City of St. Augustine Tree Inventory and Risk Assessment Phase 3 Report July 25, 2016

by

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In 2015 the City of St. Augustine applied to the Florida Forest Service for an Urban and Community Forest Grant to perform Phase 3 of a Tree Risk Assessment and Inventory. This report is the result of the awarded grant.

Assignment

In February 2016, Advanced Tree Care was given the assignment of performing a Tree Survey and Risk Assessment for the City of St. Augustine, Florida on 330 trees in various parks, right-of-ways and other public areas specified in the Tree Inventory Application submitted for the Urban and Community Forestry Grant Program. The survey included parks and city street right-of-ways around north city, northwest areas near Masters Drive, the historic neighborhoods near Rohde Ave., and the public works city complex off Pellicer/Old Dixie Hwy.

The Project was begun in February 2016 and completed June of 2016. The tree evaluations as well as this report were completed by Chuck Lippi, an ISA Board Certified Master Arborist and ~~ASCA ,~~ American Society of Consulting Arborists Registered Consulting Arborist~~, member~~ and Danny Lippi, an ISA Certified Arborist (FL6145A). We are both ISA TRAQ (Tree Risk Assessor Qualified) and members of the International Society of Arboriculture.

Our assignment was to:
1. Assess the current condition of the trees on the city right-of-ways, assigned parks and public use areas.
2. Make recommendations to reduce risk
3. Make recommendations to maintain healthy trees and improve health and structural problems

Limits of the Assignment

We visually inspected each tree for the inventory and assessment. We did not survey any palm trees or conifer trees or any broadleaf ~~or conifer~~ trees under 6 inches in diameter.

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees, below ground or not clearly visible from the vantage point on the ground. Arborists cannot guarantee that a tree will be healthy, safe or adequately protected under all circumstances or for a specified period of time. Likewise, remedial, protective and mitigating treatments and recommendations cannot be guaranteed.

Purpose and Use of the Report

This report is prepared for the City of St. Augustine and is public record. The main purpose of the tree inventory is risk assessment. A tree inventory identifies apparent tree problems and provides the starting point for a long-term management plan, which allows for effective use of tree funds, and allows for more accurate budget projections.This tree inventory and assessment provides information on the species, size and condition of the street trees in the City of St. Augustine. An additional benefit is the City is on record as having risk assessment procedures in place and an on-going risk assessment program.

Assumptions

The tree survey was done between February 19 and June 1, 2016. Our observations and conclusions are as of that period. A severe storm or other environmental factors can change the observations and maintenance recommendations.

Testing and Analysis

The Risk Assessment was done in accordance with ***ANSI A300 Standards on Tree Risk Assessment*** and the companion publication ***Best Management Practices, Tree Risk Assessment***.[iii] Tree health recommendations follow procedures and techniques of two of the country's leading arboricultural researchers: Dr. Ed Gilman, professor of environmental horticulture at the University of Florida and Dr. Kim Coder, professor at the University of Georgia.

On each tree evaluated we performed a **Level 2 Basic Assessment**, which is a detailed visual inspection of a tree and its surrounding site. The **Level 2 Assessmen**t includes a 360-degree visual inspection from ground level on each tree and sound testing of the lower trunk and root flares with a rubber mallet to listen for tonal variations that may indicate dead bark or internal hollows. When there is sufficient evidence gathered under a Level 2 Assessment for additional evaluation of a tree found to have significant structural defects such as visible cavities, decay or indications of possible decay from a sounding test, we recommend a **Level 3 Advanced Assessment** with a Resistograph to determine the extent of internal decay and strength loss. A Resistograph is a drilling device that measures and graphs decay as the narrow ⅛-inch drill bit passes through the different layers of solid and decayed wood. Level 3 Advanced Assessment is not part of the scope of this assignment and can be arranged in a separate contract.

We identified the species of each tree, measured the diameter and added a uniquely numbered black nylon tag secured to the tree with a 3-inch stainless steel nail. Each nail was driven only partially into the tree to allow room for tree growth in diameter, which pushes the tag outward along the nail toward the nail head as the tree grows in girth. Generally, we attach the tags to trees at a height of about 7 to 8 feet out of reach of the curious and facing away from the street or on the least conspicuous side of the tree whenever possible.

Data Collection

Both empirical data as well as subjective data was gathered on each tree. Data was collected on HanDBase, a data collection database application used on our handheld smartphones.

Empirical data included:
1. tree tag number
2. tree species
3. tree diameter (DBH)
4. location (street, house number or nearby intersection)

The subjective data included:
1. health condition (excellent, good, fair, poor, dead)
2. structural condition (excellent, good, fair, poor)
3. structural problems such as codominant leaders, dead branches, decay/ cavities, health problems such as decay fungi, sparse foliage, declining
4. maintenance recommendations such as pruning, dead branch removal and other work
1. risk assessment rating (see below)

Risk Assessment Rating System

The risk rating score used is a measure of relative tree health and structural condition on the tree population found along the city's right-of-way. We scored each tree according to a risk assessment rating system developed by the ANSI A-300 risk assessment standards.

1. **Likelihood of failure** of the tree or part of the tree (1=improbable, 2=possible, 3=probable, 4=imminent)
2. **Likelihood of impact** that may strike person or object (1=improbable, 2=possible, 3=probable, 4=imminent)
3. **Consequences** of failure (1-negligible, 2=minor, 3=significant, 4=severe)
4. **Tree species** (1=strong, decay resistant species such as live oak, or southern magnolia. 2=moderate to poor decay and wind resistance such as sweet gum, laurel oak or red maple)

Based upon our experience and in consideration of research at the University of

Florida for wind resistance, wood strength and decay resistance, we have added a forth category -- tree species (item 4 above). Different tree species vary in their strength, wind resistance, tolerance of construction damage (fill soil, cutting roots, soil compaction), life span and susceptibility to decay or other pests. In our opinion, tree species will affect how trees respond to urban landscape stresses and should be considered as part of the tree risk assessment. Tree species were rated on a 2-point scale with a “1” rating given to a long-lived, strong tree such as a live oak. A “2” rating was given to trees with moderate to poor lifespans and strength such as a sweetgum (*Liquidambar styraciflua*), and laurel oaks (*Quercus laurifolia*).

