Street Tree Inventory Report and Recommendations

City of Missouri City, TX

February 2007

TEXAS FOREST SERVICE
The Texas A&M University System

Contents

Credits

The Texas Sample Community Tree Inventory (TXSCTI) system and report was developed by the Texas Forest Service. It is adapted from the Street Tree Management Tool for Urban Forest Managers (STRATUM) computer model developed by researchers at the Center for Urban Forest Research, a research unit of the USDA Forest Service's Pacific Southwest Research Station. The statistical equations used to compute Standard Error values and percentages were specifically drawn from the STRATUM model, as published in the user's manual. For more information about STRATUM or the other i-Tree tools, go to www.itreetools.org.

Recommendations provided are the judgment of the Texas Forest Service forester(s) listed below, based on the data collected in cooperation with community staff or volunteers. Questions or comments should be directed to:

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Executive Summary

In October 2005, Texas Forest Service foresters and Missouri City Parks & Recreation Department personnel conducted a sample tree inventory of 157 randomly-selected street segments, covering 14.5 miles (roughly 5%) of the total street miles maintained by the city.

Results include:

* Missouri City has approximately 19,577 public trees that occupy 63% of the available planting sites.
* The population is dominated by just three species: live oak (45%), crapemyrtle (23%), and Callery pear (9%).
* Most trees are small, with over 50% of trees in the 0-5" diameter class and only 2.5% of trees larger than 20" DBH.
* 93% of street trees are in good condition and 80% require only routine care.
* An estimated 5,400 public trees and 5,000 private trees have limbs that encroach into clear zones above streets and sidewalks.
* Street trees in Missouri City are valued at more than $44 million.

Recommendations include:

* Favor shade trees other than live oak when designing street tree planting projects.
* Locate and remove the estimated 102 trees that pose risk to persons or property.
* Begin a system to prune each tree on a 5-7 year cycle.
* Adopt a public tree care ordinance that defines responsibility for street and park trees in the city and sets standards for care.
* Develop an annual work plan for tree maintenance and planting.
* Conduct an annual Arbor Day celebration and involve local groups.

City Description

In 1890, the land that now includes Missouri City was advertised for sale as "a land of genial sunshine and eternal summer." The city incorporated in March of 1956 and is one of the fastest growing communities in the Greater Houston metropolitan region, now totalling more than 62,000 people (>150% increase since 1980). It is located just 20 miles southwest of downtown Houston in Fort Bend and Harris counties and covers 30.5 square miles. Major thoroughfares through the city include US Highway 90A, Beltway 8, SH 6, FM 2234 (Texas Pkwy.), FM 3345 (Cartwright Rd.), and FM 1092. Missouri City is home to several master-planned communities, and with the proposed annexation of Sienna Plantation the city is projected to double its population over the next 20 years.

Current Tree Management

Tree management activities in Missouri City have centered on park trees, as well as some clearance issues of sidewalks and roadways. The Parks and Recreation and Public Works departments share responsibility for clearance of trees on city rights-of-way, while trees on private property are the responsibility of adjacent homeowners. If the property owner neglects to trim the trees in front of their home in order to obtain proper road and sidewalk clearance, city Code Enforcement can issue a citation, and even file nuisance charges in municipal court if necessary. Even though there is some city sponsored tree trimming activity, the city does not employ a Certified Arborist and there is no formal arboricultural training program for city employees.

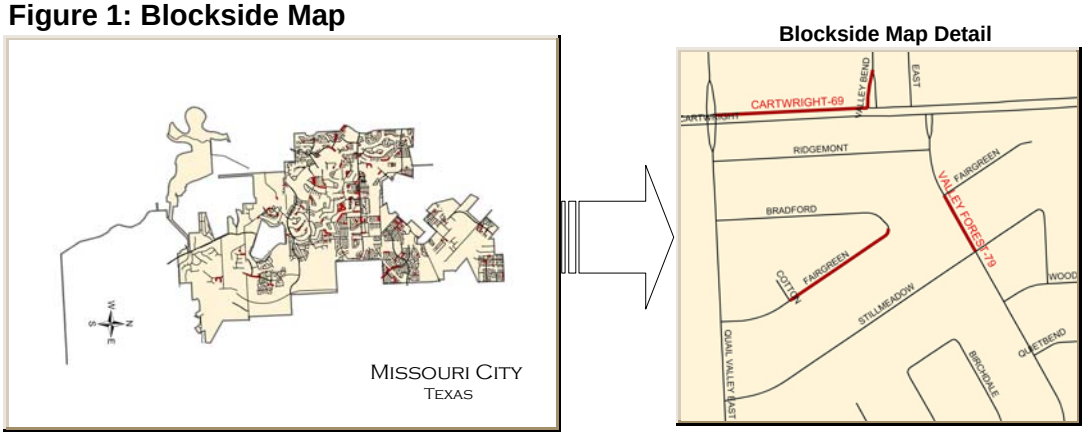
The Parks Department has a small, informal tree nursery that grows trees to be planted within the parks system. This nursery is maintained by a Parks Department employee and is used to grow several species that are not easily found at commercial nurseries. Most trees planted in parks are purchased from local nurseries.

Missouri City has a landscape ordinance that address the planting of trees in new commercial and multi-family developments but there is no current ordinance in place that requires protection of existing trees, either public or private. However, the master-planned communities in Missouri City have active landscaping programs with private maintenance crews that maintain street trees. Deed restrictions in these subdivisions prohibit the removal of trees without approval of the homeowners association (HOA).

