBON: Storage over lifetime of the canopy	4,373,961	tons	$154,205,624
PROPERTY VALUE: Increased lifetime value			$172,945,923

As larger trees provide the majority of benefits (see *The Case for Preservation* inset), it is important to ensure the longest life span possible for each tree by making sure it is the right tree species planted in the right place. Improving canopy quality means increasing the populations of long lived, more desirable tree species and thus maximizing the benefits these trees provide.

Each benefit that Tallahassee receives from its tree canopy is described in more detail below.

Urban Trees Reduce Pollution Entering Waterways. As cities grow, the amount of land that naturally absorbs rainwater (i.e., lawns, parks, fields, woods) tends to shrink, while hard surfaces that cause rain to runoff (i.e., roads, buildings, parking lots) increase in area. After flowing over roads, parking lots, and lawns, rainwater accumulates fertilizers, oil, chemicals, grass clippings, litter, pet waste, and other contaminants. This contaminated stormwater flows into man-made sewers, ultimately reaching the local lakes and streams.

Trees intercept, absorb, and slow rainwater, all of which play a major role in reducing the amount of stormwater that enters sewer systems. In fact, one mature deciduous tree can intercept over 500 gallons of rainwater a year, while a tree that holds leaves all year round (e.g., pine, magnolia) can intercept up to 4,000 gallons per year (Seitz 2008).

Tallahassee's existing tree canopy intercepts over 549 million gallons of stormwater each year (equivalent to over 830 Olympic-sized swimming pools). This service is valued at $1.3 million annually to the city. Loss in canopy cover will directly equate to loss in stormwater intercepted and require additional capacity from man-made water treatment systems (or will result in polluted water entering local waterways).

Urban Trees Reduce Energy Costs. Demand and costs for energy are rising, with heating and cooling accounting for approximately half of residential energy bills (Department of Energy 2015). Florida's hot climate exacerbates this energy need.

The Case for Preservation

It is no surprise that larger trees provide more services to the community. They intercept more stormwater, remove more air pollution, provide more energy savings, and sequester more carbon.

It is important to understand that this increase in services is exponential. Preservation of large trees should be a high priority for communities wherever possible.

Consider the air pollution benefits alone: large healthy trees (30"+ DBH) have been shown to remove 70 times more air pollution a year than small healthy trees (less than 3" DBH) (Nowak 2002).

Consider comparing the number of new trees it would take to replace the services provided by one mature tree. Ten to twenty-four new swamp white oak (3" DBH) would be needed to compensate for the benefits lost from the removal of just one mature swamp white oak (*Quercus bicolor,* 30" DBH) (National Calculator 2015). *

Because part of Tallahassee's vision is to maintain and enhance the services trees provide to residents, prioritizing care for existing trees (over planting new trees) is a critical piece of this effort.

** Exact replacement equivalent depends on the specific tree benefit to be matched.*

Trees provide energy savings by reducing cooling and heating costs, both through their shade as well as emissions of moisture. In fact, the cooling effect of one healthy tree is equivalent to 10 room-sized air conditioners operating 20 hours a day (North Carolina State University 2012). The shade of properly-placed trees can save homeowners up to 58% on daytime air conditioning costs, while mobile homeowners can save up to 65% (Smith 1999).

Tallahassee's tree canopy saves nearly 31.9 million kilowatt hours in electricity, for an estimated cost savings of over $1.1 million annually.

Urban Trees Alleviate Heat Stress. Due to the urban heat island effect, urban areas without trees often experience temperatures 15–25°F hotter than nearby, less developed areas. Heat stress has been proven to cause significant public health problems and even mortality. In fact, each year, more Americans die from extreme heat than all other natural disasters combined (i.e., hurricanes, floods, tornadoes, lightning) (EPA 2015).

Those over 65 or under age 5 are especially vulnerable to heat-related health problems, and these two age groups account for 14.3% of Tallahassee residents.

Urban trees are widely accepted as one of the most effective long-term solutions to reducing the effects of urban heat islands. Tree canopy can lower ambient temperatures by 20–45°F (EPA 2015).

Urban Trees Remove Carbon Dioxide from the Air. Most of the carbon dioxide (CO_2) in the atmosphere comes from human activities that involve the burning of fossil fuels. High levels of CO_2 result in climate issues, which has resulted in more frequent and severe storms, droughts, and other natural stresses across the country in recent decades.

Photograph 4. Live oaks draped in Spanish moss. McCarty Park is part of the Chain of Parks.

Trees are constantly removing and storing carbon dioxide from the atmosphere. One single large tree is able to absorb as much as 48 pounds of carbon dioxide (CO_2) per year; one acre of trees stores the same amount of CO_2 released by driving an average car for 26,000 miles (Megalos 2015).

In Tallahassee, trees sequester 270,000 tons of carbon each year, and store an additional 4.4 million tons over their lifetimes. This sequestration service is valued at $9.5 million annually, while the lifetime benefit of the city's trees' carbon storage service is estimated at $154 million.

Urban Trees Clean the Air. Air pollution creates significant public health issues. Ozone and particulates can especially aggravate existing respiratory conditions (like asthma) and create long-term human health problems (American Lung Association 2015).

Trees can remove up to 60% of street-level air pollution, including carbon dioxide, ozone, nitrogen dioxide, sulfuric dioxide (a component of smog), and small particulate matter (i.e., dust, ash, dirt, pollen, and smoke) (Coder 1996).

Chronic Lower Respiratory Disease (CLRD) is a group of diseases that block airflow to the lungs, such as emphysema, chronic bronchitis, and asthma. CLRD is the third leading cause of death in Leon County according to the latest county community health assessment. Asthma is one of the most common chronic conditions in children, and hospitalization rates have been increasing since 2002 (FL Department of Health).

Tallahassee's urban forest removes almost 2.8 million pounds of air pollutants every year, a service valued at over $3.5 million. Loss in canopy would have significant impact on air quality and thus public health.

Urban Trees Boost Property Values. Trees increase residential property and commercial rental values by an average of 7% (Wolf 2007). This is beneficial to both the property owner and the city budget's bottom lines. Property values increase, and properties sell faster since communities with trees are more desirable places to live.

In Tallahassee, trees increase total property values by almost $173 million.

Urban Trees Improve Public Health. Trees have been shown to create healthy environments for people by improving air quality and reducing heat island effects. New York City saw a significant decrease of asthma in young children (-29%) after increasing its tree canopy through the installation of over 300 trees for each square kilometer (Lovasi et al. 2008).

Studies have also shown that individuals with views or access to greenspace tend to be healthier; employees experience 23% less sick time and greater job satisfaction, and hospital patients recover faster with fewer drugs (Ulrich 1984). Trees have also been shown to have a calming and healing effect on ADHD adults and teens (Burden 2008).

Urban Trees Mean More Successful Business Districts. Studies have shown that tree-covered commercial shopping districts are more successful than those without canopy. In multiple studies, consumers showed a willingness to pay 11% more for goods and shopped for a longer period of time in shaded and landscaped business districts (Wolf 1998b, 1999, and 2003). Consumers also felt that the quality of products was better in business districts surrounded by trees and were willing to pay more (Wolf 1998a).

Urban Trees Make Streets Safer and More Walkable. In an age where walkability and pedestrian-friendly areas tend to draw the most people, tree cover is a powerful tool in revitalizing districts and neighborhoods.

Urban trees have been shown to slow traffic and help ensure safe, walkable streets in communities. Traffic speeds and driver stress levels have been reported to be lower on tree-lined streets, contributing to a reduction in road rage and aggressive driving (Wolf 1998a, Kuo and Sullivan 2001). According to the Federal Highway Administration, tree canopy along a street discourages speeding (U.S. Department of Transportation 2015). The buffers between walking areas and driving lanes created by trees also make streets feel safer for pedestrians and cyclists.

Urban Trees Build Stronger, More Vibrant Communities. Tree-lined streets can create stronger communities and attract new residents. While less quantifiable, the tree benefits related to community building are no less important than other services. One study showed that residents of apartment buildings surrounded by trees reported knowing their neighbors better, socializing with them more often, having a stronger community, and feeling safer and better adjusted than did residents of more barren, but otherwise identical areas (Kuo and Sullivan 2001).

Photograph 5. The Chain of Parks – Park Avenue.

Urban Trees Can Contribute to a Decrease in Crime. Recent studies have shown that tree-lined streets have been linked to lower crime. A study in Baltimore found that a 10% increase in tree canopy was associated with a roughly 12% decrease in crime. It has also been shown that outdoor areas populated with trees tend to suffer from less graffiti, vandalism, and littering than their treeless neighbors (PHS 2015).

Urban Trees Provide Essential Wildlife Habitat. Trees are an essential component to habitat and conservation in urban areas. They intercept and clean large quantities of polluted stormwater, preventing further degradation to vital aquatic and terrestrial habitats. Additionally, as smaller forests are connected through planned or informal urban greenways, trees provide essential habitat to a range of birds, pollinators, and other wildlife that feed on insects (Dolan 2015). A healthy wildlife population indicates a healthy place for people to also live.

Urban Trees Provide Buffers for Noise and Pollution. Pollution and noise from busy roadways and rail lines can create unhealthy and undesirable conditions for those living nearby (ALA 2015). Buffers of trees reduce both noise and pollution. A 100-foot-wide, 45-foot-high, densely-planted tree buffer can reduce highway noise by 50% (NC State 2012).

The following chapters present the information and foundation for the Urban Forest Master Plan's recommendations.

To Keep in Mind

Many communities, after learning about the breadth and value of all the important services trees provide, often want to start planting more trees right away. However, to effectively and efficiently make long-lasting improvements, it is important to first accurately assess the state of the existing urban forest, establish goals for the future, and use this information to map out the most effective ways to move forward.

CHAPTER IV. DETERMING VISION AND GOALS TOGETHER

Before determining the city's next steps, a shared vision for Tallahassee's future needed to be developed. Without having determined a clear vision and defined goals related to urban forestry beforehand, it is difficult for a community to work together toward real progress.

Vision Developed from Community Input. Since over 70% of the tree canopy in Tallahassee is privately-owned, the goals for the future must be determined with input from all stakeholders, including city staff, residents, businesses, and community organizations. For this reason, a substantial part of the development of this plan involved collecting input and priorities from stakeholders throughout the Tallahassee community. This work involved significant data collection and analysis, and an extensive outreach and engagement effort to city staff and departments, citizens, organizations, and companies with a stake in the urban forest, and is described below.

- **Input from Organizations and City Staff.** Over 30 stakeholder organizations were engaged through a series of three meetings and 15 one-on-one interviews. Topics discussed included the current conditions of the urban forest, current management approaches (which were also compared to industry standards and best practices work throughout the country), challenges facing the community, priorities for the future, and potential solutions. These groups are listed in Appendix A. In addition, the Tallahassee-Leon County urban forester spoke to a number of groups throughout the process, such as the Canopy Roads Citizens Advisory Committee, Tallahassee Builders Association, Sustainable Tallahassee, Council of Neighborhood Associations (CONA), Leon County Master Gardeners, Capital Area Neighborhood Network (CANN), Chamber of Commerce, Tallahassee Trust for Historic Preservation, and the League of Women Voters, and more. These meetings are still ongoing.

Photograph 6. Urban Forester Mindy Mohrman speaks to a Sustainable Tallahassee group about the urban forest master plan (March 2018)

- **Input from the Citizens.** Two public meetings were held to present the current conditions to the community, get a sense of community values and goals related to trees and tree cover in Tallahassee, and brainstorm solutions to some of the challenges brought up by the public. An online survey was also available for 4 months. A summary of input from the public is included in Appendix B.

- **Data Analysis.** This public input was combined with data from a new urban tree canopy (UTC) assessment and a 3% sample inventory of street trees (both discussed further in *Chapter V: State of the Urban Forest*), as well as a review of existing plans and policies in place, including development code and city processes related to trees.
- **Urban Forestry Expertise.** Finally, DRG, the city's consultant for this project, also brought experience and knowledge in urban forestry management and national best practices to the process to guide the community's priorities and further discover existing conditions and gaps (see *Chapter V: State of the Urban Forest*).

Photograph 7. First of two public meetings held to get community input on issues and priorities related to Tallahassee's tree canopy. Jack L. McLean Community Center (March 2018).

Photograph 8. Second public meeting to discuss tree canopy challenges and solutions. Frenchtown Renaissance Center (March 2018).

Resulting Vision and Goals

The information gleaned from all of these efforts was used to create the vision for the future of Tallahassee's urban forest.

Urban Forest Vision Statement:

Tallahassee values its extensive tree canopy and will strive to ensure that current and future actions result in improved quality canopy with no net loss of quantity. In response to current growth and future changes, the city and the community at-large will work together in partnership toward an urban tree canopy that will be a high-quality, sustainable, and safe asset providing benefits to all citizens.

This vision for the urban forest is aligned with Tallahassee's City Vision and will be the foundation for framing next steps over the next 20 to 30 years.

Overall City Vision

"Tallahassee, Florida, is a city that remembers its past while focusing on the future – a vibrant capital city: fostering a strong sense of community, cherishing our beautiful natural environment, and ensuring economic opportunities for all our citizens."

Critical Success Factors/Goals

From this Vision, critical success factors, or goals, have been determined that are also aligned with the broader overarching goals of the city (see inset).

Goal 1: Improve Canopy Quality
Improve the quality and safety of the urban forest to ensure long-term sustainability.

Goal 2: Maintain Canopy Levels
Maintain an extensive tree canopy on public and private lands in balance with growth and change.

Goal 3: Engage the Larger Community
Engage and partner with the larger community urban forestry efforts.

CHAPTER V. STATE OF THE URBAN FOREST

Together with defining goals, existing conditions of the trees within the city must also be assessed. This involves more than simply determining the extent of tree canopy cover. It is also important to consider the *quality* of urban trees, the key players effecting the urban forest, and how trees are currently being managed. Additionally, local challenges to urban forest management and whether the urban forest of Tallahassee is sustainable are important factors to consider.

This chapter explores these questions in three categories - the trees themselves, the players active in or impacting the urban forest, and the current management approach to caring for the urban forest.

Summary of Results

Of the 27 indicators of a sustainable urban forest (see inset) that were examined, Tallahassee rated Moderate in 67% of them (18 indicators) and 22% Good (6 indicators), and only 11% (3 indicators) rated Low, as shown in Table 2. A concise summary of the assessment results for each of the three categories is below, followed by more detail in subsequent sections.

Defining a Sustainable Urban Forest

For the purposes of this plan, the concept of sustainability is defined as the ability to maintain the urban forest for some time into the future without compromising the ability of future generations to do the same (Clark 1997). In practice, a sustainable urban forest is a forest that is diverse, with species that are well suited to site conditions, insect and disease resistant, and low maintenance. A tree population meeting these criteria is sustainable, resilient, and produces maximum social, economic, and ecological benefits for the community.

There are several components that can help determine whether an urban forest is sustainable: establishing if the urban forest is healthy enough or of high enough quality to remain functioning with minimum care; ensuring the financial requirements for maintaining the urban forest is realistic for years to come; and verifying that the value of the urban forest is understood by all local players that actively impact trees in Tallahassee.

There are different methods for defining, evaluating, and assessing the health and sustainability of an urban forest. Because urban environments are human-made, a true assessment requires looking beyond just the tree data. Survival of an urban forest relies greatly on human activity. For this reason, an urban forest assessment must include both social and economic components.

To assess Tallahassee's urban forest, Davey Resource Group utilized a combination of James Clark's Model of Urban Forest Sustainability and Andy Kenney's Criteria and Indicators for Strategic Urban Forest Planning and Management. This system, customized to meet Tallahassee's unique needs, rated the city's performance level in 27 "indicators of a sustainable urban forest," broadly categorized into three groups: The Trees, The Players, and The Management Approach. Each indicator received a low, moderate, or good performance level rating, as shown in Table 3.

This assessment used the city's recently-completed urban tree canopy data (UTC, completed as a part of this project) and a 3% sample inventory of trees on public lands, along with feedback from interviews and meetings with organizations, the general public and city staff to assess the existing urban forest.

The Trees: Moderate Performance Rating. Looking at just the trees themselves, Tallahassee rated primarily in the Moderate performance category. Urban tree canopy is high (55% overall tree canopy, which is almost 80% of what has been determined as possible) and is fairly well distributed across all areas of the city. The city, however, does not have a full inventory of public trees, which is a considerable gap in critical knowledge, as all work to care for and manage these trees should be based on this data. A 3% sample inventory was completed as part of this project, and from this sample effort it appears that age, condition, and diversity levels are close to ideal city-wide, though this cannot be determined by neighborhood (where it matters most). Additionally, in terms of suitability, 58% of trees sampled were in conflict with overhead utilities and 3% were in conflict with sidewalks. Trees with the highest wind resistance represent only 22% of the population, while trees with low or medium-low wind resistance represent 53% of the trees in Tallahassee. Invasive trees represent 7% of the population, and Carolina cherry laurel and water oak (both short-lived and not wind-resistant species) represent 15% and 10% of the population, respectively. All these factors point to potential and significant natural tree canopy losses in coming years.

Table 3. Summary of Assessment Results

Indicators of a Sustainable Urban Forest in Tallahassee		Assessed Performance Level		
		Low	Mod.	Good
The Trees	Urban Tree Canopy			■
	Size/Age Distribution		■	
	Condition of Public Trees – Streets, Parks		■	
	Species Diversity		■	
	Trees on Private Property		■	
	Suitability		■	
	Equitable Distribution			■
The Players	Neighborhood Action		■	
	Large Private & Institutional Landholder Involvement		■	
	Green Industry Involvement			■
	City Department/Agency Cooperation			■
	Funder Engagement		■	
	Utility Engagement		■	
	Developer Engagement		■	
	Public Awareness		■	
	Regional Collaboration		■	
The Management Approach	Tree Inventory		■	
	Canopy Assessment			■
	Management Plan	■		
	Risk Management Program	■		
	Maintenance of Publicly-Owned Trees (ROWs)	■		
	Planting Program		■	
	Tree Protection Policy		■	
	City Staffing and Equipment		■	
	Funding		■	
	Disaster Preparedness & Response			■
	Communications		■	

The Players: Moderate Performance Rating. When examining the many players that impact the urban forest in Tallahassee, the result was again primarily at the Moderate level. Many groups were determined to be engaged (green industry, funders, regional entities, large landholders), but without a well-known and widely-accepted citywide goal, many organizations are working on their own toward their individual goals/priorities. Neighborhood engagement levels vary greatly, as does the public awareness of the importance of trees. The community is at the beginning stages of working together in this urban forestry effort. This plan was a solid step in improving community engagement.

The Management Approach: Moderate Performance Rating. Compared to the other two categories, there were more challenges identified in the management approach category, primarily due to the lack of complete inventory data and management plan. Inventory data are the backbone of effective tree management. There are efforts already underway to begin a systematic and ongoing inventory of public trees. At this time, however, Tallahassee only has detailed inventory data on 11% of street trees (mainly along canopy roads and within the downtown area). This lack of inventory data for the remaining 89% of the public trees hinder the creation of a data-driven, operationally-based management plan, risk management program, and proactive maintenance programs, which are core components of progressive urban forestry programs. Tree care is currently almost totally reactive (request-based) in nature. Additional resources (funds, staff, equipment) will be needed to implement a proactive management program. On the positive side, a full tree canopy assessment was just completed and now provides valuable canopy cover data. Tree protection policies exist, though are not as effective as they could be (detailed in the following sections). Tree planting is consistently funded and implemented each year but is done primarily on a request basis and is not based on any larger city goal (no goals in place currently). A quality and a robust disaster management plan is in place. Communication was consistently brought up as a concern throughout the public engagement process - both between city departments and between city and residents.

More detailed findings on each of these categories are detailed further in the following sections.

...The Trees Assessment (MODERATE)

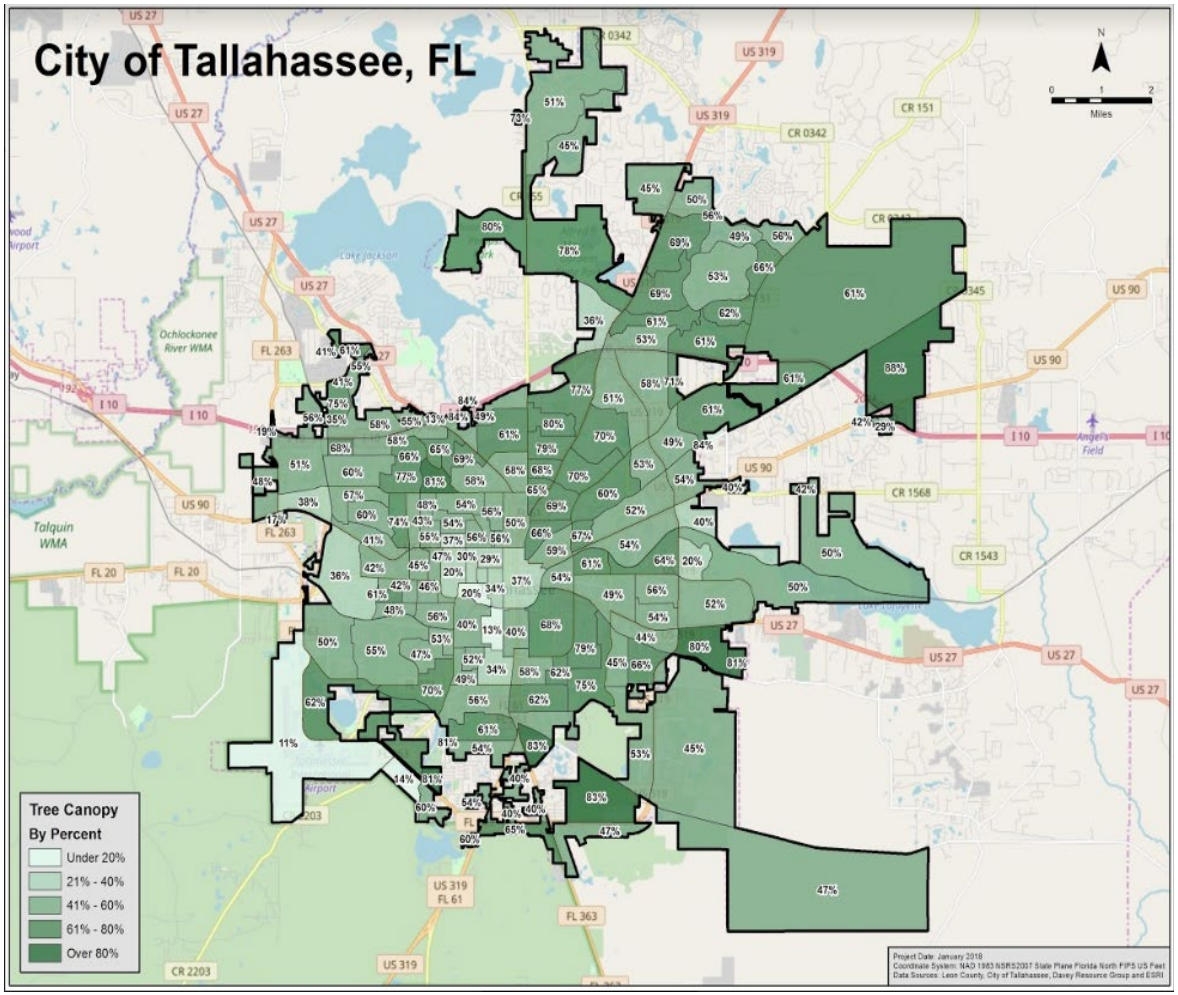
Assessing the trees in Tallahassee involves examining both the overall tree canopy across the entire city (public and private trees) as well as just the public trees managed by the city. More detailed findings and highlights of the tree resource assessments follow:

OVERALL TREE CANOPY

Urban tree canopy (UTC) is high, covering 55% of the land within the City of Tallahassee.

Map 2 shows the canopy cover broken down by each census block in Tallahassee.

The UTC also projected how much canopy is actually possible throughout the city. It was estimated that a total of 71% tree canopy cover is possible in Tallahassee if all plantable areas were indeed planted (methodology for this estimate can be found in the appendix). It can then be said that Tallahassee has achieved 79% of what has been determined as total possible tree canopy. This is known as "relative tree canopy" cover.



Map 2. Tallahassee Urban Tree Canopy Percentage by Census Block.

There is no currently established city canopy goal by which measure progress. This UTC percentage is higher than most cities in the same region of the country, as well as most cities of similar size.

Table 4. Urban Tree Canopy Compared to Other Cities

City, State/Province	Existing Canopy		Canopy Goal		Population	City Size (Square Miles)
	UTC Cover	Year Assessed	UTC Cover	Target Date		
Tallahassee, FL	55%	2015	-	-	190,894	103
Atlanta, GA	48%	2008	Increase	Ongoing	472,522	134
Charlotte, NC	47%	2012	50%	2050	842,051	298
Gainesville, FL	47%	2015	-	-	131,591	63
Pittsburgh, PA	40%	2011	60%	20-year plan (2031)	303,625	58
Jacksonville, FL	38%	2002	Increase	Ongoing	880,619	747
Tampa, FL	32%	2011	-	-	377,165	175
Boston, MA	29%	2006	49%	2016	673,184	90
Baltimore, MD	20%	2007	40%	2036	621,849	92
Philadelphia, PA	20%	2011	30%	15-year plan (2025)	1,568,000	142
Miami, FL	20%	2016	20%	Ongoing	453,579	55

Canopy has increased overall since 1954, though losses have occurred since the 1980s and will likely continue without proactive care as community continues to grow. One of the reasons tree canopy is currently so high is that over past decades, Tallahassee has experienced great periods of growth - population has grown by more than 500% since the 1950s. Normally this kind of growth would be associated with losses in canopy, but it initially had the opposite effect in Tallahassee. This influx of people and business resulted in land that was previously agricultural in use (with very low canopy cover) converting to primarily residential uses (typically highest canopy covered areas). However, in recent years, as growth has continued and become more concentrated, tree canopy has begun to drop (see Figure 2).

Between 1954 and 1983, population more than doubled from just under 30,000 to just over 80,000 and tree canopy grew from covering 48% of the city to 61%. Impervious surfaces (roads, buildings) started to grow (3% to 9%) and low vegetation (fields) dropped (40% to 26%). These changes are likely due to the land use changes of agricultural land converting to residential land.

Between 1983 and 2015, however, while population continued to grow, doubling again from just over 80,000 to 190,000, canopy dropped from 61% to 55% and impervious surfaces grew from 9% to 17%. This reflects the further urbanization of the area and even faster growth in population.

Tallahassee continues to grow today, and growth requires change. Strategic preservation (not everything can or should be saved) of canopy in the coming years will be critical to maintaining canopy levels.

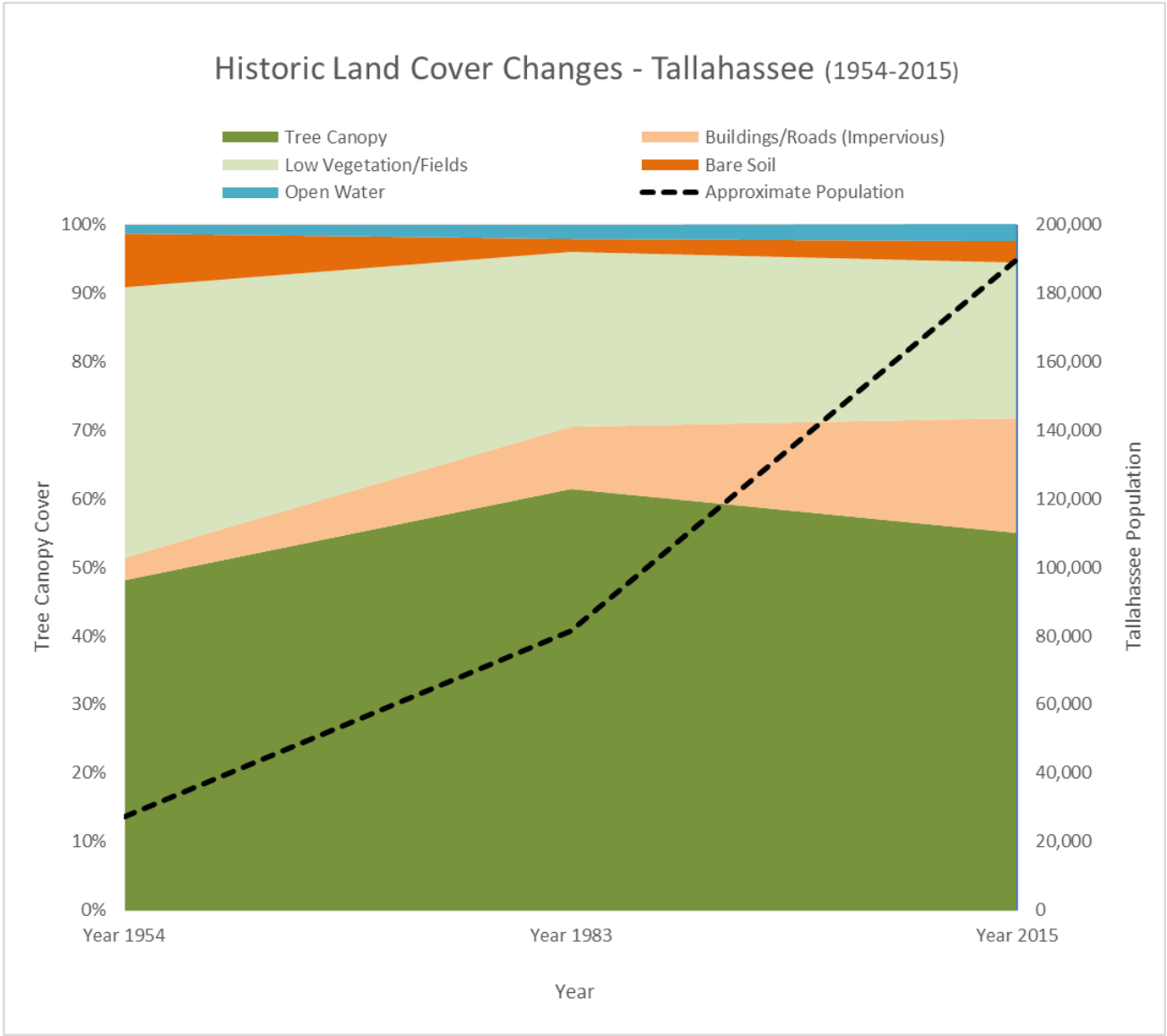
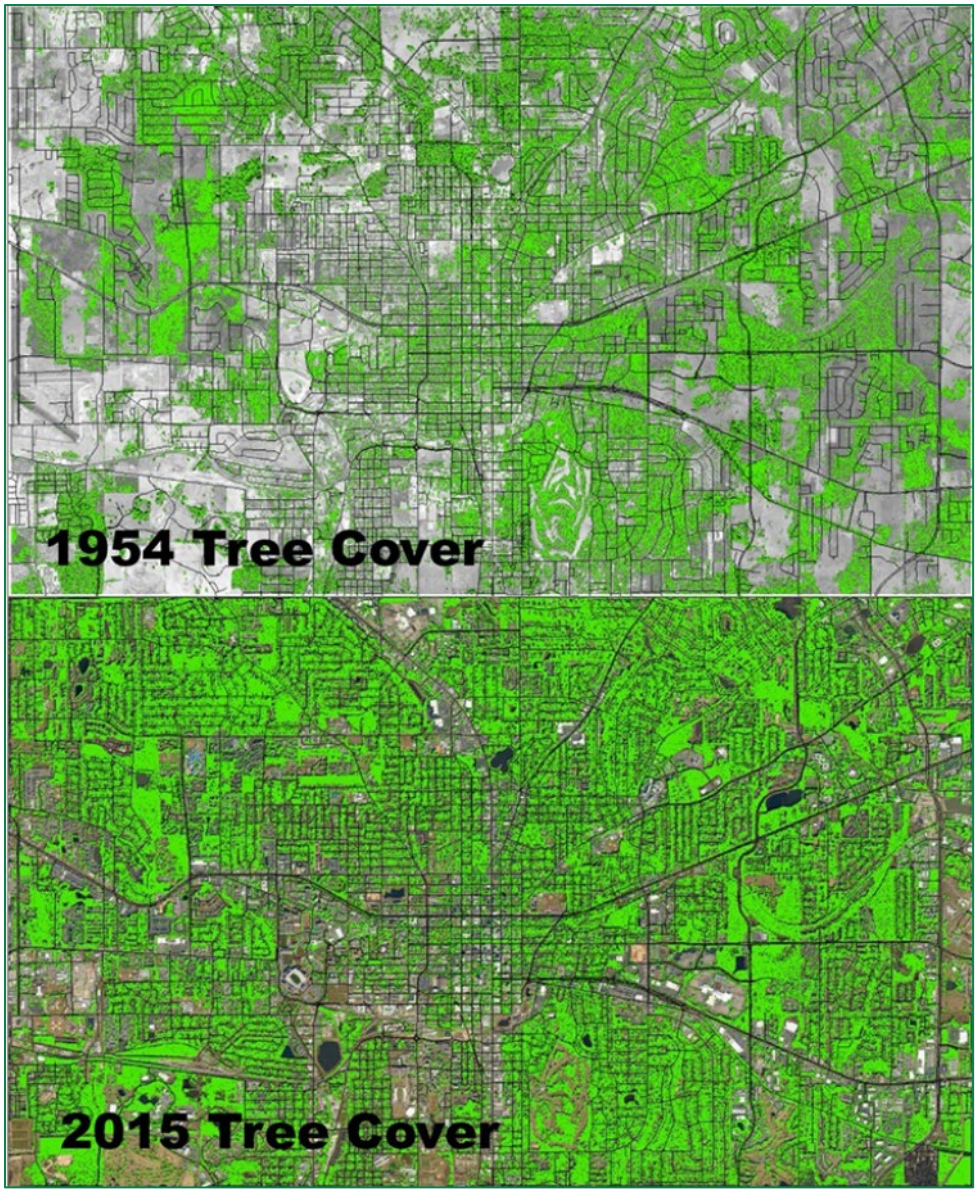


Figure 2. Historic land cover changes in Tallahassee.



Canopy is generally equally distributed across Tallahassee. Though the *quality* of canopy may differ across parts of the city, the *amount* of canopy across neighborhoods is generally equitable, though still shows slight tendencies of more affluent areas having higher canopy. This is important because, as mentioned in *Chapter III: Why Trees*, trees provide important benefits to the community. If all the canopy was located in only a few select areas of Tallahassee, those benefits would only be available to those select few.

The equity of canopy distribution and access to trees for all Tallahassee residents can be examined in a number of ways. First, the amount of canopy cover overall by census blocks was examined. The majority of census blocks (over 80%) have canopy between 20–69%, with the lowest block group (airport area) with 11% and the highest (a timber production area) at 87% canopy cover, as shown in Table 5.

Table 5. Canopy Cover by Census Blocks

Canopy Cover	Quantity of Census Blocks	% of Census Blocks
0–9%	0	4%
10–19%	6	
20–29%	5	81%
30–39%	10	
40–49%	27	
50–59%	44	
60–69%	34	
70–79%	13	15%
80-89%	10	

Canopy can also be studied by looking at the distribution based on land uses. As seen in Table 6 and Figure 3, canopy cover is lower in areas with more dense development such as commercial, industrial, government, and institutional land uses. As is common in many cities, the land use type with the highest rates of canopy cover is residential areas, which means that the benefits gained from the trees are concentrated in the areas where people spend the most time and will receive the most value.

Figure 3. Tree canopy cover by land use – acres and percent coverage.

Table 6. Canopy Cover by Land Use

Land Use	Total Acres	Canopy Cover
Commercial	7,779	40%
Industrial	2,298	43%
Residential	36,415	62%
Government	5,432	36%
Institutional	1,730	34%
Open Space	12,642	56%

Canopy can also be examined by various socioeconomic factors (derived from recent census data) to identify any further equity trends. Select highlights of these findings follow, with additional canopy trend charts found in Appendix J.

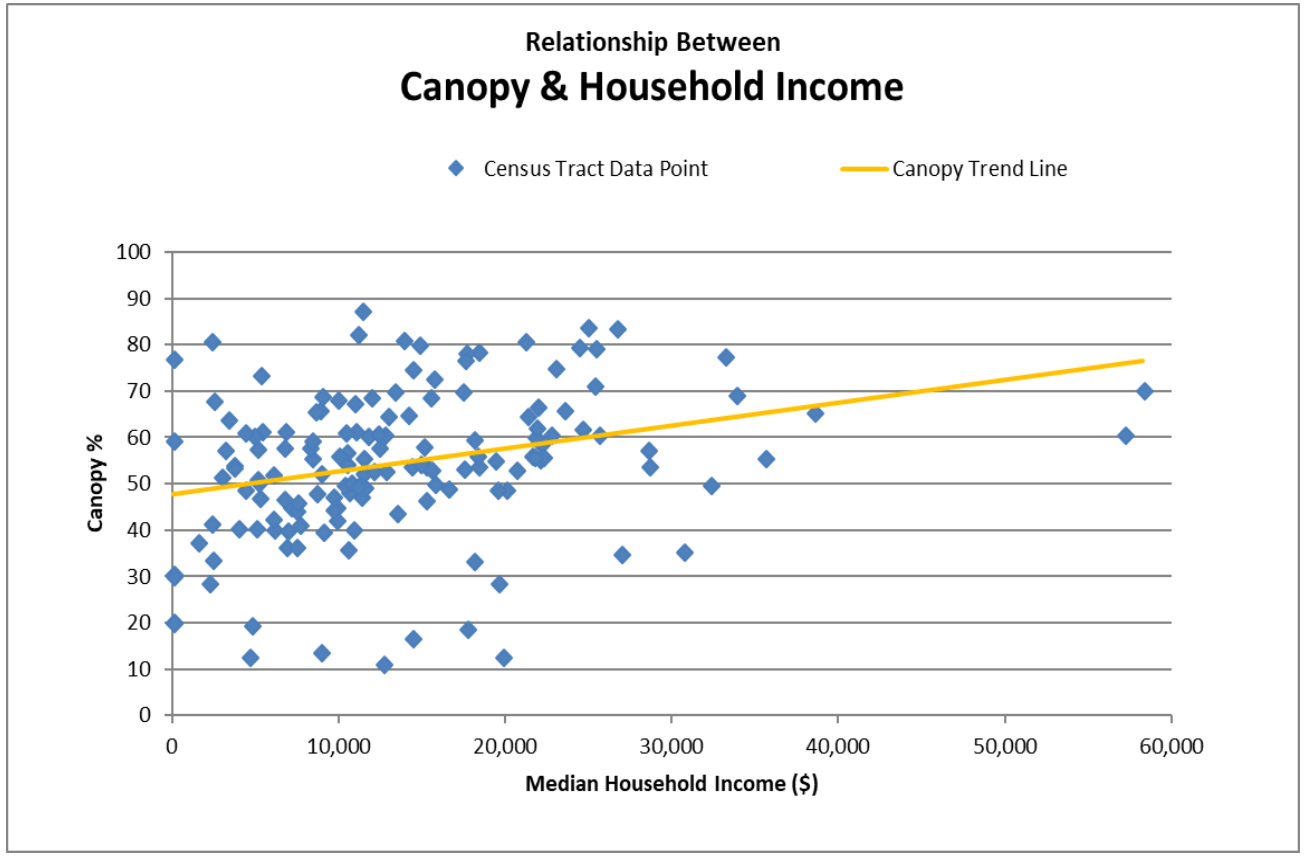


Figure 4. Urban tree canopy compared to median household income by census tract. More affluent neighborhoods have higher canopy. Trends showed higher canopies in areas with higher incomes and education levels.