Trees were rated in each category and the sum of the four categories represents the Hazard Score. The higher score means a higher risk for that category. The highest risk tree could attain a hazard rating of 14. The lowest risk tree could have a hazard rating of 4. Trees receiving a score in the mid-range, 6 to10 may or may not require maintenance depending on budget considerations and available resources. Trees with a rating between 11 to 14 should be mitigated, in our opinion, with greater urgency given to trees with higher ratings in this range.

According to Clark and Matheny,[iii] “Thus hazard ratings cannot strictly define a numerical line for action between either removal and retention or treatment and no treatment. This must be an administrative decision, one made by owner and manager. In municipal situations, where an agency might manage a very large number of trees, there may be practical limits to the amount of work that can be undertaken and only the most severe and significant hazards may be addressed. Some level of risk will always be present when people live among trees. The decision of how much risk is tolerable remains with the owner and manager.”

Pruning Categories

Trees that were marked for some form of maintenance received one of the following descriptive classifications. All work should follow ANSI A300 Pruning Standards:

Priority 1 Removal Trees designated for removal have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category have a large percentage of dead crown, decay and/or pose an elevated level or risk for failure. Any hazards that could be seen as potential dangers to persons or property and seen as potential liabilities to the client would be in this category. Large dead and dying trees that are high liability risks are included in this category. These trees are the first ones that should be removed.

Priority 2 Removal Trees that should be removed but do not pose a liability as great as the first priority will be identified here. This category would need attention as soon as “Priority 1” trees are removed and Priority 1 Prune is done.

Priority 3 Removal Trees that should be removed, but pose minimal liability to persons or property, will be identified in this category.

Priority 1 Prune Trees that require priority one pruning are recommended for trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter.

Priority 2 Prune These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards.

Large Tree Routine Prune These trees require routine horticultural pruning to correct structural problems, remove dead branches or vines, or correct growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. End weight reduction pruning is considered part of "Routine" pruning. Trees in this category are large enough to require bucket truck access or manual climbing.

Small Tree Routine Prune These trees require routine horticultural pruning to correct structural problems, remove dead branches or vines, or correct growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are small enough to use a ladder or pole saw.

Training Prune These are generally smaller trees that can benefit from early structural pruning that will improve the structure by reducing or eliminating codominant leaders, unbalanced crowns and other structural problems.

OBSERVATIONS

Tree Species Distribution

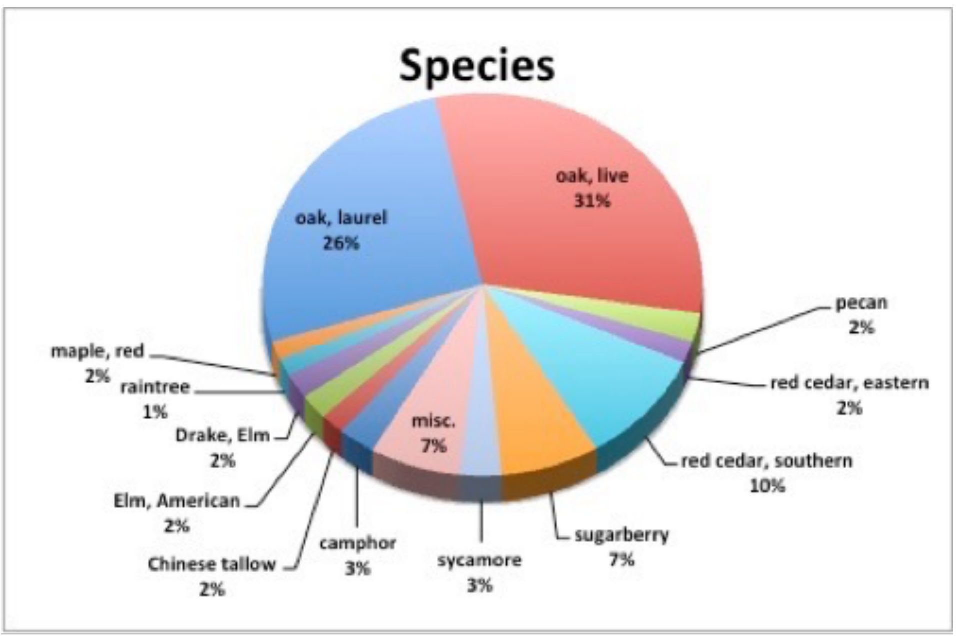

Figure 1. Live oaks are the predominant canopy tree, followed closely by laurel oaks, and then southern red cedars.

There were 330 trees evaluated in this inventory/risk assessment. In all 27 species of trees were found in the areas surveyed. Figure 1 illustrates the distribution of the major different tree species. Live oaks (*Quercus virginiana*) were the predominant species followed by laurel oaks (*Quercus laurifolia*), and southern red cedars (*Juniperus silicicola*).

General Tree Species Characteristics

Live Oaks Because the Southern live oak is such a predominant street tree, it is worth noting some of its attributes. The Southern live oak is a native tree, which is considered to be one of the premier tree species in the United States. According to Dr. Ed Gilman, Environmental Horticulture Professor at the University of Florida and one of the country's leading arboriculture researchers, "A large, sprawling, picturesque tree, usually graced with Spanish moss and strongly reminiscent of the Old South, live oak is one of the broadest-spreading of the oaks, providing large areas of deep, inviting shade. An amazingly durable American native, it can measure its lifetime in centuries if properly located and cared for in the landscape."[iv] He goes on to say live oaks have a reputation for being a tough tree and have very good wind resistance.