Inventory Methods

The Texas Sample Community Tree Inventory (TXSCTI) system is designed to provide city staff and community leaders with basic information about the street tree resource. Texas Forest Service (TFS) foresters identify and survey a 5-15% sample of street segments, or "blocksides" (see Figure 1 below), and collect data on the individual trees they find there. This sample is not a substitute for a complete inventory of street trees, but instead is designed to make basic short- and long-term recommendations for managing this important community asset.

Figure 1: Blockside Map



Field data collection is limited to relatively few measurements in order to speed up the process (see Appendix A for data collection form and definitions). Trees located within the public right-of-way (ROW) on both sides of a chosen blockside segment, or within a center median, are evaluated for species, trunk diameter, general condition, maintenance needs, and safety clearance. Private trees outside the ROW are evaluated solely for safety clearance. Blockside segments are also surveyed for available planting spaces, both within the ROW or median and within 30' of the roadway on private property. All estimates provided in this report represent public ROW and median trees combined, unless specifically identified otherwise.

The sampled trees provide the basis for statistical estimates for the entire street tree population. In general, sample sizes that produce a Standard Error (SE) value of 20% or less of the total tree estimate are considered sufficient for making basic judgments about the state of the street tree resource. Streets with center medians are included in the survey, with the length of these street segments increased by one-half the median length as if the median represented a third side of the street. Table 1 details the sampling results for this survey.

Table 1: Street Tree Sampling Results

Total Miles (# blocksides):	294.96 (3147)
Miles Sampled (# blocksides):	14.49 (157)
Sample Size:	4.9% (5.0%)
Estimated Total Public Trees:	19,577
Standard Error (SE):	+/- 3,197
Standard Error Percent:	16.3%

The report findings are divided into three sections: Street Tree Structure, Street Tree Care, and Street Tree Values. The TFS forester has provided professional insight into the data results, followed by a set of recommendations based on an understanding of the city's current program and the state of the street tree resource.

Street Tree Structure

The pattern of trees found in a community can be referred to as its structure. This includes the different tree species and their sizes, as well as the overall number of trees and how they fill the available space along city streets – what urban foresters call stocking. These key measures will guide the recommendations at the end of the report.

Stocking

In any city there are a certain number of miles of streets to maintain. A model residential street has trees planted along both sides of the right-of-way (ROW), often between the curb and sidewalk. Larger collector streets and boulevards may also have medians that are wide enough to support street trees. If all planting spaces are filled with trees of the largest size possible for the available growing space (termed "full stocking"), a typical U.S. city will have about 105 ROW trees per mile. This benchmark is equivalent to one tree every 50 feet, but takes into account visibility triangles at corners and lost planting spaces due to intersections, driveways, and other public infrastructure. Median spaces provide additional planting opportunities above that number, as do spaces on adjacent private property that can shade public sidewalks and ROWs. The estimates here did not take into account underground utility conflicts that would lower the potential number of planting sites.

Table 2 shows the current estimate of street trees in the community, as well as planting site criteria and opportunities, as found in the sample inventory.

Table 2: Street Tree Stocking

Estimated No. ROW Trees:	17,454
Estimated No. Median Trees:	+ 2,123
Estimated Total No. Street Trees:	19,577
Total Street Miles:	294.96
Estimated Stocking (trees/mile):	66.37
% Stocking:	63%
Median/ROW Planting Spaces:	27,188
Private Yard Planting Spaces:	+ 22,243
Total Planting Opportunities:	49,431

Planting Site Criteria

Tree Size: Medium or large tree to be planted, if room; only small trees planted under powerlines.

Location: Within public ROW and/or within 30' of ROW edge in private front yard. Tree lawn minimum 4' width.

Distances: Overhead - 15'
Hydrant, utility pole, street light - 10'
Street intersection - 25'
Driveway - 5'
Other trees - 20-50'

Key findings:

Missouri City has an estimated street tree stocking level of 63%. But with as many as 27,000 available planting spaces along medians and ROWs, there is still significant opportunity for increasing street tree canopy cover. To reach full stocking (105 trees per mile), the city would need to plant approximately 11,000 new street trees.

In addition, private homeowners have space in their front yards to plant another 22,000 trees within 30 feet of the curb. Since these owners provide tree maintenance, either individually or through their homeowner associations, Missouri City can realize the added benefits of trees over streets and sidewalks without the associated increase in management costs.

Species

As a rule, urban foresters recommend having no more than 10% of the street tree population made up of any single species, and no more than 20% made up of any one tree genus (i.e. the oaks or elms). This can prevent the loss of too many trees due to an outbreak of insects or disease, like the story of Dutch Elm disease in the Eastern U.S. or current outbreaks of Emerald Ash Borer in the Upper Midwest. Species diversity is one sign of a healthy tree resource.

Figures 2 and 3 show the most common species and genera, respectively, found in the sample inventory. The top ten species or genera are shown (could be more if categories tie for tenth place), plus a category combining the remaining species or genera. A complete list of species encountered during the inventory are listed in Appendix B.