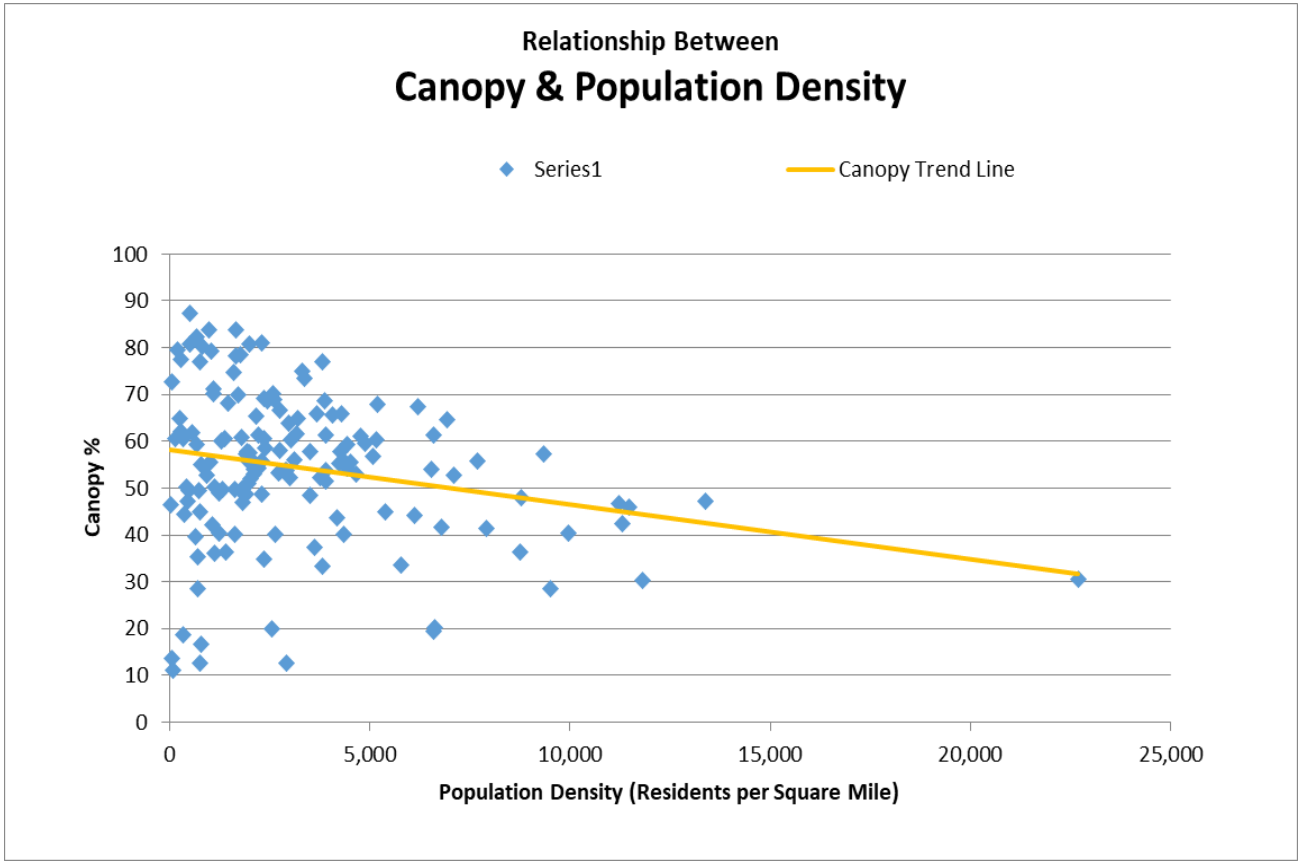
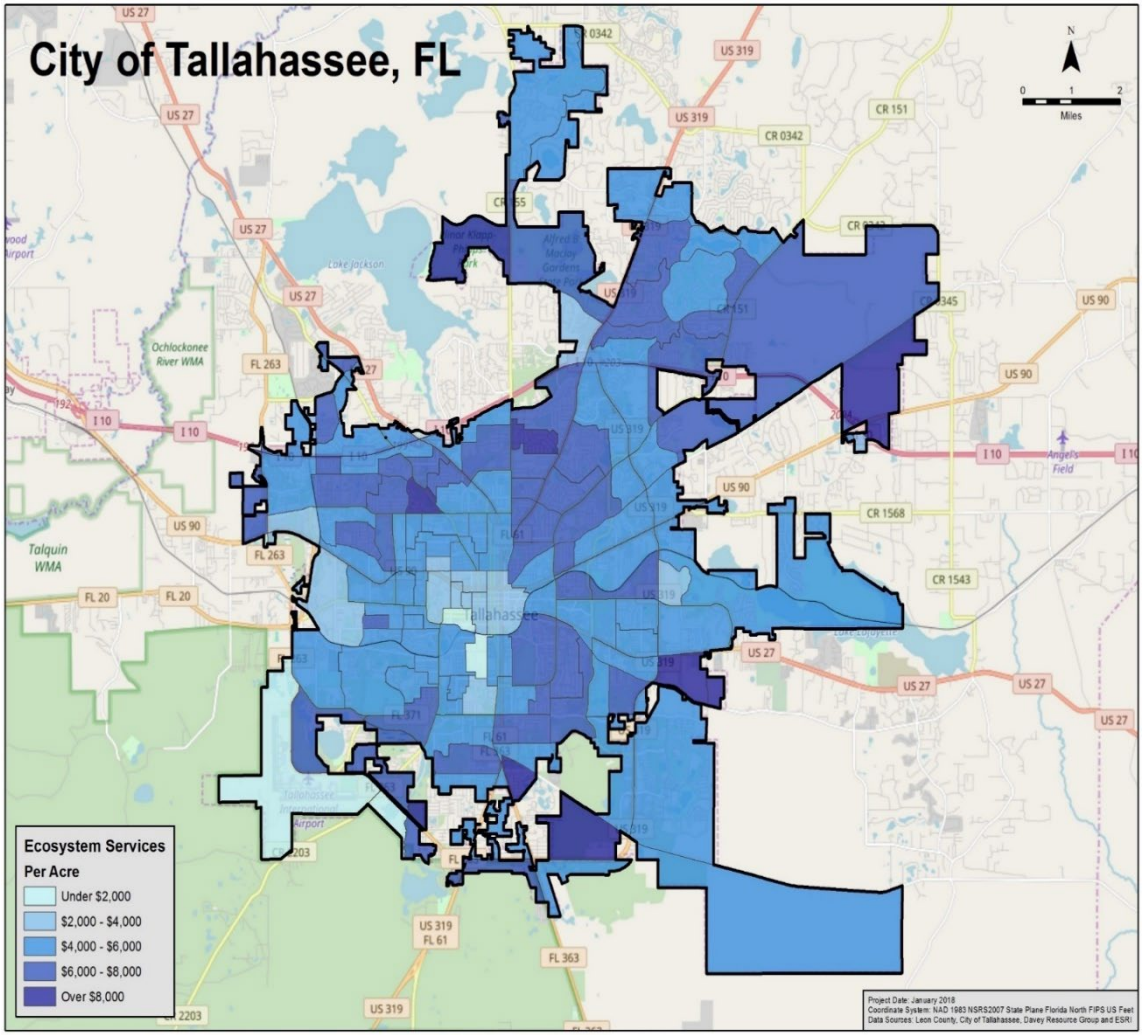


Figure 5. Urban tree canopy compared to population density by census tract. As population density in Tallahassee increases, canopy decreases. This is a common trend in developed areas.

Another way to examine whether canopy is equitably distributed across the city is to compare the quantifiable benefits of tree canopy cover (described in detail *in Chapter III: Why Trees*) in various areas of the city. When that data are calculated as an average value of benefits per acre, more significant gaps in equal access to tree benefits emerges.

Map 3 shows the average benefits value per acre by census blocks in Tallahassee. This ranges from under $2,000 in benefits per to acre to over $8,000 in benefits per acre available to residents. This is a significant variation in services among Tallahassee's neighborhoods.

While looking at canopy more closely by socioeconomic trends shows some inequality of canopy cover, examining the average value of benefits per acre shows a larger discrepancy. Improving equal access to trees and their benefits should be considered when planning future planting and preservation plans (detailed further in *Recommendation 3: Create a Purposed-Based Planting Plan*).



Map 3. Tallahassee Urban Tree Canopy Benefits Per Acre by Census Tract.

Publicly-Managed Trees

The city is lacking inventory data on public trees. Inventory data are used to inform many important urban forest management decisions and actions. The city has begun a comprehensive inventory project and set a target schedule to complete it using a combination of city and grant funding.

Currently, however, tree inventory data (information on the size, location, species, condition of each publicly-managed tree) are extremely limited. The only complete inventory data the city has is for street trees in the downtown area (2,900 trees) and along the canopy roads (6,400 trees).

It is estimated that there are approximately 93,000 streets trees and available planting sites (see inset for details on this estimation). This also excludes thousands more trees in parks and around public buildings for which no information is available on condition, size, species, and more.

This is a critical issue, as inventory data are required for any proactive and effective management of public trees. Inventory data are the primary data on which all urban forestry care and preservation activities are based.

Without this, proactive care is almost impossible, so the city should commit to securing future funding so the public tree inventory can be completed.

How Many Trees are Under the City's Care?

As a complete public tree inventory is not available, it is extremely difficult to know the precise number of existing trees and potential planting sites. This is important information to have for effective planning and budgeting. In absence of an inventory, estimates for street trees can be derived from the sample inventory and/or using professional estimates, and are explained below.

- *Extrapolating the 3% Sample Inventory Data*. Based on extrapolating the 3% sample inventory using i-Tree, it is estimated that citywide there are approximately 93,000 street trees and available planting sties in Tallahassee. The sample was statistically valid, and its findings reflected a unique situation in the city where many areas along streets are heavily wooded with many small-diameter, naturally-occurring trees, as opposed to the typical single landscape tree in front of one or two properties.

- *National Averages of Trees Per Street Mile*. There is an accepted average of 100 street trees and planting sites per street mile which is used by urban foresters to estimate the potential total number of tree sites in large, metropolitan U.S. cities. Combining that number with observations from the inventory, Davey Resource Group estimates that there could be between 90 and 100 trees on each of the city's 991 miles of streets, which further validates the estimate produced by the sample inventory.

Therefore, until a complete inventory is performed, the city can assume that there are between 90,000 and 100,000 street trees. For the purpose of this plan, and planning and budget considerations, the number of street trees will be estimated at 93,000.

The majority of public trees appear to be in fair condition, which is an unstable status. Knowledge and management of tree condition is important not just for the longevity of the trees but also for planning appropriate maintenance programs and addressing public safety issues. Based on the citywide representative 3% sample inventory, 82% of trees were recorded as in fair condition, while only 4% were in good condition. Trees in poor condition represent 11% of the population, while dead and dying trees make up the last 3%. The city should be keenly aware of the fact that the vast majority of public trees are in fair condition because this means that any number of stressors (i.e., climate change, construction damage, storms, insects, and disease) can quickly drop these street streets into the poor condition category, which may decrease their lifespans and benefits produced and increase maintenance costs and risk levels. However, with proper care, these fair trees could remain functioning or even improve to good condition.

The number of young vs. older trees is near recommended levels. Based on the sample inventory, it is estimated that over 65% of public trees are currently considered young, or 8 inches or smaller in diameter (diameter at breast height, or DBH). Having more young than mature trees is a best management practice to ensure a long-term canopy. However, many of the trees along rights-of-way in Tallahassee are more akin to naturalized woodland areas than traditional, individual street trees, so this may skew these numbers (See photographs 9 and 10). This is part of the reason that there are so many short-lived and invasive species estimated in the public tree population (thanks to natural regeneration). Working towards an urban forest populated with larger trees is also an important goal, as mature trees provide exponentially higher benefits (see *Chapter III: Why Trees*). As such, a balance of *tree planting and preservation of the longer-lived high-quality tree canopy is critical* to sustainable urban forest. See Figure 7 for Tallahassee's tree age distribution compared to what is considered the ideal.

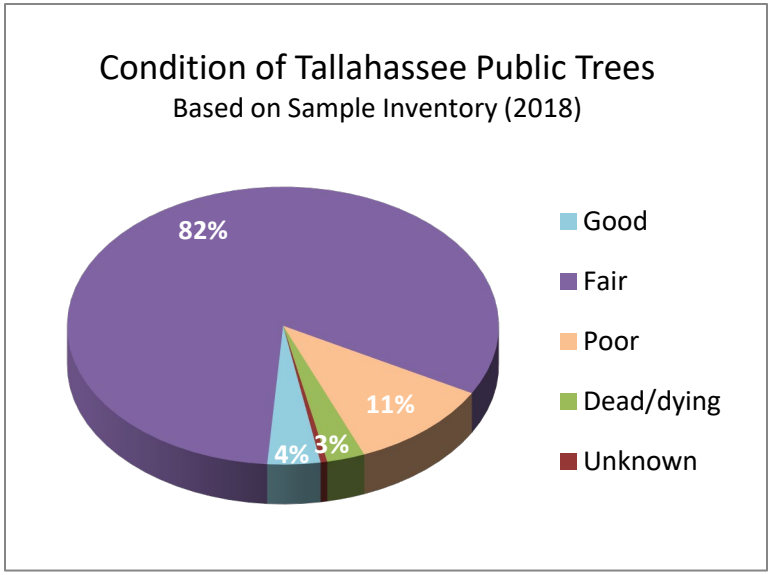


Figure 6. Street tree condition based on 3% sample inventory.

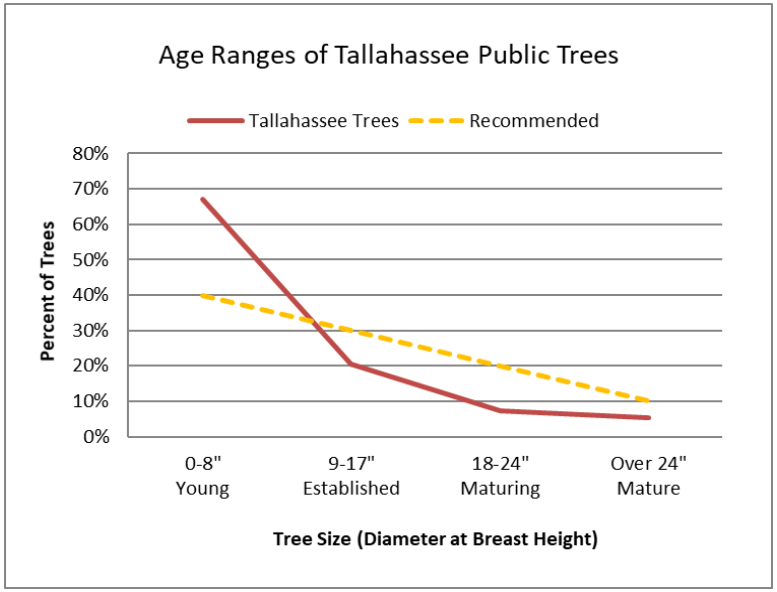


Figure 7. Age distribution of street trees based on 3% sample inventory.

Photographs 9 and 10. Trees along rights-of-way in Tallahassee vary in types greatly, from more traditional street tree layout of individual trees along an urban street (above left), to more naturalized woodland areas (above right).

Species analysis showed fair to good diversity levels but identified many invasive and short-lived species. This points to a lower quality canopy and future canopy loss. When examining the diversity of publicly-managed trees, not only is it important to have a wide variety of species, but also the desired species. Best management practices recommend that no one genus makes up more than 20% and no one species makes up more than 10% of the total public tree population.

- The genus *Quercus* exceeds the 20% maximum recommended level, representing 26% of all Tallahassee's public street trees. While this is higher than ideal, the oak is a signature species in Tallahassee, so this is to be expected and doesn't necessarily require corrective action.
- *Prunus caroliniana* (Carolina cherry laurel) (15% of all street trees) is the only tree species to exceed the maximum 10% level recommended for any one tree species. *Quercus nigra* (water oak) is just at the maximum recommended level of 10%. As this is a short-lived pioneer species (a tree that is first to regrow in a natural area), this points to changes in canopy in future years just due to its short life span.

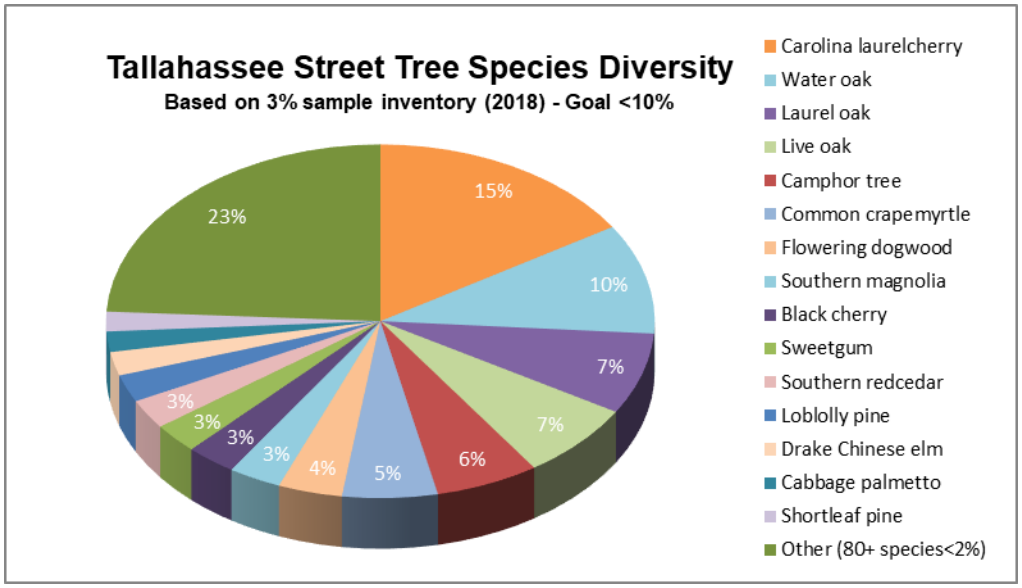


Figure 8. Tallahassee street trees species diversity.

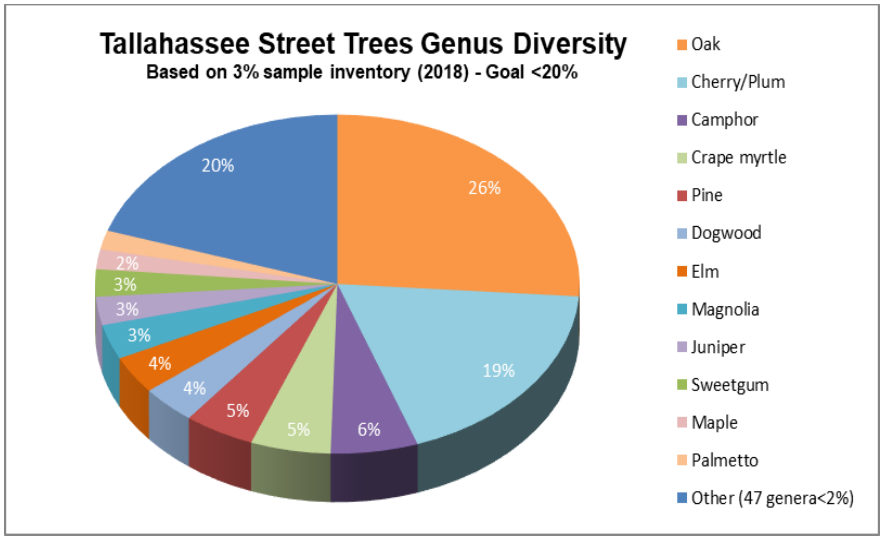


Figure 9. Tallahassee street trees genus diversity.

Photograph 11. Camphor tree (Source: IFAS).

However, other issues beyond species diversity numbers warrant examination. The next highest levels of species are made up of *Quercus nigra* (water oak, 10%), *Q. laurifolia* (laurel oak, 7%), *Q. virginiana* (live oak, 7%) and *Cinnamomum camphora* (camphor tree, 6%, an invasive).

Prunus Caroliniana, Quercus nigra, and *Q. laurifolia,* while native, are pioneer tree species that naturally regenerate with a quick growth rate but are short-lived species that can get brittle with age. This means that many seemingly healthy trees of these species may require removal in coming years.

C*innamomum camphora* is an invasive species and constitutes a significant portion (6%) of public trees. As efforts are implemented in future years to remove invasives like the camphor tree, short-term loss of canopy may also occur, though in the long-term it will pay off with both higher quantity and quality canopy.

Based on the sample inventory data, invasives comprise 7% of Tallahassee's tree population, as shown in Table 7; however, a complete inventory and one that includes parks may reveal that invasive species make up a greater percentage of the city's trees.

Table 7. Invasive Species Present in the 3% Sample Street Tree Inventory

Invasive Species	Trees	Percent
Cinnamomum camphora (camphor tree)	163	6%
Albizia julibrissin (mimosa)	41	1%
Ligustrum lucidum glossy privet	10	0%
Triadica sebifera (Chinese tallowtree)	4	0%
Ligustrum sinense (Chinese privet)	1	0%

Many trees have limited room to mature and/or are low wind-resistance trees, and thus can also be considered unsuitable. Trees can be considered unsuitable for a location if there is inadequate room for long-term healthy growth or they are ill suited to the climate.

Space to Grow. One factor in growth space is the room to grow above, which can be impeded by the presence of overhead utilities. Based on sample data, over half (58%) of Tallahassee's trees are growing too close to overhead utilities. Another factor in growth space is the room to grow below, which can be impeded by the presence of sidewalks and underground utilities. Sample data show only 3% of trees in conflict with sidewalks city-wide.

Figure 10. Percent of Tallahassee trees in conflict with city infrastructure.

Changes in Climate. The Tallahassee species make-up was compared against the U.S. Forest Service's Tree Atlas database, which projects changes in species adaptability to the predicted changes in climate over the next 100 years. *Cornus florida* (dogwood, Tallahassee's official city flowering tree) is already declining as the climate warms, as it is already on the most southern edge of its survival zone. Fortunately, beyond *C. florida*, there are few significant changes to the existing species predicted in the coming decades due to a warming climate, based on the U.S. Forest Service's Tree Atlas database. Tables on the impact of climate change on Tallahassee trees can be found in Appendix H.

Wind Resistance. Changes in climate also lead to more severe storms, so the ability of a tree to withstand high winds also makes it a suitable species for the Tallahassee area. Loss to storms could lead to future canopy loss, as the severity of storms and hurricanes continue to worsen in the coming decades.

Thirty-seven percent of Tallahassee's public trees are considered to have Low Wind Resistance. *Quercus laurifolia* (laurel oak, 7%), *Q. nigra,* (water oak 10%), and *Prunus caroliniana* (Carolina cherry laurel, 15%) make up the majority of these low wind-resistance species. Other species include: *Carya illinoinensis* (pecan); *Juniperus silicicola* (southern red cedar); *Q. falcata* (southern red oak); *Liriodendron tulipifera* (tulip poplar); *Pyrus calleryana* (callery pear); *Triadica sebifera* (Chinese tallowtree); and *Ulmus parvifolia* (Chinese elm). A full list of wind resistant species (all levels) can be found in Appendix G (University of Florida 2007).

These species diversity findings all indicate that a wide variety of changes to Tallahassee's canopy should be expected in the future. Both strategic planting (see Recommendation 3) and mature tree preservation are critical to improving the species make-up and the quality of tree canopy of Tallahassee's urban forest so it is sustainable for future generations.

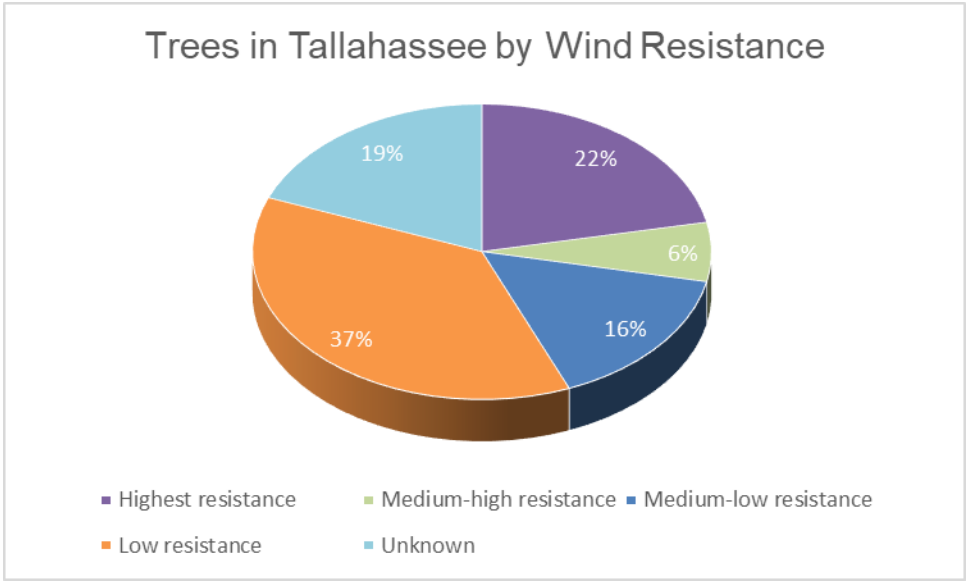


Figure 11. Tallahassee street trees and wind resistance.

...The Players Assessment (MODERATE)

The second category of assessment related to the players within the urban forest. The level of involvement and cooperation of all players is key to developing a sustainable urban forest. This involves identifying who is and isn't currently active, as well as what each group is doing (or can be doing) to advance the community's goals. The highlights of this assessment follow:

Clear community wide goals have not been put in place, so all players are currently acting independently with varying missions. It was found that while many groups and individuals are active in the urban forest, they are not actively working to achieve one or a collective set of citywide goals. As there are no clear city goals in place, none of these players can be considered actively engaged working toward a common community goal.

Neighborhood engagement and public awareness is highly variable. Neighborhoods are the most effective level to engage the public in caring for and improving the urban forest. There are a few neighborhoods in Tallahassee that have been actively engaged in urban forestry efforts, while many others either have other priorities and don't see the value of the urban forest, or they actively dislike trees. Many people have expressed wariness of trees (fear of damage to homes, loss of electricity during storms). However, there are also many residents that vocally defend and advocate for the protection of Tallahassee's iconic canopy. Not every community believes the benefits of trees outweigh the costs/risks.

Green industry is involved and engaged. Tallahassee has an abundance of experts in the green industry, spanning a variety of fields, including nurserymen, arborists, naturalists, conservationists, landscape architects, extension agents, educators, and more. Many are committed long term to the advancement of local urban forestry goals and are willing to offer expertise and various levels of support.

> "We cannot separate sustainable urban forests from the people who live in and around them. Sustainable urban forests are not born, they are made. They do not arise at random but result from a community-wide commitment to their creation and management. Obtaining the commitment of a broad community, of numerous constituencies, cannot be dictated or legislated. It must arise out of compromise and respect."
>
> -- Clark, et. Al., A Model of Urban Forest Sustainability, Journal of Arboriculture

City interdepartmental cooperation is good. City staff appear to work well across departments, working towards different though not conflicting departmental goals as established by city leadership. Most of the utilities in Tallahassee are provided by the city. These departments are already part of the urban forestry city team and are actively working on current urban forestry initiatives.

Other groups that have a significant impact on tree canopy, like large private landholders and the development community, are beginning to be fully engaged. This process of developing a master plan began a movement to engage these groups. A presentation of the process was presented to the Tallahassee Home Builders Association who was invited to participate further. A select few large, private landholders (mainly the large universities) have expressed support of an urban forest though have not been actively engaged as of yet. Others have not been approached yet, but once community goals are set and promoted the opportunity will be there.

Funder engagement is moderate. Tallahassee has a variety of different sources for funding, including city funds, national/regional contributors like the U.S. Forest Service, Florida Urban Forestry Council, and Leon County, and compensatory funds from developers as trees are removed. Private funding sources have not been explored. While these funds are varied in sources, they cover primarily reactive planting and management and not proactive tree care.

...The Management Approach (MODERATE)

How an asset is managed is just as important as who is actively impacting those assets. This involves identifying the urban forest data, staffing, budget, and equipment resources available, as well as considering existing policies and procedures. Highlights of the management analysis findings are:

Management of public trees is reactive due to the lack of a complete public tree inventory. Inventory data are the backbone of all management decisions, inform management actions, and help determine appropriate funding levels and other resources needed for proactive management. This is the basis of all effective asset management. While a systematic inventory project has begun, a complete city-wide inventory does not yet exist in Tallahassee; based on the 10,000 trees in existing completed inventory, the city only has data on only about 11% of the trees it manages. This lack of data is a critical gap for any future efforts for proactive care, maximizing tree benefits, and ensuring public safety.

Tallahassee now has excellent data on tree canopy cover. The City of Tallahassee is fortunate to now have a high-resolution canopy assessment performed using 2016 aerial imagery, developed as part of this project. Details on these findings can be found in The Trees section of this chapter. This GIS-based data layer is available for access by the city and its citizens for many potential future uses and will provide a reliable basis for change analysis when the next canopy assessment is performed 10 years from now as recommended.

Formal management plans are not in place, and tree maintenance work is largely reactive. Currently, there is no urban forest management plan, risk management, or proactive maintenance program in place. Tree care (pruning and removals) are currently performed in reaction to calls or crises rather than accomplished according to a proactive plan or schedule. This reactive approach can be directly associated with operational inefficiencies, shorter tree lifespans, and increased risks to public safety.

Public tree plantings are not strategic. The city plants an average of 300 to 400 trees per year, primarily on an opt-in/request basis and largely funded through the city's Tree Bank fund. Additional right-of-way tree plantings are done by the city to replace trees lost due to infrastructure improvements. These planting are not currently strategically planned or targeted to help reach broader citywide goals, or designed specifically to support neighborhood or street-level projects and needs.

Tree preservation policies exists but they need review and updating. Tree preservation regulations are in place for land development projects, though no *public* tree ordinance exists. Compliance requirements should be easier to understand and incorporate current arboricultural standards. Additionally, inspection and enforcement during and after development are difficult with current staffing levels. Most large cities in the United States have a separate ordinance or section specifically for public trees. The suggested items for review are discussed further in *Recommendation 2: Evaluate and Update Tree Protection Regulations*.

Internal communication within departments is good, but external communication with the public should be expanded. Effective avenues of two-way communication are critical, both between the city and its citizens and between city departments. Coordination within the city is good, though the public repeatedly asked for better communication between city staff and citizens. Citizens indicated they are uncertain about where to find the information they need and requested more transparency about decisions regarding trees in the city, particularly related to developments.

The equipment fleet is adequate for current conditions and continuation of a reactive program. Community Beautification has small and large power equipment, bucket trucks, a crane, loader, dump truck, and vehicles to perform routine tree pruning, tree removal, and debris hauling tasks. A tub grinder is contracted to process woody and other vegetative debris. The equipment and fleet are adequate for the current staff and various crew configurations to perform their assignments. However, as the city transitions to a more proactive maintenance program, they may need to re-evaluate their needs and plan for additional equipment purchases.

City staff assigned urban forest management duties perform a wide range of tasks and are decentralized. The city staff responsible for an extensive urban forest management workload are decentralized in four departments: Parks, Recreation and Neighborhood Affairs, Planning, Growth Management, and Community Beautification and Waste Management. The Urban Forester position is housed in the Planning Department and is charged with developing and guiding the citywide urban forest initiative. Community Beautification currently has 13 arborists comprised of field, management, and technical staff who care for the estimated 93,000 street trees within Tallahassee. Field crews in Parks and Community Beautification, with the assistance from contractual tree maintenance companies, perform citywide maintenance tasks such as tree pruning, removal, stump grinding, and storm response. Growth Management has two arborists on staff who review plans and inspect development projects involving tree protection and/or other landscape requirements.

Additionally, staff in all departments respectively respond to and inspect requests from citizens and other departments, address overhead and underground utility work in the rights-of-way, manage the work of maintenance and planting contractors, review site plans, issue permits, coordinate the work of nonprofits and program partners, attend community meetings, support special events, manage fleet and personnel, and perform other administrative duties.

At the current budget and staff levels, the city can only operate an urban forest management program that is primarily reactive in nature. Although high-use/high-risk areas like playgrounds and school routes are inspected on a regular basis, there is not enough staff or equipment to fully implement a proactive maintenance program citywide, nor data to inform the needs and priorities of such a program. However, the staff that is in place are well-trained and the equipment available is adequate for continuing the current reactive approach. Challenges exist to improve and enforce tree protection regulations due to a lack of staff and a system for recording and tracking compliance with regulations during and after land development (see *Recommendation 2: Evaluate and Update Tree Preservation and Planting Regulations*).

Funding is adequate for the current, reactive maintenance system, but as the city transitions to a proactive system, additional funding will be needed. Adequate funding will be required to support a proactive maintenance program, implement a strategic planting plan, preserve the UTC during land development, and create a sustainable urban forest in Tallahassee. As reported by the city, citywide average annual urban forest management expenses in Tallahassee are approximately $510,000. This is the average annual amount spent across four departments for tree maintenance, planting, and management tasks.

Table 8 compares Tallahassee's recent budget averages and urban forest management activities to national, regional, and peer group averages.

Table 8. Urban Forest Management Program Funding and Activity Benchmark Comparisons

	Tallahassee	National *	Cities with Pop. 100,000 - 249,999*	Southern Region*	*"What If" City Tree Budget using Peer Population Averages*
Funding					
Average municipal tree care and program budget	$510,000**	$801,595	$1,368,607	$829,105	*$1,368,607*
Average annual budget per public tree	$3.86***	$42.59	$44.85	$60.52	*$3,960,870*
Average annual budget per capita	$2.70	$8.76	$9.05	Not avail.	*$1,719,500*
Tree care and management program budget percent of total municipal operating budget	0.07%****	0.52%	0.48%	0.47%	*$3,000,000*
Urban Forest Management Task Allocation					
Percent of budget for maintenance	69%	47%	Not avail.	42%	
Percent of budget for planting	18.5%	13%	Not avail.	15%	
Percent of budget for management	6.3%	13%	Not avail.	Not avail.	
Percent of budget for other	Not avail.	27%	Not avail.	Not avail.	
Budget per Management Area					
Street trees	64%	62%	Not avail.	52%	
Park trees	26%	23%	Not avail.	32%	
Other public property trees	10%	15%	Not avail.	16%	

* Mean statistics from Hauer R. J. and Peterson W. D. 2016. Municipal Tree Care and Management in the United States: A 2014 Urban & Community Forestry Census of Tree Activities. Special Publication 16-1, College of Natural Resources, University of Wisconsin – Stevens Point. 71 pp.

** Average citywide tree budget between 2014–2017 as reported by City of Tallahassee

*** Derived from average annual budget and an estimated 93,000 street trees (park and other public tree quantities are unknown)

**** 2017 City of Tallahassee Operating Budget of $700.6 million

USING THIS ASSESSMENT. By performing the assessment and looking at the results in context of the city's goals, improvements needed to achieve a more sustainable urban forest begin to emerge. These assessment results, when combined with a vision for Tallahassee's future urban forest, help clarify the strategies for action going forward, and are the basis for the recommendations that are presented in the next chapter. The 27 indicators of the assessment can also be used as benchmarks for measuring progress when the urban forest is reassessed in five to ten years.

IS IT WORTH THE EFFORT? Tallahassee, like most cities, has many issues and challenges that need to be addressed. Some may think that improving the quantity and quality of the urban forest by investing public funds into the management of the program is not worth the effort. The assessment, however, does show that investing in the urban forest is one of the most effective actions Tallahassee can take to provide higher levels of public service more efficiently. The Commission's Priorities of economic development, quality of life, and infrastructure planning are also supported by investing in the management of the urban forest.

By inputting the 3% sample inventory data into i-Tree Streets, an estimate of the benefits that the Tallahassee street trees alone provide can be quantified. ***i-Tree estimates that Tallahassee's street trees produce nearly $4.3 million in benefits annually*** (the detailed i-Tree report can be found in Appendix I). The average annual budget of the Community Beautification department (tasked with managing all street trees) is approximately $411,000, which produces a very high rate of return on this investment - $10 dollars return for every $1 dollar spent on public tree care. Additional funding for staff, equipment, and projects may be more easily justified with this kind of strong supportive data.