Pamela Crawford, a landscape architect who studied storm damage in the fall of 2004 following the hurricanes, wrote in her book ***Stormscaping: Landscaping to Minimize Wind Damage in Florida***, "Live oak is a large tree that has consistently been categorized as the most wind-tolerant shade tree for the entire state of Florida."[v]

Laurel Oaks Another commonly found street tree and park tree is the laurel oak (*Quercus laurifolia*). Gilman describes the tree, "Laurel Oaks have a life span of 50 to 70 years. Tree trunks and large branches often hollow from decay and wood rot. The smallest trunk injury or improper pruning cut can result in columns of decay inside the trunk which are 10, 20 or more feet long." Gilman goes on to say, "It (the laurel oak) grows well as a street tree and will serve the community well, but hollows with age as it approaches 50 years old."[vi]

Dr. Mary Duryea, Associate Dean for Research and Forestry Professor at the Institute of Food and Agricultural Sciences of the University of Florida, has been studying hurricane damage on the trees for the past 20 years. Dr. Duryea has made lists of the trees she has found to have the lowest wind resistance and the highest wind resistance. The live oak is on her list of the trees with the highest wind resistance. The laurel oak (*Quercus laurifolia*) on the contrary is listed a having medium-low to low wind resistance. The wind-resistance list has subsequently been incorporated in several University of Florida Extension Service Publications.[vii,viii]

Pamela Crawford, a landscape architect who studied storm damage in the fall of 2004 following the multiple hurricanes, wrote in her book ***Stormscaping: Landscaping to Minimize Wind Damage in Florida,*** "Live oak is a large tree that has consistently been categorized as the most wind-tolerant shade tree for the entire state of Florida. Regarding the laurel oak, Crawford said, "We had more reports of laurel oaks down than any other tree in central and north Florida. If you have one of these within falling distance of your house, remove it, especially if it is an older tree. Laurel oaks are weaker and shorter lived than live oaks and and the four storms of 2004 proved that the older ones were particularly dangerous." [ix]

Discussion of Problems and Defects Observed

Tree Health and Structural Condition

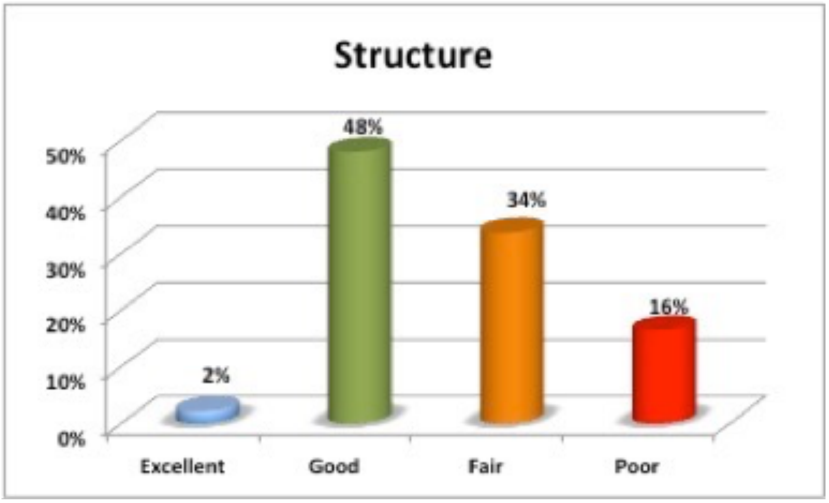

Figure 2. Most trees had good structure. Many trees had fair structure which is typical of a canopy with a high number of laurel oaks.

Each tree was also evaluated as to its overall health and structure. It is important to understand that health and structure are two separate and independent considerations. A tree can be healthy yet have poor and hazardous structure. Live (green) trees can fail and sometimes do. Structurally sound trees sometimes decline and die from poor health. Most of the trees evaluated (48 percent) had good structure. Thirty four percent of the trees had fair structure mostly because of codominant leaders (Figure 2). Trees with codominant leaders can be classified as “codominant leader without included bark” and “codominant leaders with included bark”. Trees with codominant leaders with included bark are much more prone to failure than trees with codominant leader and no included bark. A codominant leader with included bark is shown in Figure 3. The two leaders can more readily split than when there is a stronger u-shape in the crotch between two or more codominant leaders.

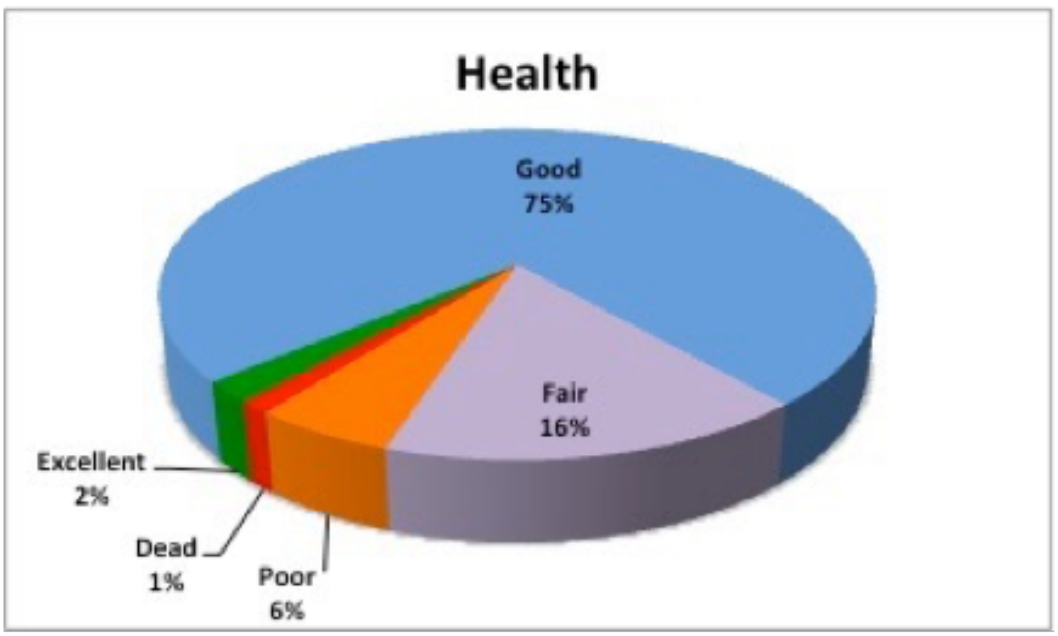

Figure 4. Most of the trees had good health. This also correlated to a low number of pathogens or diseases in the survey.