Figure 2: "Top Ten" Species

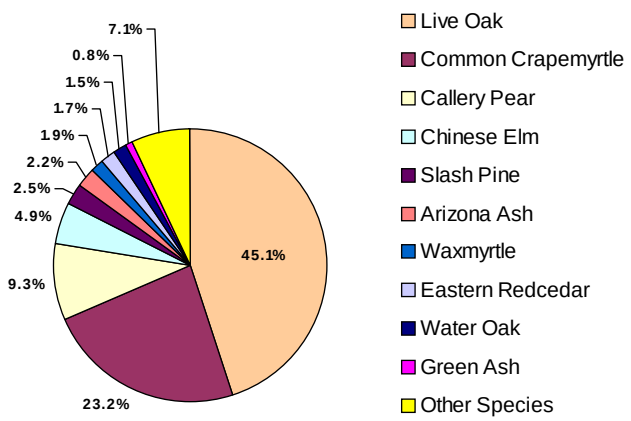
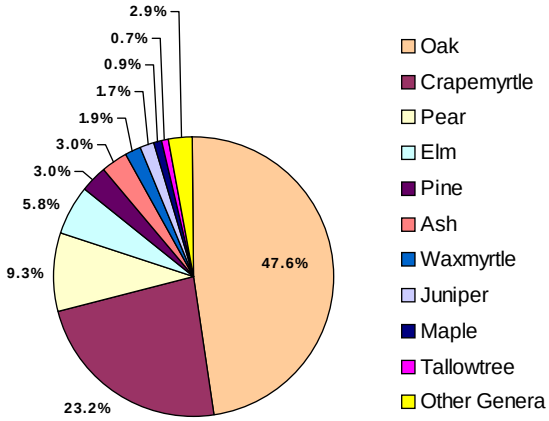


Figure 3: "Top Ten" Genera



Key findings:

The population of street trees in Missouri City is dominated by just three species: live oak (45%), crapemyrtle (23%), and Callery pear (9%). This imbalance is accentuated by the fact that crapemyrtle and pear trees are ornamental trees that typically do not reach shade tree size. And though live oaks do well in this area and are popular to plant, reliance on a single shade tree species for the majority of streetscapes poses a significant risk from a disease or insect outbreak.

In fact, because live oaks are so prevalent today, it may be impossible to achieve a model distribution in the future. Missouri City would have to plant more than 68,000 trees of other species to achieve the recommended 10% level for live oaks – more trees than there are spaces to plant them! On the other hand, it may not be wise to completely avoid planting live oaks; this species is highly adapted to the climate and performs well in difficult urban settings. But as a rule it would be good to begin to favor other medium and large-statured species when designing street tree planting projects.

Missouri City's rapid growth and agricultural history are reflected in the species found in this survey. Five of the top ten species (crapemyrtle, pear, Chinese elm, slash pine, and Arizona ash) are not native to the region and are often considered fast-growing. Unfortunately, these species may also be rather short-lived. Overall, 33 species were counted in this survey, but relatively few are native species which can grow to large size and produce multiple benefits for a long period of time.

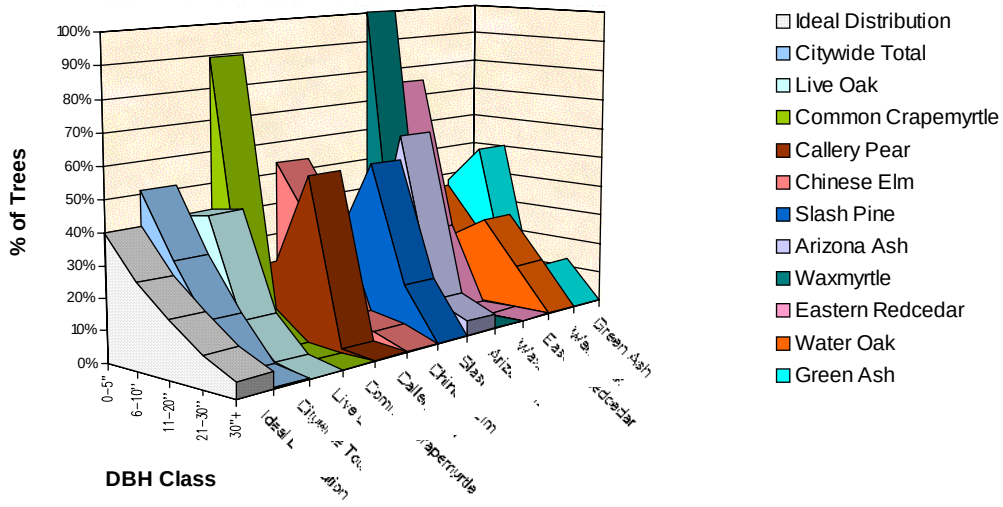
Size

Tree diameter is measured at a point on the trunk located 4.5 feet off the ground, also called diameter at breast height (DBH). This sample inventory assigned each tree to one of five size classes, as detailed in Appendix B (palms are assigned to a class by feet of clear trunk height). The ten most prevalent species are displayed as a graph in Figure 4 (below).

The distribution of street trees by size mirrors its age structure, since older trees are usually larger than young trees. Species composition can also influence the size class distribution, since small-statured species will never grow into the larger classes. Taking into account mortality rates that are higher for trees when they are young, a balanced size distribution for a species will have more trees in the smaller size classes and fewer in the large size classes. For example, the City of Davis, CA set an overall goal of having 40% young trees (<6" DBH), 30% maturing (6-12" DBH), 20% mature (12-24" DBH), and 10% old trees (>24" DBH).

This survey considers medium (25-50' tall) and large (>50' tall) species mature when they reach the 11-20" DBH class. A reasonable target distribution would then be: 40% young trees (0-5" DBH), 27% maturing (6-10" DBH), 18% mature (11-20" DBH), and 15% old (>20" DBH).