For every $1 spent on street trees, Tallahassee receives $10 in benefits to the community.

CHAPTER VI. NEXT STEPS/RECOMMENDATIONS

The existing conditions described in the previous chapter give context to the urban forest management vision and goals. The following recommendations, having been informed by the past, present, and future goals, have been developed to show a possible way forward.

These 13 recommendations are proposed and presented in relation to the three stated urban forest goals discussed in *Chapter IV: Determining Vision & Goals Together*.

Goal 1: Improve Canopy Quality. Improve the quality, safety, and sustainability of the urban forest.

1. Complete an Inventory of Public Trees and Transition to Proactive Management
2. Evaluate and Update Tree Policies and Regulations
3. Create a Purposed-Based Planting Plan that Reflects City Goals
4. Address the Challenge of Tree Availability at Local Nurseries

Goal 2: Maintain Canopy Levels. Maintain an extensive tree canopy on public and private lands in balance with growth and change.

5. Officially Adopt and Incorporate Community Goals
6. Plan for a UTC Update in Ten Years
7. Add a Preservation-Focused Message to Existing Disaster Communications Plan
8. Further Enhance Voluntary Tree Planting and Preservation on Private Property

Goal 3: Engage the Larger Community. Engage and partner with the larger community these on urban forestry efforts.

9. Develop a Team for Plan Implementation
10. Define and Implement a Roll Out Plan to Maintain Momentum
11. Expand Overall Communications
12. Get the Public Engaged to Improve Their Own Communities
13. Incorporate Trees into Tallahassee's Think About Personal Pollution (TAPP) Curriculum

Goal 1: Improve Canopy Quality

Improve the quality, safety, and sustainability of the urban forest.

Recommendation #1 – Continue Toward the Completion of a Public Tree Inventory and Transition to Proactive Management

To operate under asset management best practices and principles, the city needs a complete public tree inventory, and must implement a proactive tree maintenance and planting program. Taking a data-driven approach to urban forest management is the most effective means to providing services equitably and in a cost-efficient manner.

Part I: Complete a 100% inventory of street and park trees and trees on other public properties.

The city has begun an inventory of its public trees, and this management effort should continue to be a priority. Inventory data are the backbone of all management decisions, inform management actions, and help determine appropriate funding levels and other resources needed for proactive management. Data-driven asset management has become a standard operating practice for municipalities that results in greater effectiveness and efficiency. Perhaps even more importantly, a thorough inventory is a valuable tool for assessing risk and planning short-term and long-term risk reduction activities. Therefore, Tallahassee should perform a complete inventory of all public trees.

It is estimated that on public streets alone, there are nearly 93,000 trees, and there are likely thousands more in parks and on other city-managed lands. A prudent way to accomplish an inventory of this scale is to perform it in phases. The data could be collected over a period of 3 to 5 years or can be obtained over a period of years corresponding to the number of management units established by the city for proactive urban forest maintenance (i.e., existing infrastructure management units, groups of neighborhoods, etc.).

About Public Tree Management

Public trees and the urban tree canopy are infrastructure assets, and as such should be managed efficiently and effectively to extend their service lives, maximize their benefits, and streamline operations. The key principles for successful operations management are to recognize the economic value of the asset, optimize the funding invested in that asset over its life cycle, and collaborate as an organization to ensure these public assets are functional and safe.

Additionally, the city will need to ensure that the tree inventory data is compatible with CityWorks, the city's asset management software program, to facilitate the management of the tree and mapping data.

Tree Inventory Uses and Benefits for Tallahassee

Investing in and maintaining a tree inventory provides more than just data on tree location, size, condition, and maintenance required. Tree inventory information can provide these other benefits to Tallahassee:

Increase Public Safety. Any kind of tree management program must address basic maintenance needs. This need follows from the primary obligation of prudent stewardship that lies at the heart of liability. An inventory can prioritize all risks so that they can be addressed appropriately. The inventory can also be used subsequently to monitor trees for safety on a continual basis. The existence of data on trees makes it easy to locate and re-evaluate them on a regular schedule thereby decreasing tree risks and the city's liability.

Facilitate Short- and Long-Term Planning. Planning can be made much easier by using the data from a tree inventory. Management issues, such as prioritizing maintenance, maintaining species diversity, and training young trees, can be readily addressed. When intervention becomes necessary, an inventory is invaluable. Whether the concern is pest management, or pruning, having complete tree data that can be easily ordered and analyzed will make planning for the job and its costs much easier. Urban forester managers can also track the work history of each tree with the inventory. This helps in addressing service requests, determining when an individual tree is near the end of its useful life, and supplying critical data to evaluate species performance.

Increase Efficiency. Once an inventory has identified the work to be done, a manager can use it to execute that work in a much more efficient manner than before. By scheduling work in a given area to be done at the same time, or scheduling similar work types at the same time, substantial savings are usually realized from the reduction of time spent on logistics. The savings in travel and set-up time are substantial, with historical examples showing about a 50% reduction in cost—especially when a system of rotational work and/or preventative maintenance is adopted. There is also increased efficiency in the office created by using an electronic inventory to locate and manipulate records, and select and schedule work.

Justify Budgets. Up-to-date tree inventories provide the data needed to determine specific levels of funding needed for tree maintenance and tree planting projected over a multi-year period. With accurate data, a manager can establish, prioritize, and justify annual budget requests. The tasks and associated costs are clearly spelled out and can be supported by detailed lists. Many tree managers have found that they have much greater success with budget requests that are based on the analysis of high-quality data. Also, a good inventory provides a solid basis for grant applications.

Document Actions. For all sorts of reasons, tree managers are frequently asked to provide documentation of their actions. This documentation can range from work accomplished to a contractor's costs per tree, from a removal list to a particular service request. Some requests may be routine, while others may have strong budgetary or even legal implications. Most tree inventory software makes such documentation very easy through reports that can be run off the inventory database.

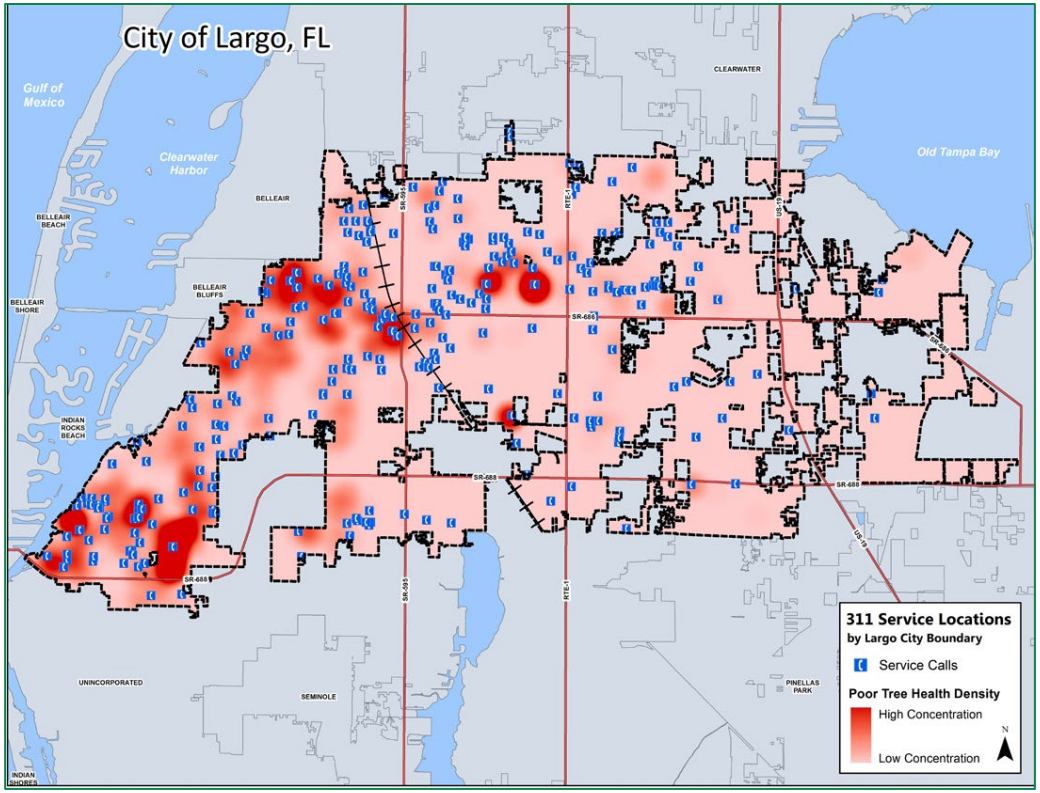
Calculate Tree Benefits. USDA Forest Service researchers have made it possible to use inventory information to calculate the environmental benefits and values of trees. The i-Tree software suite's (www.itreetools.org) calculations contribute scientific and reliable benefits data that can be used by tree managers, planners, and educators.

Part 2: Begin the transition into a proactive, management unit-based tree maintenance and planting program.

Currently, public tree care in Tallahassee is largely reactive, due to lack of both inventory data and resources, and is usually triggered by citizen requests, damage from severe weather and accidents, and as determined by the staff. Reactive tree care is not an ideal approach; it is not an efficient use of funding and commonly the trees in most need of maintenance for public safety reasons may not be attended to first in this approach.

The priority to preserve Tallahassee's tree canopy and improve its quality is to ensure the that all public trees are properly and proactively cared for. Proactive tree management programs have been shown to reduce long-term care costs, increase public safety, provide more predictable workloads and budgets, reduce utility outages from storms, and improve the health and appearance of the urban environment.

In a proactive maintenance program, tree work is typically performed as part of a cyclical care program where individual tree health, structure, and risk are assessed and addressed on a regular basis. The inspection and maintenance are performed in defined management units on an annual rotation of between 5 and 10 years.



Map 4. Map of Largo, Florida with the Tree Health Compared to Service Calls Case Study: Case for Proactive Tree Care, Largo, Florida

The City of Largo primarily plans tree work in response to requests from citizens, often submitted via the eGov (311) system. Davey Resource Group analyzed two years of eGov tree-related service requests by comparing the requested service locations to locations of trees in poor condition.

While the map indicates that calls (blue dots) are coming from all over the city, most of the calls are not coming from the areas in highest need of pruning and care (shown in red) according to the city's professionally-completed tree inventory. This suggests that Largo's request-based system does not effectively reach the trees with the highest need for care and is, therefore, an ineffective method for managing the urban forest. A proactive care plan is integral to real progress and effective maintenance.

To initiate a proactive tree management program in Tallahassee, it is recommended that defined management zones be created. The city currently uses a 27-unit management zone system for organizing other city operations. For urban forest management and budgeting purposes, these same areas can be used to begin a zone-based approach to preventive maintenance and planting. However, it is recommended that multiple, adjacent zones should be grouped into 10 larger management areas to correspond to a 10-year proactive maintenance cycle.

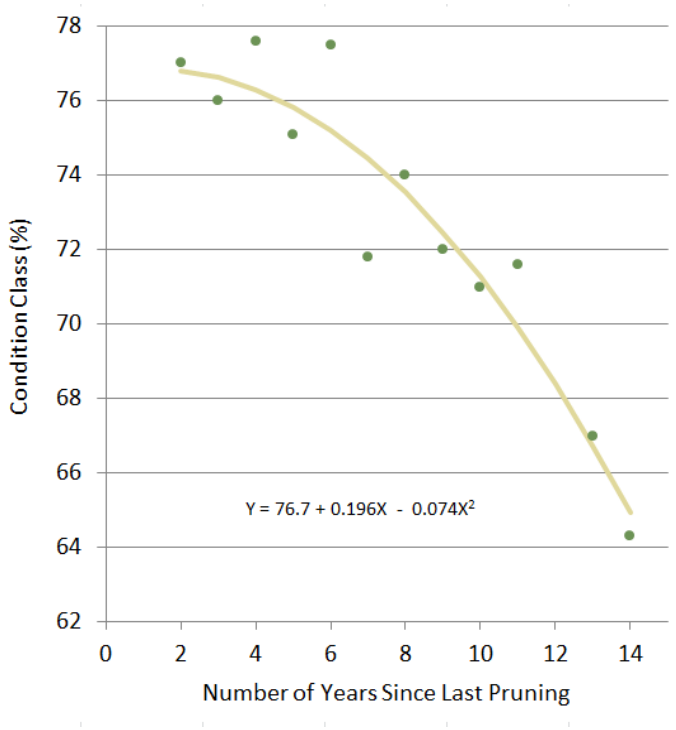
In the future, when the street tree inventory is complete and when park and other public trees are inventoried, or after full stocking is achieved, the management unit boundaries can be realigned or adjusted so that they all contain an equal distribution of publicly maintained trees. Using tree quantities as the basis for creating management zones is preferred because it evens out annual budget requirements, is less politically based, and can better achieve the long-term goals of urban forest sustainability and efficient use of resources.

Completing an inventory of public trees and transitioning to a proactive management program will significantly help the city achieve its goals of improving the urban forest's quality and maintaining the desired canopy level.

These management activities are also key components of achieving urban forest management program accreditation from the Society of Municipal Arborists (SMA), which is a goal the city has been steadily working toward. In combination with other program improvements recommended in this plan, by having an inventory and performing cyclical maintenance, Tallahassee would qualify for SMA's peer-reviewed program that formally recognizes urban and community forestry programs for implementing comprehensive management practices, adhering to current national and professional standards, and making notable accomplishments in municipal tree management.

Why Prune Trees on a Cycle?

Pruning trees on a systematic and consistent cycle of 5-7 years has been shown to significantly improve the condition of the tree population city-wide. One study (Miller and Sylvester 1981) examined the frequency of pruning for 40,000 street trees in Milwaukee, WI. A decline in tree health correlated directly increases to the length of the pruning cycle (as shown in Figure 7). When pruning was not completed for more than 10 years, the 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.



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

Recommendation #2 - Evaluate and Update Tree Policies and Regulations

Administratively, comprehensive urban forest management is supported by city policy and ordinances. These frameworks set guidelines and establish the standards of care expected in the management of public trees (by the municipality itself) and private trees (by private entities in general and during development). Since trees and tree benefits are linked to public health and safety issues, having a policy and a set of regulations is justified and recommended.

Tallahassee recognizes trees as community assets and has ordinance language that protects the community's tree canopy cover *during land development* and urban redevelopment projects. Currently, public trees are managed under the land development ordinance. However, most cities that value their public trees have a separate ordinance section or policy that clearly governs and guides the treatment of public trees in the right-of-way.

The following recommendations listed here and detailed below are made to improve upon the codes and processes already in place.

2.1 Evaluate and Update the Development Regulations

a. Review & revise plant lists, definitions, and diversity requirements to factor in canopy quality improvement concerns
b. Create a user guide
c. Consider conducting analyses on past projects to evaluate effectiveness of regulations
d. Explore the benefits of a canopy cover-based code per land use
e. Continue outreach on planning and land development concepts that link urban forestry issues to the city vision
f. Improve enforcement via tracking systems and additional staff

2.2 Create a Public Tree Policy or Ordinance to Formalize the Current Protocols

a. Basic components
b. Additional options

POLICY vs. ORDINANCES

It is important to understand the difference between a policy and an ordinance/law.

POLICY. A policy states the goals of a municipality and the method and processes it will employ to achieve them. A policy document is not a law, but it clarifies how work will be done. Policies may also identify new laws needed to achieve goals.

ORDINANCE. An ordinance or regulation is an actual law that sets standards, procedures, and principles that must be followed. It is the legal framework within which local tree management activities are conducted for the general welfare. If a law is not followed, those responsible for breaking them can be penalized. Policies can often guide formulation of laws.

So, while policy sets out the goals, standards, and planned activities of a municipal department, it may be necessary to pass a law or ordinance to enable government to put in place the necessary legal frameworks to achieve their aims.

2.1 Evaluate and Update Development Regulations. The regulations for tree protection, mitigation, and planting on private property in the city found in Chapter 5 – Environmental Management of the Land Development Code are long-standing and extensive. Generally, the prohibitions, requirements, and technical standards for tree protection during development in Chapter 5 are valid and justified, but overall the ordinance has been less than successful and a source of confusion because of a variety of issues that were revealed during this plan's development. These issues include:

- Unclear definitions need to be revised;
- Insufficient resources and trained staff to conduct plan review, inspections, enforcement, monitoring, and perform public education;
- Species lists for the debit and credit system are outdated and need to be reviewed and updated in terms of assuring and increasing species diversity, tree canopy quality, and overall resilience of the urban forest;
- Requirements for species diversity for replacement/mitigation requirements should be strengthened;
- New tree preservation information and technologies are not integrated into the development code or administrative and operating policies;
- MMTD area and application of its requirements causes conflicts with many of the Chapter 5 requirements; and,
- General public and developers do not understand the reasons for tree protection and mitigation, and/or how compliance with Chapter 5 benefits their projects, properties, and the city in the long term.

Revising Chapter 5 Development Standards and enhancing the administration of its requirements support the city's dual goals of no net loss in the urban tree canopy and improving the condition of the urban forest. Therefore, a variety of actions are recommended in both the short and long terms:

a. Review and revise plant lists, definitions, and diversity requirements to improve future canopy quality. The city is correct that not all trees are equal; some are better suited to urban environments, or are native species with desirable characteristics, or are important to the natural heritage of the city. So, for tree preservation during land development, having prioritized species lists to incentivize protection (and penalize the removal) of the most valuable and beneficial trees is reasonable. However, the city's lists were originally created for tree preservation only, but now are used to select species for mitigation planting, thereby effectively ruling out the use of many other trees and cultivars available.

To improve the decision-making process using the Plant Lists:

- Consider reformatting Plant Lists A through D in the Development standards into a matrix. In addition to presenting planting credits, the matrix would have other information about species selection such as appropriateness for use as a street tree or for parking lots or for special preservation/conservation areas such as wetlands and canopy roads, etc. The actual lists should be removed from the ordinance language and replaced with language that indicates that an approved tree matrix exists and is available on the city's website and/or will be provided before site plans are submitted for review.
- The ordinance should make it clear that Plant Lists A through D are to only be used for calculating tree preservation credits and removal debits.
- For proposed landscape installations or required mitigation planting, similar plant lists can be created that would be greatly expanded to include other species and cultivars of trees that have proven to be sustainable in Tallahassee.
- For any and all tree lists, the Growth Management Department (in consultation with city forestry staff) should have the responsibility for creating the lists, and assigning relative value; and should have the authority to remove or add species to any list based on industry standards, local knowledge, species diversity considerations, climate changes, etc.

b. Create a "User's Guide" for the Land Development Code. City tree ordinances and conservation and preservation area development standards are often viewed as complicated "recipes" written in legalese. It is helpful for applicants and the public to have a technical manual to explain the process and requirements for land development, working around trees, and tree planting. This companion document is written in plain English, has informative illustrations, and contains simple details about all the codes' requirements. The user's guide/manual should be made available electronically and in print format and could contain:

- Information explaining why the codes and requirements exist.
- Submittal requirements and the process.
- Sample calculation for code requirements.
- Landscape details/drawing for tree preservation to graphically show how to execute code and permit requirements properly; and tree protection including barrier fencing, CPZ requirements, proper pruning, soil volume per size/species, etc.).
- Information and specifications for using new tree preservation and planting methods, technology, and standards particularly in the Multimodal Transportation District (MMTD) area (such as SilvaCells, root barriers, structural soil, flexi-pave materials, minimum soil volumes, alternative sidewalk construction like ramps, bridging, and piers).
- Plant lists/matrices.
- Glossary of technical and arboricultural terms.

Two examples of technical manuals are:

- Polk County (FL) Land Development Code Customer Guide
  http://www.floridaplanning.org/wp-content/uploads/2016/04/Polk-County-Land-Development-Code-Customer-Guide-Final.pdf
- Tampa (FL) Tree & Landscape Code Technical Manual
  https://www.tampagov.net/sites/default/files/land-development/files/TREE_AND_LANDSCAPE_TECH_MANUAL%20.PDF

c. **Evaluate effectiveness of existing development regulations.** Consider conducting a detailed analysis, or "project autopsy" on multiple land development and tree protection projects. This long-term study would be applied to projects that are representative of large and small, urban and suburban, MMTD and non-urban service area locations, etc. to get actual data on canopy lost, saved, or planted that can reveal where the current code and requirements succeed or fail to achieve the city's goals. This data can then be used to assess the current regulations' effectiveness so staff can take corrective action as needed to revise the code and/or improve internal processes.

d. **Explore the benefits of a canopy cover-based code per land use.** Rather than credit and debit systems, many communities have enacted codes that simply require a minimum tree canopy (either existing or planted) for specific land uses, i.e., 10% canopy cover in dense urban areas up to 50% in residential areas. With accurate UTC mapping, the loss or addition of canopy can easily be determined on a parcel-by-parcel, neighborhood, or citywide basis. A modification to this approach would be to adopt this method for the MMTD and stratify the land use within it as high, medium, and low density, and then assign a target canopy cover percentage to those areas. This could be used in combination with the credit and debit system.

   Note: The Multi Modal Transportation District falls significantly within the city limits, and its requirements for building, road, and utility construction cause many conflicts and will greatly restrict the city's ability to preserve large trees and maintain a high canopy cover in the future. As long as the MMTD is a priority for the city, and unless adjustments to the MMTD are made to accommodate trees, then it must be understood and accepted that tree canopy in areas of intense development will be significantly lower than other areas. The MMTD currently allows alternative and innovative infrastructure designs and systems to be used that will support the largest canopied tree possible to be planted. The city is currently working with a consultant and other stakeholders to reassess the MMTD area and development requirements.

e. **Continue to perform outreach to the public and land developers about the planning and development processes and ordinance requirements.** It is important to explain *how* to be in compliance with code requirements, but also *why* they are in place and *who* they can go to for help. The city should continue to provide "pre-submittal" guidance that links city staff to applicants as "pre-development" liaisons. This proactive process ensures that the review process is thorough and that support and direction is provided to the developer and community through the entire project. This system increases code compliance and promotes consistent communication, all while encouraging and facilitating economic growth in Tallahassee. Since every parcel and land development project is different, the city should exercise flexibility and continue to act as a guide along the process of preserving and enhancing the urban tree canopy.

f. **Improve enforcement via tracking systems and additional staff.** Currently, when a new development is proposed, there are two arborists in Growth Management available to review plans and interact with the developer and other city agencies about preliminary issues, short-comings, and conflicts that could be easily resolved during the initial planning stages of the project. Additional staff would enhance this process.

   Currently, it is required by the Code that new trees planted for mitigation in new development projects must remain viable in perpetuity, and that city staff will inspect them every three years to assure that they are alive and thriving; and it is assumed that existing mature trees will survive the impacts of construction and continue to have long service lives. Regular inspections of development sites during construction and after the project is complete is especially critical regarding mature tree protection. Additional qualified staff would be able to spend more time on site to ensure protection protocols are adhered to and could monitor large tree survival during the first 3 to 5 critical years after disturbance, and perform the triennial inspection referenced in the Code.

   However, there are insufficient city resources to assure that the review process is thorough and that both of these conditions for trees are met. Therefore, these recommendations are made:

   - *Increase the project review and inspection staff compliment and training.* Additional staff would decrease the review period, increase response time for questions and issues that invariably arise during construction projects, and potentially resolve tree/code conflicts before the project begins. Additional staff would allow the city to more thoroughly monitor tree protection and planting operations on development sites to ensure permit requirements and industry standards are being met and would allow proper follow-up inspections over several years after the project is complete. It is preferred that any staff participating in plan review and/or site inspection related to trees have landscape or forestry qualifications. However, if the additional staff are not arborists, or if no additional staff can be assigned initially, then annual training should be provided to the inspectors about basic tree physiology, tree planting and preservation standards, and risk assessments.
   - *Expand the use of existing project management software program.* Consider tracking the number of and pertinent data about new trees planted and/or mature trees protected. The program could alert the user of inspection intervals and tasks. This documentation could also be sent to the developer or current land owner for any corrective action required.

2.2 Create a Public Tree Management Policy to Formalize the Current Protocols. It is important to keep in mind that while Tallahassee has a development code that addresses tree protection on private land during building projects, it does not have a separate policy or ordinance clearly stating standards of protection and care for public trees. As the city's current public tree resource is significant with an estimated 93,000 street trees and planting sites, it is recommended that Tallahassee develop a public tree policy that reflects the community's goals and current industry standards and that will protect and grow the public urban tree canopy.

The following general recommendations are made for Tallahassee to consider for a creating a street tree policy or ordinance:

- Include acceptable and unacceptable basic performance standards for the treatment of public trees. The language used to define these practices should be clear and quantifiable so that the policy is clear and defensible.
- At a minimum, make a reference to these current national arboricultural industry standards: ANSI A300 Tree, Shrub, and other Woody Plant Management – Standard Practices, ANSI Z133.1 American National Standards for Arboricultural Operations – Safety Requirements, and Florida Grades and Standards for Nursery Stock.
- At the same time, be cautious of including too many details in the policy statement itself, as materials and methods of tree care, planting, and management often change and this would render the policy out-of-date. Specific details about items such as allowed species, soil volumes, plant sizes, clearance requirements over streets and sidewalks, etc. should be included in a separate manual or best practices guidance document that be updated more easily.
- Include a section on "Prohibitions," such as "No person shall damage, prune, remove, or plant any tree or shrub in any public street or other public place without having first obtained a permit from the city. Damage to public trees includes, but is not limited to, construction and excavations, vehicular accidents, vandalism, adhering advertisements or electrical wires, allowing toxic substances to come in contact with soil within the dripline (gas, brine water, oil, liquid dye, or other substance) deleterious to tree life."
- Designate which department or departments and which position is responsible for enforcing and monitoring the performance standards.
- Include the authority of the city to collect compensatory payments for unauthorized tree removal or damage and that the funds be restricted for urban forest management use.
- Clarify a public tree permit system that explains the process of getting permission for non-municipal entities to do removals, pruning, planting, or any activity affecting public trees.

A new policy will take time to create and require stakeholder and public input. During the discussion phase, Tallahassee may also want to consider including additional issues and provisions needed to reach the city's goals and address unique, local issues, such as:

- Defining priorities in public infrastructure projects so that the benefits of trees are maximized while allowing for other desired outcomes such as safety, pedestrian and bike access, lighting, etc.
- Acknowledging the city's ability to plant trees on private property if adequate space does not exist on the right-of-way (as is the practice with the Adopt-A-Tree program and within 100 feet of the centerline).
- Formalizing a historic tree recognition program, centered around the city's Patriarch Trees.
- Defining priorities, requirements, and responsibilities for utility pruning and projects affecting public trees.
- Consider a policy statement regarding invasive insect and disease response that describes the city's authority to direct removal/treatment of trees on both public and private property if a significant insect or disease threat exists in the city.

If the city wants the property owners and land developers to respect and properly preserve and plant trees on private property (as required by Article IV), then it should set an example and, through a public tree management policy and/or ordinance, require equal or greater standards to be applied to trees on public property. A sample public tree ordinance is included in Appendix C.

Recommendation #3 - Create a Purposed-Based Planting Plan that Reflects City Goals

Planting new trees is a critical responsibility and task to ensure the longevity of the urban forest. However, planting should be done with a purpose in mind - not simply a random selection of what sites are available or what's easiest to fill. A strategic, citywide plan for tree planting should be developed that is based on accurate and complete inventory data and prioritized by geographic, equity, diversity, and specific ecological service needs such as reduced urban heat island and increased storm resiliency.

Trees do not last forever and like other city infrastructure assets, replacement and expansion programs should be in place. The urban forest is sustainable only if more trees are being planted than are lost to old age, insects and disease, storms, and land development. Currently, more public trees in Tallahassee are removed than planted (over 2:1). This trend should be reversed to better reflect the city's goal of no net loss.

Planting can have the purpose of improving species and age diversity, be focused on ensuring equitable tree canopy across all neighborhoods, lessening the stormwater issues in an area, or any combination of objectives. Whatever the current or neighborhood-based goals are, they should be defined in advance so the annual planting works toward creating a more sustainable green city asset.

Tallahassee is rightly dedicated to improving the quality of its urban canopy which means promoting and protecting trees that will provide the most benefits and require the least maintenance. Actions the city can take to be more strategic with planting projects are:

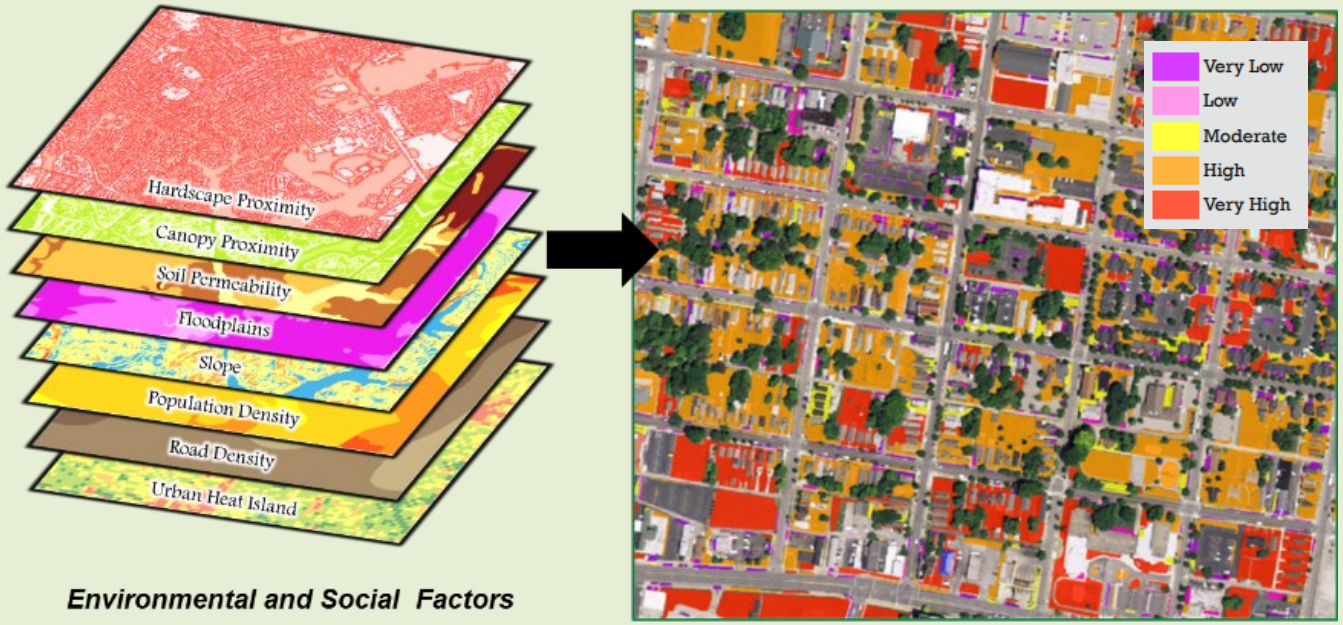
- Based on updated and complete inventory data (including vacant planting sites), perform a street/park level priority planting analysis. This will allow staff and stakeholders to create a city-wide Master Tree Planting Plan that will ensure proper species diversity, guide street tree planting by developers and citizens, and to be "shovel-ready" to take advantage of grants and donations for trees.
- Create mini-master tree planting plans for specific neighborhoods where the need for greater canopy or species diversity is the highest. Smaller scale plans can actively engage the residents in the planting and follow-up care of new trees.
- Set a long-term goal to systematically take actions to change the composition of the urban tree canopy such that top most frequently occurring species are characterized as long-lived, wind-resistant, and high-benefit producers.
- Set a goal that Tallahassee's urban forest population will be composed of no more than 10% of one tree species, no more than 20% of one genus, and no more than 30% of any one family.
- Establish planting benchmarks, such as the number of trees planted per year or the number of trees planted in relationship to trees removed annually. An ultimate goal might be to achieve and maintain a 90% to 100% stocking level for the street tree population.

With the excellent UTC mapping and GIS data available, the city should begin the strategic planting plan development project by referencing the priority planting areas GIS layer to identify and map the areas that are most in need of expanded canopy.

Priority Planting Areas in Tallahassee Identified

As part of the recent urban tree canopy (UTC) assessment, an advanced analysis has identified prioritized planting areas across the entire City of Tallahassee. These are areas highlighting the most optimal places to plant to achieve the highest benefits impact.

Current land cover types (i.e., tree canopy, low vegetation, concrete surfaces, water and bare soil) were overlaid with heat and stormwater related data (i.e., soil types, floodplains, hottest areas, population density, and slope) to identify ideal potential planting areas. Unrealistic sites for planting (i.e. recreational fields, agriculture, and utility rights-of-way) were eliminated, leaving a final map of potential planting areas ranking low to high, as shown below. When planted, the highest priority areas will provide the community with the highest impact of services. These maps are now available through the city (electronically and in a printed map book) for use in future planting planning.



Environmental and Social Factors

A strategic, purposed-based planting plan supports the no-net-loss and the improved quality goals for the urban forest. It also supports an efficient and more effective use of the Tree Fund for tree planting, as well as other funds that become available.

Recommendation #4 - Address the Challenge of Tree Availability by Engaging Local Nurseries

Having an urban forest comprised of many different species is important in Tallahassee for many reasons: to prevent the insect and disease problems associated with an overabundance of a few species; having a sufficient mix of species that are adaptable to climate changes; having a palette of trees that can tolerate urban and other difficult planting sites and conditions; and providing aesthetic diversity in the city.

Improving species diversity in the city is an important goal that directly supports the vision of having a high-quality, sustainable urban forest. Currently, the city, land developers, homebuilders, and property owners are equally limited in species selection for tree planting projects by what is available at local and regional retail and wholesale nurseries in terms of species choices, quantities, and pricing. Additionally, the city not only needs a greater variety of trees, but needs them to be an appropriate size and be grown in a form (single trunk, high branched form) suitable for street tree use.

The vast majority of the trees planted in the city on all properties have been and will be obtained from nurseries. Area nursery growers can be one of the city's best champions for expanding and improving the quality of the urban forest. However, they are businesses that respond to the demands of the market and that produce and provide products that will give them a reasonable rate of return on their investment. Therefore, efforts must be made to engage these important stakeholders to expand the palette of tree species available for planting in Tallahassee's urban forest.

In support of the Commission's priorities of improving economic development and enhancing neighborhood vitality, forming strong relationships with local nurseries and creating a larger market for underutilized tree species will not only improve the quality of Tallahassee's tree canopy, it could also help the local economy and create new jobs in the nursery industry.

Recommendations to improve the availability of a greater variety of desired trees species in the future are:

- Communicate directly with the nurseries about the need for them to grow or obtain more diverse species that are reflective of the city's preferred species list. If a nursery is not actively growing a specific species, they can find nurseries that are and have them delivered locally.
- Educate homeowners and developers about the types and benefits of preferred native, non-native/urban-tolerant, and/or underused tree species. As these customers of local nurseries become more familiar with these desirable trees, they can create a demand that nurseries will respond to which will improve availability.
- Create a 5-year "planting plan" based on estimated numbers of trees per species that will be planted by the city on streets, in parks, and by developers (based on any changes to credit/debit lists in the land development code, see Recommendation 6). Sharing estimated quantities of the preferred species will demonstrate the near-term market to the nurseries (see more in *Recommendation #3: Create a Purpose-Based Planting Plan*).

- Survey nurseries for their current and three-year projected availability per species. With this information when public tree planting projects are planned, and/or when development plans are presented for review and approval, the city can specify or approve trees (now known to be available) for these projects that help increase overall diversity.
- Explore contract tree growing agreements with select nurseries. These types of contracts are simply an agreement between a landscape grower and anyone who wishes to secure grown trees and plant material for future projects. The city already has such arrangements for its Adopt-A-Tree program, but expanding custom growing contracts to include quantities and species needed for development projects is recommended and would have multiple benefits. First and foremost, the city can be assured that specific tree species in the quantities needed will be available. Additionally, by contracting with an experienced, reputable grower, the city will be receiving quality trees that can also accommodate special requests concerning the shape or size of the tree. Finally, the buyer in these agreements has a guaranteed price as part of the contract, which makes budgeting and project cost control easier.
- The city can also consider partnering with other cities or the county to form a regional "tree buying cooperative." By combining tree orders with other governments, a high-volume request is produced, and tree and transportation/delivery prices will likely be reduced. This cooperative can expand the city's ability to get more diverse and high-quality species for its projects. Through this cooperative, the city might also want to allow homeowners to purchase underused tree species at the discounted, wholesale prices for trees.

Goal 2: Maintain Canopy Levels

Maintain an extensive tree canopy on public and private lands in balance with growth and change.

This plan defines a *community* goal of maintaining existing canopy in the long term while increasing canopy quality (see the detailed community vision in Chapter IV). This is a long-term goal over the coming decades. Tree canopy is expected to fluctuate as Tallahassee works to change the composition of our urban forest from recommendations found under Goal 1: Improve Canopy Quality.

Recommendation #5 - Officially Adopt and Incorporate Community Goals

It is vital to incorporate these goals into city policy to ensure their survival and continued momentum during future transitions in leadership and staffing in the coming years. By including urban forestry goals in relevant policy and code, the city establishes canopy as a priority from the outset.