The evaluation of **tree health** classified the trees as having excellent, good, fair, poor, and dead. Figure 4 shows the distribution of tree health categories**.** In general tree health is good for the trees evaluated. Trees with fair or poor health have canopies with significant areas of tip dieback and smaller or irregular shaped leaves.

Figure 3.Two leaders with included bark are shown. These two leaders are more prone to failure by splitting when the tree crown becomes larger and strong wind conditions occur.

Problems and Defects Observed

Codominant Leaders — The most common defect observed was codominant leaders (Figure 3). The portion of trees with codominant leaders with included bark is less than half of the total number of trees with codominant leaders. Most of the trees with codominant leaders did not have included bark and are less of a hazard. Generally, we recommend end weight reduction pruning on codominant leaders especially leaders with included bark.

Decay Small - All trees have some level of decay, especially those growing in an urban environment. Decay usually occurs when a wound is made on a tree. The wound can come from a parked car, a line trimmer, a branch falling from a nearby larger tree, or any other number of possible sources. The older a tree is, the more decay it will have. A small amount of decay is expected and normal and does not constitute a need for concern. Trees with moderate or large amounts of decay are fewer and the extent of decay was investigated and remarked upon in the database with options for remediation.

Dead Branches -- Dead branches tend to be an area of concern. Trees were evaluated by the amount of dead branches observed in relation to the size of the crown. There are two classifications: “Decayed branches less than 10 percent of the crown” and “Decayed branches greater than 10 percent of the crown”. Large dead lateral branches are an indication of significant tree health and structure problems. But dead branches are not always an indication of a tree problem. Mature trees naturally shed lower and interior branches that are getting too much shade and not producing sufficient carbohydrates. Gravity will eventually cause dead branches to fall. And dead branches over streets and sidewalks can become hazardous. So a regular program of dead branch spotting and removal is an important aspect of any tree maintenance program.

Dead branches appearing in the upper crown of a tree can be a sign of more serious problems usually associated with root problems. Dead branches in the upper crown should be examined by a qualified arborist.

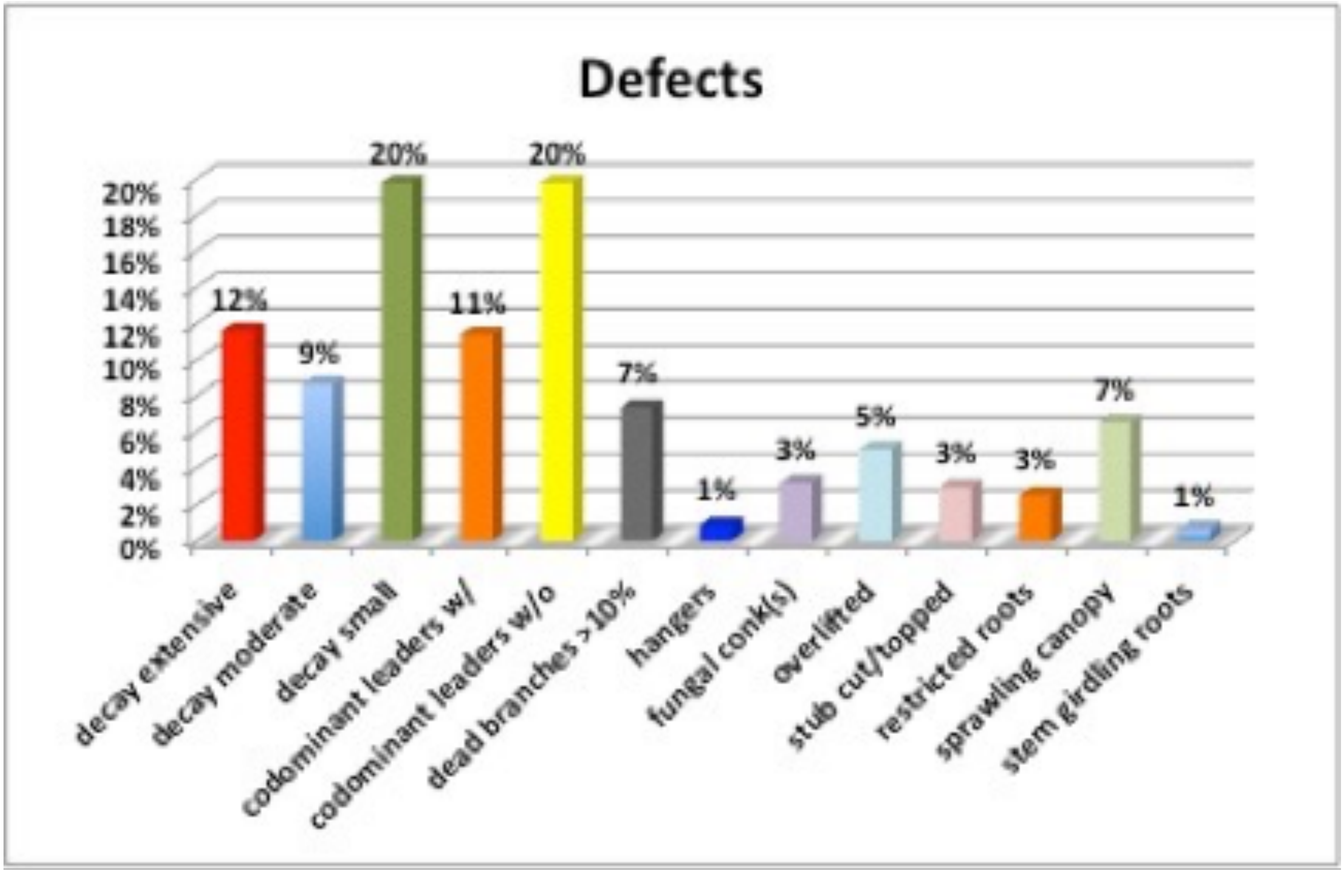

Figure 5. Defects observed with varying level of severity.