Figure 4: DBH Distribution of Top Ten Species, in Order of Abundance



Key findings:

The citywide size distribution of street trees reflects the rapid growth in Missouri City in recent years, with more than 50% of trees in the 0-5" DBH class and only 2.5% of trees larger than 20" DBH (Figure 4). This distribution also reflects some of the species choices for many streetscapes, since small-statured species like crapemyrtle and waxmyrtle rarely grow into a larger class.

Some of the size distributions for individual species present other challenges (see Appendix B for detail). In particular, Callery pear has over 50% of trees in the 11-20" DBH class; a tree reaching this class represents a very large pear tree. Although these trees appear in good health today, pears of this size and age tend to begin to decline and break apart in storm events. The same caution can be given for the population of Arizona ash trees, where management costs for keeping these trees in safe condition can rise as these trees age, especially if training pruning was not carried out when the trees were young. For slash pine, a different risk is exposed as these trees age: the risk of attack by bark beetles (particularly species of Ips engraver beetles) often brought on by stress from drought conditions.

Street Tree Care

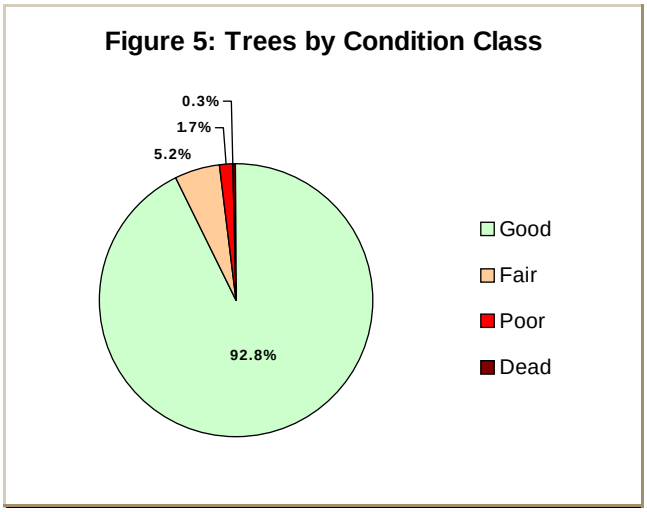
The care and maintenance practices – or lack thereof – that cities perform on their street trees will determine the condition of the resource as well as its future needs. This sample inventory evaluated trees for their overall condition, maintenance needs, and safety clearance.

Condition

Sampled trees were briefly observed and assigned to one of four condition classes: good, fair, poor, or dead. This evaluation was designed to capture an overall assessment of the tree, including its health and structural soundness, but did not rate each portion of the tree such as leaves, twigs, branches, trunk, and roots.

Figure 5 shows the distribution of street trees by condition class, as found in the sample inventory.

Figure 5: Trees by Condition Class



Key findings:

Street trees in Missouri City are generally well cared for, with almost 93% in good condition. If proper maintenance continues, these trees can remain in good health and produce increasing environmental benefits to the community for years to come.

About 5% of street trees are in fair condition. These are trees that can usually be restored to full health with appropriate treatment. A relatively small number of trees rated poor (1.7%) in the survey. Some of these trees could move up one level to the fair classification if timely maintenance is conducted. Without maintenance, they will likely continue to decline and will need to be removed at some point. Removal costs are almost always higher than maintenance costs.

Very few dead trees were discovered in the sample. All dead trees should be located and removed.

Maintenance

Tree maintenance is the primary responsibility of the street tree manager. A prudent maintenance program will remove or repair trees that pose risk to the public, as well as improve tree health and reduce future maintenance costs. This sample inventory evaluated ROW and median trees and assigned each to a maintenance category, as shown in Table 3 (below).

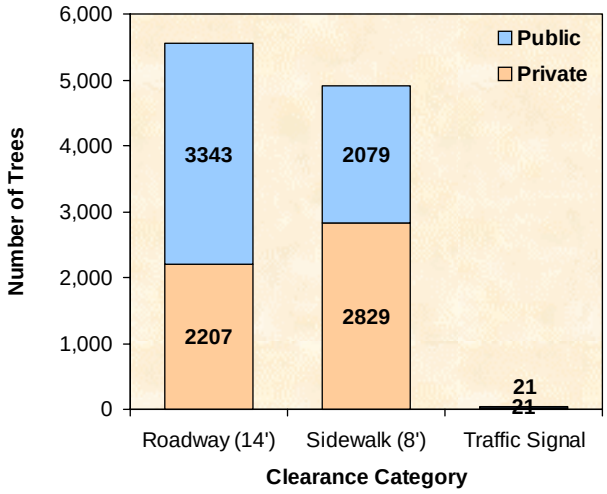
Table 3: Maintenance Needs

Treatment	Description	Estimate	Percent
Prune-Immediate	Dangerous broken branches and/or large deadwood. Presents safety risk to persons or property. Pruning should be accomplished as soon as resources are available.	0	0.0%
Prune-High Priority	Broken branches or deadwood, but no apparent immediate safety risk to persons or property. Prune as soon as resources are available.	0	0.0%
Prune-Routine	Routine, ongoing pruning should be scheduled on a cycle of five to seven years to remove dead, dying, or diseased branches.	15,588	79.6%
Prune-Training	Recent plantings require pruning of root and trunk suckers; dead, crossing, diseased, or weak branches; and to develop a strong central leader and scaffold limbs.	3,765	19.2%
Remove-Immediate	Trees should be removed ASAP because their condition and proximity to active-use areas pose an apparent risk to persons or property.	102	0.5%
Remove	Low priority removals should be scheduled when resources are available and after high-priority removals. Trees are generally located away from facilities and areas of use.	122	0.6%

Clearance

One important aspect of a tree maintenance program is to create safe clearance for the public and emergency vehicles over streets and sidewalks, and for visibility of traffic signs and signals. In these situations, even though a tree may be located on the adjacent private property, it is the city's responsibility to insure that the required pruning is performed – either by the owner or the city. Figure 6 shows the estimated number of trees that require pruning to meet the appropriate distance standard.