Adoption and incorporation into city policy can be done in the following ways:

- **Adoption by City Commission.** Upon its completion, it is strongly recommended to have the City Commission officially adopt the resulting full urban forest master plan, including the canopy goals and vision in an official city proclamation.
- **Referenced in Comprehensive Plan Updates.** At a minimum, the vision and goals related to tree canopy should be incorporated into the next update of Tallahassee's comprehensive plan. As an example, in Tampa's most recent comprehensive plan *Imagine 2040*, the plan discusses tree canopy goals at length in the Urban Forestry chapter. It also calls for the UTC (urban tree canopy) assessment to be regularly updated. This conveys a clear and official conviction of the importance of tree canopy in that community.
- **Referenced in Next Canopy Roads Management Plan.** An updated management plan is currently underway to manage the trees along Tallahassee's canopy roads. Ideally, this management plan should reference the larger Urban Forestry Master Plan and frame its management goals in a way to fit within the recommendations for urban forestry city-wide referenced in this report.
- **Incorporation into Appropriate Development Regulations.** City tree ordinances should include a general reference to the urban forest master plan goals. This helps property owners and developers understand *why* the regulations are in place and sheds light on how tree canopy is critical to a healthy community. It also serves to reiterate Tallahassee's commitment to trees as city infrastructure. Note that an exact canopy goal number should not be used, as it may change over the years.
- **Inclusion and mention in other relevant planning projects** used by the community (i.e., Multimodal District Plan, Leon County Greenways Master Plan, GreenPrint, etc.) should be considered as they develop. Keep in mind that this should extend beyond plans that focus primarily on greenspace, but also those aimed at improving areas of the community overall. Trees are a critical component to mobility plans, business district improvements, public health initiatives, and more.

These efforts are also key to communication and engagement (Goal 3).

Recommendation #6 - Plan for a UTC Update in Ten Years

Tree canopy assessments should be updated every 10 years to gauge progress and identify areas and reasons for any losses that may be occurring (whether expected or not). Some loss, like that which results from efforts to improve the quality of tree canopy, is expected; other losses can be tracked and cause identified and solutions implemented to slow those losses.

This data will enable identification not just of trends of gains or losses in canopy, but also where the largest canopy changes are occurring. The data will also help identify problems areas, along with ways to rectify losses and get back on track to reach future canopy goals. As this is extremely valuable information, it is recommended to plan and budget for this update well in advance.

- **Plan for a UTC Update in 2026. Tallahassee's first UTC was just recently completed using 2016 aerial data.** The next UTC update should be in 2027 or 2028 (using 2026 aerial imagery or the most recent available). Many cities, including Tampa, require the regular update of UTC mapping in their tree ordinance (Tampa Ord No 2006-74, § 9, 3-23-06), or this can be a requirement in the next update of the comprehensive plan or sustainability plan.
- **Explore Partnerships and Secure Funding in Advance.** Once the first UTC is completed, updates can be significantly less expensive to undertake. However, funding should be secured in advance. UTCs can also be implemented with partners on a larger scale, which also has the potential to save costs. Tallahassee may want to explore partnering with larger regional entities like Leon County, watershed groups, or the regional county planning council to share costs while providing the necessary land cover data to gauge progress and trends.

Recommendation #7 - Add a Preservation-Focused Message to Existing Communications Plan

The Tallahassee/Leon County disaster response program is currently comprehensive and tested, both overall and as it pertains to trees. It is also updated and revised as needed. Community Beautification is currently working on a revised storm/emergency Standard Operating Procedures (SOP).

However, many trees are lost in the weeks after a disaster, often prematurely, due to fear-based decision making by private property owners. Severe storms can defoliate a tree or cause losses of large limbs, causing the impression of appearing dead or dangerous to the untrained eye. This is when unwarranted removals often occur, often by untrained and unqualified impromptu tree contractors that exacerbate that fear without reason. Without proactive preservation efforts, many trees fall prey to these uneducated contractors offering to remove every tree that experienced any damage. The reality is, however, that many trees, especially those native to the southern coastal states, can withstand high winds and storm damage and rebound after severe storm events.

Photograph 12. Storm damaged tree after Hurricane Hermine.

What is an Urban Forest Disaster Management Program?

An urban forestry-focused disaster management plan is a clear plan of response post-storm to ensure public safety, maintain optimum urban tree canopy, promote tree health, and decrease emergency management costs. These plans can take many forms: an addendum to a city-wide emergency management plan, or simply a summary of the urban forestry management program's expected role and functions in a disaster for preparation and response purposes.

Plans often include the following:

- Chain-of-command description and clarification
- Method of communication to be used in emergencies
- A triage process for tree debris removal (often clearing critical lanes and access to hospitals and other key sites first)
- Preset debris sites to facilitate quick and safe removals
- Prearranged tree pruning and removal contract agreements after disasters, to avoid high-rate fees in last-minute situations

A forward-thinking communications component that gets initiated post-storm can reduce some of these unneeded losses. Residents' fears can be addressed and options provided so that property owners can safely determine which trees can be saved. By establishing pre-set messaging and avenues to spread the word, losses of otherwise healthy trees can be drastically reduced. Reducing the fear-based premature removals following a storm event is critical to stopping any unneeded removals and reaching city long-term goals.

This effort requires pre-planning to locate and provide tree expertise resources that would be available for public use, clarifying the messaging to be used, and determining the avenues of information dissemination in advance. Each of these pieces are described in more detail below.

- **Find and Organize the Expertise Ahead of Time.** Who will be available to provide the much-needed tree assessment expertise after a natural disaster? This must be determined and planned out in advance of any event. There are a few options: Work with the local chapter of ISA (International Society of Arboriculture) and other green industry experts to potentially set up a local team that would be willing to respond to homeowners after an event.
    - **Consider utilizing a U.S. Forest Service Strike Team.** A Strike Team is a group of foresters that come to the aid of a region after a natural disaster by providing tree damage and risk assessments and FEMA public assistance information to communities. Their mission is to "provide additional professional capacity to municipalities impacted by natural disasters during the late stages of response and during recovery." These teams can be funded in a cost-share system and potentially be covered in part through FEMA funds. Visit http://www.southernforests.org/urban/ufst to learn more about this resource and to become familiar with this system and funding options in advance of any event so mobilization is simple in the hectic days after a storm.
- **Set the Message.** Address property owners' fears directly, provide them with options, and tie the importance of these steps into the overall city canopy goal.

  The Arbor Day Foundation recommends three main messages to convey to the public after a storm:

  1. "Stay safe" – watch for hangers, leaning trees, downed wires, chainsaw injuries, etc.
  2. "Stay calm" – it may not be a bad as it seems, help is on the way, panic makes things worse.

3. "Get help from qualified people (arborists)" - get careful professional damage assessment help from those who are insured Certified Arborists.

   Sample text from Arbor Day Foundation related to this issue is included here:

   Watch Out for Scam Artists Posing as Arborists. After a storm, it is common for people claiming to be tree specialists to show up at your door offering their services to remove or repair trees. In the words of one city forester: "They seem to come out of the woodwork - people we have never even heard of before." Unfortunately, many such individuals have little or no training, and sometimes have little interest in removing anything but money from the pocketbooks of unsuspecting residents. The National Arbor Day Foundation urges you to not be a victim. "Make sure you are dealing with a reputable individual or tree care firm when you contemplate repairs or removal of any trees on your property," warns John Rosenow, president of The National Arbor Day Foundation. "Legitimate arborists rarely go door to door to solicit business."

- "Take your time" in deciding whether to remove a tree or not, if no hazard is present. Also consider tying this message to the city goal of preserving canopy.
- People often tend to become radical about trees after a disaster, wanting either to "kill" or "save" them all, and they need to hear voices of reason from arborists and city officials.

Sample Messaging for Public

Not Sure If Your Tree Can Be Saved After the Hurricane?

While unsafe trees should indeed be removed, many that appear dead or severely damaged may not be. In these weeks after storms, there are many fly-by-night contractors in place that will go door-to-door offering to remove your trees, often when it isn't needed. The reality is, however, that many trees, especially those native to our area, can withstand high winds and storm damage and rebound after these severe storm events.

Your tree could lose a large limb or even all its leaves, but it may not be dead. The key is to not jump the gun and remove it before getting a qualified opinion. Give your tree a chance. Find a certified arborist to get an educated decision to save or remove.

Can't find or reach the right people? *...then go on to explain the steps determined to get expertise help.*

- Trees can recover from substantial damage, and what looks awful at first to an amateur may be judged as much less serious by an experienced professional arborist.
- Identify avenues of information dissemination IN ADVANCE. Fortunately, communications systems post-event is already in place in Tallahassee, both through city-based messaging (texts, e-mails, posts to social media) as well as through neighborhood level networks like the Neighborhood PREP (Plan for Readiness and Emergency Preparedness) response teams. These tree preservation messages may just be able to be incorporated into the existing systems.

The key is to get all of this in place and ready BEFORE a disaster happens, so it can just be implemented (not developed) in the hectic days following a disaster.

Recommendation #8 - Further Enhance Voluntary Tree Planting and Preservation on Private Property

The amount and quality of the city's tree canopy is extremely dependent on the existence, composition, and longevity of trees on private property (which makes up over 70% tree canopy of Tallahassee). Therefore, it is important to engage with and educate all types of property owners about the benefits of trees and how to properly plant and care for them.

- An ongoing public education program should be established with the simple message that "trees matter." People are more likely to accept professional advice when they know their actions will have direct benefits to them, their children, and their neighborhoods. The city does not have to lead or take on the full financial and staff support for this educational effort, but should assist and motivate non-profits, schools, and county and state partners to spread the word.
- Enlist local arborists, cooperative extension agents, nurseries, and industry groups to give workshops and demonstrations on proper tree planting and mature tree care.
- Consider partnering with local non-profits or local businesses to initiate a tree give-away or cost-share programs for property owners to plant on their own properties. These giveaways can be targeted to areas of the city where there are gaps in canopy cover and/or where equity goals need to be met. Large businesses also tend to have an interest in making their community a nicer place to live and work to retain good employees and improve their corporate image.
- Large landholders (such as schools, businesses, agricultural operations, country clubs, and even cemeteries) can have a significant impact on increasing tree canopy simply due to large amounts of land available for planting and/or preserving trees. Tallahassee may want to first begin cultivating partnerships with the many school and educational organizations in the city and county, such as Florida A&M, Florida State University, Flagler College, University of Florida, Tallahassee Community College, and public and private local schools, and then reach out to other land owners. To create even greater buy-in with these important stakeholders, the city should make private land owners aware of grants that can support tree planting to expand Tallahassee's urban canopy. Government and non-profit foundation grants are available to property owners with excess or unused land over 5 acres in size that could be used to improve habitat. Surplus land that is mowed or covered with invasive trees and plants could be converted to native forestland and most of the cost could be funded through grants. Examples of these grant programs in Florida include the Department of Agriculture and Consumer Services' Florida Forest Service and Fish and Wildlife Conservation Commission grant programs, U.S. Fish and Wildlife Department grants, the U.S. Department of Agriculture's Natural Resource Conservation services grants, and the Fish and Wildlife Foundation grant program. Tree planting and reforestation improve wildlife habitat and help control invasive plant species; and if large landowners implement a grant-funded project, they will benefit from reduced land management costs and the community benefits from the expanded tree canopy and its many ecological and economic services.

Goal 3: Engage the Larger Community

Engage and partner with the larger community on citywide urban forestry efforts.

Recommendation #9 - Develop a Team for Plan Implementation

This plan suggests many improvements for the management of public trees, but as this represents only 30% of the city's tree canopy, real progress will require the efforts and support from the community. A team approach to implementation is critical to long-term success.

- **Harness the existing momentum and interest from stakeholders.** Much of the stakeholder group expressed genuine interest in continuing on with this effort and many specified in their comment sheets things they were interested in doing to implement this plan. This informal team/group can reconvene and build working groups based on their strengths. New members can be invited based on the players identified as missing from the process or lacking engagement.

An implementation team can also provide the structure to engage individuals as team volunteers focused on one or two recommendations.

Recommendation #10 - Define and Implement a Roll-Out Plan to Maintain Momentum

Without a clear roll-out strategy defined in advance, plans like this can easily end up collecting dust on a shelf. The following steps are recommended to build on the foundation that has already been created during the development of this plan to both educate the community on this effort and harness the existing interested from both organizations and citizens.

- **Create Master Plan Synopsis for Public Consumption.** Creating a 5- to 10-page graphic-heavy public version of this plan is extremely helpful and can ensure more than just a select few will read the plan. Effective public versions include just the basic points in a magazine-type format that is easy to read with clear calls to action. This can be converted for use on the Tally Trees website as well (see Recommendation 11: Expand Overall Communications).
- **Engage Large Landholders (Businesses, Schools, Hospitals, Universities).** Explore options to match up the mission of various large landholders with the benefits that tree canopy in Tallahassee provides, i.e., when speaking with hospitals, frame trees as critical to quicker recovery rates and lower rates of asthma. Use any matching missions to approach each large landholder in a peer-to-peer manner. Once engaged, these large landholders can act to make small and large improvements to increasing both the quantity and quality of trees on their properties.

- **Continue Regular Presentations on the Urban Forest.** Continue to meet with local industry and neighborhood groups with updates on progress and calls to action to encourage community involvement and cooperation in implementation. Presentations could include the motivation behind developing a plan, the summary of findings of this plan, and the next steps of implementation. The implementation team (see Recommendation #9) could also assist with some of this outreach/public speaking.
- **Devise set branding and messaging related to this effort.** As multiple partners will be needed to achieve real progress in Tallahassee, implementation will occur via multiple players and individual volunteers. With this many moving parts, it is critical that, at the minimum, all involved are conveying the same messages and goals. For this reason, it is strongly encouraged to develop pre-defined messaging available to all involved to encourage the desired actions and ensure a consistent unified voice.

  Points to consider in this effort:

  - Focus messages on what people care about - the benefits that trees provide (livable neighborhoods, public health, heat stress alleviation, etc.) rather than the trees themselves.
  - Choose a limited number of message topics and work to convey those same messages over and over. Studies have shown in marketing that people need to hear or see a message 7 times, often in a different place, to really internalize a concept or idea.
  - Consider a message that will alleviate some angst that may come from canopy losses that will take place over the coming years. Important messages to convey include reframing the coming loss of some trees as a way of moving toward higher quality canopy, addressing the fear of trees within the public, better explaining regulations in place, educating the public on why trees are important, branding the city as a tree oasis, and that efforts now are working to preserve it.
  - Get a mantra and invite action. Learn from the local TAPP (Think About Personal Pollution) public campaign aimed at addressing water pollution related to stormwater runoff. There are many effective aspects of this program that can be applied to this urban forest effort, including their use of a mantra "Slow the Flow" (vs. "don't fertilize your lawn") and their message is "think" about it before you do it – not the command to "do it." These are effective messages that are doable, to-the-point, and inviting (instead of demanding).

  The brand and messaging will be the foundation of the entire effort, so it should be done thoughtfully and purposefully.

- **Rebrand the Adopt-a-Tree program and use it to launch PR on new plan.** The City of Tallahassee already offers a free tree planting program with the option of planting on private land (on front yards only within 100 feet of the street centerline), though interest to date has been surprisingly low. Multiple comments were made in the public meetings that the community did not know about this program. This program can be rebranded with a more direct name to better convey what it is. It can also be used as a PR "hook" tied in directly to this master plan effort and better conveys the fact that this is a free tree program. For example:

  "Tallahassee is working to minimize heat stress, improve public health, and lessen stormwater flooding by ensuring a no-net-loss of tree canopy across the city. This is critical as short-lived species die off, and the city grows and builds and develops more housing and businesses.

  To kick off this effort, the city is offering to plant a tree for free on your property (front yard only – some restrictions apply). Learn more and sign up to get your free My Tree for Tally today!"

  Better and more targeted messaging should be developed since this is a great opportunity to drive interest in this unused program and create a PR splash.

Recommendation #11 - Expand Overall Communication Efforts

Effective avenues of two-way communications are essential between city departments as well as between the city and its citizens. A need for improved communication between citizens and the city was cited multiple times by the public during the development of this plan. The public cited being unsure on who to call with questions (for both public and private trees) and wanting better knowledge of development plans.

The following items provide avenues for sharing information:

- **Update Urban Forestry Pages on City Website.** The *current* Urban Forestry page within the city website (www.talgov.com/tallytrees) includes the following content: Urban Forest Master Plan progress, and at the bottom "below the fold" links to Adopt a Tree, Canopy Roads Citizen Community, Tree Care Tips, Benefits of Trees and links to relevant pages related to trees and Development (Figure 12).

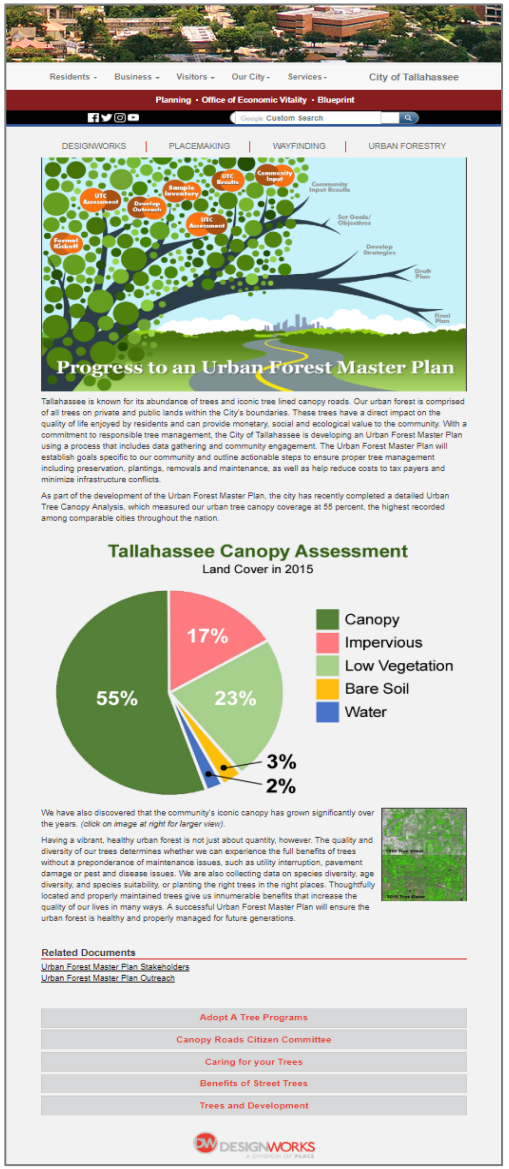


Figure 12. Screen shot of existing city urban forestry page.

- *Centralize a hub page on the city website for all trees.* Currently there is tree information on multiple pages on the city website and the pages are structured based on city organization, not public needs. Information on trees and tree canopy in Tallahassee should be housed on one "hub" page within the city website as a central point for consumers to start their search for information. This should logically be on the Urban Forestry page, especially as it has the "/tallytrees" URL that is easy to remember and convey to the public.
- *Restructure and add relevant content to the hub page.*
  - Address citizens' most common questions first. Regardless of what department does the work, the hub page should address the top 5–10 questions that consumers (citizens) have. Examples of common questions from users when they are looking for tree information within the city site follow.
    - I'm concerned about my street tree. Who do I contact?
    - I saw a tree in a park that doesn't look good. What should I do?
    - I'm looking for a reputable contractor for a tree on my private property.
    - I would like to have a street tree.
    - Why are trees being removed on my street?
    - Links to city and county development pages.

    Two examples of city urban forestry web pages that address users questions well include NYC Parks: https://www.nycgovparks.org/services/forestry and the City of Cambridge (MA): https://www.cambridgema.gov/theworks/ourservices/urbanforestry/faq.
  - *Consider sharing success stories.* In many cases, the public only sees or notices negative actions (removals, tree hazards, etc.), but in actuality, there are many positive efforts and projects going on throughout the city all the time. And while development projects can result in removals, they often involve contribution of funds to the Tree Bank, though much of the public cited no knowledge of what these monies funded. Also consider featuring success stories as neighborhoods start to engage in this city-wide effort. These are important stories to share.
  - *List out city initiatives and priorities* with explanations of each. Linking to a PDF of this master plan is an obvious content choice, but also consider featuring the Vision, 3 Goals and list of next steps. This is important to share upfront as actual text is on the site that a user can absorb without reading through a large document. This is also an ideal place to address and explain the activities that will be coming related to quality improvements (this is explained in Chapter II: Challenges and Chapter V: State of the Urban Forest/Trees).
  - *Keep a disaster response/update page updated at all times.* A link to a disaster preparedness and response page specifically focused on trees is a good page to always have in place. This can include how to prepare for storms with minimal tree damage (proactive care, etc.) as well as information on what to do after a storm (see Recommendation #7).

- *Improving links to and from relevant pages within other departments/agencies.* There are gaps in linking between relevant pages that can improve a user's ease of access to all the information they want (and education resources they need). For example, only the Adopt a Tree program is included in the Environmental Practices section of the site. The city, however, does/offers more related to Environmental Practices than just this one program. A more effective plan would be to create a page in the Environmental Practices section that describes WHY trees and tree canopy is important and a part of the city's environmental efforts, then link back to the hub page discussed above. Other pages/departments that should have active links back and forth with the Trees hub page could include Neighborhood Services (how to improve canopy in your own neighborhoods), Sustainability (how trees contribute to a city's sustainability), county stormwater (how trees contribute to stormwater management), etc.

- **Consider hosting an annual public meeting.** To improve two-way communication with the public, consider hosting a forum to present a "State of Tallahassee's Urban Forest Report" each year. This gathering could allow the city to summarize efforts in place currently, progress updates and accomplishments and inform the public of new programs, initiatives, and next steps, and provide a venue to get feedback and concern input from the citizens.
- **Engaging public in implementation of plan** will keep ongoing communications open. Recommendations 9–13 provide suggested ways to engage the public.
- **Continue to support an internal urban forestry staff team**. Currently, urban forestry staff are housed in multiple departments. During the development of this plan, an internal urban forestry team was created aimed at better and more consistent interdepartmental communication and coordination to ensure the program operates under current industry standards, and to interface more clearly and easily with the public.
- **Further explore and convey development code and city processes**. Continue to educate public, local tree and lawn care services, and development community around development code (described further in *Recommendation #2: Evaluate and Update Tree Preservation and Planting Regulations*).

- **Expand on the current avenue of information dissemination when removals occur**. Removals will happen as the city strives to improve canopy quality and continues to ensure public safety. A system of signage with clear messages (not legalese) and potentially links to the city web site on specific related issues or initiatives can help explain why the removal is occurring to passers-by. The city currently uses the notices shown in Figure 13. However, work to create positive messages that focus on the end game and not the removal or change itself. For example, the signage could instead have the large title of "Working to Improve Tallahassee's Tree Canopy" instead of large removal focus. The signs could include information about the issues with pioneer species (short lived, weak wooded despite it looking healthy now, etc.).

The implementation team (see Recommendation 9) can also be involved in these processes to improve communications.

Figure 13. Current communications signage in Tallahassee.

Recommendation #12 - Get the Public Engaged to Improve Their Own Communities

Real progress occurs when people work to improve their own communities rather than local government doing work for them. Currently there is not a lot of neighborhood-driven effort in place related to trees and tree canopy. Neighborhoods can be empowered to implement this plan in their own communities via mini master plans or through tree stewards programs.

- Consider providing interested neighborhoods with the information needed to create a "mini master plan" at the neighborhood level. Establishing small area goals that fit into this city-wide urban forest master plan framework can help create buy-in at the local neighborhood level. Each community that generates enough local interest could go through a process of learning about the canopy in their own neighborhood and see prioritized planting areas in their neighborhoods, thanks to the extensive GIS canopy data now available from the recent UTC.
- Additionally, Tallahassee can support the development of neighborhood Tree Stewards programs for citizens who want to be more involved. The citizens could then care for newly planted trees and organize special events in their own neighborhoods, as well as being a source of information on proper care and maintenance of trees. Examples of programs in other communities follows.

Examples of Volunteer Tree Care Programs

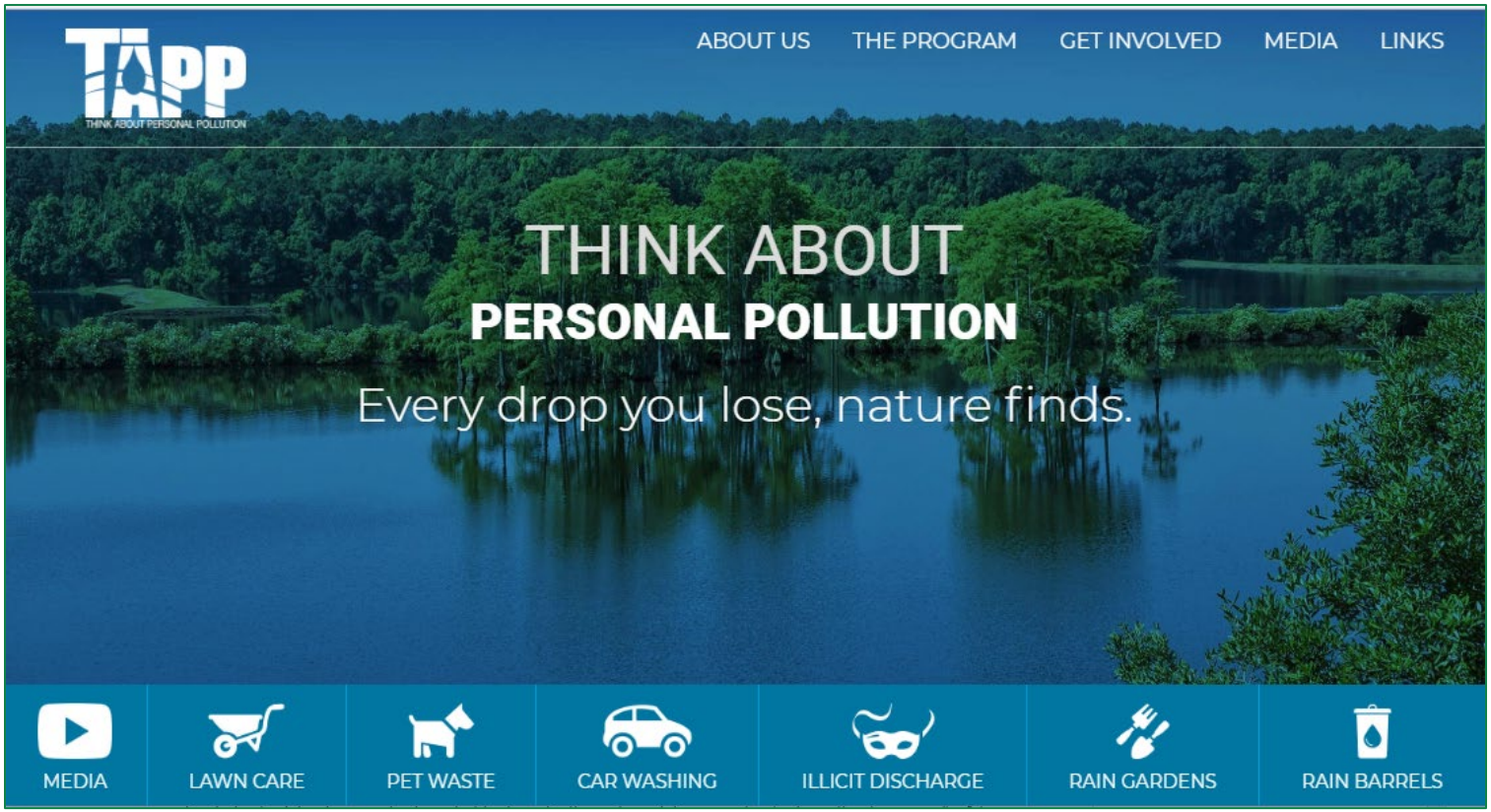
Tree Tenders, Pittsburgh, PA. In 1993, the Pittsburgh Shade Tree Commission (PSTC) created a volunteer program named Tree Tenders® to help plant and care for existing trees. Tree Tenders® from neighborhoods were trained to care for newly-planted trees. The PSTC also helped community groups organize tree care work events and maintained a small tool bank for use by volunteers. In 2006, Tree Pittsburgh, a 501(c)(3) charitable, nonprofit urban forestry organization, was established and continued the volunteer program and created a certificated Tree Tenders® program. Tree Pittsburgh requires that Tree Tenders® take an 8-hour course and learn about urban forestry practices, tree biology and health, proper planting, pruning, and maintenance. The cost of the course is $40 (scholarships are available), which includes registration, materials, light food, and instruction. Tree Tenders® participate in events organized by Tree Pittsburgh that include tree care days, pruning workshops, and tree planting. Since 2006, Tree Pittsburgh has certified over 1,300 Tree Tenders®.

CommuniTree Stewards, Syracuse, NY. Funded by the City of Syracuse and Onondaga County, the CommuniTree Steward Program started in 2002 to cost-effectively plant and maintain trees by exchanging tree maintenance classes for volunteer work on public trees. The program is run by Cornell Cooperative Extension (CCE). Students enroll in the winter and begin the required CCE courses in April. Coursework includes tree biology, tree identification, soils, matching tree species to the site, tree planting, basic pruning, structural pruning, proper mulching, and watering. Students are closely monitored and instructed during forestry projects. By the end of the summer, most students need little supervision; by the fall, CommuniTree Stewards participate in large-scale, bare-root planting events. Veteran Tree Stewards, who return annually to work on tree projects and plantings, will often pair up with new Tree Stewards and will serve as instructors. CommuniTree Stewards have planted thousands of trees in the City of Syracuse and Onondaga County villages. Volunteers are also able to serve on specialty projects such as tree inventories and invasive species mapping. Veteran CommuniTree Stewards have gone on to organize their own neighborhood projects, so the program has had an impact beyond its original intended area.

Combining Youth Employment Opportunities with New Tree Care in Indianapolis. Newly-planted public trees in Indianapolis don't always have predetermined caretakers. For this reason, Keep Indianapolis Beautiful (the city's nonprofit tree partner) employs a team of young people to plant, mulch, stake, water, and prune public trees for seven weeks each summer. The Youth Tree Team program, which began in 2008, pays local high school students to take on this role of promoting new tree establishment and care. The program is supported through corporate donations, a foundation, and other donations.

Recommendation #13 - Incorporate Trees into TAPP Curriculum

As mentioned earlier, the local TAPP (Think About Personal Pollution) program is a well-devised public campaign to address water pollution related to stormwater runoff. As trees and tree canopy intercept millions of gallons of stormwater each year, trees are a definite fit within TAPP's "Slow the Flow" mantra yet are not currently included as one of the solutions. It would be beneficial to contact the program head to inquire about incorporating tree planting and preservation into the program.



CHAPTER VII. IMPLEMENTATION

Upon completing a master plan, the following challenges often include how to pay for the implementation, verifying the equipment/software/personnel needed to complete the plan, and which recommendations should be prioritized. A suggested timeline for implementation, a discussion of resources required, and suggested progress benchmarks follow.

Resources Required

Funds, staff, equipment, and other resources will be needed for 1) management plan implementation; 2) public relations and outreach work; and 3) the successful roll-out of plan. This section will confirm the resources and funding needed to fulfill the plan, identify funding or equipment that could be used more efficiently, and explore new opportunities for securing additional resources.

Funding. Not surprisingly, many cities cite their biggest impediment to implementing an urban forest master plan and sustaining a proactive tree care and planting program is funding. While there are national comparisons that can be made (see Table 8), there is no national standard for the minimum amount or most effective urban forest budget allocation. The level of adequate funding is ultimately defined by the cost to implement and maintain a proactive tree care program for a particular city.

Determining an Annual Budget. As discussed in *Chapter V. State of the Urban Forest*, average annual urban forest management expenses in Tallahassee are approximately $510,000 across four departments for tree maintenance, planting, and management. A determination of an adequate budget level (for proactive, comprehensive care) for the City of Tallahassee is extremely difficult without data from a complete tree inventory. However, using the benchmark information and sample inventory results, two estimates can be developed. These two methods, while not concrete, provide a glimpse of the scale and range of the potential budget required, and thus can be used for initial discussion and planning purposes.

- **Peer City Comparison.** Using the data from peer group cities for comparison, the annual urban forestry budget for Tallahassee could range between $1,368,607 and $3,960,870 depending on the benchmark used.
- **Street Tree Budget Based on Sample Inventory**. Using data from the 3% sample street tree inventory and city production information, and assuming a 10-year cyclical proactive program, an annual budget of at least $2,343,000 would be needed to provide yearly pruning, priority removal, young tree maintenance, and replacement tree planting. A 20-year cycle would require $1,171,500 each year.

Both methods show a significant funding shortfall to begin this important transition from a reactive public tree management program to a proactive one in Tallahassee.

Beyond street tree maintenance and planting, other important urban forest management tasks and recommendations in the plan also require sufficient funding. The city's urban forest budget allocations also need to support:

- equipment purchases, rentals, or other capital expenditures
- additional full- or part-time staffing, training, and development
- plant health care
- storm response
- risk management
- invasive pest management
- volunteer programming and coordination
- expanded outreach and communications
- additional urban forest management, UTC, and GIS analyses

Current Funding Sources. The sources of funding the city currently uses to support urban forest management are varied, and include general funds, capital funds, state grants, and Landscape Fee-In-Lieu (Tree Bank) funds. The Tree Bank holds fees collected by Growth Management as mitigation compensation for trees lost during land development projects, which are then dispersed by the Community Beautification Department. The City Commission Policy describing the administration and use of the funds is clear—the priority is to use the funds for landscaping and tree planting in target areas of the city. But, other authorized uses include funding the maintenance of public trees, care of Patriarch trees, public tree inventories, training, and other activities that protect, enhance, and expand the urban forest. In the short term, the Tree Fund should be considered as a source of additional funds that are needed to start the journey towards a proactive program, particularly in support of completing the public tree inventory and beginning proactive maintenance.

Suggestions and Ideas for Other Funding Sources. Other options exist for funding new urban forestry initiatives and expanding the existing program; each will require that the city evaluate the applicability, practicality, and political reality of using one or a combination of these sources.

1. **Consider a tree fee.** The justifications and use of a tree assessment and fee would be much like those for the city and county's fire service, stormwater, and solid waste disposal fees. All properties benefit from the city's tree canopy and public trees, and the collection of a small fee would ensure that every property owner contributed equitably to sustaining the urban forest. The fee could be based on the total feet of right-of-way frontage or as a percentage of the property value. In a recent University of Florida study, property owners said they would pay up to $7 more per month for tree planting and maintenance in their neighborhoods. The findings of the study indicate that citizens are interested in urban forest infrastructure and are willing to pay for the benefits of having more trees near their homes.

2. **Evaluate the possibility of allocating a portion of the current stormwater fee or a future increase in the fee to the urban forestry program.** Trees play a significant role mitigating the city's stormwater issues. As the benefit calculations proved, the street trees alone provide the city an estimated $886,000 in stormwater runoff services with the average benefit per tree equaling $9.88 per year. Acknowledging the large contributions trees make to municipal stormwater programs, cities across the country are using stormwater fees for both grey and green infrastructure construction, and enhancement. Tallahassee could use stormwater fees (or a small part of a future rate increase when that is needed) to supplement the funding for tree planting and urban canopy maintenance and be able to justify that action with the tree benefit data.
3. **Seek grants from non-traditional sources.** The State's Division of Forestry has offered urban forest grants for decades, and Tallahassee has been the recipient of these grants multiple times in the past. However, there other granting agencies and private foundations that may provide funding to the City of Tallahassee to support patriarch tree preservation, native habitat conservation, community involvement, tree planting, and other projects. Consider applying for grants focused on the benefits trees provide (i.e., grants with an air quality focus, urban heat island, stormwater management, public health, and watershed-based funding), not just urban forestry-related grants. Grants and philanthropic funding should be carefully coordinated with city funding and should follow policies and procedures already in place. It is critical that private funding supplement the city's public funding rather than replace it.
4. **Ensure the city receives all qualified FEMA reimbursements.** FEMA is the major federal agency that will be a partner of the city in the event of a severe storm emergency. FEMA will reimburse the city for the costs of debris removal, hazard reduction pruning, and removal of certain trees in the rights-of-way if a federal disaster is declared. Final reimbursement of storm-related damages from FEMA is dependent on accurate record keeping and documentation of storm-related cleanup work. This is another reason the city should be diligent at completing the public tree inventory and keeping it up-to-date.

With sufficient financial resources to secure professional services, equipment, and management, the city can accomplish its goals, better respond to changes and challenges in the urban forest, and best serve the citizens of Tallahassee.

Staffing. The city has qualified, dedicated, and professional arboricultural staff in many departments. However, the staff complement may be too limited in terms of realistically achieving the goals set for the urban forest management program and beginning a proactive program.

For instance, Growth Management staff are responsible for reviewing development site plans, all tree permitting, and monitoring projects. With only two trained arborists in the department, this department is challenged to provide the expertise and oversight needed for every project and initiative. Because of the minimal number of trained arborists assigned to Growth Management, site inspection for trees in development projects is limited and can also be considered reactive. A reactive system like this can allow trees on development sites to be improperly planted, die without replacements, or fail due to lack of or improper tree protection efforts, which ultimately results in hundreds of thousands of dollars of investment into the urban forest being wasted or lost over the course of a few years.

Increasing Tree Benefits While Reducing Costs

Communities and homeowners can increase the benefits of the urban forest and decrease the costs through knowledge of the following:

- Determine and prioritize long-term objectives and a desired future for your urban forest.
- The less maintenance a tree requires, the lower its financial costs (use low-maintenance, drought-resistant, salt-tolerant trees)
- Trees in harsh urban sites will incur greater financial and environmental costs than established trees in parks and natural areas.
- Longer-lived, large canopy trees will reduce costs and delay removal expenses.
- Established forests and trees need less maintenance, so preserving them should take precedence over planting new trees.
- Understand the community's attitudes and perceptions toward the urban forest.
- Seek public input during the development of management goals and objectives.
- Plant the right tree in the right place.

Source: "The Costs of Managing an Urban Forest," University of Florida, IFAS Extension.

The Community Beautification Department's staff are well trained and receive regular professional arboricultural, equipment use, and safety training, and hold arboricultural industry qualifications. But given the demands and responsibilities of transitioning to a more proactive street tree management program and the large public tree population, Community Beautification staff may be challenged to perform proactive maintenance, inspect citizen and departmental requests, and monitor infrastructure construction projects.