Vines -- Vines are sometimes found on trees but are not beneficial for the tree. Vines can excessively shade trees by growing over the tops of trees, even tall trees. Vines can hide structural defects such as decay and cavities that might require further investigation. Vine foliage can also catch wind increasing the wind load on a tree and make a tree more susceptible to wind failure in a strong wind storm. Some vines are deliberately planted as ornamentals. Some vines are aggressive native vines. These vines should be removed or at least cut back severely and maintained in a cut back condition.

Urban Canopy Size

DBH - Measuring DBH, diameter at breast height, gives an indication of the size and age of the urban canopy under study (Figure 6). The canopy was mostly between 10 and 30 inches in diameter. This a mature canopy with a good distribution of younger and older trees. Managing a canopy with this distribution is essential because some trees will be ending their lives as younger trees grow to replace them, much like a forest. Understanding the size distribution of the canopy helps with urban management.

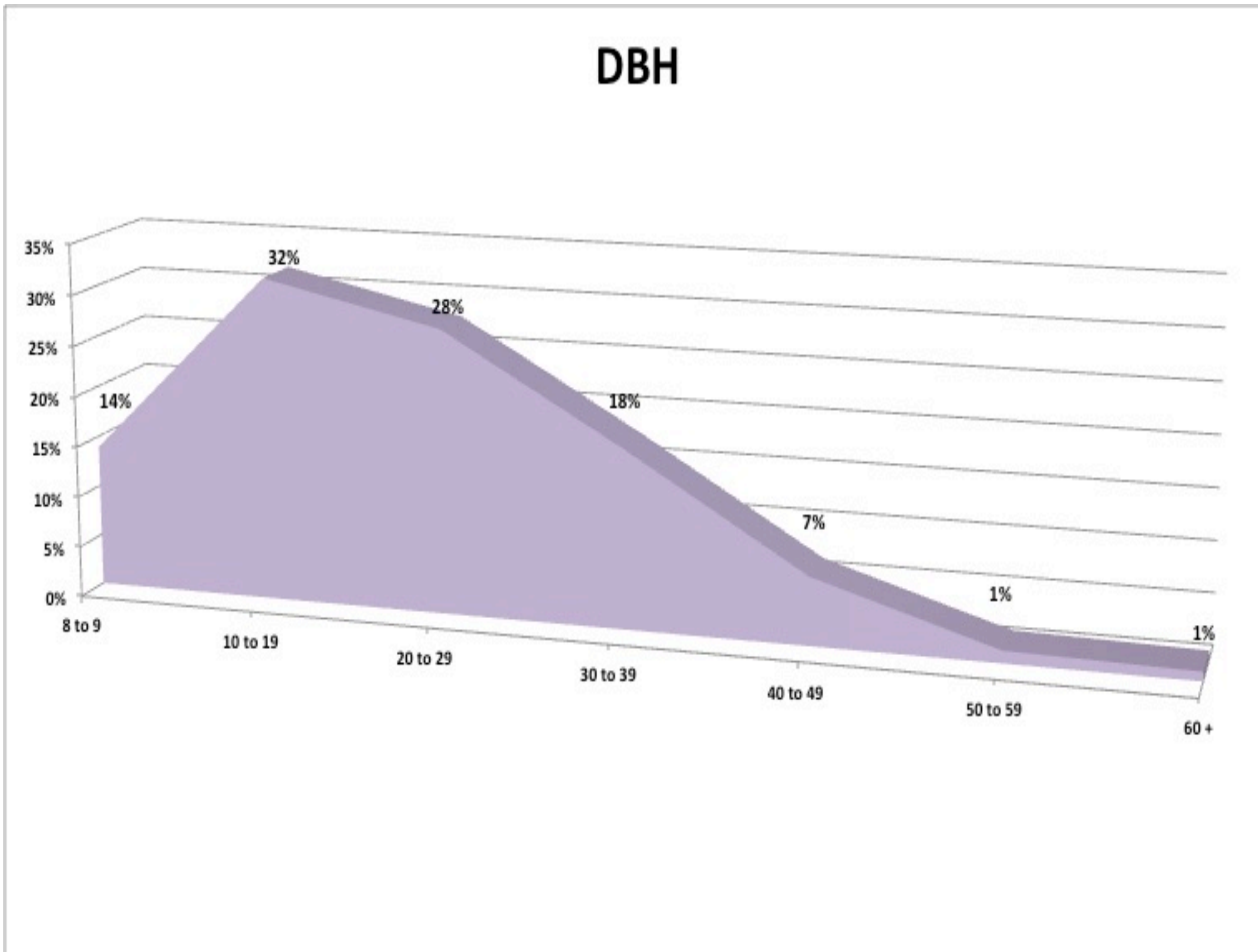
DBH
35%
30%
25%
20%
15%
10%
5%
0%
14%
32%
28%
18%
7%
1%
1%
8 to 9
10 to 19
20 to 29
30 to 39
40 to 49
50 to 59
60 +

Figure 6.

Live Oak Age Distribution -- Because the live oak was the predominant tree found in the survey on the public right-of-way, We analyzed the DBH of the live oak population (Figure 7). We found although there are some very old, large live oaks, the majority of the live oaks have a DBH of 31 inches or less. The majority of the live oaks have a wide range, in the 10-inch to 35-inch DBH range which means the city has a mature live oak population. As a rough estimate, live oaks with a DBH of 19 inches could be somewhere in the range of 25 to 50 years old, maybe older.