Figure 6: Safety Clearance



Key findings:

Since most trees were found to be in good condition, it should be no surprise that the majority (80%) of trees require only routine care. However, a relatively small number of trees (102) need to be removed immediately, and an estimated 122 trees need removal as soon as resources allow.

Because Missouri City has a lot of small trees – either because of the species chosen or because they were recently planted – training pruning is required for 19% of trees. This type of pruning promotes structural stability, helps reduce future maintenance costs, and allows each tree to reach its potential.

Safety clearance over sidewalks (8') and streets (14') is another area of concern. While our estimates show very few trees (42) obstruct street signs or signals, an estimated 5,400 public trees and 5,000 private trees have limbs that encroach into these safety zones above streets and sidewalks. Safety clearance work provides an excellent reason to develop a routine maintenance schedule for all street trees.

Street Tree Values

Developing a management program for street trees undoubtedly carries the burden of cost. But public trees also deliver valuable returns to a community, and in recent years many of these values have been quantified. These include the value of air and water pollution reductions, stormwater and energy savings, carbon sequestration, and even deferred medical costs. The aesthetic benefits of street trees are often harder to quantify – but just as important if you ask most citizens. Current research aims to quantify the health benefits to pedestrians from direct solar shading, the economic benefits from increased shopping activity in business districts, and reduced street repair costs. In fact, public trees are the only portion of a city's infrastructure that can increase in value over time because healthy trees grow each year and increase the benefits they provide. Investing in a tree maintenance program can actually deliver a positive return to a city, when the full benefits of trees are considered.

Tree Replacement Value

The accepted method for quantifying the value of trees was developed by the Council of Tree and Landscape Appraisers, published as the "Guide for Plant Appraisal–9th Edition (2000)." This method combines tree ratings in four categories (species, condition, size, and location) to calculate the cost of replacing a given tree in the event it is damaged or destroyed. The location rating is an average of three factors: site, contribution, and placement. This sample inventory used a conservative location rating of 70%, recorded DBH class values and condition ratings, and published species ratings and regional replacement costs ("Texas Supplement and Species Approximation, 2003") to arrive at the estimated street tree value shown in Table 4. A complete list of replacement values, by species, is shown in Appendix C.

Table 4: Tree Replacement Values

Estimated No. Trees:	19,577
Estimated Total Value:	$44,190,820
Average Tree Value:	$2,257 ea.

Key findings:

Street trees in Missouri City have a landscape value totalling more than $44 million, an average of about $2,200 each. Considering the number of small trees that will continue to grow over time, city leaders can expect greater value from street trees for many years.

Appendix C illustrates the value of large trees. Crapemyrtles represent the second-most common tree in town, but because the average size is small (4" DBH), the replacement value is relatively low ($468/tree). Unfortunately, this species simply won't grow much beyond this average DBH, meaning its value contribution won't increase either. Arizona ash, on the other hand, has the largest average DBH in the survey (15.8") and a correspondingly high average value ($6,372/tree). This species may be close to maximizing its value, though, since older Arizona ash trees tend to begin dying or breaking apart.

The real star in terms of value in Missouri City is live oak. We estimate that there are a lot of them (over 8,800) and it has the highest species rating possible (100%); but the average DBH is just 8.7 inches, which is not large at all for this species. Given sufficient time and care, these trees can easily grow to an average of over 20" DBH, and the largest ones will exceed 30" DBH. So not only does live oak represent over 55% of the current value of street trees, this species will undoubtedly become even more valuable to the community over time, easily justifying any management expenses required to keep them maintained and in good health.

Recommendations

The purpose of this report is to provide city leaders with a snapshot of the current structure, maintenance needs, and replacement value of the street tree population. Below are the short- and long-term recommendations from the Texas Forest Service that the city can use to craft a plan for managing street trees into the future.

Short-Term (1-3 years)

Planting: develop a strategy to plant new trees annually

With as many as 27,000 public tree planting sites, some sort of formal streetscape program should be implemented and budgeted to plant trees in appropriate locations along streets and medians. Even if the program is small, it will insure that some new trees are added each year to replace trees that are removed. A second option would be to focus on the 22,000 planting sites on private property, within 30' of the curb. This sort of NeighborWoods program could bring together civic groups, HOAs, and businesses to distribute trees to citizens to plant in their front yards.

One way to support either program would be to formalize the informal tree nursery at the parks maintenance building. Even a modest budget could allow the city to produce hundreds of low-cost trees each year, using a better mix of species than is currently being planted. Other species to consider include Shumard oak, swamp chestnut oak, cedar elm, baldcypress, red maple, and sycamore.

Maintenance: lower the risk to the public from trees

In beginning to manage the risk from street trees, the first priority should be to locate and remove the estimated 102 trees that pose risk to persons or property. This is a relatively small number, so it may be most efficient to first educate other city departments (public works, fire, police) how to identify and report a risky tree.