As the city transitions to a proactive, more efficient and effective urban forest management program, these initial staffing recommendations are made:

1. At least one more Certified Arborist should be in the Growth Management Department to assist with site plan review and project inspections.
2. Three additional arborists could be hired so Community Beautification field crews can operate as two distinct and consistent units that can perform street tree pruning and removal tasks.
3. If no full-time city staff can be added, then create an arboriculture training program for code enforcement and other staff that perform site and tree inspections.

Equipment. As stated in *Chapter V: State of the Urban Forest,* equipment is currently adequate for existing reactive work. However, to implement a proactive, cyclical tree maintenance program for public trees, new and additional equipment are needed; the number and types of equipment can be determined after the inventory is complete. Knowing the quantity and types of maintenance recommended for the entire public tree population will give the city data upon which to make decisions about equipment purchases for in-house crews and/or whether to contract the work.

Measuring Progress in the Coming Years

This Urban Forest Master Plan should be considered a living document. As such, it should be reviewed annually to assess successes and failures, to be re-evaluated when updated inventory and UTC data are available, and to address any new threats or challenges that arise in future years. There are multiple metrics with which to measure progress during the annual reviews of the plan:

- Changes in diversity/increase of canopy quality
- Changes in tree canopy cover levels
- Reassessment with same framework - movement from low to moderate or moderate to good
- How many neighborhoods are involved in their urban forest? Are any new large landholders engaged?
- Accomplishment of “check list” items – code adjusted, UTC update scheduled, public tree inventory complete, management plans adopted, number of outreach efforts completed, etc.

These review criteria should be chosen in advance, and a plan and schedule should be in place before undertaking the annual reassessments. A progress report can and should be presented to city staff, leadership, and to the general public. Benchmarks to measure this success should be based on plan goals; examples are presented below.

If the City's goal is:	Potential benchmark could be:
All public trees in good condition and well maintained.	70% of all trees are in Good or Excellent condition and are maintained to maximize current and future benefits.
Improved composition of existing tree canopy to long-lived, wind resistant species and non-invasives.	Top high value species change to ideal species (no pioneer or invasive species).
A diverse urban forest population.	No species represents more than 10% of the citywide tree population.
Invasive trees are controlled on public property.	No more than 5% of inventoried trees are considered invasive species.
A safe urban forest on public lands.	All high-risk removals and prunings are complete, and all publicly managed trees are free of recognized hazards.
An urban forest and tree canopy that is appreciated and valued by the public.	Measurement of the quantity of public engagement efforts – number of volunteer project participants, educational programs/outreach efforts, and partnerships in place.
No net loss of public urban canopy cover.	More public trees are planted than removed. Or a policy/practice that for every public tree removed at least 1 is planted.

Timeline

With all of the strategies and action steps presented in this master plan, it can be overwhelming and difficult to determine how to begin implementing the recommendations. A suggested general timeline, covering the next two decades, is presented for the city's consideration which should clarify how all these tasks fit together and can be implemented in a reasonable manner. It is important to initiate multiple strategies at once; since many of them will take on their own momentum with little additional support of the city, especially as the public gets more involved.

- **Year 1 (2019)**
  - Get urban forest master plan and community urban forest goals officially adopted by the city commission (Recommendation 5).
  - Create shorter, public version of master plan (Recommendation 10).
  - Set up implementation team and internal city urban forestry team (Recommendations 9 & 11).
  - Set benchmarks for measuring future progress.
  - Set branding and messaging related to urban forestry for all players to use (Recommendations 10 & 11).
  - Expand city web site related to trees (Recommendation 11).
  - Define and begin to implement a roll-out plan (Recommendation 10).
  - Rebrand Adopt-A-Tree program and use as PR to promote renewed urban forest efforts coming from this plan (Recommendations 10–12).
  - Start discussion on priorities for strategic planting plan, including local nurseries in discussion (Recommendations 3 & 4).
  - Continue next planned phase of inventory data collection (Recommendation 1).
  - Implement required maintenance work on high priority trees identified in most recent inventory phases (Recommendation 1).
  - Implement added communication messaging to disaster response communications.
  - Explore incorporating trees into TAPP curriculum (Recommendation 13).
- **Year 2 (2020)**
  - Initiate regulation effective analysis by reviewing multiple past development projects (Recommendation 2).
  - Begin revisions to development regulations (Recommendation 2).
  - Explore new public tree protection ordinance (Recommendation 2).
  - Start developing user's manual (Recommendation 2).
  - Continue phased inventory data collection (Recommendation 1).
  - Continue to implement required maintenance work on high priority needs identified in most recent inventory phases (Recommendation 1).
  - Host first annual meeting and promote rebranded Adopt-a-Tree and mini-master plan options to neighborhoods (Recommendation 11 & 12).

- **Years 3–5 (2021-2023)**
  - Continue phased inventory data collection.
  - Start proactive maintenance in select management units (Recommendation 1).
  - Officially adopt revised land development regulations and post user's manual and tree matrix for public use (Recommendation 2).
  - Continue public outreach as determined in roll-out plan and engagement efforts (Recommendations 10–12).
  - Implement mini-master plan and potentially a tree stewards program (Recommendation 12).

- **Years 5–10 (2024–2028)**
  - Ongoing proactive maintenance in select management units (Recommendation 1).
  - At year 5, convene stakeholders and repeat the self-assessment process (potentially in a one-day meeting) to gauge progress based on assessment matrices performance ratings, and reevaluate current efforts.
  - Continue public outreach as determined in the roll-out plan and engagement efforts (Recommendations 10–12).
  - At year 10, convene stakeholders and repeat self-assessment process again to gauge progress.
- **Years 11–20 (2029–2039)**
  - Ongoing proactive maintenance in select management units (Recommendation 1).
  - Conduct another UTC analysis in or around 2028 – ten years after this last analysis.
  - Ongoing proactive maintenance in select management units.
  - At year 20, develop a new urban forest master plan.

CHAPTER VIII. FINAL THOUGHTS

The City of Tallahassee is committed to working toward a sustainable, extensive urban forest, and to implementing the recommendations in this plan. The process of developing an urban forest master plan has given Tallahassee a better understanding of the urban forest, the challenges facing it, the expectations of the community, and the actions needed to make positive changes in its quality and function.

This plan contains both short- and long-term goals and objectives that Tallahassee can implement incrementally until the urban forest management program is providing the level of service desired by staff and citizens. It can be considered a roadmap guiding the city forward to a more sustainable urban forest and a key piece to working toward city priorities of quality of life and improving infrastructure.

The city also intends to support and guide citizens, businesses, institutions, and local non-profit organizations with their efforts to be actively engaged in the urban forest. As the majority of tree canopy is privately owned, improving the urban forest is the responsibility of the entire community - not just the city alone. The work recommended in this plan should be a joint effort by the city, the citizens, and local organizations working together to create a vibrant community in which to live, work, and play.

This master plan is evidence of the city taking the lead to improve and protect Tallahassee's tree canopy for all residents, and serves as a positive next step to preserving and improving the iconic canopy that uniquely defines the city's character and provides benefits for all citizens.

GLOSSARY

aesthetic/other report: The i-Tree Streets Aesthetic/Other Report presents the tangible and intangible benefits of trees reflected by increases in property values in dollars ($).

air quality report: The i-Tree Streets Air Quality Report quantifies the air pollutants (ozone [O3], nitrogen dioxide [NO2], sulfur dioxide [SO2], coarse particulate matter less than 10 micrometers in diameter [PM10]) deposited on tree surfaces and reduced emissions from power plants (NO2, PM10, Volatile Oxygen Compounds [VOCs], SO2) due to reduced electricity use measured in pounds (lbs.). Also reported are the potential negative effects of trees on air quality due to Biogenic Volatile Organic Compounds (BVOC) emissions.

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

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

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

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

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

carbon dioxide report: The i-Tree Streets Carbon Dioxide Report presents annual reductions in atmospheric CO2 due to sequestration by trees and reduced emissions from power plants due to reduced energy use in pounds. The model accounts for CO2 released as trees die and decompose and CO2 released during the care and maintenance of trees.

community forest: see urban forest.

condition: The general condition of each tree rated during the inventory according to the following categories adapted from the International Society of Arboriculture's rating system: Excellent (100%), Very Good (90%), Good (80%), Fair (60%), Poor, (40%), Critical (20%), Dead (0%).

cycle: Planned length of time between vegetation maintenance activities.

defect: See structural defect.

diameter: See tree size.

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

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

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

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

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

grow space size: Identifies the minimum width of the tree grow space for root development.

inventory: See tree inventory.

i-Tree Streets: i-Tree Streets is a street tree management and analysis tool that uses tree inventory data to quantify the dollar value of annual environmental and aesthetic benefits: energy conservation, air quality improvement, CO2 reduction, stormwater control, and property value increase.

i-Tree Tools: State-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. The i-Tree Tools help communities of all sizes to strengthen their urban forest management and advocacy efforts by quantifying the structure of community trees and the environmental services that trees provide.

management costs: Used in i-Tree Streets, they are the expenditures associated with street tree management presented in total dollars, dollars per tree, and dollars per capita.

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

net annual benefits: Specific data field for i-Tree Streets. Village-wide benefits and costs are calculated according to category and summed. Net benefits are calculated as benefits minus costs.

ordinance: See tree ordinance.

overhead utilities: The presence of overhead utility lines above a tree or planting site.

pioneer species: early colonizer of a new habitat, initiating a secondary succession.

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

risk: Combination of the probability of an event occurring and its consequence.

species: Fundamental category of taxonomic classification, ranking below a genus or subgenus, and consisting of related organisms capable of interbreeding.

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

street tree: A street tree is defined as a tree within the right-of-way.

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

sulfur dioxide (SO2): A strong-smelling, colorless gas that is formed by the combustion of fossil fuels. Sulfur oxides contribute to the problem of acid rain.

summary report: A report generated by i-Tree Streets that presents the annual total of energy, stormwater, air quality, carbon dioxide, and aesthetic/other benefits. Values are reflected in dollars per tree or total dollars.

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

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

tree height: If collected during the inventory, the height of the tree is estimated by the arborist and recorded in 10-foot increments.

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

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

tree size: A tree's diameter measured to the nearest inch in 1-inch size classes at 4.5 feet above ground, also known as diameter at breast height (DBH) or diameter.

urban **forest:** All of the trees within a municipality or a community. This can include the trees along streets or rights-of-way, in parks and green spaces, in forests, and on private property.

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

volatile organic compounds (VOCs): Hydrocarbon compounds that exist in the ambient air and are by-products of energy used to heat and cool buildings. Volatile organic compounds contribute to the formation of smog and/or are toxic. Examples of VOCs are gasoline, alcohol, and solvents used in paints.

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APPENDIX A
PUBLIC ENGAGEMENT SUMMARY

Public Engagement Summary. Meetings were held covering the topics of The Trees, The Players, and The Management Approach with stakeholders from various parts of the city, in order to better inform the plan. For the purposes of this project, stakeholders are to be considered key players in the urban forest - likely organizations, city departments, corporations, community organizations - not individual public citizens. Three meetings set at the Renaissance Center:

Meeting 1: The Trees: Tuesday 1/23/18, 8–10 AM
Meeting 2: The Players: Tuesday 2/27/18, 8-10 AM
Meeting 3: The Management Approach: Tuesday 3/27/18, 8-10 AM.

A full list of notes gathered from the stakeholder meetings can be found on file with the city.

Organizations Involved

Citizens of Tallahassee
Canopy Roads Citizens Advisory Committee
City of Tallahassee (COT) Community Beautification / Right of Way Tree Management
COT Community Policing
COT Growth Management
COT Neighborhood Affairs
COT Parks and Recreation
COT Resiliency
COT Underground Utilities and Public Infrastructure - Public Infrastructure Engineering
COT Underground Utilities and Public Infrastructure - Stormwater Services
COT Underground Utilities and Public Infrastructure - Electric Utility
Downtown Tallahassee Business Owners
Florida Agricultural and Mechanical University - Grounds Management
Florida Chapter American Society of Landscape Architecture - Tallahassee Chapter
Florida Department of Management Services - Grounds Management
Florida Environmental and Land Services, Inc.
Florida Forest Service - Local Agent
Florida Forest Service - Urban Forestry
Florida Nursery, Growers, and Landscape Association - Big Bend Chapter
Florida State University - Grounds and Landscape Operations
Greater Tallahassee Chamber of Commerce
Leon County Institute of Food and Agricultural Sciences Extension Office
Leon Trees
Local Forestry/Arboricultural Consultant - Big Bend Forestry
Local Forestry/Arboricultural Consultant - Legacy Arborist Services

Office of Economic Vitality
Sustainable Tallahassee
Tall Timbers Research Station and Land Conservancy
Tallahassee Community College - Grounds Management
Tallahassee - Leon County Planning Department
Tallahassee Board of Realtors
Tallahassee Builders Association
Visit Tallahassee
Florida Department of Transportation

Organizational Meetings:

Canopy Roads Citizens Advisory Committee
Tallahassee Builders Association
Sustainable Tallahassee
Council of Neighborhood Associations (CONA)
Leon County Master Gardeners
Leon County Water Resources Committee
Community Redevelopment Agency
Tallahassee Planning, Land Management & Community Enhancement (PLACE)
Utility Citizens Advisory Council
Capital Area Neighborhood Network (CANN)
Chamber of Commerce Business
Leon County Certified Arborists
City Commission
FSU Urban and Regional Planning Class
Tallahassee Trust for Historic Preservation
League of Women Voters
Seven Hills Regional User Groups for GIS
Local American Society of Landscape Architects chapter

Public Meetings Summary

Public Meetings Summary. Two public meetings were held to both educate the community on the purpose of an urban forest master plan and get public input for the plan. Meetings were held Tuesday, March 27, 2018 at 6–8 p.m. at the Jack L. McLean Community Center and Wednesday, March 28, 2018 at 6–8 p.m. at Frenchtown Renaissance Center. After a presentation by Urban Forester Melinda Mohrman on the current state of Tallahassee's urban forest, attendees broke into several smaller groups for discussion. Several themes emerged, particularly in the challenges and solutions for Tallahassee's urban forest:

- **Education/Outreach.** There is a lack of awareness on proper management/maintenance of trees and tree selection, or getting the right tree in the right place. Solutions included starting an outreach program similar to TAPP, using mail inserts in electricity/water bills, and the city hosting classes to educate on these areas of weaknesses.
- **Operations, Ordinances, Maintenance, and Development.** The public feels there is significant conflict between trees and other city infrastructure, including powerlines, sewage/water lines, sidewalks, and development, as well as a general lack of commitment by the city to protect the city's tree resource. There was a strong emphasis on getting *more effective* tree protection ordinances and enforcing the ordinances, as well as a desire to employ local developers who would put more emphasis on saving trees during construction projects.

- **Transparency/Communication.** The public strongly feels that information regarding tree preservation and removal during development projects is difficult to find. They would like to see more transparency in communication, particularly getting information regarding development projects much earlier in the development process. Improvement of the city's website was requested, as well as increased communication via television, radio, e-mail, facebook, radio, and text.

Full summary of notes can be found on file with the city.

Tallahassee Tree Survey Results

A survey was available online over a four-month period and was advertised via social media, newspaper articles, and in-person meetings. Over 600 people took the survey. A summary of the results follows.

Total Responses Received: 603

Question 1: Where do you live (zip code)?

Zip	Responses	Zip	Responses
32301	114	32314	1
32302	2	32317	33
32303	126	32327	2
32304	25	32333	4
32305	10	32340	1
32308	81	32343	1
32309	70	32344	1
32310	10	32920	1
32311	38	33065	1
32312	78	Out of State	4

Question 2: What is your age group?

- Under 18 - 0%(0)
- 18–24 - 3% (19 responses)
- 25–44 - 37% (221 responses)
- 45–64 - 37% (223 responses)
- Over 65 - 23% (140 responses)

Question 3: Do you own or rent your place of residence?

- Rent – 19% (113 responses)
- Own – 81% (490 responses)

Question 4: Below is a list of some of the community noted benefits that trees provide. Rate the importance of the benefit to you.

Trees…	Importance				
	Not	Not Very	Neutral	Somewhat	Very
improve air quality	0%	1%	1%	9%	90%
positively impact property values	1%	3%	6%	29%	62%
control stormwater runoff	1%	1%	3%	16%	80%
improve water quality	0%	0%	4%	14%	82%
provide shade	0%	1%	1%	17%	80%
provide energy cost savings	1%	2%	3%	20%	74%
improve public health.	1%	1%	5%	18%	75%
enhance community appeal to current and potential residents	2%	5%	7%	21%	66%
enhance recreation areas	1%	1%	2%	19%	78%
prevent erosion	1%	1%	2%	14%	83%
provide wildlife habitat	1%	1%	3%	10%	85%
provide privacy	2%	3%	5%	29%	61%
buffer noise	1%	3%	4%	23%	70%
Other (specified below)	128 responses (detailed below)				

Other Comments (128 responses). Open-end responses to this question were grouped into categories of ideas:

- **Trees make Tallahassee unique, adding beauty and charm. 59%** of comments (75 responses) focused on the idea that trees are one of the things that makes Tallahassee unique and beautiful and serves as a primary and iconic identifier. Many cited this city asset as a primary reason people want to live here. Comments included:
  - "Tallahasseans are proud of our trees. We need to promote our city as the city of trees. It is a huge selling point. The vision of live oaks draped in Spanish moss is the reason I moved here."
  - "They make Tallahassee what it is."
  - "Tallahassee is known for its trees. If we continue to cut them all down, we lose what makes us special."
  - "Key factor in image and identity of Tallahassee."
  - "It's very beautiful and distinguishes us from ugly run-down cities like Orlando and Miami."
  - "Trees are an extremely important part of our city as a whole. Everyone who visits says something about them. We need to keep as many as possible."
- **Trees contribute directly to the quality of life in Tallahassee. 41**% of comments (52 responses) focused on the idea that trees in Tallahassee directly relate to quality of life for residents. Comments included:
  - "improve attitude and mental health through natural beauty in our everyday life."
  - "provide a sense of emotional well-being, living in such a green environment."
  - "contribute to the characteristics of the City of Tallahassee and its sense of place, so that it isn't another generic minefield of plastic signs and high-rise buildings."
- **Stop losses of large mature trees to development. 10%** of comments (13 responses) focused on the issue of losses of large trees to development. Comments included:
  - "It seems like it is pretty clear Tallahassee NEEDS to keep its urban forests as a priority instead of giving so much to developers."
  - "I have seen far too many old growth trees removed under the guise of improving Tallahassee and encouraging development. Growth is good but not at the expense of our formerly beautiful city."
  - "As new shopping and housing complexes go in, and large trees are removed, I miss the landscape. I wish there was a policy in place they would have to keep large trees..."

- **Trees are needed for wildlife habitat and biodiversity. 9%** of comments (12 responses) focused on the need for trees related to the larger ecosystem's needs. Comments included:
  - "Our trees are vital to our lives, and the lives of all the wildlife that uses them."
  - "Provide habitat for birds and other animals."
  - "Trees and their diversity help sustain all sorts of plant and wildlife. Their growth and protection are of upmost importance for the survival of these intricate webs of life."
- **Trees play a critical role reducing CO_2 from the atmosphere. 9%** of comments (12 responses) focused on trees roles in the reduction of greenhouse gases from air. Comments included:
  - "Trees control environmental air pollution from automobiles."
  - "Trees are a necessary component of actions to address global climate change issues."
- **Categories of remaining comments (less than 5% of responses):**
  - Trees are critical for reduction in heat stress.
  - Trees contribute to better health of residents.
  - Trees teach children about nature.
  - Trees screen unsightly views.
  - Trees are a problem by interfering with utilities (power).

Question 5: Rate how strongly you agree or disagree with the following statements.

	Agreement				
	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Majority of Responses Agree					
Continue developer remediation efforts. The city should continue to require that when trees are removed by a developer, the developer replant new trees on the property when possible or pay money into a tree bank to pay for trees to be replanted.	4%	2%	5%	13%	76%
Continue Adopt-a-Tree. The city should continue offering its Adopt-A-Tree program.	3%	1%	13%	18%	65%
Use natives. When planting new trees, types that are native to Florida should be used.	1%	3%	4%	23%	69%
Prune to avoid blockage. Trees should be trimmed and properly maintained to ensure they don't block signs, street lights, and drivers' visibility.	1%	3%	6%	25%	66%
Prune to avoid utilities. Trees should be trimmed or removed to ensure they don't damage utilities, including electric lines.	5%	11%	13%	33%	38%
Trees make Tallahassee more attractive and add to the community's charm.	1%	1%	1%	9%	87%
Responses Spread Across the Agree/Disagree Range					
Tree removal of less desirable types (those that are not native to our area and/or will not thrive in our environment) or dead/declining trees should be less regulated.	17%	18%	24%	25%	16%
Remove trees in conflict. Trees causing damage to existing sidewalks and streets should be removed.	20%	29%	21%	16%	14%
Development focused on core. Development should be encouraged in the urban core as opposed to the suburbs to help minimize the impacts to trees.	8%	12%	23%	30%	27%
Trees enhance the safety of neighborhoods.	3%	6%	39%	26%	26%
Majority of Responses Disagree					
Trees appear to slow down economic development efforts.	58%	20%	13%	4%	5%
Trees compromise the safety of neighborhoods.	46%	20%	27%	4%	2%
Trees create safety issues	29%	28%	22%	15%	5%
Other (specified below)	123 responses (detailed below)				

Other Comments (123 responses). Open-end responses to this question were grouped into themes. A summary follows:

- **Development & Tree Preservation Theme. 65% of the comments received (80 comments in total) focused on the issue of preservation of mature trees as it relates to development in Tallahassee**. Comments included:
  - "Developers should be required to protect and preserve our old growth trees."
  - "The planting of young trees to replace mature trees is not a solution - leave the existing trees and alter the development."
  - "I think weather urban development or suburban, each case should be considered carefully and if a major removal of heritage trees there should be well advertised and public input requested!! The city does an amazing job of landscaping our beautiful city and the trees are a major part of Tallahassee's identity and charm. Let's keep the charm and not pave over it!"
  - "Regulations should strongly encourage preservation of existing, healthy good/native trees rather than replanting trees or paying money into tree bank."
  - "I think we need to amend the current tree protection laws to actually protect trees. We have seen that our tree ordinance is not working. Any developer can destroy any tree by merely paying a fine and planting some little replacement 'sticks'. Losing the Cascades Park oaks was a real low point for this community. Enough is enough."
  - "Trees do sometimes slow development efforts, but I do not believe that is a bad thing. Careful consideration and preservation of desirable trees including patriarch trees can encourage more incremental and smarter development that works with rather than against the city's natural beauty."
  - "Developers should replace trees AND pay into a mitigation bank."
  - "The city should continue to monitor developers to ensure that Tallahassee does not become a clear cut city."
- **Species Choices Theme.** 11% of the comments received (14 comments in total) focused on the issue of native vs. non-native species and spanned the spectrum of opinions. Comments included:
  - "I think the urban forest master plan should include, or at least consider, allowing the use of non-native trees that are well adapted to growth in the area. Perhaps the use of native trees could be encouraged by adjusting planting credits to favor the use of native species."
  - "More oaks, less palm trees downtown."
  - "More palm trees would make this city more attractive to people moving here."
  - "Not all native trees are good as permitted replanted trees. For instance, a southern magnolia is a native tree; cultivars of southern magnolia are not considered native by the city; however, those cultivars exist because they are more disease resistant, climate adapted, and tolerant of urban conditions. The city should stop encouraging designers and landscapers to plant dogwoods and fringe trees in parking lots and developments just because they are native. They end up dying and never get replanted."

- **City Operations Suggestions Theme.** 11% of the comments received (14 comments in total) focused on suggestions for changes in city operations or policies. Comments included:
  - "Notice should be given to residents of removal efforts of trees of 100+ years old for development, and all efforts should be made to build around such trees."
  - "The city should offer education concerning tree health and maintenance so that healthy, safe trees are NOT removed."
  - "The city should provide a little more guidance in tree maintenance on private property."
  - "Thanks for the 3 trees in my yard from the Adopt-A-Tree program."
- **Utilities Theme.** 6% of the comments received (7 comments in total) focused on suggestions for utilities, primarily related to moving utilities underground. Comments included:
  - "Regarding the utility lines, I think efforts should be made to put them underground to avoid storm issues as well as preserve the trees."
  - "City should begin converting to underground utilities now!"
  - "Trees add charm to Tallahassee, but should not interfere with overhead utilities."
- **Themes of remaining comments (less than 5% of responses):**
  - Trees are critical for wildlife.
  - Trees are a key part of Tallahassee's identity and quality of life.
  - Trees provide many benefits – health, lower crime, better air/water quality, etc.

Question 6: Rank in order of importance for the following:

Rank in order of importance for the following:	Most Important <----------> Least Important						
	1	2	3	4	5	6	7
Growing the tree canopy	22%	16%	16%	14%	13%	9%	11%
Safety for pedestrians and bikers	21%	20%	22%	16%	12%	5%	5%
Affordable housing	18%	12%	13%	21%	16%	10%	10%
Trees shading roads and sidewalks	12%	25%	18%	15%	13%	12%	5%
Higher densities in urban core to reduce urban sprawl	12%	10%	10%	9%	13%	20%	27%
Reduction in power outages	10%	9%	11%	12%	19%	17%	21%
Vibrant downtown	5%	8%	9%	14%	15%	27%	22%

APPENDIX B
URBAN FOREST ASSESSMENT RESULTS

Indicators of a Sustainable Urban Forest THE TREES	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Urban Tree Canopy Cover	Achieve the desired tree canopy cover according to goals set for the entire city and neighborhoods. Alternatively, achieve 75% of the total canopy possible for the entire city and in each neighborhood.	Canopy is decreasing; no data are available or no goals are set.	Canopy is not dropping, but not on a trajectory to achieve the established goal.	Canopy goal is achieved or well on the way to achievement and/or relative canopy is over 75%.	Coverage level is known (55%) and goal is to maintain. Historic data on canopy are being collected that can be used in a comparable way to gauge change in canopy over time. Current relative canopy is 79%.
Age Distribution	Establish a diverse-aged population of public trees across the entire city and for each neighborhood. Ideal standard: 0-8" DBH: 40% 9-17" DBH: 30% 18-24" DBH: 20% Over 24" DBH: 10%	Age distribution is not proportionately distributed across size classes at the city level.	Age distribution is evenly distributed at city level, though unevenly distributed at the neighborhood level or neighborhood level data not available.	Age distribution is generally aligned with the ideal standard diameter classes both city-wide and at the neighborhood level.	Based on 3% sample inventory, age distribution of public trees appears to be on par with best practices. Full data will be needed to determine that for sure.
Condition of Publicly Owned Trees *(trees managed intensively)*	Possess a detailed understanding of tree condition and potential risk of all intensively-managed, publicly-owned trees. This information is used to direct maintenance actions.	No current information is available on tree condition or risk.	Information from a partial or sample or inventory is used to assess tree condition and risk.	Information from a current, GIS-based, 100% complete public tree inventory is used to indicate tree condition and risk.	Inventory is available on downtown and Canopy Roads trees only. Recently completed 3% sample inventory has produced condition data that are likely to represent the entire public tree population, but city-wide specific data are unavailable.
Trees on Private Property	Possess a solid understanding of the extent, location, and general condition of trees on private lands.	No data are available on private trees.	Current tree canopy assessment reflects basic information (location) of both public and private canopy combined.	Detailed information available on private trees, eg., bottom-up sample-based assessment of trees.	Recent canopy assessment provides location of trees on private property. No additional data are available.

Indicators of a Sustainable Urban Forest THE TREES	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Diversity	Establish a genetically diverse population of publicly-owned trees across the entire city and for each neighborhood. Industry standards recommend that no more than 30% of any family, 20% of any genus, or 10% of any species dominate the urban forest.	Fewer than five species dominate the entire tree population citywide.	No species represents more than 20% of the entire tree population citywide.	No species represents more than 10% of the entire tree population citywide.	Based on 3% sample inventory, only the cherry laurel species and oak genus surpass the recommended diversity limits, but otherwise Tallahassee's diversity levels appear close to ideal. However, because some of the population is weaker-wooded pioneer species or invasive, Tallahassee is missing the right kind of diversity.
Suitability	Establish a tree population suited to the urban environment and adapted to the overall region. Suitable trees are gaged by level of susceptibility or resilience to imminent threats (pests, storms, climate changes) are considered the "Right Tree for the Right Place" concept and are non-invasive.	Less than 50% of trees are considered suitable for the site or data is unavailable to make this determination.	50% to 75% of trees are considered suitable for the site.	More than 75% of trees are considered suitable for the site.	Based on 3% sample inventory, climate change projections as well as pests do not seem to indicate much of problem for Tally. Invasive species represent about 7% (mostly camphor tree). Trees interfering with sidewalks (or with the potential to) represent 26% of the Tally forest. However, utility conflict (58%) and the number of lower-wind-resistance trees (53%) represent high proportions of Tally's forest. Though some categories slightly exceed the 50% limit for moderate, overall the categories average out to moderate suitability.
Equitable Distribution	Ensure that the benefits of tree canopy are available to all, especially for those most affected by these benefits. Achieve low variation between tree canopy and equity factors citywide by neighborhood.	Tree planting and public outreach and education is not determined by tree canopy cover or benefits.	Tree planting and public outreach and education is focused on neighborhoods with low tree canopy.	Tree planting and public outreach and education is focused in neighborhoods with low tree canopy and a high need for tree benefits.	Tree canopy is generally equally distributed across neighborhoods in Tallahassee.

Indicators of a Sustainable Urban Forest THE PLAYERS	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Neighborhood Action	Citizens understand, cooperate, and participate in urban forest management at the neighborhood level. Urban forestry is a neighborhood-scale issue.	Little or no citizen involvement or neighborhood action.	Some active groups are engaged in advancing urban forestry activity, but with no unified set of goals or priorities. (13)	The majority of all neighborhoods are organized, connected, and working towards a unified set of goals and priorities.	Some neighborhood groups are very engaged, while others would rather avoid trees.
Large Private & Institutional Landholder Involvement	Large, private, and institutional landholders embrace citywide goals and objectives through targeted resource management plans.	Large private land holders are unaware of issues and potential influence in the urban forest. No large private land management plans are currently in place. (3)	Education materials and advice is available to large private landholders. Few large private landholders or institutions have management plans in place. (9)	Clear and concise goals are established for large private land holders through direct education and assistance programs. Key landholders and institutions have management plans in place. (4)	Private landholders are aware of the rules and follow them, but not engaged.
Green Industry Involvement	The green industry works together to advance citywide urban forest goals and objectives. The city and its partners capitalize on local green industry expertise and innovation.	Little or no involvement from green industry leaders to advance local urban forestry goals.	Some partnerships are in place to advance local urban forestry goals, but more often for the short-term. (4)	Long-term committed partnerships are working to advance local urban forestry goals. (10)	Engaged and involved industry experts from Tall Timbers, Florida Forest Service, FAMU extensions, etc.
City Department and Agency Cooperation	All city departments and agencies cooperate to advance citywide urban forestry goals and objectives.	Conflicting goals and/or actions among city departments and agencies. (2)	Informal teams among departments and agencies are communicating and implementing common goals on a project-specific basis. (4)	Common goals and collaboration occur across all departments and agencies. City policy and actions are implemented by formal interdepartmental and interagency working teams on all city projects. (8)	Departments work together, with different goals as set by the demands of the community.

Indicators of a Sustainable Urban Forest THE PLAYERS	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Funder Engagement	Local funders are engaged and invested in urban forestry initiatives. Funding is adequate to implement citywide urban forest management plan.	Little or no funders are engaged in urban forestry initiatives. (2)	Funders are engaged in urban forestry initiatives at minimal levels for short-term projects. (11)	Multiple funders are fully engaged and active in urban forestry initiatives for short-term projects and long-term goals. (3)	Public funders (city, county, USFS, DEP) are engaged in urban forest initiatives. Private funding is intermittent through special interest non-profits and funds generated from development projects.
Utility Engagement	All utilities are aware of and vested in the urban forest and cooperate to advance citywide urban forest goals and objectives.	Utilities and city agencies act independently of urban forestry efforts. No coordination exists. (2)	Utilitles and city agencies have engaged in dialogues about urban forestry efforts with respect to capital improvement and infrastructure projects. (7)	Utilities, city agencies, and other stakeholders integrate and collaborate on all urban forestry efforts, including planning, site work, and outreach/education. (6)	City-managed components seem good, but internet providers aren't engaged/cooperating. Possible conflict with mini-cell towers and solar industry.
Developer Engagement	The development community is aware of and vested in the urban forest and cooperates to advance citywide urban forest goals and objectives.	Little or no cooperation from developers in (or awareness of) municipality-wide urban forest goals and objectives. (9)	Some cooperation from developers and general awareness and acceptance of municipality-wide goals and objectives. (7)	Specific collaborative arrangements across development community in support of municipality-wide goals and objectives.	Developers are aware of code, but code is confusing, making it difficult for developers to understand what they need to do. Tree protection zones are not always followed/enforced.
Public Awareness	The general public understands the benefits of trees and advocates for the role and importance of the urban forest.	Trees are generally seen as a nuisance, and thus a drain on city budgets and personal paychecks. (3)	Trees are generally recognized as important and beneficial. (6)	Trees are seen as valuable infrastructure and vital to the community's well-being. The urban forest is recognized for the unique environmental, economic, and social services it provides to the community. (6)	East side of the city seems to participate in adopt-a-tree program more than the West side. Public cares about trees, but struggles to understand long-term urban forest planning.
Regional Collaboration	Neighboring communities and regional groups are actively cooperating and interacting to advance the region's stake in the city's urban forest.	Little or no interaction between neighboring communities and regional groups. (4)	Neighboring communities and regional groups share similar goals and policy vehicles related to trees and the urban forest. (6)	Regional urban forestry planning, coordination, and management is widespread. (4)	City and county efforts are closely aligned due to interlocal agreement and comprehensive plan.

Indicators of a Sustainable Urban Forest THE MGMT APPROACH	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Tree Inventory	Comprehensive, GIS-based, current inventory of all intensively-managed public trees to guide management, with mechanisms in place to keep data current and available for use. Data allow for analysis of age distribution, condition, risk, diversity, and suitability.	No inventory or out-of-date inventory of publicly-owned trees.	Partial or sample-based inventory of publicly-owned trees, inconsistently updated.	Complete, GIS-based inventory of publicly-owned trees, updated on a regular, systematic basis.	Inventory data have been collected on downtown trees and canopy roads only. A 3% sample inventory was just completed of ROW trees for location, species, and size only.
Canopy Assessment	Accurate, high-resolution, and recent assessment of existing and potential city-wide tree canopy cover that is regularly updated and available for use across various departments, agencies, and/or disciplines.	No tree canopy assessment.	Sample-based canopy cover assessment.	High-resolution tree canopy assessment using aerial photographs or satellite imagery.	A full high-resolution canopy assessment was just completed using 2016 aerial imagery. This GIS data layer will be housed with the city/county GIS department and available for future analysis and use.
Management Plan	Existence and buy-in of a comprehensive urban forest management plan to achieve city-wide goals. Re-evaluation is conducted every 5 to 10 years.	No urban forest management plan exists.	A plan for the publicly-owned forest resource exists but is limited in scope, acceptance, and implementation.	A comprehensive plan for the publicly-owned forest resource exists and is accepted and implemented.	No formal urban forest management plan exists. Management of public urban forest is largely reactive (resident call and complaint driven).
Risk Management Program	All publicly-owned trees are managed for maximum public safety by way of maintaining a city-wide inventory, conducting proactive annual inspections, and eliminating hazards within a set timeframe based on risk level. Risk management program is outlined in the management plan.	Request-based, reactive system. The condition of publicly-owned trees is unknown.	There is some degree of risk abatement thanks to knowledge of condition of publicly-owned trees, though generally still managed as a request-based reactive system.	There is a complete tree inventory with risk assessment data and a risk abatement program in effect. Hazards are eliminated within a set time period depending on the level of risk.	No formal urban forest risk management plan exists. Some proactive work is done throughout the year, including around school routes before school starts and other high target areas. Field crews and staff keep an eye out for risk issues and report risk abatement work to appropriate staff as needed.

Indicators of a Sustainable Urban Forest **THE MGMT APPROACH**	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
Maintenance Program of Publicly-Owned Trees *(trees managed intensively)*	All intensively-managed, publicly-owned trees are well maintained for optimal health and condition in order to extend longevity and maximize benefits. A reasonable cyclical pruning program is in place, generally targeting 5- to 7-year cycles. The maintenance program is outlined in the management plan.	Request-based, reactive system. No systematic pruning program is in place for publicly-owned trees.	All publicly-owned trees are systematically maintained, but pruning cycle is inadequate.	All publicly-owned trees are proactively and systematically maintained and adequately pruned on a cyclical basis.	See comments for Management Plan above.
Planting Program	Comprehensive and effective tree planting and establishment program is driven by canopy cover goals, equity considerations, and other priorities according to the plan. Tree planting and establishment is outlined in the management plan.	Tree establishment is ad hoc.	Tree establishment is consistently funded and occurs on an annual basis.	Tree establishment is directed by needs derived from a tree inventory and other community plans and is sufficient in meeting canopy cover objectives.	The city plants an average of 300-400 trees per year, primarily on an opt-in/request basis. These plantings are consistently funded through the city's Tree Bank. Some ROW tree plantings are done by the city to replace lost trees due to infrastructure improvements.
Tree Protection Policy	Comprehensive and regularly updated tree protection ordinance with enforcement ability is based on community goals. The benefits derived from trees on public and private property are ensured by the enforcement of existing policies.	No tree protection policy.	Policies are in place to protect trees.	Comprehensive and regularly updated policies based on community goals are in place to protect trees and are ensured through enforcement.	There is no existing *public* tree ordinance. There are, however, regulations in the development zoning that dictate tree protection rules for development projects. Full enforcement of these zoning regulations is difficult with current staffing levels.