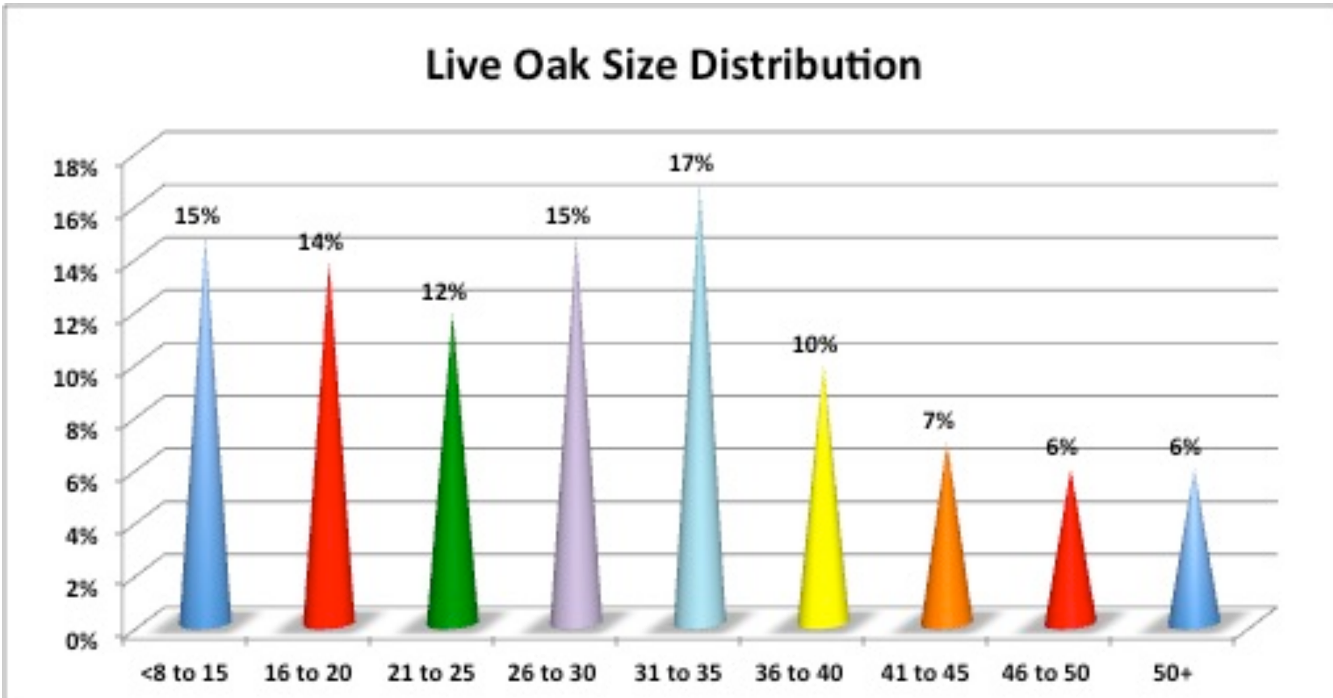

Figure 7.

Maintenance

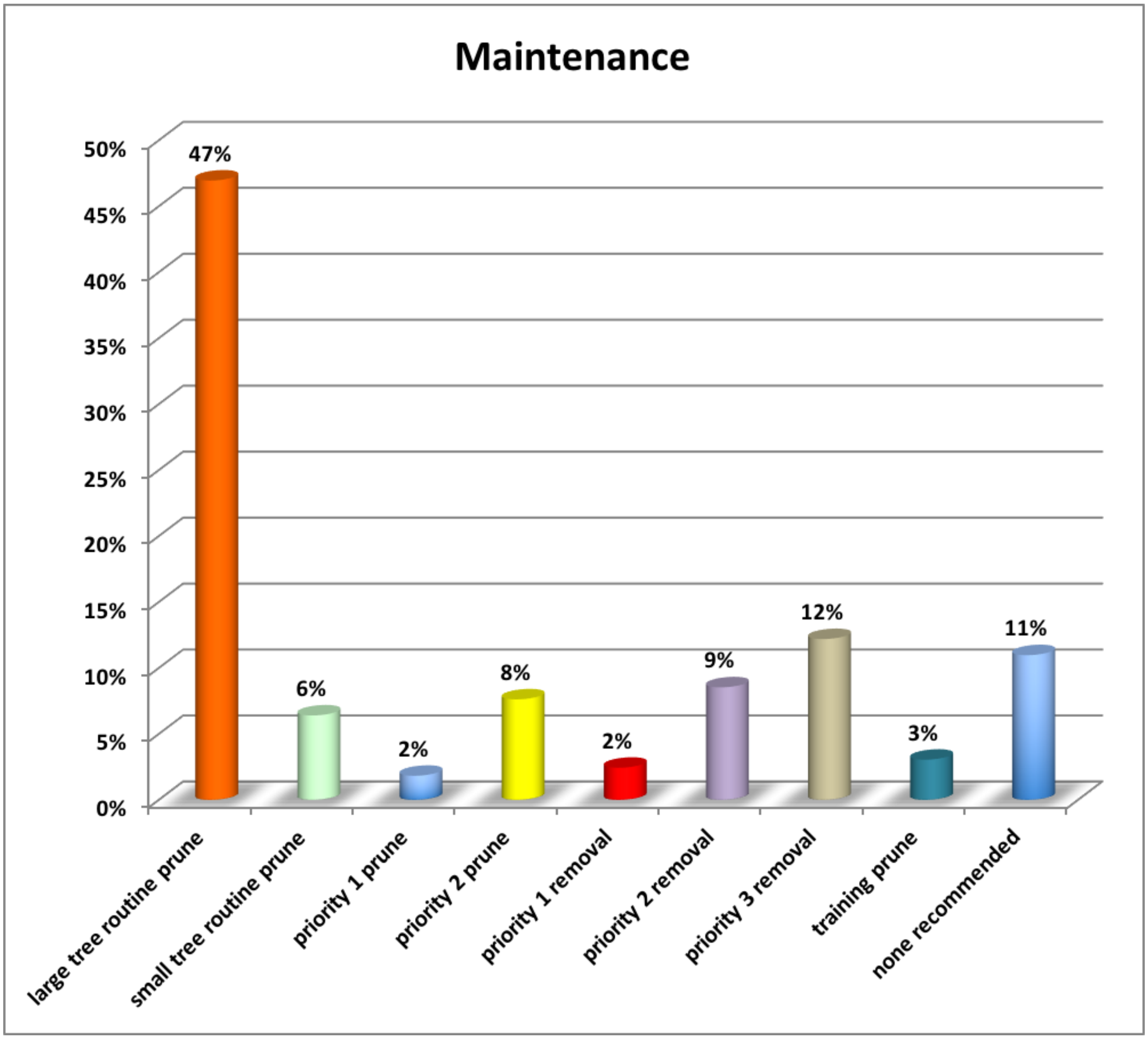

Figure 8.