From our survey, more than one in four public trees requires pruning for safety clearance over streets and sidewalks, so the second priority should be to develop a system to manage these trees. One step would be to develop easy-to-understand diagram for clearance that can be mailed to homeowners, homeowner associations, management companies, or landscape firms that perform work on street trees. Another step could be for the city to begin a systematic pruning cycle to visit each neighborhood on a 5-7 year cycle. Based on our estimates, tree managers would need to visit between 2,225 and 3,100 trees per year to reach every tree and conduct this safety pruning. This systematic approach will keep these trees healthy and allow city staff to notify the owners of the estimated 5,000 trees on private property that also have clearance problems. Consider using a contract workforce for this maintenance program.

The resources of city staff can best be used in the short term by concentrating on training pruning of young trees. This minimal maintenance investment will prevent poor branching and will greatly reduce future maintenance costs. Young tree training pruning requires few specialized tools and is easily taught to staff members. Other basic maintenance practices such as watering, mulching, and fertilizing are also appropriate practices to begin.

All tree work should conform to the latest ANSI A-300 (Standard Practices for Tree, Shrub and Woody Plant Maintenance), ANSI Z-133 (Safety Standards), and the latest Tree Pruning Guidelines from the International Society of Arboriculture (ISA) or Tree Care Industry Association (TCIA), and should be directed by ISA Certified Arborists.

Short-Term Recommendations, cont'd

Policy: review ordinances, standards, and training

Since one does not exist, consider adopting a public tree care ordinance that clarifies who is responsible for street and park trees in the city. These ordinances commonly create a citizen tree board and set rules for the responsibility of the city and adjacent property owners over trees. Ordinances that take ultimate responsibility for street and park trees can qualify for the Tree City USA program. More detailed ordinances have written standards for all aspects of tree care.

Develop an annual work plan for tree maintenance and planting to keep track of your progress. This basic plan will also help the city meet the Tree City USA standards. Conduct a basic tree care workshop to train city personnel from all applicable departments on proper tree maintenance practices. Texas Forest Service regional foresters can help schedule training classes, workshops, and other educational opportunities.

Community Support: get the public involved

Conduct an annual Arbor Day celebration and involve citizen groups to help plan the event. If a tree advocacy group does not exist, Arbor Day involvement can serve as a springboard towards establishing a Keep Missouri City Beautiful or Trees for Missouri City. These organizations can be great partners that support and advocate for tree issues in the community.

Work to attain Tree City USA status. This award program of the National Arbor Day Foundation and the State Foresters recognizes communities that invest in and manage public trees. Your Texas Forest Service forester can help start an application, and can support a recognition ceremony at city council meetings or on Arbor Day.

Look to the private sector for additional support. Through your non-profit partners, many local businesses are often willing to donate towards activities that have such a strong public benefit as planting and caring for trees.

Long-Term Recommendations

Develop a Street Tree Master Plan to guide annual work plans and provide long-range budget forecasting. This can be an important tool in communicating with city leaders on the need for an ongoing maintenance budget. This plan will identify street tree priorities, goals and objectives and should help integrate street trees as part of the public infrastructure.

Conduct a 100% inventory of street trees. If done using GPS coordinates, you will create a new, green layer of infrastructure to the city's growing set of GIS information and allow for more efficient management and maintenance of the community's urban forest resource.

Such an inventory can then be used to conduct a more thorough analysis of the city's trees, through models like the U.S. Forest Service's STRATUM or UFORE, or American Forests' CityGreen. These tools can calculate the ecosystem benefit of trees from processes such as pollution mitigation, stormwater runoff prevention, energy savings and other values that trees provide to a community.

Appendix A–Part 1: Sample Blockside Data Sheet

Blockside #:_____ **ROW Width (ft.):** _____ **Date:** _____ **Crew:** _____

Street: _____ **From:** _____ **To:** _____

Tree #	Median/ Private Tree?	Species/ Code	DBH Class					Condition Class/Rating					Maintenance						Clearance Issues			
													Prune				Remove					
			0-5	6-10	11-20	21-30	30+	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	N/A
1	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
2	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
3	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
4	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
5	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
6	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
7	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
8	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
9	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
10	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
11	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
12	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
13	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
14	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
15	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
16	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
17	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
18	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
19	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
20	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
21	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
22	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
23	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
24	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA
25	M PVT		1	2	3	4	5	E	G	F	P	D	PI*	PH	PR	PT	RI*	R	TS*	R	S	NA

Special Notes

Address/Intersection

Number of Planting Sites per Block:

In Public ROW: _____

In Private Yard: _____ **(<30' from ROW)**

Blockside Sheet 1 of ____

Appendix A–Part 2: Data Sheet Definitions

Tree Inventory Information: TXSCTI

Blockside Number: Blockside = street name from street name to street name. 5% random sample has been mapped with ROW width and Blockside numbers assigned before the survey begins.

Tree #: Tree number is just to help you keep track of where you are since this is a sample inventory. Start at a block end. All trees are counted in ROW for residences, businesses, parks and other maintained areas. Only survey trees over 5 inches in fencerows or wild areas. If you have more than 25 trees, use a sheet with blank tree number column and fill in 26, 27, 28… and fill in "Blockside Sheet ____ of ___" at bottom of survey sheet.

Median Tree: The survey is taken by driving up one side of the block and down the other. Circle 'M' if tree is a tree in a center median strip.
Private Tree: Circle if tree is on private property **and** has 'Clearance Issues' - don't record DBH Class, Condition Rating or Maintenance for this tree.

Species Code: From list. Write name in if not on list.

DBH Class: 1 (0-5), 2 (6-10), 3 (11-20), 4 (21-30), 5 (31+). If forked, take diameter below fork. If multi-stemmed at the ground, sum diameters of stems and divide by number of stems.