Indicators of a Sustainable Urban Forest THE MGMT APPROACH	Overall Objective or Industry Standard	Performance Levels			Tallahassee Today
		Low	Moderate	Good	
City Staffing and Equipment	Adequate staff and access to the equipment and vehicles to implement the management plan. A high level urban forester or planning professional, strong operations staff, and solid certified arborist technicians.	Insufficient staffing levels, insufficiently-trained staff, and/or inadequate equipment and vehicle availability.	Certified arborists and professional urban foresters on staff, but are lacking adequate staff levels or adequate equipment to improve services.	Multi-disciplinary team within the urban forestry unit, including an urban forestry professional, operations manager, and arborist technicians. Vehicles and equipment are sufficient to complete required work.	There are multiple well-trained certified arborists and urban foresters on staff with access to quality equipment. However, amount of staffing is inadequate to enforce tree protection regulations, keep an up-to-date inventory on public trees, and develop/implement a proactive tree care program.
Funding	Appropriate funding in place to fully implement both proactive and reactive needs based on a comprehensive urban forest management plan.	Funding comes from the public sector only and covers only reactive work.	Funding levels (public and private) generally cover mostly reactive work. Partial risk management and planting in place.	Dynamic, active funding from engaged private partners and adequate public funding are used to proactively manage and expand the urban forest.	Funding is consistently made available for current management efforts, but these efforts are mostly reactive.
Disaster Preparedness & Response	A disaster management plan is in place related to the city's urban forest. The plan includes staff roles, contracts, response priorities, debris management, and a crisis communication plan. Staff are regularly trained and/or updated.	No disaster response plan is in place.	A disaster plan is in place, but pieces are missing and/or staff are not regularly trained or updated.	A robust disaster management plan is in place, regularly updated, and staff is fully trained on roles and processes.	For public trees and storm damage affecting ROW, a full disaster management plan is in place and in compliance with FEMA guidelines. Ongoing meetings/updates are made to plan. Issues on private land with "predatory / fly-by-night" teams that show up. Resiliency Plan in progress and Neighborhood PREP (Plan for Readiness and Emergency Preparedness) programs in place.
Communication	Effective avenues of two-way communication exist between the city and its citizens. Messaging is consistent and coordinated, when feasible.	No avenues are in place. City departments and public determine on an ad-hoc basis the best messages and avenues to communicate.	Avenues are in place, but used sporadically and without coordination or only on a one-way basis.	Avenues are in place for two-way communication, are well-used with targeted, coordinated messages.	Communication avenues are in place within city departments via informal means, but are currently considered effective. City communications with citizens occur via text, e-mail and social media, though public feels more communication related to trees is needed.

APPENDIX C
SAMPLE PUBLIC TREE POLICY

POLICY STATEMENT: PUBLIC TREE MANAGEMENT - SAMPLE
ISSUING DEPARTMENT: <department name>
DATE ISSUED: <date>

Policy Purpose. The <city> recognizes that its urban forest is a vital part of the community and wishes to ensure its citizens' right to enjoy the many benefits provided by public trees while being protected from the attendant risks of personal injury and property damage. <City> finds that the interests of the public health, safety, and welfare of its citizens require the establishment of standards to ensure the prudent and professional management of public trees and policies to limit the destruction of and ensure the survival of as many public trees as possible in the City. This policy guides the practices for planting, care, pruning, and removal of public trees by supporting efficient, proactive management by City departments and staff, and ensuring that only approved and appropriate actions affecting public trees are taken by non-municipal entities. The goal of this policy is to allow <city> to have a safe, diverse, extensive, and sustainable public tree canopy.

Authority. The <department> has complete authority, control, and supervision of all trees which now or in the future exist upon any public place in the City and over trees which exist upon any private property in the City when such trees are in such a hazardous condition as to threaten public property and/or affect adversely the public health, safety, and welfare.

Standards of Work. Tree planting, pruning, fertilizing, or any other maintenance action performed on any public tree by a municipal agency, a utility, and/or a non-municipal entity must be done per ANSI Standards and ISA Best Management Practices (standards and guidance documents on file with the <department contact>). Examples are:

ANSI (American National Standards Institute) standards are professional specifications and standards governing safe and appropriate and horticultural practices, as periodically updated or revised, including but not limited to the most current editions of standards and Parts of the following American National Standard for Tree Care Operations chapters:

- ANSI A300 Tree, Shrub, and other Woody Plant Management – Standard Practices.
- ANSI Z133.1 – American National Standards for Arboricultural Operations – Safety Requirements.
- Florida Grades and Standards for Nursery Plants

Performance Standards.

1. *Prohibition.* No person shall damage, prune, remove, or plant any tree or shrub in any public street or other public place without having first obtained a permit from <department>.
2. *Definition of Damage.* Damage to public trees is prohibited and includes, but is not limited to, construction and excavations, vehicular accidents, vandalism, adhering advertisements or electrical wires, animal damage (tied to or damaged by), allowing toxic substances to come in contact with soil within the dripline (gas, brine water, oil, liquid dye, or other substance deleterious to tree life).
3. *Removal of Public Trees.* The City will remove public trees that are dead, dying, or dangerous based on the professional judgement of the <position/title; department>. In general, the City does not permit the removal of a healthy tree on public lands. If a tree on public lands has become a nuisance to adjacent properties (obstructing site, shielding street lights, damaging utilities, low clearance for drivers and pedestrians), a request can be submitted for corrective pruning or removal. As needed, advanced notification will be posted prior to pruning or removal.
4. *Planting of Public Trees.* Trees are planted by the city each year, and the species selected for each site will be compatible with the site conditions and will contribute to diversifying the species composition of the entire public tree population. A street tree planting can be requested by the adjacent property owner through the <department >. Tree plantings are done each year in appropriate seasons and quantities are budget driven. As needed, advanced notification will be posted prior to planting. Other than <department> no person shall plant any tree or shrub in any public street or other public place without having first obtained a permit. Invasive tree species are prohibited.

Permitting. A permit for public tree maintenance and/or planting performing by a non-municipal entity must be obtained before the work begins. Upon receipt of an application for a permit, the <position/ title; department> shall review the application to review the request. No permit shall be valid for a period longer than one (1) year.

Work by Public Agencies or Utilities. The removal or pruning of trees by state or county agencies, public service companies, and natural gas companies performing normal construction and maintenance pursuant to applicable state or federal safety construction laws and regulations, do not fall within the purview of this policy. However, all public agencies and utility companies must notify <department> before commencing work.

Private Trees: Protection of the Public Right-of-Way and Other Public Properties.

1. *Pruning for Clearance.* Any owner of real property abutting a street shall prune any tree on the owner's property so that no tree obstructs or interferes with the view to oncoming traffic or pedestrians; or obstructs or interferes with free passage of pedestrians on any sidewalk or the free passage of vehicles on the paved portion of any street or the view of traffic signs or signals. Private trees shall be maintained to provide a minimum clearance of 8 feet over sidewalks and 14 feet over the paved portion of streets.

If clearance is not adequate, the <department> may give notice to the owner, agent, or occupant of such property to prune trees within the time specified in the notice, which shall not be less than ten (10) days. If the owner, agent, or occupant who is served with notice fails to comply with the terms of the notice within the time prescribed, the <department> may prune any limbs, branches, or other tree parts. Upon completion of the work, the property owner may billed for the work performed by the city.

2. *Pruning or Removal for Safety.* Whenever the <department> determines that any tree on any private premises in the city is in danger of falling in or across any public street, or is a danger to public safety because of decay or lack of proper support, the <department> may notify the property owner that it is their duty to remove, prune, or cut down the tree or part in accordance with directions of the <department>. If the owner does not comply, the <department> may cause the required work to be done and send a bill to the owner for costs of services and materials resulting from such work.

Public trees in <city> contribute to the quality of life of all residents and businesses and are a valuable and beautiful asset throughout the city that provide quantifiable environmental, economic, and social benefits. Accordingly, the purpose of this policy statement is to 1) protect and promote the health, safety, and welfare of the public (both current and future citizens) by protecting and increasing tree canopy, 2) aid in increasing the quality of the city-wide tree canopy, and 3) safeguard and enhance the natural environment and resources of the city. These objectives are in result of and in accordance with the <city> Urban Forest Master Plan, City Commission priorities, and <other relevant planning documents>.

Recommended by:

_____

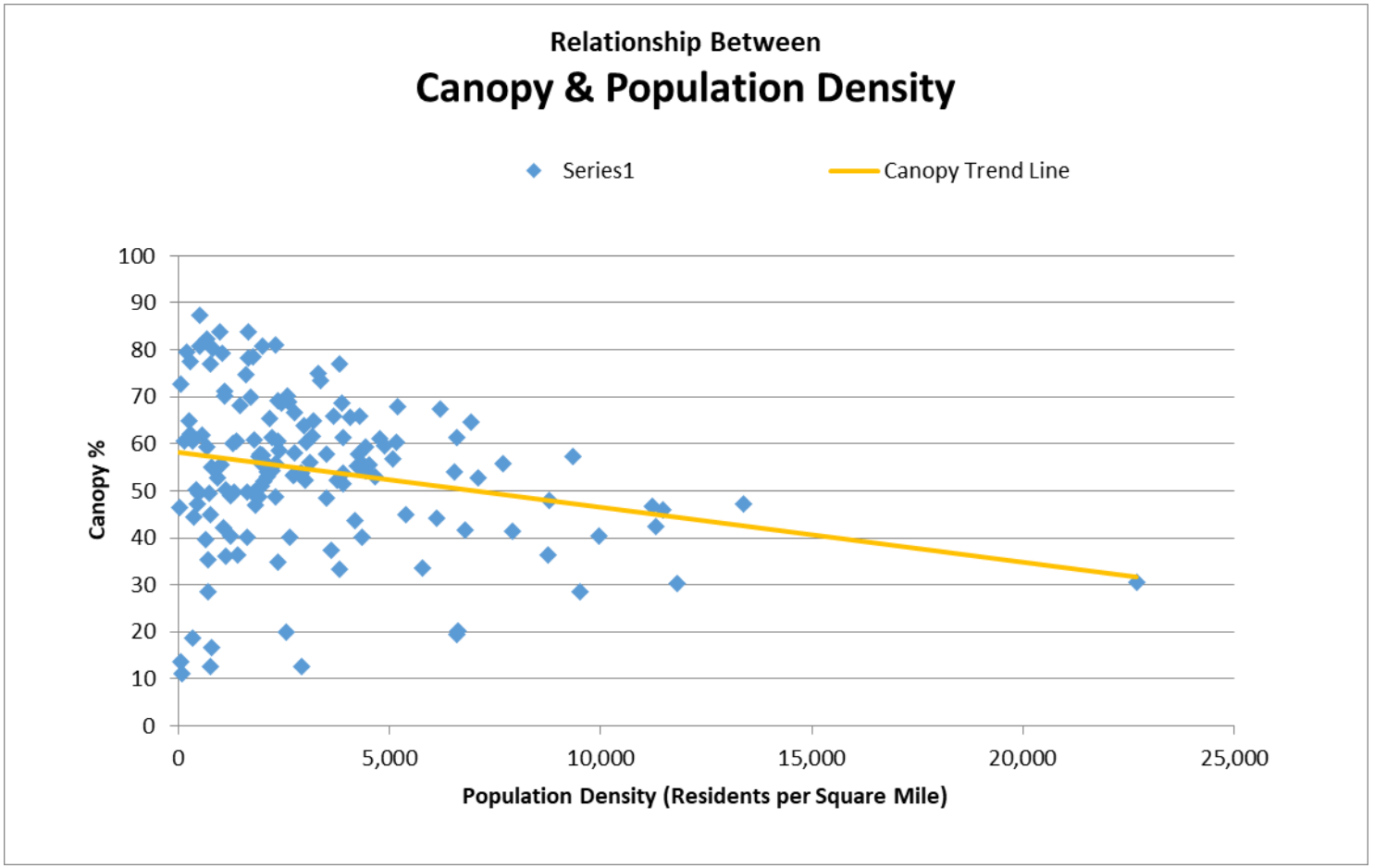
Name, Title

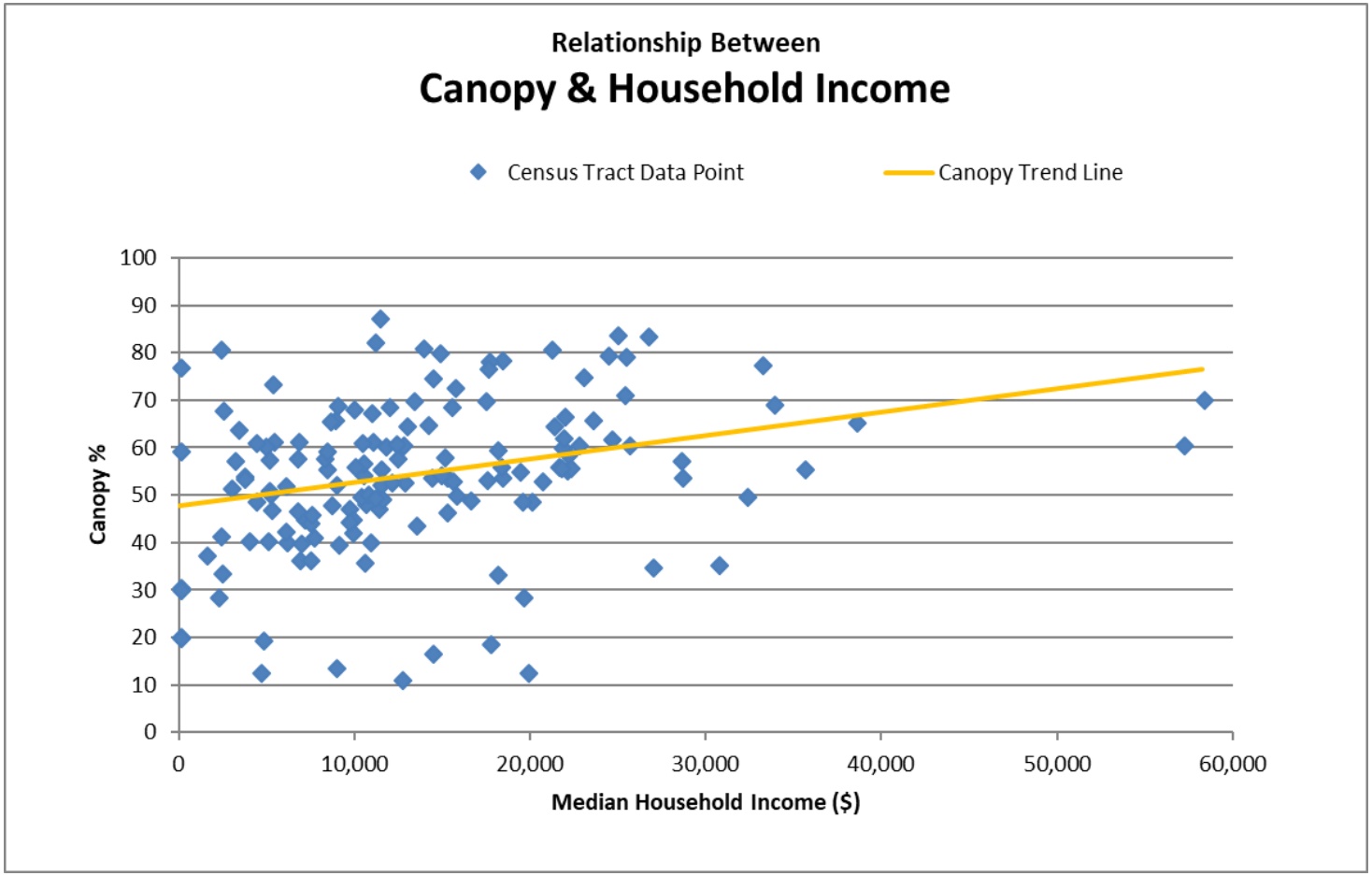
_____

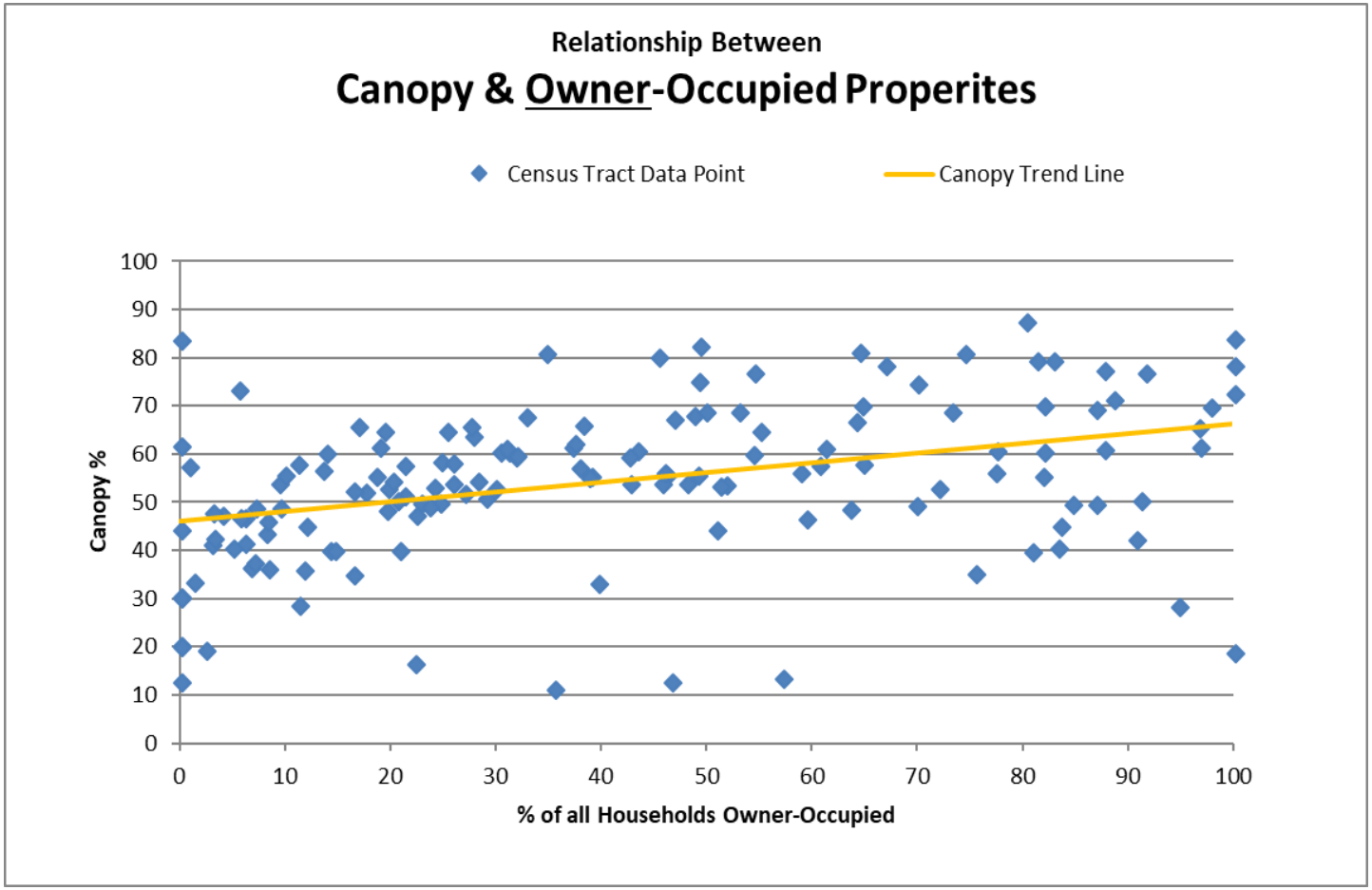
Date

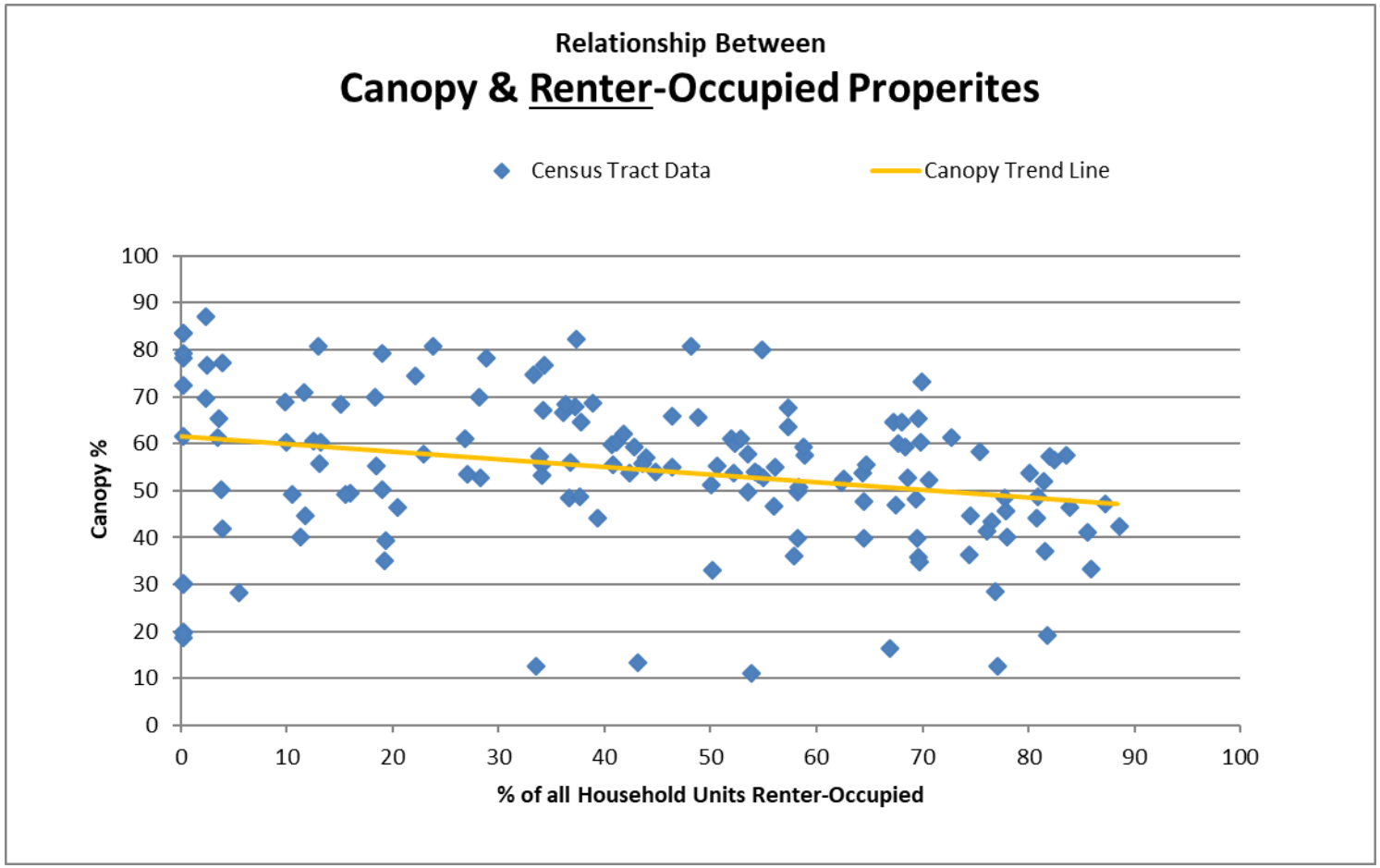
APPENDIX D
SOCIOECONOMIC & CANOPY TREND CHARTS

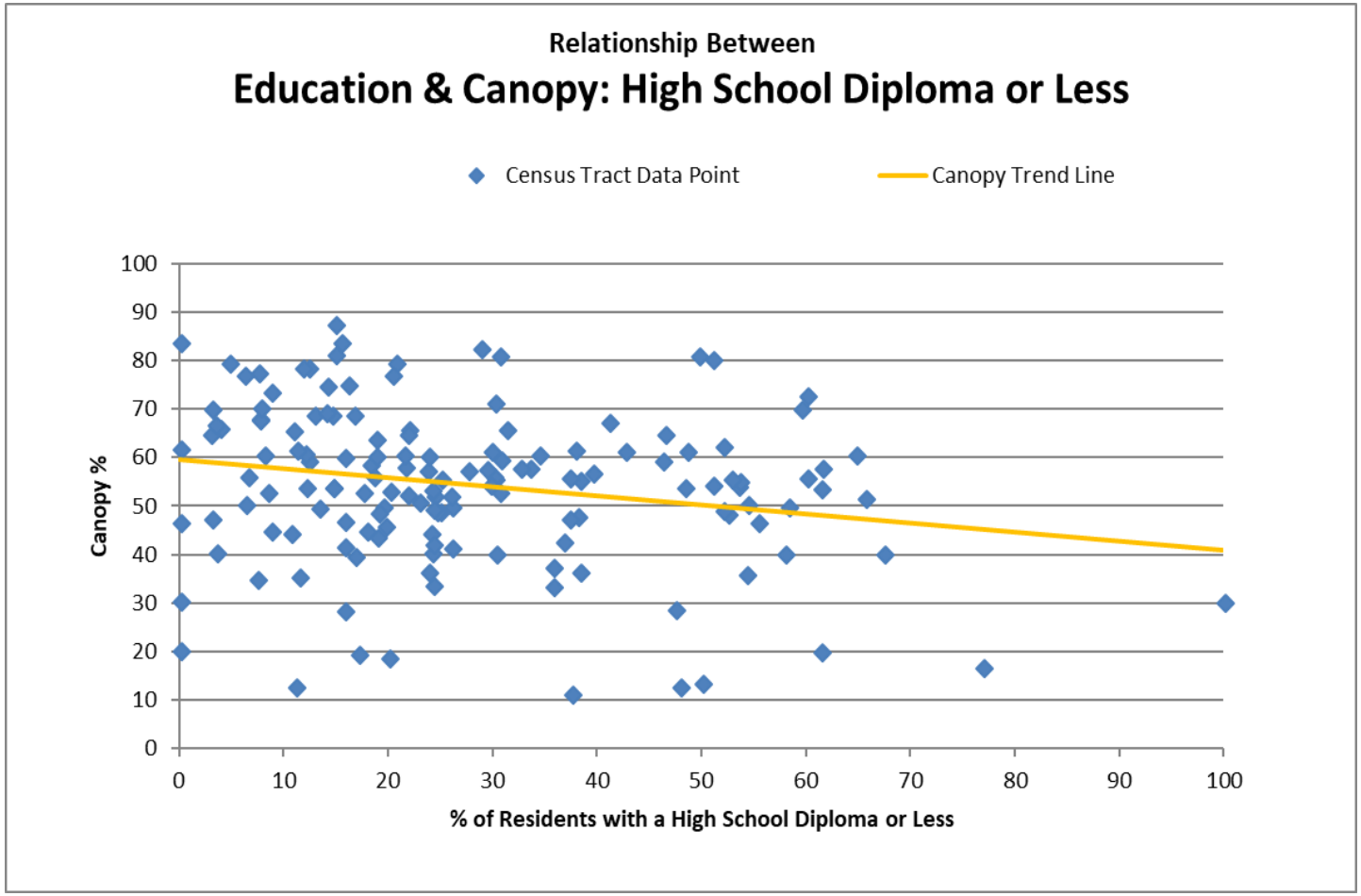
The following charts were put together using canopy data from the UTC and census data.

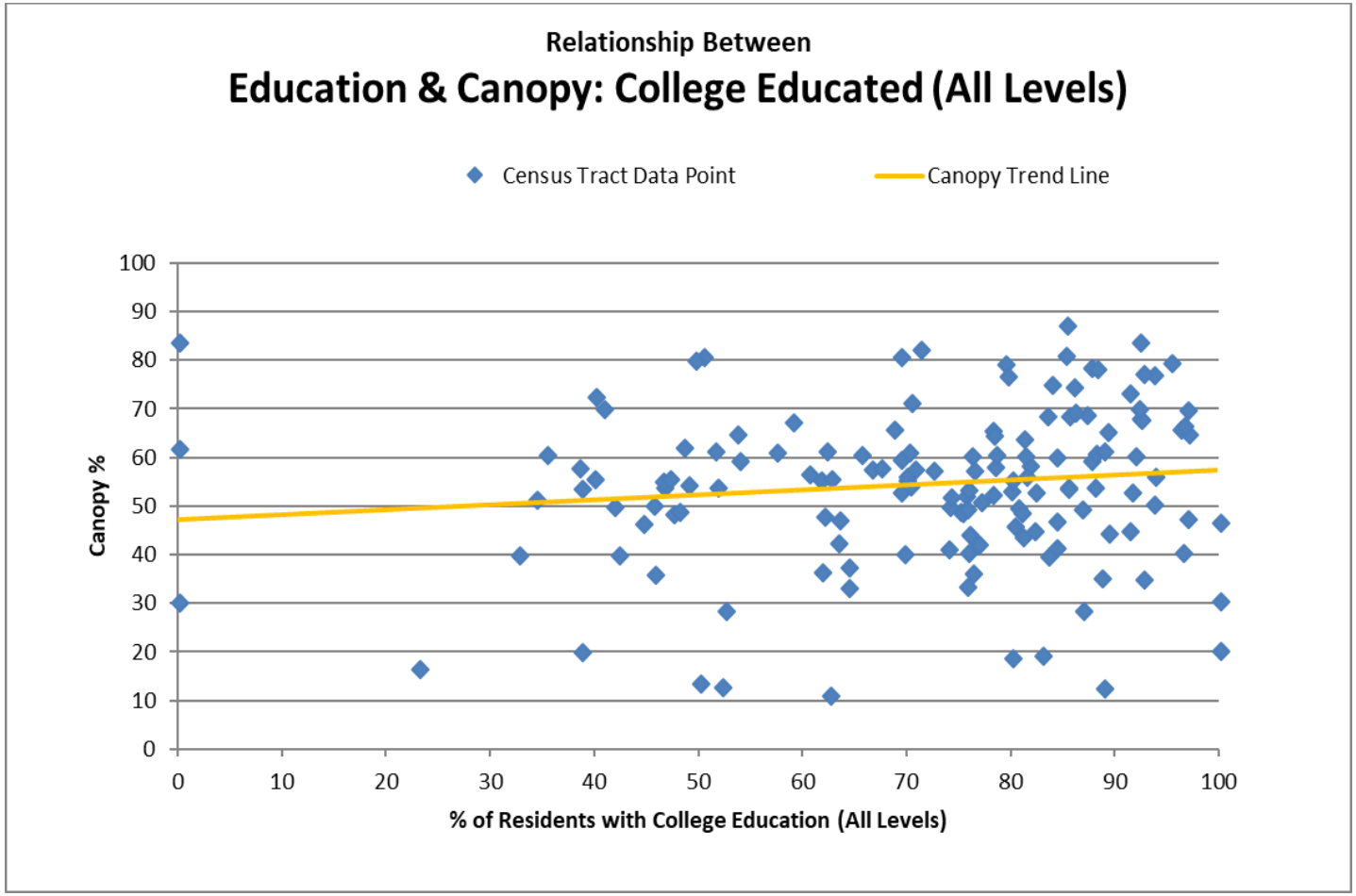


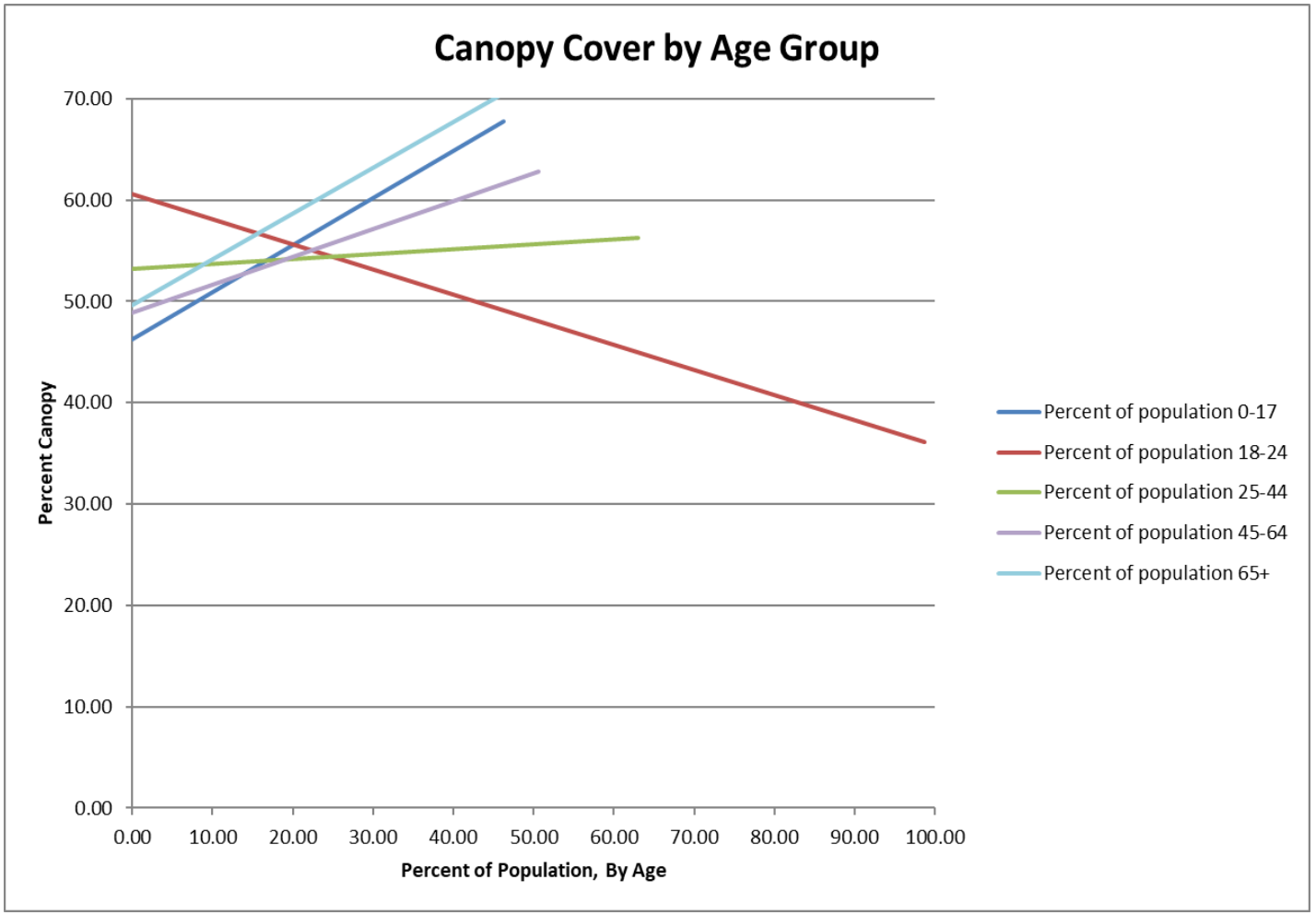

Relationship Between
Canopy & Household Income
Census Tract Data Point
Canopy Trend Line
Canopy %
100
90
80
70
60
50
40
30
20
10
0
0
10,000
20,000
30,000
40,000
50,000
60,000
Median Household Income ($)


Relationship Between
Canopy & Owner-Occupied Properites
Census Tract Data Point
Canopy Trend Line
Canopy %
% of all Households Owner-Occupied
0
10
20
30
40
50
60
70
80
90
100


Relationship Between
Canopy & Renter-Occupied Properites
Census Tract Data
Canopy Trend Line
Canopy %
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
% of all Household Units Renter-Occupied


Relationship Between
Education & Canopy: High School Diploma or Less
Census Tract Data Point
Canopy Trend Line
Canopy %
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
% of Residents with a High School Diploma or Less


Relationship Between
Education & Canopy: College Educated (All Levels)
Census Tract Data Point
Canopy Trend Line
Canopy %
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
% of Residents with College Education (All Levels)

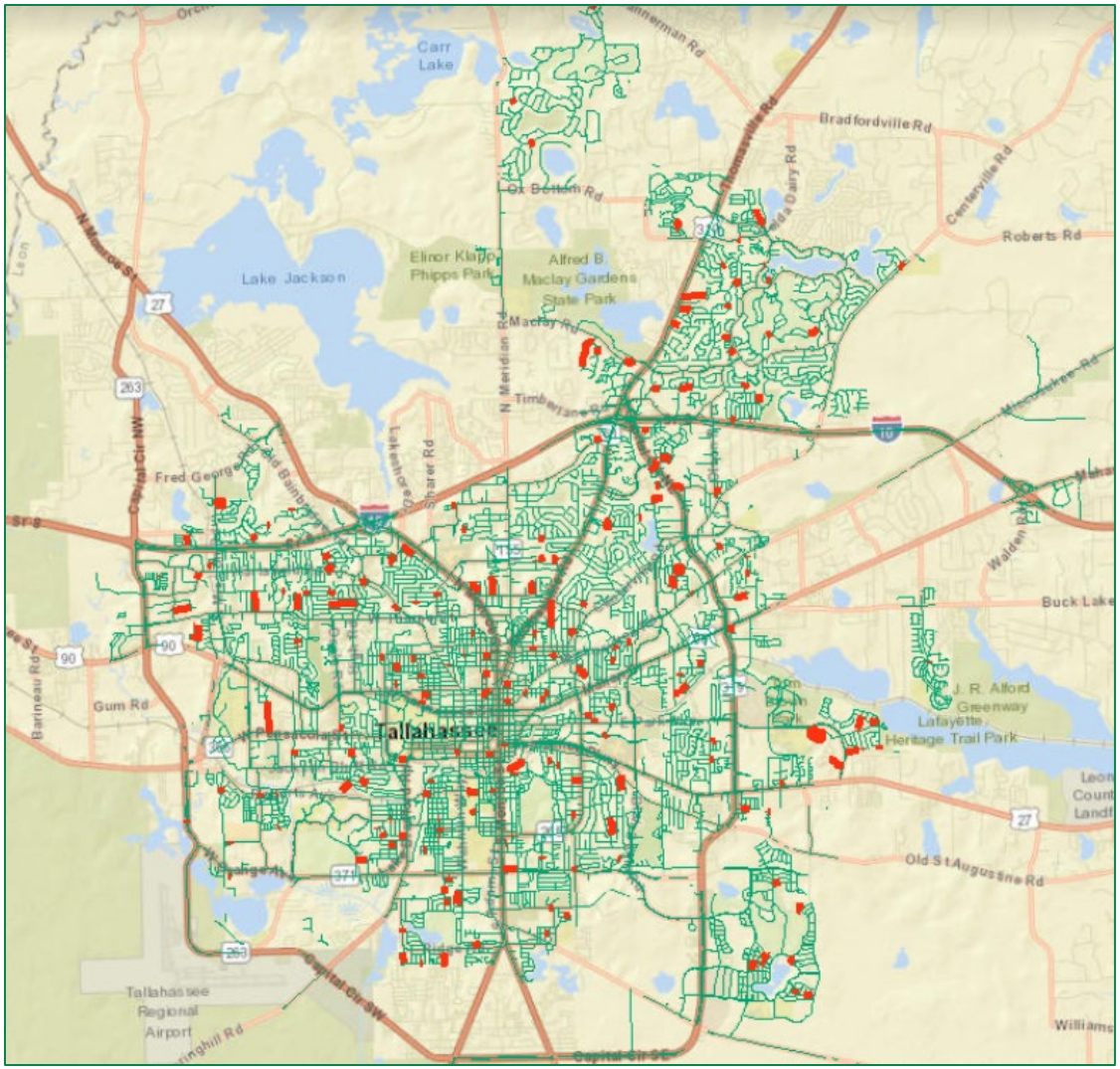

Canopy Cover by Age Group
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Percent Canopy
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Percent of Population, By Age
Percent of population 0-17
Percent of population 18-24
Percent of population 25-44
Percent of population 45-64
Percent of population 65+

APPENDIX E
SAMPLE INVENTORY METHODOLOGY

Utilizing i-Tree Streets, a 3% random street segment inventory (229 street segments) was conducted to collect trees and available planting locations along those segments. Local subcontractor, Florida Environmental Land Services, Inc., collected the inventory in December–January of 2017–18.