Maintenance -- Maintenance needs and recommendations are shown in Figure 8. Individual tree information is found in the data sheets in Appendix B.

Tree Removal – Twenty-four percent of the trees have been recommended for removal (Figure 9) and only 8 trees (all laurel oaks) are given a Priority 1 Removal. Seven percent of all the trees were invasive species. Twenty one invasives are designated as Priority 3 Removals and three invasives are designated as Priority 2 Removals. The urgency of the removal is dependent upon the risk assessment score corresponding to each tree and their Priority classification. Not all removals have the same urgency. The urgency is determined by the likelihood of failure, size of tree part likely to fail, the target and the tree species.

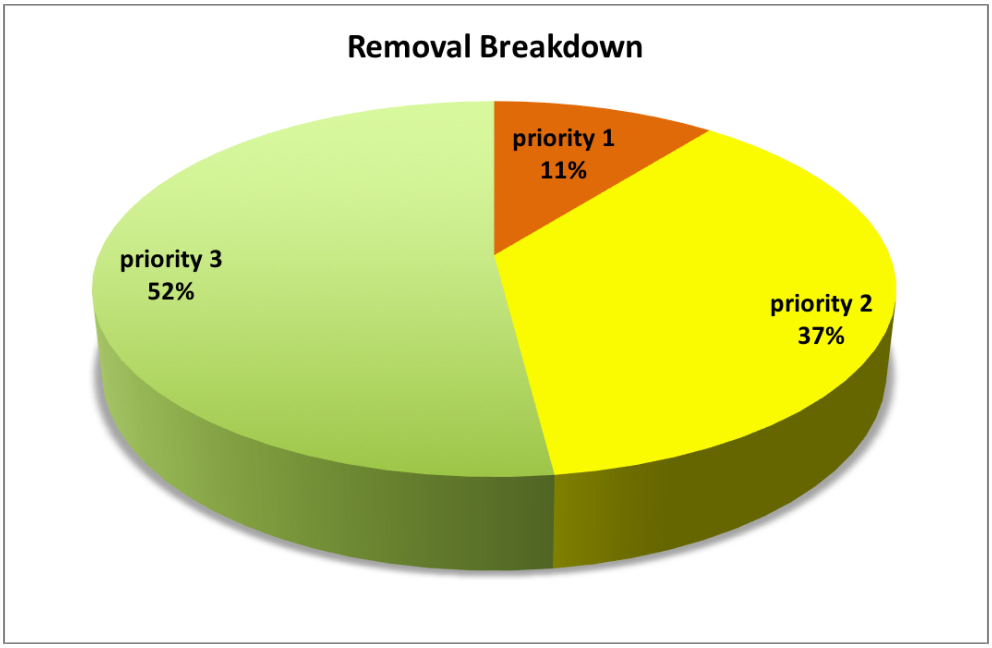

Figure 9.

Risk Assessment -- Each tree has a Risk Assessment score based upon the four risk factors -- likelihood of failure, size of tree part likely to fail, target, and tree species. The higher the score, the higher the risk. Scores for trees that are indicated for additional testing are subject to change based upon the subsequent testing results. The distribution of the Risk Assessment scores is shown in Figure 10.

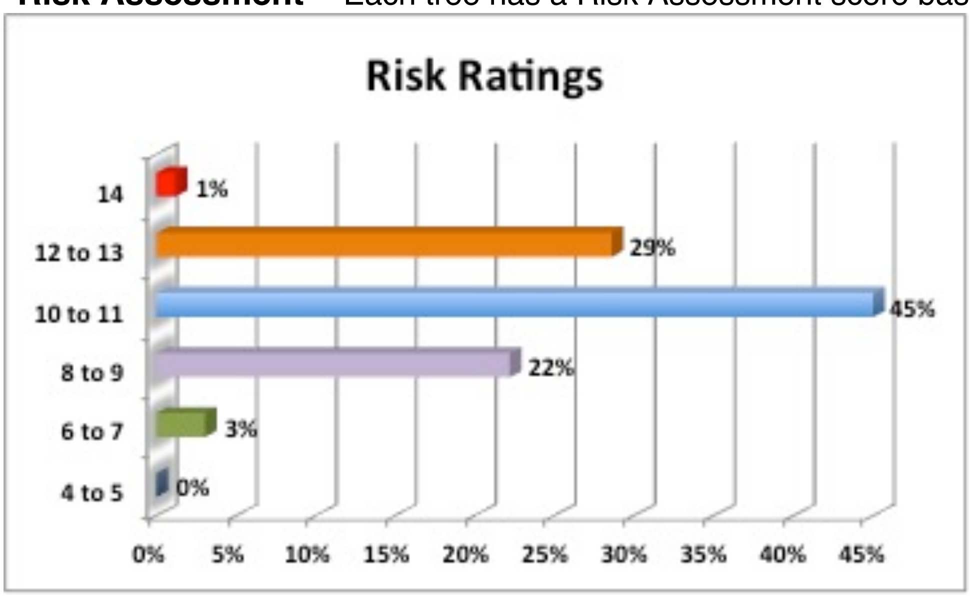

Figure 10.