Condition Class: Condition addresses the current state of the tree's health, structural soundness, shape, and growth rate. Discoloration, decay, dieback, decreased internodal length, and/or disfigured or dead stems or roots are symptoms of poor condition. Determine the overall health and condition of a tree by analyzing root characteristics, trunk and branch structure, canopy, twigs, buds, foliage, and any presence of disease and pest pathogens. Classify and record the condition of each tree in one of the following categories adapted from the rating system established by the International Society of Arboriculture:
Excellent: Trees in this class are judged to be exceptional trees possessing the best qualities of their species. They have excellent form and very minor maintenance problems. There are virtually no dead branches, deformities, or nutritional problems. These trees are in an acceptable location and can be expected to achieve a full mature shape and life expectancy.
Good: Trees in this class are judged to be desirable and with proper maintenance can be returned to an excellent classification. They may be interfering with utility lines, planted in an overcrowded location, or have minor insect, pathogen, or nutritional deficiencies.
Fair: Most trees in this category have some or all of the following problems: large dead limbs with as much as one-half of the tree already dead, large cavities in the trunk, major deformities, girdling roots, obvious insect, pathogen, or nutritional problems. Immediate maintenance and proper care may be able to save the tree.
Poor: Trees in this group are in a very degraded condition with irreversible problems. They have over 50% dead branches, drastic deformities, and severe insect, pathogen, or nutritional problems. They will have to be removed soon.
Dead: Trees in this category are either already dead or in such very poor condition that removal is required. These trees have over 90% dead branches and have completely succumbed to either insects, pathogens, or nutritional deficiencies. It is important to conduct the installation tree inventory after spring growth has begun. This ensures that a dormant tree is not misidentified as dead.

Maintenance:
PI*: Prune Immediate Priority. Requires immediate pruning – record under special notes at bottom of page. Trees in the immediate pruning category present possible safety risks to persons or property. Trees in this category are characterized by broken branches and large deadwood. Pruning should be accomplished as soon as resources are available.
PH: Prune High Priority. Trees requiring high priority pruning should be attended to as quickly as scheduling will allow. These trees, like the immediate priority pruning category, have broken branches and areas of deadwood. The dead areas, however, do not present an apparent immediate safety risk to persons or property.
PR: Prune Routine Priority. All other trees except young and recent plantings fall into the routine pruning category. They require removal of dead, dying, diseased, or obviously weak and heavy branches and deadwood. Routine, ongoing pruning should be scheduled and programmed to ensure all tree pruning is accomplished on a minimum cycle of five to seven years. It is important to remember that low priority problems can become high priority if they are not maintained for an extended period of time.
PT: Prune Train. The final maintenance category is training pruning. Trees in this category are generally young, recent plantings. Minimum maintenance includes trimming root and trunk suckers, deadwood, crossing, diseased, or weak branches, and staking improvement or removal. Trees in this category need to be scheduled for maintenance and not neglected. Generally, young trees should be pruned to reflect their species' natural growth pattern or to a single leader or a strong central leader to promote the development of strong scaffold limbs.
RI*: Removal Immediate Priority. Record under special notes at bottom of page. Trees categorized as high priority removals should be removed as soon as possible based on their lower condition class and proximity to active use areas or structures.
R: Removal-low priority. Low priority removals should be scheduled and accomplished when resources are available after high priority removals have been accomplished. These trees are generally located away from population areas and facilities.
Clearance Issues: Note if it is a private tree by circling PVT.
***TS: Traffic Signal.** Record under special notes at bottom of page. Circle if tree is blocking traffic control device such as a sign or light.
R: Road Clearance. Limb(s) is less than 14' over the curb or roadway.
S: Sidewalk Clearance. Limb(s) is less than 8' over a sidewalk and other hardscapes (for parks and other public facilities besides streets).
N/A: No Clearance Issues.

Planting: (Medium to large trees to be planted if room. If power lines, only small trees to be planted)
Planting Site: Note number of spaces in Public ROW **and** within 30' of ROW in Private Front Yard
Curb or Road Edge: need a 4-foot tree lawn to plant a tree.
Distances From:
Utilities – underground (5'), overhead (15'), Hydrants, utility poles, and light posts (10'), Intersections (from corners) (25')
Driveways (5'), Other trees: 20-40'