The 3% street segment samples were generated using the provided spatial data sets of the street centerlines and city boundary. The total number of street centerlines (7,321) was then multiplied by 3% to select random segments. For the City of Tallahassee, the inventory was conducted on 229 street centerline segments. Only street centerlines that were local roadways and contained within the city limits were used for the inventory. Using ESRI's ArcGIS Desktop 10.3, random number values were calculated for each street centerline feature and sorted in ascending order. The first 219 segments were chosen for the inventory (from iTree streets manual).

Sample inventories are generally a 3–6% sample of total street segments, depending on community size and variation from segment to segment. This level will produce about a 10% standard error for the total number of trees citywide. All communities differ in their tree density, street miles, and population characteristics. Therefore, no single sampling intensity will work uniformly for all communities of a similar size. Ultimately, it is up to you to determine sampling size and an acceptable level of error based on how the results will be used.



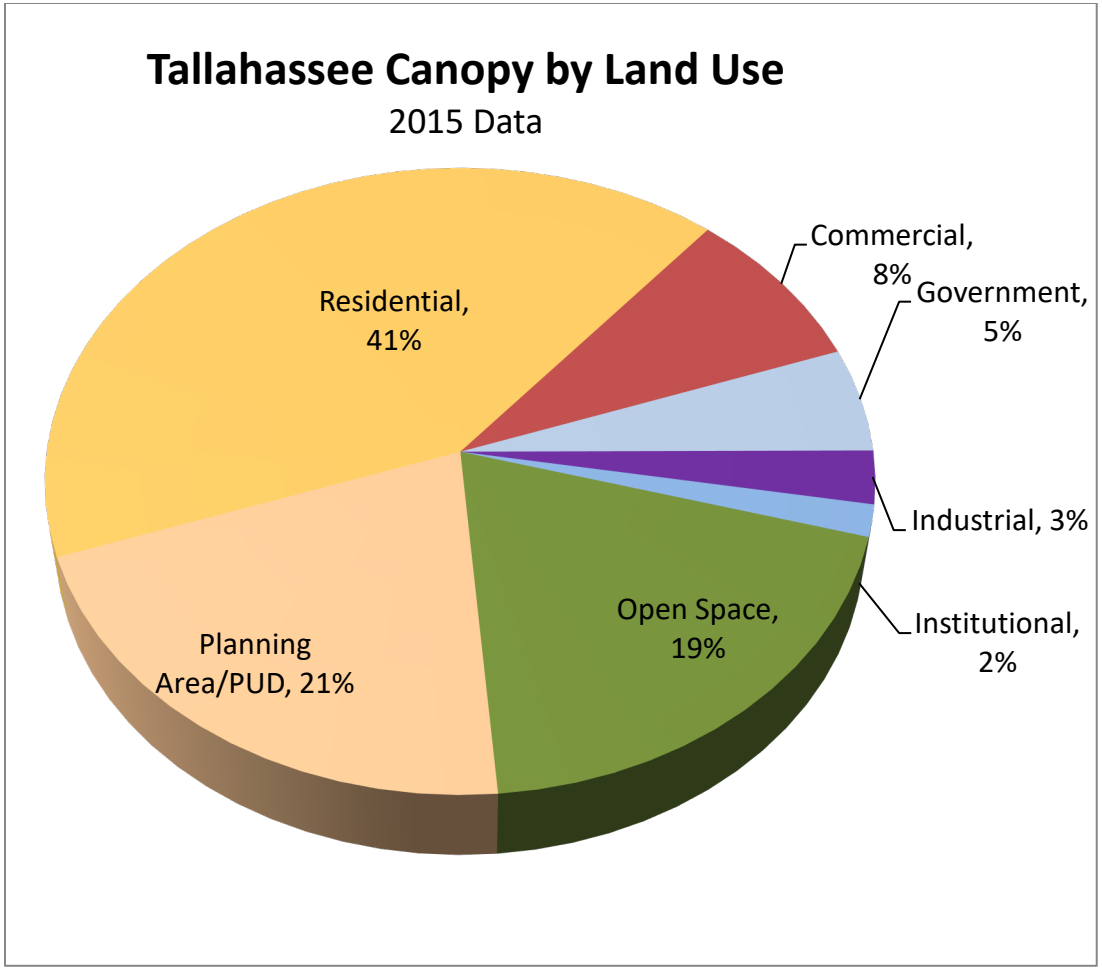
Map of street segments sampled for the 3% sample inventory. Red portions indicate selected street segments.

APPENDIX F
URBAN TREE CANOPY ASSESSMENT RESULTS

In addition to the following tables of information about the UTC of Tallahassee, we also have canopy by parks, subdivisions, and watersheds, which are available on file with city.

Data Charts

Land Use		Tree Canopy		Low Vegetation (lawn, shrubs)		Bare Soil (construction sites)		Open Water		Impervious (roads, buildings)		Total Additional Canopy Acres Possible	Total Canopy Possible - %	Relative Canopy (Existing Canopy / Total Canopy Possible)
Name	Total Acres	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%			
Commercial	7,779	3,078	40%	1,228	16%	100	1%	110	1%	3,264	42%	1,212	55%	72%
Government	5,432	1,932	36%	2,159	40%	484	9%	126	2%	730	13%	1,109	56%	64%
Industrial	2,298	991	43%	551	24%	129	6%	66	3%	562	24%	578	68%	63%
Institutional	1,730	595	34%	383	22%	43	2%	21	1%	689	40%	361	55%	62%
Open Space	12,642	7,021	56%	3,841	30%	716	6%	896	7%	168	1%	1,522	68%	82%
Planning Area/PUD	12,788	7,607	59%	3,017	24%	363	3%	261	2%	1,541	12%	2,434	79%	76%
Residential	23,626	15,017	64%	4,258	18%	132	1%	374	2%	3,845	16%	3,718	79%	80%
Citywide Totals	66,296	36,241	55%	15,437	23%	1,966	3%	1,855	3%	10,797	16%	10,934	71%	77%


Tallahassee Canopy by Land Use
2015 Data
Residential, 41%
Commercial, 8%
Government, 5%
Industrial, 3%
Institutional, 2%
Open Space, 19%
Planning Area/PUD, 21%

Forest Fragmentation Table

Based on aerial map imagery, GIS analysts at DRG were able to assign canopy to a variety of classes, with "patch" being the least desirable (and most susceptible to degradation by anthropogenic causes or invasive species) and "Core Canopy" of greater than 500 acres being most desirable (and able to support higher levels of overall biodiversity by being less disturbed).

Fragmentation Class	Acres	Percentage
Patch Canopy	4,341	12%
Edge Canopy	11,833	33%
Perforated Canopy	9,088	25%
Core Canopy (< 250 acres)	6,764	19%
Core Canopy (250-500 acres)	906	3%
Core Canopy (> 500 acres)	3,319	9%
Total	36,251	100.00

Historical Urban Tree Canopy Change

Based on aerial maps provided by the City of Tallahassee, GIS analysts at DRG classified each point as one of five classes: tree canopy, impervious surfaces, grass/shrub, bare ground, and water.

Land Cover Class	1954	1983	2015 UTC
Tree Canopy	48%	61%	55%
Impervious Surface	3%	9%	17%
Grass/Low-Lying Vegetation	40%	26%	23%
Bare Soil	8%	2%	3%
Open Water	1%	2%	2%

Prioritized Planting Sites

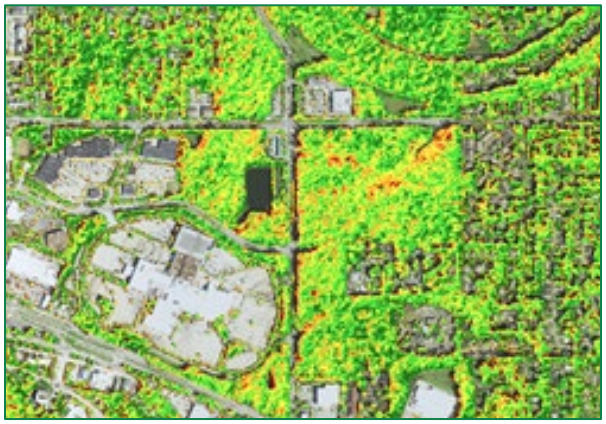
To identify and prioritize planting potential, DRG assessed a number of environmental features, including proximity to hardscape, canopy fragmentation, floodplain proximity, soil permeability, slope, soil erosion, and urban heat island index. Priority was assigned by the city, with greater importance placed on mitigating urban heat island effects and stormwater reduction.

Priority Rank	Number of Locations	Square Feet	Acres
Very Low	31,427	55,443,434	1,273
Low	31,543	184,831,123	4,243
Moderate	32,064	89,155,550	2,047
High	31,467	81,879,066	1,880
Very High	31,657	65,868,324	1,512
		Total Plantable Acres	10,954

Canopy Health and Hurricane Change Methodology

Tree Canopy Health

DRG processed remotely sensed data to measure and assess an object's spectral characteristics to monitor ecosystem dynamics and vegetation health for dead or dying trees. Locations of poor vegetation health were quantified and further assessed to determine possible risks. Combined with field data collection and ancillary GIS data, a health assessment produced detailed maps that will help resource managers prioritize work, predict patterns, and make informed decisions. For this assessment, 2015 4-band NAIP imagery was used to determine a canopy health index. This index is relative to only classified tree canopy vegetation. This allows for comparison of how trees are doing to those within the city. Health index was calculated using a standard vegetation analysis called Normalized Difference Vegetation Index (NDVI). The health was split up into six categories: Shadow/Unclassified, Critical, Poor, Fair, Good, and Very Good.



Canopy Change, before and after Hurricane Hermine

Canopy change was assessed pre- and post-Hurricane Hermine. The before hurricane tree canopy layer was produced using a combination of LIDAR data and NAIP imagery, both collected in 2015. The comparison image was captured one week after the hurricane made landfall. The tree canopy layer was updated using 2016 3in NearMap imagery. The tree canopy layer was examined for change and reported in three classes: No Change, Loss to Development, Tree Removal. Trees lost to the hurricane cannot be directly accounted for because tree removal could have occurred before the hurricane. That's why the class is named "Tree Removal." Canopy loss was mostly attributed to new developments throughout the city. In order to provide a comprehensive canopy change assessment, tree loss due to development was also recorded.

Development Loss

Tree Removal

Reason	Acres	Percentage
No Change	36,113.93	99.62
Development/Construction	95.99	0.26
Tree Removal	40.74	0.11

Classification Methodology and Accuracy Assessment

Davey Resource Group Classification Methodology

DRG utilized an object-based image analysis (OBIA) semi-automated feature extraction method to process and analyze current high-resolution color infrared (CIR) aerial imagery and remotely-sensed data to identify tree canopy cover and land cover classifications. The use of imagery analysis is cost-effective and provides a highly accurate approach to assessing your community's existing tree canopy coverage. This supports responsible tree management, facilitates community forestry goal-setting, and improves urban resource planning for healthier and more sustainable urban environments.

Advanced image analysis methods were used to classify, or separate, the land cover layers from the overall imagery. The semi-automated extraction process was completed using Feature Analyst, an extension of ArcGIS®. Feature Analyst uses an object-oriented approach to cluster together objects with similar spectral (i.e., color) and spatial/contextual (e.g., texture, size, shape, pattern, and spatial association) characteristics. The land cover results of the extraction process were post-processed and clipped to each project boundary prior to the manual editing process in order to create smaller, manageable, and more efficient file sizes. Secondary source data, high-resolution aerial imagery provided by each UTC city, and custom ArcGIS® tools were used to aid in the final manual editing, quality checking, and quality assurance processes (QA/QC). The manual QA/QC process was implemented to identify, define, and correct any misclassifications or omission errors in the final land cover layer.

Classification Workflow

1) Prepare imagery for feature extraction (resampling, rectification, etc.), if needed.
2) Gather training set data for all desired land cover classes (canopy, impervious, grass, bare soil, shadows). Water samples are not always needed since hydrologic data are available for most areas. Training data for impervious features were not collected because the city maintained a completed impervious layer.
3) Extract canopy layer only; this decreases the amount of shadow removal from large tree canopy shadows. Fill small holes and smooth to remove rigid edges.
4) Edit and finalize canopy layer at 1:2,000 scale. A point file is created to digitize-in small individual trees that will be missed during the extraction. These points are buffered to represent the tree canopy. This process is done to speed up editing time and improve accuracy by including smaller individual trees.
5) Extract remaining land cover classes using the canopy layer as a mask; this keeps canopy shadows that occur within groups of canopy while decreasing the amount of shadow along edges.
6) Edit the impervious layer to reflect actual impervious features, such as roads, buildings, parking lots, etc. to update features.
7) Using canopy and actual impervious surfaces as a mask; input the bare soils training data and extract them from the imagery. Quickly edit the layer to remove or add any features. DRG tries to delete dry vegetation areas that are associated with lawns, grass/meadows, and agricultural fields.
8) Assemble any hydrological datasets, if provided. Add or remove any water features to create the hydrology class. Perform a feature extraction if no water feature datasets exist.
9) Use geoprocessing tools to clean, repair, and clip all edited land cover layers to remove any self-intersections or topology errors that sometimes occur during editing.

10) Input canopy, impervious, bare soil, and hydrology layers into DRG's Five-Class Land Cover Model to complete the classification. This model generates the pervious (grass/low-lying vegetation) class by taking all other areas not previously classified and combining them.
11) Thoroughly inspect final land cover dataset for any classification errors and correct as needed.
12) Perform accuracy assessment. Repeat Step 11, if needed.

Automated Feature Extraction Files

The automated feature extraction (AFE) files allow other users to run the extraction process by replicating the methodology. Since Feature Analyst does not contain all geoprocessing operations that DRG utilizes, the AFE only accounts for part of the extraction process. Using Feature Analyst, DRG created the training set data, ran the extraction, and then smoothed the features to alleviate the blocky appearance. To complete the actual extraction process, DRG uses additional geoprocessing tools within ArcGIS®. From the AFE file results, the following steps are taken to prepare the extracted data for manual editing.

1) DRG fills all holes in the canopy that are less than 30 square meters. This eliminates small gaps that were created during the extraction process while still allowing for natural canopy gaps.
2) DRG deletes all features that are less than 9 square meters for canopy (50 square meters for impervious surfaces). This process reduces the amount of small features that could result in incorrect classifications and also helps computer performance.
3) The Repair Geometry, Dissolve, and Multipart to Singlepart (in that order) geoprocessing tools are run to complete the extraction process.
4) The Multipart to Singlepart shapefile is given to GIS personnel for manual editing to add, remove, or reshape features.

Accuracy Assessment Protocol

Determining the accuracy of spatial data is of high importance to DRG and our clients. To achieve to best possible result, DRG manually edits and conducts thorough QA/QC checks on all urban tree canopy and land cover layers. A QA/QC process will be completed using ArcGIS® to identify, clean, and correct any misclassification or topology errors in the final land cover dataset. The initial land cover layer extractions will be edited at a 1:2,000 quality control scale in the urban areas and at a 1:2,500 scale for rural areas utilizing the most current high-resolution aerial imagery to aid in the quality control process.

Land Cover Classification

Land Cover Classification	Code Value
Tree Canopy	1
Impervious	2
Pervious (Grass/Vegetation)	3
Bare Soil	4
Open Water	5

To test for accuracy, random plot locations are generated throughout the city area of interest and verified to ensure that the data meet the client standards. Each point will be compared with the most current NAIP high-resolution imagery (reference image) to determine the accuracy of the final land cover layer. Points will be classified as either correct or incorrect and recorded in a classification matrix. Accuracy will be assessed using four metrics: overall accuracy, kappa, quantity disagreement, and allocation disagreement. These metrics are calculated using a custom Excel® spreadsheet.

Land Cover Accuracy

The following describes DRG's accuracy assessment techniques and outlines procedural steps used to conduct the assessment.

1. *Random Point Generation*—Using ArcGIS, 1,000 random assessment points are generated.
2. *Point Determination*—Each point is carefully assessed by the GIS analyst for likeness with the aerial photography. To record findings, two new fields, CODE and TRUTH, are added to the accuracy assessment point shapefile. CODE is a numeric value (1–5) assigned to each land cover class) and TRUTH is the actual land cover class as identified according to the reference image. If CODE and TRUTH are the same, then the point is counted as a correct classification. Likewise, if the CODE and TRUTH are not the same, then the point is classified as incorrect. In most cases, distinguishing if a point is correct or incorrect is straightforward. Points will rarely be misclassified by an egregious classification or editing error. Often incorrect points occur where one feature stops and the other begins.

3. *Classification Matrix*—During the accuracy assessment, if a point is considered incorrect, it is given the correct classification in the TRUTH column. Points are first assessed on the NAIP imagery for their correctness using a "blind" assessment—meaning that the analyst does not know the actual classification (the GIS analyst is strictly going off the NAIP imagery to determine cover class). Any incorrect classifications found during the "blind" assessment are scrutinized further using sub-meter imagery provided by the client to determine if the point was incorrectly classified due to the fuzziness of the NAIP imagery or an actual misclassification. After all random points are assessed and recorded; a classification (or confusion) matrix is created. The classification matrix for this project is presented below. The table allows for assessment of user's/producer's accuracy, overall accuracy, omission/commission errors, kappa statistics, allocation/quantity disagreement, and confidence intervals.

Classification Matrix

Reference Data	Classes	Tree Canopy	Impervious Surfaces	Grass & Low-Lying Vegetation	Bare Soils	Open Water	Row Total	Producer's Accuracy	Errors of Omission
	Tree Canopy	540	1	15	0	0	556	97.12%	2.88%
	Impervious	6	172	10	3	0	191	90.05%	9.95%
	Grass/Vegetation	3	0	185	1	3	192	96.32%	3.65%
	Bare Soils	0	1	1	27	0	29	93.10%	6.90%
	Water	0	0	0	0	32	32	100.00%	0.00%
	Column Total	549	174	211	31	35	1,000		
	User's Accuracy	98.36%	98.85%	87.68%	87.10%	91.43%		Overall Accuracy	95.60%
	Errors of Commission	1.64%	1.15%	12.32%	12.90%	8.57%		Kappa Coefficent	0.9289

4. Following are descriptions of each statistic as well as the results from some of the accuracy assessment tests.

   Overall Accuracy – Percentage of correctly classified pixels; for example, the sum of the diagonals divided by the total points ((540+172+185+27+32)/1,000 = 95.60%).

   User's Accuracy – Probability that a pixel classified on the map actually represents that category on the ground (correct land cover classifications divided by the column total [540/549 = 98.36%]).

   Producer's Accuracy – Probability of a reference pixel being correctly classified (correct land cover classifications divided by the row total [540/556 = 97.12%]).

   Kappa Coefficient – A statistical metric used to assess the accuracy of classification data. It has been generally accepted as a better determinant of accuracy partly because it accounts for random chance agreement. A value of 0.80 or greater is regarded as "very good" agreement between the land cover classification and reference image.

   Errors of Commission – A pixel reports the presence of a feature (such as trees) that, in reality, is absent (no trees are actually present). This is termed as a false positive. In the matrix below, we can determine that 1.64% of the area classified as canopy is most likely not canopy.

Errors of Omission – A pixel reports the absence of a feature (such as trees) when, in reality, they are actually there. In the matrix below, we can conclude that 2.88% of all canopy classified is actually classified as another land cover class.

Allocation Disagreement – The amount of difference between the reference image and the classified land cover map that is due to less than optimal match in the spatial allocation (or position) of the classes.

Quantity Disagreement – The amount of difference between the reference image and the classified land cover map that is due to less than perfect match in the proportions (or area) of the classes.

Confidence Intervals – A confidence interval is a type of interval estimate of a population parameter and is used to indicate the reliability of an estimate. Confidence intervals consist of a range of values (interval) that act as good estimates of the unknown population parameter based on the observed probability of successes and failures. Since all assessments have innate error, defining a lower and upper bound estimate is essential.

Confidence Intervals

Class	Acreage	Percentage	Lower Bound	Upper Bound
Tree Canopy	34,676	55.1%	54.9%	55.3%
Impervious Surfaces	10,501	16.7%	16.3%	16.8%
Grass & Low-Lying Vegetation	14,269	22.7%	22.5%	22.8%
Bare Soils	1,990	3.2%	3.1%	3.2%
Open Water	1,522	2.4%	2.4%	2.5%
Total	62,957	100.0%		

Statistical Metrics Summary	
Overall Accuracy =	95.60%
Kappa Coefficient =	0.9289
Allocation Disagreement =	2%
Quantity Disagreement =	2%

Accuracy Assessment

Class	User's Accuracy	Lower Bound	Upper Bound	Producer's Accuracy	Lower Bound	Upper Bound
Tree Canopy	98.4%	97.8%	98.9%	97.1%	96.4%	97.8%
Impervious Surfaces	98.9%	98.0%	99.7%	90.1%	87.9%	92.2%
Grass & Low-Lying Vegetation	87.7%	85.4%	89.9%	96.4%	95.0%	97.7%
Bare Soils	87.1%	81.1%	93.1%	93.1%	88.4%	97.8%
Open Water	91.4%	86.7%	96.2%	100.0%	100.0%	100.0%

Ecosystem Services Methodology

1.1 Air Quality

The i-Tree Canopy v6.1 Model was used to quantify the value of ecosystem services for air quality. i-Tree Canopy was designed to give users the ability to estimate tree canopy and other land cover types within any selected geography. The model uses the estimated canopy percentage and reports air pollutant removal rates and monetary values for carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM) (Hirabayashi 2014).

Within the i-Tree Canopy application, the U.S. EPA's BenMAP Model estimates the incidence of adverse health effects and monetary values resulting from changes in air pollutants (Hirabayashi 2014; U.S. EPA 2012). Different pollutant removal values were used for urban and rural areas. In i-Tree Canopy, the air pollutant amount annually removed by trees and the associated monetary value can be calculated with tree cover in areas of interest using BenMAP multipliers for each county in the United States.

To calculate ecosystem services for the study area, canopy percentage metrics from UTC land cover data performed during the assessment were transferred to i-Tree Canopy. Those canopy percentages were matched by placing random points within the i-Tree Canopy application. Benefit values were reported for each of the five listed air pollutants.

1.2 Carbon Storage and Sequestration

The i-Tree Canopy v6.1 Model was used to quantify the value of ecosystem services for carbon storage and sequestration. i-Tree Canopy was designed to give users the ability to estimate tree canopy and other land cover types within any selected geography. The model uses the estimated canopy percentage and reports carbon storage and sequestration rates and monetary values. Methods on deriving storage and sequestration can be found in Nowak et al. 2013.

To calculate ecosystem services for the study area, canopy percentage metrics from UTC land cover data performed during the assessment were transferred to i-Tree Canopy. Those canopy percentages were matched by placing random points within the i-Tree Canopy application. Benefit values were reported for carbon storage and sequestration.

1.3 Stormwater

The i-Tree Hydro v5.0 Model was used to quantify the value of ecosystem services for stormwater runoff. i-Tree Hydro was designed for users interested in analysis of vegetation and impervious cover effects on urban hydrology. This most recent version (v5.0) allows users to report hydrologic data on the city level rather than just a watershed scale giving users more flexibility. For more information about the model, please consult the i-Tree Hydro v5.0 manual (http://www.itreetools.org).

To calculate ecosystem services for the study area, land cover percentages derived for the project area and all municipalities that were included in the project area were used as inputs into the model. Precipitation data from 2005–2012 were modeled within the i-Tree Hydro to best represent the average conditions over an eight-year time period. Model simulations were run under a Base Case as well as an Alternate Case. The Alterative Case set tree canopy equal to 0% and assumed that impervious and vegetation cover would increase based on the removal of tree canopy. Impervious surface was increased 2.8% based on a percentage of the amount of impervious surface under tree canopy and the rest was added to the vegetation cover class. This process was completed to assess the runoff reduction volume associated with tree canopy since i-Tree Hydro does not directly report the volume of runoff reduced by tree canopy. The volume (in cubic meters) was converted to gallons to retrieve the overall volume of runoff avoided by having the current tree canopy.

Through model simulation, it was determined that tree canopy decreases the runoff volume in the project area by 560,485,807 gallons per year using precipitation data from 2005–2012. This equates to approximately 16,164 gallons per acre of tree canopy (560,485,807 gals/34,675.7 acres).

To place a monetary value on storm water reduction, the cost to treat a gallon of storm/waste water was acquired by the City of Tallahassee. This value was $0.0023 per gallon. Tree canopy was estimated to contribute roughly $1,291,359 to avoided runoff annually to the project area.

1.4 Energy Conservation

Trees have a profound effect on energy demands and use, and have been studied using various methods (Carver et al. 2004; McPherson and Simpson 2003). The process of estimating energy (electricity) savings starts with determining the number of 1-unit structures by vintage (age) class within each census block group. Vintage refers to construction type for a building (i.e. average floor area, floor types, insulation (R-value), and number of stories) and generally is broken into three categories: pre-1950, 1950-80, and post-1980.

Census data obtained from the most current American Community Survey (Table B25024 – UNITS IN STRUCTURE and Table B25034 – YEAR STRUCTURE BUILT) were used to determine the number of one-unit structures. The data were based on 5-year estimates. Since the number of one-unit structures differed at the block group level, the number of one-unit structures was determined by vintage and block group by multiplying the percentage of units in each vintage by the total number of one-unit structures in each block group (McPherson et al. 2013). For each block group, total energy savings were tallied for each block group using a function of percent UTC, vintage class, and energy saving coefficients (McPherson and Simpson 2003, McPherson et al. 2013). The monetary value for energy savings was valued by summing all estimated kWh saved for each vintage class and multiplied by the current 2017 electricity cost priced at $0.035 per kWh (cost provided by the City of Tallahassee).

1.5 Property Value

Many benefits of tree canopy are difficult to quantify. When accounting for wildlife habitat, well-being, shading, and beautification, these services are challenging to translate into economic terms. In order to provide some estimation of these additional services, property value based on the average value of home prices for Tallahassee was calculated and reported. During a search it was found the average value of homes in Tallahassee was $169,700 in 2017. Limitations to this approach include determining actual value of individual trees on a property and extrapolation of residential trees to other land use categories (McPherson et al. 2013).

In a study completed in 1988, it was found that single-family residences in Athens, Georgia had a 0.88% increase in the average home sale price for every large front-yard tree on the property (Anderson and Cordell 1988). Using this study, sales price increase was utilized as an indicator of additional tree benefits. Because home sale can vary widely, the 0.88% was used as a multiplier to determine the value of a large front yard tree on various types of land use classes. This value was converted into annual benefits by dividing the total added value by the estimated leaf surface area of a 30-year-old shade tree – $1,493/5,382ft^2) which yields a base value of $0.28/ft^2.

Using methodology from McPherson et al. 2013 to convert into units of UTC, the base value of tree canopy was determined to be $0.24 ft^2 UTC. Since this value was derived using residential land use designations; transfer functions were used to adapt and apply the base value to other land use categories. To be conservative in the estimation of tree benefits, the land use reduction factors calculated property value at 50% impact for single-family residential parcels, 40% for multi-residential parcels, 20% for commercial parcels, and 10% for all other land uses. The price per unit of UTC values were multiplied by the amount of square feet of tree canopy within each municipality and the project area as a whole.

Land Use Reduction Transfer Function Values

Land Use Category	Impact	Price per unit of UTC
Single-Family Residential	50%	$0.120
Multi-Family Residential	40%	$0.096
Commercial	20%	$0.048
All Other	10%	$0.024

Prioritized Planting Methodology

The planting location polygons were created by taking all grass/open space and bare ground areas and combining them into one dataset. Non-feasible planting areas such as agricultural fields, recreational fields, major utility corridors, airports, etc. were removed from consideration. This layer was reviewed and approved by the City of Tallahassee before the analysis proceeded. The remaining planting space was consolidated into a single feature and then exploded back out to multipart features, creating separate, distinct polygons for each location. Using zonal statistics, the priority grid raster was used to calculate an average value for each planting location polygon. The averages were binned into five (5) classes with the higher numbers indicating higher priority for planting. These classes ranged from Very Low to Very High.

How Sites Were Prioritized. To identify and prioritize planting potential, DRG assessed a number of environmental features, including proximity to hardscape, canopy fragmentation, floodplain proximity, soil permeability, slope, soil erosion factor (K-factor), and urban heat island index. Each variable was weighted in importance with input from the City of Tallahassee, as shown in the chart on the following page.

Each factor was assessed using data from various sources and analyzed using separate grid maps. Values between zero and four (with zero having the lowest priority) were assigned to each grid assessed. The grids were overlain and the values were averaged to determine the priority levels at an area on the map. A priority ranging from Very Low to Very High was assigned to areas on the map based on the calculated average of all grid maps.

Once the process of identifying priority was completed, the development of planting strategies was the next task. All potential planting sites were not treated equal as some sites were considered to be more suitable than others. Through prioritization, sites were ranked based on a number of factors pertaining to stormwater reduction and a relative urban heat island index. While available planting sites may ultimately be planted over the next several decades, the trees that are planted in the next several years should be planned for areas in most need, and where they will provide the most benefits and return on investment.

Priority Ranking Variables

Dataset	Source	Weight
Proximity to Hardscape. Identifies locations where sheet flows and increased runoffs from precipitation events can occur more frequently leading to greater risk of water contamination. Focusing on areas to reduce the amount of impervious surface improves water quality by adding trees that capture harmful pollutants.	Urban Tree Canopy Assessment	0.25
Urban Heat Island Index. Identifies locations where summer temperature can be extreme by analyzing a ratio of impervious surfaces to tree canopy. This creates a relative heat stress index and can be used to find areas that are void of trees.	Urban Tree Canopy Assessment	0.25
Proximity to Floodplain/Riparian. Pinpoints locations that may be more susceptible to flooding which can increase sedimentation into the rivers and streams. Stabilizing these banks and soils can help prevent water quality issues.	National Hydrologic Dataset	0.20
Canopy Fragmentation. Spatially locates gaps in the current tree canopy and places where it may be more advantageous to plant to reduce fragmentation which can lead to healthier trees and forests by reducing the possibility of the space to be inhabited by invasive species.	Urban Tree Canopy Assessment	0.15
Slope Gradient. Determines the slope of the landscape. Steeper slopes are much more likely to have erosion and should be vegetated.	National Elevation Dataset	0.05
Soil Permeability. Considers a soil's ability to drain water efficiently which can reduce ponding in flood-prone locals.	Natural Resource Conservation Service	0.05
Soil Erosion (K-factor). Assesses the soil characteristics to identify which soil types are more prone to erosion which can lead to diminished water quality as well as stability on the landscape.	Natural Resource Conservation Service	0.05

Historic Canopy Assessment Methodology

To assess historical land cover at each point, DRG visually inspected imagery at each point for both years simultaneously. Land cover was specified as one of five classes: tree canopy, impervious surfaces, grass/shrub, bare ground, and water. Tree canopy percentage was analyzed using a "top-down" or "bird's-eye" approach, meaning that where tree canopy visibly overlaps another land cover class, tree canopy was still recorded for the point location. Points and imagery were overlaid in ArcGIS for inspection and classification.

The above-described assessment used the following rules for evaluation; establishing and following such rules ensured consistent assessment in leaf-off conditions:

1. Scrutinize 1954 image and determine the best classification per point.
2. Scrutinize 1983 image and determine the best classification per point.
3. If images match beyond a reasonable doubt, classification is recorded the same for both years.
4. If images clearly show a visible change, classification is recorded differently for 1954 and 1983 to the respective land cover class of the image year.

The land cover assessment was completed by two analysts who have 15 years of combined experience classifying land cover data. Though no formal accuracy assessment was performed, DRG conducted a thorough quality control check on all point data for analyst agreement and to reduce bias and error. When disagreement occurred, analysts met to deliberate and decide on the final classification based on discussion.

Special considerations were taken to account for parallax (difference in the apparent position of an object viewed along two different lines of sight), image shift, and shadowing. In the case of shadowing, the base of the tree was located before appropriately determining whether or not the point could have fallen within the tree crown. Occasionally, shadows fully engulf the sampling point where no definitive assessment can be made using the 1954 or 1983 imagery. For these situations, the analysts converged to make the most reasonable classification based on surrounding land cover. For image shifts and parallax, contextual observation at and around the point location was considered before recording the classification. These deficiencies were somewhat common due to the flight collection patterns and flight times being different for both sets of images. Parallax variance is usually less than five feet, but can still alter the classification of a point if not examined thoroughly. Best judgments were used to make a defensible and consistent inspection of each classified point.

Forest Fragmentation Methodology

We use a script that was developed from a Ritter et al. 2000 paper on patterns of forest fragmentation. The automated process we used was modified to work with higher resolution data sets available for Tallahassee aerial imagery (1m resolution comparted to the 30m resolution data used in the original research). In general, patch forest is considered the most unhealthy of all type of canopy because there is an increased risk of establishment of invasive species as well as increased exposure to anthropogenic causes. Edge canopy is defined by the outer most edge (we used a 100m range to define this metric, which is recommended) of connected forest. Edge canopy has the ability to support wildlife and biodiversity from both patch and core canopy inhabitants. Perforated canopy is larger dense tracts of forest that have developed perforations in the tree canopy. These types of canopy are much more susceptible to invasive species as they are often open areas that support establishment due to their open sunlight potential. Core forest is defined as large tracts of trees that have no gaps in the tree canopy and support higher biodiversity of wildlife, insects, and plants. Core forests are considered to be the most desirable, mainly from the fact that they are much less disturbed.

APPENDIX G
WIND RESISTANT TREE SPECIES

This is the chart from University of Florida, Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/fr173.

Southeastern Coastal Plain Tree Species			
Highest Wind Resistance	Medium-High Wind Resistance	Medium-Low Wind Resistance	Lowest Wind Resistance
Dicots			
Carya floridana, Florida scrub hickory *Cornus florida*, dogwood *Ilex cassine*, dahoon holly *Ilex glabra*, inkberry *Ilex opaca*, American holly *Ilex vomitoria*, yaupon holly *Lagerstroemia indica*, crape myrtle *Magnolia grandiflora*, southern magnolia *Quercus geminata*, sand live oak *Quercus laevis*, turkey oak *Quercus myrtiflora*, myrtle oak *Quercus virginiana*, live oak *Podocarpus spp*, podocarpus *Vaccinium arboreum*, sparkleberry	*Acer saccharum*, Florida sugar maple *Acer palmatum*, Japanese maple *Betula nigra*, river birch *Carpinus caroliniana*, ironwood *Carya glabra*, pignut hickory *Carya tomentosa*, mockemut hickory *Cercis canadensis*, red bud *Chionanthus virginicus*, fringe tree *Diospyros virginiana*, common persimmon *Fraxinus americana*, white ash *Liquidambar styraciflua*, sweetgum *Magnolia virginiana*, sweetbay magnolia *Magnolia* x *soulangiana*, saucer magnolia *Nyssa aquatica*, water tupelo *Nyssa sylvatica*, black tupelo *Ostrya virginiana*, American hophombeam *Prunus angustifolia*, chickasaw plum *Quercus michauxii*, swamp chestnut *Quercus shumardii*, Shumard oak *Quercus stellata*, post oak *Ulmus alata*, winged elm	*Acer negundo*, boxelder *Acer rubrum*, red maple *Acer saccharinum*, silver maple *Celtis laevigata*, sugarberry *Celtis occidentalis*, hackberry *Cinnamomum camphora*, camphorb *Eriobotrya japonica*, loquat c *Eucalyptus cinerea*, silverdollar eucalyptus *Fraxinus pennsylvanica*, green ash *Morus rubra*, red mulberry *Myrica cerifera*, wax myrtle *Persea borbonia*, redbay *Platanus occidentalis*, sycamore *Prunus serotina*, black cherry *Quercus alba*, white oak *Quercus phellos*, willow oak *Salix* x *sepulcralis*, weeping willow *Ulmus americana*, American elm	*Carya illinoensis*, pecan *Liriodendron tulipifera*, tulip poplar *Prunus caroliniana*, Carolina laurelcherry *Pyrus calleryana*, Bradford pear *Quercus falcata*, southern red oak *Quercus laurifolia*, laurel oak *Quercus nigra*, water oak *Sapium sebiferum*, Chinese tallowa *Ulmus parvifolia*, Chinese elm
Conifers			
Taxodium distichum, baldcypress *Taxodium ascendens*, pondcypress		*Pinus elliottii*, slash pine *Pinus palustris*, longleaf pine *Pinus taeda*, loblolly pine	*Juniperus silicicola*, southern red cedar x *Cupressocyparis leylandii*, Leyland cypress *Pinus clausa*, sand pine *Pinus glabra*, spruce pine
Palms			
Butia capitata, pindo or jelly *Phoenix canariensis*, Canary Island date *Phoenix dactylifera*, date *Sabal palmetto*, cabbage, sabal			Washingtonia robusta, Washington fan
a Prohibited in Florida b Invasive, not recommended in Florida c Caution: manage to prevent escape in Florida (Fox et at. 2005)			
We present these lists with the caveat that no tree is perfectly wind-proof and that many other factors contribute to wind resistance including soil conditions, wind intensity, previous cultural practices, tree health and age. These lists do not include all trees that could be wind resistant. They list those species encountered during our studies in large enough numbers to run statistical comparisons.			