Sidewalks -- Dealing with sidewalk lifting is an important aspect of controlling risk and improving safety. There are many new construction techniques that are better for trees than simply cutting roots, which can destabilize a tree. In effect cutting roots substitutes one risk (tripping) for another (tree instability). An arborist knowledgeable in sidewalk construction techniques should always be part of the sidewalk repair process.

Conclusions

A tree inventory and risk assessment provides valuable information for managing and maintaining an urban forest. Although no tree can be deemed safe and risk-free, a properly executed tree inventory and risk assessment can provide an organized and methodical way to deal with the trees that present the greatest risk. It allows for using limited resources to take care of the trees in greatest need of maintenance first and then taking care of trees with lower risk assessment scores as the budget permits. Use the tree inventory as a baseline for your on-going tree maintenance. Update each tree record when pruning work, sidewalk work or any excavation around a tree is done. Also record tree branch failures.

Appendix A

Definitions

Air Spade – equipment used to excavate soil from roots using high velocity air expelled through a special nozzle. The air moves soil but generally does not harm roots or other solid obstacles. The Air Spade is generally a non-invasive diagnostic tool for examining roots, tree crowns and root flares.
Codominant Leaders – a tree with multiple trunks often beginning as a single leader and dividing into two or more leaders of similar size higher up on the trunk. Codominant leaders are considered a structural defect because they can be prone to failure (splitting)
Compartmentalization – the ability of a tree to isolate (wall off) damage and decay and continue to grow around the damaged area. Trees that are good compartmentalizers are better able to withstand damage from injuries such as pruning cuts, gashes, lightning strikes, etc.
Condition – an evaluation of a tree's structure and health
Critical Root Zone – this an area around a tree where roots must be protected and is another term for Tree Protection Zone
DBH – diameter at breast height, a measurement of a tree's diameter usually measured approximately four and one half feet above the ground
Dripline – the outer edge of a tree canopy
Epicormic sprouts – Excessive sprouting. Short twigs and small leaves growing along the upper surface of one or more main branches. The presence of epicormic sprouts are an indication of poor tree health, over-pruning, a weakened tree.
Florida Grades and Standards – Guidelines established by the Florida Department of Agriculture and Consumer Services. Acceptable grades are Florida #1 and Florida Fancy. Florida #2 and Culls are not acceptable grades.
Reduction Pruning – A recommended pruning method that reduces (subordinates) codominant leaders and large side branches by reducing their size from the outside in. Reduction pruning is often the preferred method of taking weight off the ends of branches versus the commonly utilized but undesirable method known as "lion tailing" which removes interior branches and keeps only the branches out at the end creating instability and increasing risk of branch or trunk failure.
Resistograph – a diagnostic tool that utilizes a 1/8-inch diameter drill bit to measure decay inside a tree trunk or branch by measuring and graphing the resistance of the drill bit as it moves through the wood.
Root Flare – the area at the base of the tree trunk that becomes wider (flares out) where roots grow horizontally in the soil. The individual root flares are where the roots are connected to the base of the tree trunk.
Root Plate – a circular area with an outer boundary that is usually considered to be a distance from the tree trunk that is three times the diameter of the tree.

Certification of Performance

I, Danny Lippi, certify that:

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy, safe or adequately protected under all circumstances or for a specified period of time. Likewise, remedial, protective and mitigating treatments and recommendations cannot be guaranteed.

I have no current or prospective interest in the vegetation or the property that is the subject of this report and have no personal interest or bias with respect to the party or parties involved.

I certify that all the statements made in this report are true, complete and correct to the best of my knowledge and belief and are made in good faith.

The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts.

My analysis, opinions and conclusions were developed and this report has been prepared according to commonly accepted arboricultural practices.

My compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party nor upon the results of the assessment, the attainment of stipulated results or the occurrence of any subsequent events.

There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.

I reserve the right to change my reports/opinions on the basis of new or different evidence.

Loss or alteration of any part of this report invalidates the entire report.

I further certify that I am a member in good standing of the American Society of Consulting Arborists (ASCA), the International Society of Arboriculture (ISA) and the Florida Urban Forestry Council and am an ISA Board Certified Master Arborist FL-0501B and an ASCA Registered Consulting Arborist #443.

References

[i] American National Standards Institute (ANSI) A300 Risk Assessment Part 9 Tree, Shrub, and Other Woody Plant Management Standard Practices (***Tree Risk Assessment*** a. Tree Structure Assessment), 2011.

[ii] Thomas Smiley, Nelda Matheny and Sharon Lilly, ***Best Management Practices Tree Risk Assessment***, International Society of Arboriculture, Champaign, Illinois, 2011.

[iii] Dr. James R. Clark and Dr. Nelda P. Matheny, ***A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas***, 2nd edition, International Society of Arboriculture, 1994, pp. 37 – 57.

[iv] Dr. Ed Gilman, Trees for Urban and Suburban Landscape, Delmar Publisher, New York, 1996, p. 497.

[v] Pamela Crawford, ***Stormscaping: Landscaping to Minimize Wind Damage in Florida,*** Color Garden Publishing, 2005, p. 41.

[vi] Dr. Ed Gilman, ***Trees for Urban and Suburban Landscape***, Delmar Publisher, New York, 1996, p. 483.

[vii] Dr. Ed Gilman, Dr. Mary Duryea, Dr. Eliana Kampf, Dr. Traci Jo Partin, Dr. Astrid Delgado, Dr Carol Lehtola, ***Assessing Damage and Restoring Trees After a Hurricane***, University of Florida Department of Environmental Horticulture Publication ENH1036, 2006, pp. 10-11.

[viii] Dr. Mary Duryea and Dr. Eliana Kampf, ***Wind and Trees: Lesson Learned from Hurricanes, Chapter 5***, University of Florida Department of Forestry Publication FOR 118, 2006, p. 6.

[ix] Pamela Crawford, ***Stormscaping: Landscaping to Minimize Wind Damage in Florida***, Color Garden Publishing, 2005, p. 41.