TFS January 2006 RLN

Appendix B: List of Species Sampled and the Distribution of Each by DBH Class

Common Name	Scientific Name	Distribution by DBH Class					Tree Count	Percent of Total	Running %
		0-5	6-10	11-20	21-30	30+			
Live Oak	*Quercus virginiana*	41%	43%	13%	2%		434	45.1%	45.1%
Common Crapemyrtle	*Lagerstroemia indica*	90%	9%	1%			223	23.2%	68.3%
Callery Pear	*Pyrus calleryana*	20%	25%	54%	1%		89	9.3%	77.5%
Chinese Elm	*Ulmus parvifolia*	53%	36%	6%	4%		47	4.9%	82.4%
Slash Pine	*Pinus elliottii*		29%	54%	17%		24	2.5%	84.9%
Arizona Ash	*Fraxinus velutina*	14%	10%	62%	10%	5%	21	2.2%	87.1%
Waxmyrtle	*Myrica cerifera*	100%					18	1.9%	89.0%
Eastern Redcedar	*Juniperus virginiana*	75%	25%				16	1.7%	90.6%
Water Oak	*Quercus nigra*	36%	21%	29%	14%		14	1.5%	92.1%
Green Ash	*Fraxinus pennsylvanica*	38%	50%		13%		8	0.8%	92.9%
Chinese Tallowtree	*Sapium sebiferum*		100%				7	0.7%	93.7%
Pecan	*Carya illinoensis*	17%	50%	17%		17%	6	0.6%	94.3%
Red Maple	*Acer rubrum*	20%	80%				5	0.5%	94.8%
Loblolly Pine	*Pinus taeda*		60%	40%			5	0.5%	95.3%
American Sycamore	*Platanus occidentalis*	20%	40%	40%			5	0.5%	95.8%
Shumard Oak	*Quercus shumardii*	80%		20%			5	0.5%	96.4%
Silver Maple	*Acer saccharinum*	75%		25%			4	0.4%	96.8%
Cedar Elm	*Ulmus crassifolia*	25%	75%				4	0.4%	97.2%
Siberian Elm	*Ulmus pumila*	25%	75%				4	0.4%	97.6%
Mimosa	*Albizia julibrissin*	100%					2	0.2%	97.8%
Sugarberry	*Celtis laevigata*		100%				2	0.2%	98.0%
Eastern Redbud	*Cercis canadensis*	100%					2	0.2%	98.2%
Citrus	*Citrus species*	100%					2	0.2%	98.4%
Southern Magnolia	*Magnolia grandiflora*		100%				2	0.2%	98.6%
White Oak	*Quercus alba*			100%			2	0.2%	98.9%
Cherrybark Oak	*Quercus pagoda*	100%					2	0.2%	99.1%
Mexican Fanpalm	*Washingtonia robusta*	100%					2	0.2%	99.3%
Japanese Zelkova	*Zelkova serrata*		100%				2	0.2%	99.5%
Japanese Privet	*Ligustrum japonicum*	100%					1	0.1%	99.6%
Peach	*Prunus persica*	100%					1	0.1%	99.7%
Swamp Chestnut Oak	*Quercus michauxii*	100%					1	0.1%	99.8%
Western Soapberry	*Sapindus drummondii*		100%				1	0.1%	99.9%
Winged Elm	*Ulmus alata*	100%					1	0.1%	100.0%

Total Number of Public Trees Sampled: 962

Total Number of Species Sampled: 33

Appendix C: Tree Replacement Values, by Species

*Values are calculated for each tree in the sample using its recorded condition class rating, an average DBH for its assigned class, an average location rating of 70%, and the Houston/Beaumont 'Basic Price' ($84 per square-inch) for a 3-inch caliper specimen, installed and guaranteed for one year. Values for palm species are calculated using an average height in 'brown trunk feet' (BTF) and a Basic Price for that species. Species ratings for species marked with # were determined by the regional forester.

Tree Species	Species Rating #	Average DBH/BTF	Estimated No. Trees	Average Tree Value*	Total Value	Percent
Live Oak	100%	8.7"	8,832	$2,759.82	$24,374,633	55.2%
Callery Pear	60%	12.1"	1,811	$3,222.44	$5,836,370	13.2%
Slash Pine	70%	15.6"	488	$6,294.06	$3,074,044	7.0%
Arizona Ash	71%	15.8"	427	$6,372.27	$2,723,209	6.2%
Common Crapemyrtle	80%	4"	4,538	$468.49	$2,126,030	4.8%
Chinese Elm	73%	8.3"	956	$1,830.80	$1,751,084	4.0%
Water Oak	68%	13.1"	285	$4,162.29	$1,185,845	2.7%
Pecan	68%	14.9"	122	$5,552.11	$677,918	1.5%
Green Ash	80%	10.7"	163	$2,856.78	$465,088	1.1%
Loblolly Pine	80%	11.3"	102	$3,795.00	$386,144	0.9%
American Sycamore	60%	10.8"	102	$2,602.41	$264,797	0.6%
Eastern Redcedar	87%	4.8"	326	$731.24	$238,092	0.5%
White Oak	64%	15"	41	$5,320.10	$216,530	0.5%
Chinese Tallowtree	66%	8"	142	$1,449.09	$206,425	0.5%
Shumard Oak	80%	7.2"	102	$1,476.32	$150,217	0.3%
Cedar Elm	78%	7.1"	81	$1,448.06	$117,873	0.3%
Red Maple	45%	7.3"	102	$721.54	$73,417	0.2%
# Waxmyrtle	50%	3"	366	$166.25	$60,898	0.1%
Siberian Elm	51%	7.1"	81	$634.74	$51,668	0.1%
Japanese Zelkova	70%	8"	41	$1,241.36	$50,524	0.1%
Sugarberry	65%	8"	41	$1,152.69	$46,915	0.1%
Southern Magnolia	53%	8"	41	$939.88	$38,254	0.1%
Western Soapberry	65%	8"	20	$768.46	$15,638	0.0%
Cherrybark Oak	74%	3"	41	$246.05	$10,014	0.0%
# Citrus	65%	3"	41	$216.13	$8,797	0.0%
Silver Maple	45%	7.9"	81	$93.52	$7,612	0.0%
# Mexican Fanpalm	50%	3'	41	$168.00	$6,838	0.0%
Eastern Redbud	45%	3"	41	$149.63	$6,090	0.0%
Swamp Chestnut Oak	76%	3"	20	$252.70	$5,142	0.0%
Mimosa	38%	3"	41	$126.35	$5,142	0.0%
Winged Elm	74%	3"	20	$246.05	$5,007	0.0%
# Peach	45%	3"	20	$149.63	$3,045	0.0%
# Japanese Privet	30%	3"	20	$74.81	$1,522	0.0%
		Estimated Totals:	**19,576**	**Avg: $2,257 ea**	**$44,190,820**	