APPENDIX H
CLIMATE CHANGE AND SPECIES SUITABILITY TABLES (SIMPLIFIED)

The U.S. Forest Service's Tree Atlas resource helps provide information on how tree species habitat may be affected by climate change in the next century. The Atlas uses three climate models (Hadley, GCM, and GFDL), all with both high and low emissions scenarios to get a range of possible future conditions by year 2100. These future conditions have an impact on each species' predicted Importance Value. Importance Value represents how dominant the species is in the natural forest area, looking at three weights - density, basal area, and count - so it is a numeric representation of the degree of habitat suitability for each tree species. High importance values represent a higher overall abundance of that species and higher levels of suitable habitat for that species.

Measuring changes in importance value between today and the year 2100 can provide clues on based on the impact of climate changes on habitat suitability for each tree species. Each climate scenario shows anticipated changes in suitable habitat for that particular species under that scenario. The mean change values can be negative or positive, depending on whether the species is predicted to lose or gain suitable habitat by the year 2100. Negative numbers mean a decrease in suitable habitats; positive values mean increase in suitable habitats and thus no threat and in fact potential for growth. If current Import Value = 3.4 and future model is -3.4, a total loss of suitable habitat is predicted for that species.

Species Winners/Losers (mean) - Coastal Plain Mixed Forest Province: Coastal Plans & Flatwood Ecoregion #99 (inland section)					IV Change with Hadley Climate Model	IV Chamber with PCM Climate Model	IV Change with General Circulation Climate Model			
	3% Sample Inventory	Common Name	Botanical Name	Species Importance Value (IV) Today	High Emissions Scenario	Low Emissions Scenario	High Emissions Scenario	Low Emissions Scenario	Average IV Change Across All Models	Predicted IV by 2100
Species Habitat Suitability is Predicted to Decrease for these Species by 2100	2%	loblolly pine	*Pinus taeda*	15.06	-1.89	-1.15	-0.99	-1.58	-1.4025	13.66
	3%	sweetgum	*Liquidambar styraciflua*	6.69	-1.01	-0.89	-0.72	-1.15	-0.9425	5.75
	1%	red maple	*Acer rubrum*	5.37	-0.83	-0.48	-0.17	-0.6	-0.52	4.85
	0%	swamp tupelo	*Nyssa sylvatica* var. *biflora*	5.05	-0.54	-0.13	-0.39	-0.25	-0.3275	4.72
	0%	yellow-poplar	*Liriodendron tulipifera*	1.39	-0.28	-0.24	-0.51	-0.25	-0.32	1.07
	0%	sourwood	*Oxydendrum arboreum*	0.28	-0.09	-0.16	-0.2	-0.17	-0.155	0.13
	0%	white oak	*Quercus alba*	0.82	-0.02	-0.24	-0.08	-0.26	-0.15	0.67
	0%	American holly	*Ilex opaca*	0.85	-0.07	-0.14	-0.12	-0.16	-0.1225	0.73
	0%	water tupelo	*Nyssa aquatica*	0.45	-0.07	-0.04	-0.19	-0.1	-0.1	0.35
	0%	pond pine	*Pinus serotina*	0.63	-0.1	-0.07	-0.04	-0.14	-0.0875	0.54
	0%	swamp chestnut oak	*Quercus michauxii*	0.17	-0.08	-0.07	-0.09	-0.09	-0.0825	0.09
	0%	spruce pine	*Pinus glabra*	0.21	-0.04	-0.01	-0.14	-0.01	-0.05	0.16
	0%	black oak	*Quercus velutina*	0.04	-0.02	-0.04	-0.03	-0.04	-0.0325	0.01
	0%	sweet birch	*Betula lenta*	0.04	-0.04	-0.03	-0.02	-0.03	-0.03	0.01
	0%	American beech	*Fagus grandifolia*	0.14	0	-0.04	0	-0.03	-0.0175	0.12

Species Winners/Losers (mean) - Coastal Plain Mixed Forest Province: Coastal Plans & Flatwood Ecoregion #99 (inland section)					IV Change with Hadley Climate Model	IV Chamber with PCM Climate Model	IV Change with General Circulation Climate Model			
	3% Sample Inventory	Common Name	Botanical Name	Species Importance Value (IV) Today	High Emissions Scenario	Low Emissions Scenario	High Emissions Scenario	Low Emissions Scenario	Average IV Change Across All Models	Predicted IV by 2100
	4%	flowering dogwood	*Cornus florida*	1.37	0.1	0.03	-0.17	0	-0.01	1.36
	0%	boxelder	*Acer negundo*	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0
	0%	scarlet oak	*Quercus coccinea*	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0
	0%	northern red oak	*Quercus rubra*	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0
	0%	pitch pine	*Pinus rigida*	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	0.01
	0%	Ogechee tupelo	*Nyssa ogeche*	0.1	-0.01	-0.01	-0.01	0	-0.0075	0.09
No Change	0%	American basswood	*Tilia americana*	0	0	0	0	0	0	0
Species Habitat Suitability is Predicted to Increase for these Species by 2100	0%	waterlocust	*Gleditsia aquatica*	0	0.01	0	0	0	0.0025	0
	0%	silver maple	*Acer saccharinum*	0	0.04	0	0	0	0.01	0.01
	0%	Florida maple	*Acer barbatum*	0	0.01	0.01	0.01	0.02	0.0125	0.01
	0%	pin oak	*Quercus palustris*	0	0.04	0	0.01	0	0.0125	0.01
	0%	Atlantic white-cedar	*Chamaecyparis thyoides*	0.03	0.02	0.03	-0.02	0.03	0.015	0.05
	1%	overcup oak	*Quercus lyrata*	0.09	0.03	0.03	0	0	0.015	0.11
	0%	eastern cottonwood	*Populus deltoides*	0	0.06	0	0.01	0	0.0175	0.02
	0%	willow oak	*Quercus phellos*	0.58	0.08	-0.01	0.08	-0.07	0.02	0.6
	1%	Shumard oak	*Quercus shumardii*	0	0.04	0.01	0.04	0.01	0.025	0.03
	0%	cedar elm	*Ulmus crassifolia*	0	0.04	0.01	0.03	0.02	0.025	0.03
	0%	sycamore	*Platanus occidentalis*	0.01	0.07	0	0.03	0	0.025	0.04
	3%	black cherry	*Prunus serotina*	1.12	0.04	0.04	-0.02	0.04	0.025	1.15
	0%	water hickory	*Carya aquatica*	0.03	0.04	0.03	0.02	0.02	0.0275	0.06
	0%	slippery elm	*Ulmus rubra*	0	0.08	0.01	0.02	0.01	0.03	0.03
	0%	cherrybark oak	*Quercus falcata var.pagodifolia*	0.06	0.05	0.03	0.06	0.02	0.04	0.1
	0%	river birch	*Betula nigra*	0	0.05	0.07	0	0.06	0.045	0.05
	0%	eastern hophornbeam	*Ostrya virginiana*	0.1	0.13	-0.03	0.1	-0.01	0.0475	0.15
	10%	water oak	*Quercus nigra*	6.17	-0.21	0.49	-0.46	0.37	0.0475	6.22
	0%	bitternut hickory	*Carya cordiformis*	0	0.18	0	0.03	0	0.0525	0.05
	0%	sassafras	*Sassafras albidum*	0.11	0.12	0.07	0.08	0.06	0.0825	0.19
	0%	pignut hickory	*Carya glabra*	0.49	0.17	0.06	0.09	0.01	0.0825	0.57
	1%	pecan	*Carya illinoinensis*	0.01	0.13	0.13	0	0.12	0.095	0.11
	0%	white ash	*Fraxinus americana*	0.69	0.1	0.05	0.25	-0.01	0.0975	0.79
	0%	American hornbeam:musclewood	*Carpinus caroliniana*	0.97	0.15	0.19	0.04	0.06	0.11	1.08
	3%	southern magnolia	*Magnolia grandiflora*	0.32	0.16	0.16	-0.03	0.15	0.11	0.43
	0%	blackjack oak	*Quercus marilandica*	0.3	0.19	0.1	0.12	0.07	0.12	0.42
	0%	loblolly-bay	*Gordonia lasianthus*	0.59	0.09	0.06	0.25	0.09	0.1225	0.71
	0%	American elm	*Ulmus americana*	0.03	0.3	0.03	0.25	0.06	0.16	0.19
	0%	sugarberry	*Celtis laevigata*	0.03	0.29	0.07	0.27	0.06	0.1725	0.2

Species Winners/Losers (mean) - Coastal Plain Mixed Forest Province: Coastal Plans & Flatwood Ecoregion #99 (inland section)					IV Change with Hadley Climate Model	IV Chamber with PCM Climate Model	IV Change with General Circulation Climate Model			
	3% Sample Inventory	Common Name	Botanical Name	Species Importance Value (IV) Today	High Emissions Scenario	Low Emissions Scenario	High Emissions Scenario	Low Emissions Scenario	Average IV Change Across All Models	Predicted IV by 2100
	0%	mockernut hickory	*Carya tomentosa*	0.6	0.21	0.2	0.19	0.12	0.18	0.78
	0%	southern red oak	*Quercus falcata var.falcata*	1.54	0.31	0.11	0.26	0.18	0.215	1.76
	0%	bluejack oak	*Quercus incana*	0.49	0.35	0.22	0.23	0.21	0.2525	0.74
	0%	black hickory	*Carya texana*	0	0.42	0.09	0.39	0.12	0.255	0.26
	0%	green ash	*Fraxinus pennsylvanica*	0.94	0.36	0.25	0.29	0.19	0.2725	1.21
	0%	eastern redcedar	*Juniperus virginiana*	0.06	0.44	0.16	0.37	0.15	0.28	0.34
	0%	blackgum	*Nyssa sylvatica*	1.85	0.56	0.22	0.07	0.29	0.285	2.14
	0%	common persimmon	*Diospyros virginiana*	0.7	0.43	0.26	0.29	0.29	0.3175	1.02
	0%	sand pine	*Pinus clausa*	0.97	0.77	0.09	0.54	0.04	0.36	1.33
	0%	redbay	*Persea borbonia*	0.95	0.31	0.37	0.44	0.39	0.3775	1.33
	7%	laurel oak	*Quercus laurifolia*	4.86	0.12	0.93	-0.24	0.73	0.385	5.25
	0%	turkey oak	*Quercus laevis*	1.46	0.57	0.55	0.23	0.41	0.44	1.9
	0%	baldcypress	*Taxodium distichum*	0.93	0.63	0.43	0.52	0.49	0.5175	1.45
	0%	sweetbay	*Magnolia virginiana*	3.29	0.84	0.75	0.32	0.76	0.6675	3.96
	0%	longleaf pine	*Pinus palustris*	4.82	0.77	1.35	-0.41	1	0.6775	5.5
	2%	shortleaf pine	*Pinus echinata*	0.83	0.78	0.58	0.73	0.66	0.6875	1.52
	0%	pondcypress	*Taxodium distichum var. nutans*	3.05	1.92	0.33	1.59	0.6	1.11	4.16
	1%	winged elm	*Ulmus alata*	0.12	1.31	0.92	1.28	0.94	1.1125	1.23
	0%	post oak	*Quercus stellata*	0.99	1.65	1.36	1.56	1.33	1.475	2.47
	7%	live oak	*Quercus virginiana*	2.87	2.28	1.29	1.53	1.04	1.535	4.41
	1%	slash pine	*Pinus elliottii*	15.16	1.65	2.55	1.01	2.3	1.8775	17.04
CITATION FOR TREE ATLAS										
Prasad, A. M., L. R. Iverson., S. Matthews., M. Peters. 2007-ongoing. A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. https://www.nrs.fs.fed.us/atlas/tree, Northern Research Station, USDA Forest Service, Delaware, Ohio.										

GIS data from the sample inventory have been delivered to the city and is on file for future use.

APPENDIX I
TREE BENEFITS REPORT

Data from the 3% sample inventory were inputted into i-Tree streets and analyzed for estimated benefits of each species of tree present in Tallahassee's street tree population.

Total Annual Benefits, Net Benefits, and Costs for All Trees

Benefits	Total ($)	Total Stat	$/tree	Tree Stat
Energy	642,665	(±50,841)	7.17	(±0.57)
CO_2	122,136	(±9,841)	1.36	(±0.11)
Air Quality	19,777	(±4,209)	0.22	(±0.05)
Stormwater	885,897	(±75,678)	9.88	(±0.84)
Aesthetic/Other	2,581,822	(±198,498)	28.79	(±2.21)
Total Benefits	4,252,297	(±325,454)	47.42	(±3.63)

APPENDIX J
TALLAHASSEE'S RECOMMENDED TREE LIST

(Appendix J added November 6, 2024)

Since adoption of the Urban Forest Master Plan, species choices for public planting projects have aligned with the goal to increase the population of the recommended tree species. The *Tallahassee Recommended Tree List* was developed by a panel of staff and local experts as a first step in ensuring the right types of trees are planted in order to achieve established goals. The *Tallahassee Recommended Tree List* is an important tool that assists staff in choosing the preferred species types. The *Tallahassee Recommended Tree List* prescribes appropriate growing spaces for desired species to ensure that trees have the space to grow to maturity while reducing conflict with other types of infrastructure such as sidewalks and power lines. The *Tallahassee Recommended Tree List* is consistent with the Land Development Code and is currently in use.

The Right Tree in the Right Place

A guide for selecting proper trees for urban spaces

Scientific Name	Common Name	Florida Native	Deciduous, Evergreen, Ornamental	Under Power Lines	Street Tree	Planting Strip/ Minimum Width	Sight Distance Triangle	Parking Lot	Shade or Canopy Tree	Mature Spread	Mature Height	Growth Rate	Wind Resistance	Canopy Square Footage	Soil Area* (w/3' depth)	Size Class	Current List
Acer palmatum var. "Bloodgood"	Japanese Maple		D	x						15'-25'	15'-25'	SLOW	MED-HIGH	400	300	S	B
Aesculus pavia	Red Buckeye	x	D,O	x						15'-25'	15'-20'	MOD	n/a	400	300	S	D
Acer rubrum	Swamp Red Maple	x	D						x	25'-30'	50'-70'	FAST	MED-LOW	1600	2400	L	A
Acer saccharum flordanum	Florida Sugar Maple	x	D						x	35'-50'	50'-60'	MOD	MED-HIGH	1600	2400	L	B
Alnus serrulata	Hazel alder		D, O							8'-15'	10'-20'	MOD	n/a	400	300	S	B
Amelanchier arborea	Downy Serviceberry	x	D,O							15'-20'	25'-35'	SLOW	n/a	400	300	S	D
Amelanchier laevis	Allegheny Serviceberry		D,O							15'-20'	15'-30'	SLOW	n/a	400	300	S	
Aralia spinosa	Devil's Walking Stick	x	D							6'-10'	10'-15'	MOD	n/a	400	300	S	D
Asimina triloba	Paw Paw	x	D							15'-20'	15'-20'	MOD	n/a	400	300	S	
Betula nigra	River Birch	x	D		single stem pruned for clearance	4'	x	x	x	25'-35'	40'-50'	FAST	MED-HIGH	900	1200	M	A
Bumelia languinosa	Buckthorn		D						x	25'-35'	40'-50'	MOD	n/a	900	1200	M	D
Carpinus caroliniana	American Hornbeam Iron-wood	x	D		single stem pruned for clearance	4'			x	20'-30'	20'-35'	SLOW	MED-HIGH	400	300	S	C
Carya floridana	Florida Scrub Hickory	x	D							10'-30'	15'-30'	MOD	HIGH	400	300	S	C
Carya glabra	Pignut Hickory	x	D						x	30'-40'	50'-65'	MOD	MED-HIGH	1600	2400	L	C
Carya illinoensis	Pecan	x	D						x	40'-70'	70'-100'	MOD	LOW	1600	2400	XL	C
Carya tomentosa	Mockernut Hickory	x	D						x	40'-60'	60'-80'	MOD	MED-HIGH	1600	2400	XL	C
Castanea moliisima	Chinquapin		D						x	40'-50'	35'-40'	MOD	n/a	900	1200	M	B
Catalpa bignonioides	Southern Catalpa		D,O						x	40'-50'	50'-60'	FAST	n/a	1600	2400	L	B
Cedrus deodara	Deodar Cedar		E						x	20'-30'	40'-60'	FAST	n/a	1600	2400	L	
Celtis laevigata	Sugar Berry	x	D		x	6'			x	50'-60'	50'-70'	FAST	MED-LOW	1600	2400	L	A
Celtis occidentalis	Hackberry	x	D		x	6'			x	40'-60'	45'-80'	FAST	MED-LOW	1600	2400	L	A
Cercis canadensis	Redbud	x	D,O		single stem pruned for clearance	4'		x		15'-25'	20'-30'	FAST	MED-HIGH	400	300	S	D
Chionanthus retusus	Chinese Fringe Tree		D,O	x	single stem pruned for clearance	4'		x		10'-15'	15'-20'	SLOW	n/a	400	300	S	
Chionanthus virginicus	Fringe Tree	x	D,O	x	single stem pruned for clearance	4'		x		10'-15'	12'-20'	SLOW	MED-HIGH	400	300	S	D
Cladrastis kentukea	American Yellowwood	x	D,O					x	x	40'-50'	30'-50'	MOD	n/a	900	1200	M	
Cliftonia monophylla	Buckwheat-tree Black titi	x	E, O							6'-10'	30'	MOD	n/a	400	300	S	C
Continus coggygria	Smoke Tree	x	D,O		single stem pruned for clearance	4'				10'-15'	10'-18'	SLOW	n/a	400	300	S	
Cornus florida	Dogwood	x	D,O							25'-30'	20'-30'	MOD	HIGH	400	300	S	D

Scientific Name	Common Name	Florida Native	Deciduous, Evergreen, Ornamental	Under Power Lines	Street Tree	Planting Strip/ Minimum Width	Sight Distance Triangle	Parking Lot	Shade or Canopy Tree	Mature Spread	Mature Height	Growth Rate	Wind Resistance	Canopy Square Footage	Soil Area* (w/3' depth)	Size Class	Current List
Cornus sp.	Dogwood, native species	x	D, O	dependant on mature size						varies	varies					S	D
Crataegus aestivalis	Mayhaw	x	D,O	x						35'-40'	20'-30'	SLOW	n/a	400	300	S	C
Crataegus marshallii	Parsley Haw	x	D, O	x	x	4'				20'-35'	20'-30'	SLOW	n/a	400	300	S	C
Crataegus phaenopyrum	Washington Hawthorne	x	D,O							20'-35'	20'-35'	MOD	n/a	400	300	S	C
Crataegus sp.	Hawthorn - tree form	x	D, O	dependant on mature size						varies							C
Cunninghamia lanceolata	Chinese Fir		E						x	15'-30'	50'-75'	MOD	n/a	1600	2400	L	
Cyrilla racemiflora	Titi, Leatherwood	x	D, O							10'-20'	20'-30'	MOD	n/a	700	300	S	C
Diospyros virginiana	Common Persimmon	x	D						x	20'-35'	40'-60'	MOD	MED-HIGH	900	1200	M	A
Diospyros texana	Texas Persimmon		D							15'-25'	20'-40'	SLOW	n/a	900	1200	M	
Eriobotrya japonica	Loquat		E					x		30'-35'	20'-30'	MOD	MED-LOW	400	300	S	
Fagus grandiflora	American Beech	x	D		x	10'		x	x	40'-60'	50'-75'	MOD	n/a	1600	2400	L	C
Forestiera segregata	Florida Swamp Privet		D							5'-10'	5'-15'	MOD	n/a	400	300	S	D
Fraxinus americana	White Ash	x	D		x	6'		x	x	40'-60'	50'-80'	FAST	MED-HIGH	1600	2400	L	C
Fraxinus pennsylvanica	Green Ash	x	D		x	6'		x	x	45'-50'	60'-70'	FAST	MED-LOW	1600	2400	L	C
Ginkgo Biloba (male only)	Ginkgo (male only)				x	6'		x	x	50'-60'	50'-75'	SLOW	ME-HIGH	1600	2400	L	
Gordonia lasianthus	Loblolly Bay	x	E		single stem pruned for clearance	4'		x		10'-15'	35'-60'	MOD	n/a	900	1200	M	C
Halesia carolina	Silverbell	x	D,O		single stem pruned for clearance	4'			x	15'-30'	40'-60'	MOD	n/a	900	1200	M	D
Hamamelis virginiana	Witch hazel	x	D,O	x						15'-25'	20'-30'	SLOW	n/a	400	300	S	D
Ilex sp.	Tree form Holly species			dependant on mature size						varies	15' +	varies	n/a			varies	
Ilex x. attenuata 'East Palatka'	East Palatka' Holly	x	E		single stem pruned for clearance	4'		x		10'-15'	30'-45'	MOD	HIGH	900	1200	M	A
Ilex x. attenuata "Foster"	Foster's Holly		E	x	single stem pruned for clearance	4'		x		8'-12'	15'-25'	SLOW	HIGH	400	300	S	A
Ilex x. attenuata "Savannah"	Savannah Holly		E		single stem pruned for clearance	4'		x		6'-10'	30'-45'	MOD	HIGH	900	1200	M	A
Ilex cassine	Dahoon holly	x	E		single stem pruned for clearance	4'				8'-12'	20'-30'	MOD	HIGH	400	300	S	C
Ilex cornuta	Chinese Holly		E							15'-25'	15'-25'	MOD	HIGH	400	300	S	A
Ilex cornuta 'Burfordii'	Burford Holly		E	x						15'	15'-25'	SHRUB	n/a	400	300	S	A
Ilex decidua	Possum Haw	x	D	x						10'-15'	10'-15'	SLOW	n/a	400	300	S	C
Ilex myrtifolia	Myrtle-leaved Holly	x	E	x						15'-20'	20'-40'	MOD	n/a	900	1200	M	C
Ilex x 'Nellie R Stevens'	Nellie R. Stevens Holly		E		single stem pruned for clearance	4'				10'-15'	20'-30'	MOD	n/a	400	300	S	A
Ilex opaca	American Holly	x	E		single stem pruned for clearance	4'		x	x	15'-35'	35'-50'	SLOW	HIGH	900	1200	M	D
Ilex verticillata	Winterberry		E							5'-10'	6'-10'	SLOW	n/a				C
Ilex vomitoria	Yaupon Holly	x	E	x	single stem pruned for clearance	4'				15'-20'	15'-25'	MOD	HIGH	400	300	S	
Jugulans nigra	Black Walnut	x	D						x	50'-70'	60'-70'	MOD	n/a	1600	2400	XL	C
Juniperus silicicola	Southern Red Cedar	x	E						x	20'-30'	30'-45'	FAST	LOW	900	1200	M	
Juniperus virginiana	Eastern Red Cedar	x	E					x	x	20'-30'	40'-50'	FAST	n/a	900	1200	M	C
Kalmia latifolia	Mountain Laurel		D							5'-8'	7'-15'	MOD	MED-HIGH				D
Lagerstroemia fauriei 'Acoma"	Japanese Crepe Myrtle Acoma		D,O	x	x	4'		x		12'-15'	8'-12'	FAST	HIGH	400	300	S	A
Lagerstroemia fauriei 'Catawba'	Japanese Crepe Myrtle Catawba		D,O	x	x	4'		x		15'-20'		FAST	HIGH	400	300	S	A
Lagerstroemia fauriei 'Sioux'	Japanese Crepe Myrtle Sioux		D,O	x	x	4'		x		15'-20'		FAST	HIGH	400	300	S	A

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Lagerstroemia indica 'Miami'	Miami Crepe Myrtle		D,O		x	4'		x		20'-35'	30'-35'	FAST	HIGH	400	300	S	A
Lagerstroemia indica 'Muskogee"	Muskogee Crepe Myrtle		D,O		x	4'		x		30'-40'	30'-40'	FAST	HIGH	400	300	S	A
Lagerstroemia indica 'Natchez"	Natchez Crepe Myrtle		D,O		x	4'		x		25'-35'	30'-35'	FAST	HIGH	400	300	S	A
Lagerstroemia indica 'Tuscarora'	Tuscarora Crepe Myrtle		D,O		x	4'		x		20'-35'		FAST	HIGH	400	300	S	A
Liquidambar styraciflua	Sweet Gum	x	D						x	35'-60'	60'-75'	MOD	MED-HIGH	1600	2400	L	A
Lindera benzoin	Spicebush		D							6'-12'	6'-10'	SLOW	n/a	400	300	S	D
Liriodendron tulipifera	Tulip Poplar	x	D		x	10'		x	x	30'-50'	80'-100'	MOD	LOW	1600	2400	XL	C
Magnolia macrophylla var. ashei	Ashe Magnolia		D,O					x		20'-30'	20'-30'	MOD	n/a	400	300	S	
Magnolia grandiflora	Southern Magnolia	x	E, O		x	6'		x	x	30'-40'	60'-80'	MOD	HIGH	1600	2400	L	C
Magnolia grandiflora "Little Gem"	Little Gem Magnolia		E, O		single stem pruned for clearance	4'				8'-12'	30'-35'	MOD	HIGH	400	300	S	C
Magnolia pyramidata	Pyramid Magnolia	x	D, O	x						5'-10'	10'-20'	MOD	n/a	400	300	S	
Magnolia Kobus var stellata	Star Magnolia		D, O	x						10'-15'	15'-20'	SLOW	n/a	400	300	S	C
Magnolia x soulangiana	Saucer Magnolia		D, O							20'-30'	20'-25'	MOD	MED-HIGH	400	300	S	C
Magnolia virginiana 'Bracken's'	Bracken's		E		single stem pruned for clearance	4'				35'	25'	MOD	n/a	400	300	S	C
Magnolia virginiana 'D.D.Blanchard'	D.D. Blanchard		E		single stem pruned for clearance	6'		x	x	25' - 30'	50'-60'	MOD	n/a	1600	2400	L	C
Magnolia virginiana	Sweetbay Magnolia	x	E, O		single stem pruned for clarance	4'	x		x	15'-25'	40'-50'	MOD	MED-HIGH	1600	1200	M	C
Malus angustifolia	Southern Flowering Crabapple	x	D, O	x	single stem pruned for clarance	4'				15'-20'	25'-30'	MOD	n/a	400	300	S	A
Morus rubra	Red Mulberry	x	D							15'-40'	15'-40'	FAST	MED-LOW	400	300	S	A
Myrica cerifera	Wax Myrtle	x	E	x						20'-25'	15'-25'	FAST	MED-LOW	400	300	S	
Nyssa Aquatica	Water Tupelo	x	E						x	25'-50'	50'-80'	MOD	MED-HIGH	1600	2400	L	C
Nyssa sylvatica	Black Tupelo	x	E		x	6'			x	25'-35'	65'-75'	SLOW	MED-HIGH	1600	2400	L	C
Osmanthus americanus	Wild-olive or Devilwood	x	E, O	x		4'			x	10'-15'	15'-25'	MOD	n/a	400	300	S	C
Osmanthus fragrans	Tea Olive	x	D,O	x		4'				15'-20'	15'-30'	MOD	n/a	400	300	S	
Ostrya virginiana	American Hophornbeam	x	D		single stem pruned for clarance	4'			x	25'-30'	30'-40'	SLOW	MED-HIGH	900	1200	M	D
Oxydendrom arboreum	Sourwood	x	D,O		single stem pruned for clarance	4'			x	25'-30'	40'-60'	SLOW	n/a	900	1200	M	C
Parkinsonia aculeata	Jerusalem Thorn		D							20'-25'	15'-20'	FAST	n/a	400	300	S	
Persea borbonia	Redbay	x	E						x	30'-50'	30'-50'	MOD	MED-LOW	900	1200	M	B
Pinckneya pubens	Pinckneya / Fever Tree	?	D							12'-18'	15'-20'	MOD	n/a	400	300	S	D
Pinus clausa	Sand Pine	x	E							15'-25'	20'-40'	SLOW	LOW	900	1200	M	A
Pinus echinata	Shortleaf Pine	x	E						x	20'-30'	50'-60'	FAST	n/a	1600	2400	L	A
Pinus elliottii	Slash Pine	x	E						x	35'-50'	75'-100'	FAST	MED-LOW	2500	2400	XL	A
Pinus glabra	Spruce Pine	?	E						x	25'-40'	30'-60'	SLOW	LOW	1600	2400	L	C
Pinus serotina	Pond Pine	x	E						x		70'	MOD	n/a	1600	2400	L	B
Pinus taeda	Loblolly Pine	x	E		x	10'		x	x	30'-35'	50'-80'	FAST	MED-LOW	1600	2400	L	A
Pinus palustris	Longleaf Pine	x	E		may be best planted at smaller sizes	10'		x	x	30'-40'	60'-80'	FAST	MED-LOW	1600	2400	XL	C
Pistacia chinensis	Chinese Pistache		E		x	4'			x	25'-35'	25'-35'	MOD	MEE-LOW	400	300	S	A
Platanus occidentalis	American Sycamore	x	D		x	10'		x	x	50'-70'	75'-90'	FAST	MED-LOW	1600	2400	XL	A

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Planera aquatica	Water Elm Planer tree	x							x	30'-40'	15'-50'	FAST	n/a	900	1200	M	C
Podocarpos macrophyllus	Japanese Yew		E							20'-25'	30'-40'	SLOW	HIGH	400	300	S	C
Populus heterophylla	Swamp Cottonwood	x							x	35'-60'	15'-80'		n/a	1600	2400	L	C
Populus deltoides	Eastern Cottonwood	x	D						x	35'-60'	15'-80'	FAST	n/a	1600	2400	XL	B
Prunus americana	American Plum	x	D,O	x						15'-25'	15'-25'	MOD	n/a	400	300	S	A
Prunus angustifolia	Chickasaw Plum	x	D,O	x	x	4'				15'-20'	12'-20'	MOD	MED-HIGH	400	300	S	A
Prunus cerasifera	Purple Leaf Plum		D,O	x						15'-25'	15'-25'	MOD	n/a	400	300	S	A
Prunus x.incamp	Okame' Cherry		D,O		x	4'				15'-20'	15'-20'	MOD	n/a	400	300	S	A
Prunus campanulata	Taiwan Cherry		D,O		x	4'				15'-25'	12'-20'	MOD	n/a	400	300	S	
Prunus serotina	Black Cherry	x	D						x	35'-50'	60'-90'	FAST	MED-LOW	1600	2400	L	A
Prunus umbellata	Flatwoods Plum		D,O		x	4'				12'-20'	12'-20'	MOD	n/a	400	300	S	A
Quercus acutissima	Sawtooth Oak	x	D		x	6'		x	x	35'-50'	35'-45'	MOD	n/a	900	1200	M	B
Quercus alba	White Oak	x	D		root barrier required	10'		x	x	60'-80'	60'-100'	SLOW	MED-LOW	1600	2400	XL	C
Quercus bicolor	Swamp White Oak	x	D		root barrier required	10'		x	x	50'-70'	50'-70'	MOD	n/a	1600	2400	XL	C
Quercus coccinea	Scarlet Oak	x	D		root barrier required	10'		x	x	45'-60'	60'-75'	MOD	n/a	1600	2400	XL	C
Quercus falcata	Southern Red Oak	x	D		root barrier required	10'		x	x	60'-70'	60'-80'	MOD	LOW	1600	2400	XL	C
Quercus geminata	Sand Live Oak	x	D					x		10'-15'	20'-50'	SLOW	HIGH	900	1200	M	C
Quercus hemlsphaerica or laurifolia	Laurel Oak	x	D					x	x	35'-45'	60'-70'	FAST	LOW	1600	2400	L	A
Quercus laevis	Turkey Oak	x	D					x		10'-15'	30'-40'	MOD	HIGH	900	1200	M	C
Quercus michuaxii	Swamp Chestnut Oak	x	D		root barrier required	10'		x	x	30'-50'	40'-60'	MOD	MED-HIGH	1600	2400	L	C
Quercus myrtifolia	Myrtle Oak	x	E					x		8'-10'	15'-20'	MOD	HIGH	400	300	S	C
Quercus nuttallii	Nuttal Oak	x	D		root barrier required	10'		x	x	35'-50'	60'-80	MOD	n/a	1600	2400	L	C
Quercus nigra	Water Oak	x	D						x	60'-70'	50'-60'	FAST	LOW	1600	2400	L	A
Quercus phellos	Willow Oak		D		root barrier required	10'		x	x	40'-50'	60'-75'	FAST	MED-LOW	1600	2400	L	A
Quercus prinus	Chestnut Oak	x	D		root barrier required	10'		x	x	40'-60'	50'-60'	MOD	n/a	1600	2400	L	C
Quercus shumardii	Shumard Oak	x	D		root barrier required	10'		x	x	40'-50'	55'-80'	FAST	MED-HIGH	1600	2400	L	C
Quercus stellata	Post Oak	x	D		root barrier required	10'		x	x	35'-50'	40'-50'	MOD	MED-HIGH	900	1200	M	C
Quercus virginiana	Live Oak	x	E		root barrier required	12'		x	x	60'-120'	60'-80'	MOD	HIGH	1600	2400	XL	C
Rhamnus caroliniana	Carolina buckthorn	x	D							10'-15'	12'-15'	MOD	n/a	400	300	S	C
Sassafras albidium	Sassafras	x	D						x	25'-40'	30'-60'	MOD	n/a	900	1200	M	A
Salix babilonicaa	Weeping Willow		D					x	x	45'-70'	45'-70'	FAST	MED-LOW	1600	2400	L	A
Symplocos tinctoria	Horse sugar	x	D,O							15'-20'	15'-35'	MOD	n/a	400	300	S	D
Taxodium ascendens	Pond Cypress	x	D							10'-15'	50'-60'	FAST	HIGH	1600	2400	L	C
Taxodium distichum	Bald Cypress	x	D		root barrier required	10'			x	25'-35'	60'-80'	FAST	HIGH	1600	2400	L	C
Tilia Americana	American Linden or Bass-wood	x	D		root barrier required	10'			x	35'-50'	50'-80'	MOD	n/a	1600	2400	L	C
Ulmus alata	Winged Elm	x	D		x	6'			x	30'-40'	45'-70'	FAST	MED-HIGH	1600	2400	L	B
Ulmus americana	American Elm	x	D		x	6'			x	50'-70'	70'-90'	FAST	MED-LOW	1600	2400	XL	D
Ulmus parvifolia	Chinese "Drake" Elm		D						x	35'-50'	35'-45'	FAST	LOW	900	1200	M	B
Vaccinium arboreum	Sparkleberry	x	D,O	x	x	4'				10'-15'	6'-25'	MOD	HIGH	400	300	S	A
Viburnum rufidulum	Rusty Blackhaw	x	D,O		single stem pruned for clearance	4'				20'-25'	20'-25'	SLOW	n/a	400	300	S	
Vitex agnus-castus	Chaste Tree			x	x	4'				15'-20'	10'-15'	FAST	ME-LOW	400	300	S	
Zelkova serrata 'green vase'	Japanese Zelkova		D		x	4'			x	50'-75'	55'-80'	MOD	n/a	1600	2400	L	A

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PALMS																	
Butia odorata	Pindo Palm		E					x		15'-20'	15'-20'	SLOW	HIGH	400	300	S	
Phoenix canariensis	Canary Island Date Palm		E					x		20'-35'	40'-50'	MOD.	HIGH	900	300	M	
Phoenix dactylifera	Date Palm		E					x		30'-45'	50'-80'	MOD.	HIGH	1600	300	L	
Phoenix sylvestris	Sylvester Palm							x		20'	50'	MOD.	HIGH	900	300	M	
Sabal plametto	Cabbage Palm	x	E		x	4'	x	x		15'-25'	40'-50'	MOD.	HIGH	900	300	M	
Washingtonia Robusta	Washington Palm	NO	E					x		15'-25'	70'-100'	MOD.	n/a	900	300	L	

**Soil volume can be halved for trees sharing space*

Size Classes			Soil Volume		Canopy Square Footage
Extra Large	65'+ ht.		2400		1600
Large	50'-65' ht.		2400		1600
Medium	35'-50' ht.		1200		900
Small	15'-35' ht.		300		400

PLANNING DEPARTMENT