A Description of Texas Municipal Forestry Programs: How Critical Programs Elements Vary According to City Size, Expenditures, and Assistance from the State

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Applied Research Project

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Abstract

Purpose: The purpose of this research study was to describe how six critical program elements of urban and community forestry programs in Texas municipalities vary according to city size, expenditures, and assistance from Texas A&M Forest Service. The six critical program elements are 1) staffing levels, 2) tree ordinances, 3) advocacy, 4) urban forest management plans, 5) tree inventories, and 6) the program's status in the larger municipal structure. This study also was designed to compare current expenditure rates against benchmarks set by previous research studies found in the literature.

Method: Survey research was the sole method of data collection for this study. The survey was sent to 441 Texas city managers, parks department directors and other executive-level parks department staff, and municipal foresters in 241 unique Texas cities. Surveys were returned from 81 unique cities for a response rate of about 34% at the city level. Surveys were returned from 93 individuals for a response rate of about 21% at the individual level.

Findings: Expenditures on urban forestry activities are low compared to the findings of related literature and represent a continued downward slide. On average, Texas cities of any size are spending less on urban forestry per capita today than the average U.S. city was spending at any period previously recorded; 1974, 1980, 1986 or 1994. If the Arbor Day Foundation's Tree City USA expenditure requirement of $2 per capita (set in 1974) is adjusted for inflation, it rises to $9.38 in 2012 dollars; only about 13% of respondents meet or exceed this adjusted value. Additionally, spending on urban forestry as a percentage of a municipality's total budget is quite low.

There appears to be a strong connection between a city receiving assistance from the Texas A&M Forest Service and those cities currently possessing the critical elements of an urban and community forestry program. Strong tree ordinances are relatively common in Texas municipalities, including municipal codes that protect trees on private property during construction activity or regulate the removal of trees on private property. Tree boards and non-

profit groups are both fairly common as well. Urban forestry management plans are very uncommon and there appears to be a strong connection between high expenditure rates and management plans. The same connection to high expenditure rate can't be made with tree inventories of street trees or park trees which are also very uncommon, whether they are comprehensive or sample inventories.

About the Author

Keith O'Herrin grew up in the rural Kickapoo River valley in the heart of the 'Driftless Area' of Southwest Wisconsin. He received his B.S. in Urban Forestry from University Wisconsin – Stevens Point before working as the City Forester of La Porte, Indiana for 2 years. He has now been with the Urban Forestry Program of the City of Austin, Texas for 3 years where he is currently a Forestry Supervisor. He is also a Master's of Public Administration candidate at Texas State University – San Marcos.

Southwest Wisconsin in early fall

Dedication

This research is dedicated to my parents, Bill and Mary

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I. INTRODUCTION

At first glance many people take 'urban forestry' to be an oxymoron, but every city and town in America has trees which grow along streets and in parks, and in front yards and back yards. Those trees provide shade and other benefits whether they are managed or not; managing those trees to provide as much benefit as possible is the practice of urban forestry.

Urban forestry is "a specialized form of forest management concerned with the cultivation and management of trees in the entire area influenced and/or utilized by the urban population" (Dunster and Dunster 1996, 323). The urban environment is one of the toughest imaginable for a tree to grow where they face obstacles such as soil, air and water pollution, vandalism and mechanical injury, soil compaction, and soil nutrient deficiencies. Urban trees which aren't actively managed have a poor chance of survival. Steiner (1980) even went so far as to outline criteria necessary to develop cultivars (cultivated varieties) of shade trees with an improved tolerance of the nutrient and moisture deficient conditions found in urban soils. Growing trees in an urban environment to even the juvenile size where the community begins to see a return on the investment often proves to be a challenge.

To meet this challenge urban foresters are specially trained in "combining arboriculture, the care and management of individual trees, with 'traditional' forest management, the care and management of groups of trees" ("Federal UCF Program Summary" 2005, 1). Though, unlike traditional foresters which manage groups of trees as a crop for timber production, urban foresters manage groups of trees for the environmental and social benefits they provide to increase the quality of life in a community. Urban and community forestry programs employ urban foresters who "ultimately work for the resource owner, not the resource" (Thompson et al. 1994, 37). As the majority of the U.S. population now lives in urban areas, and the current trend shows the number of rural residents decreasing and urban residents increasing, the number of resource owners continues to grow.

While the beauty of urban trees is appreciated by many of these resource owners, the innumerable cost-savings provided by urban trees are usually either taken for granted or entirely unrecognized. Harris et. al. (1999, 9) stated that "because the benefits provided by urban trees are directly related to size, any tree care activity that supports tree health and structural stability

leads to sustainability." The value of the urban forest has been empirically proven to be real and quantifiable in terms of the benefits provided to a given community through expenditures saved (Dwyer et al. 1992). However, it isn't just the well-known environmental services such as stormwater mitigation, soil erosion prevention, air quality improvement and reduction of cooling costs that a community benefits from when it invests in its urban forest. Dwyer et al. (1992, 231) found that "tree planting and tree care on public and private lands can be viewed as an investment that achieves an annual return in property taxes" by increasing property value by up to 5% per year. Wolf (2004) found that consumers greatly value shopping districts with trees and other vegetation over those without. Even the social contributions of trees in the urban environment have been examined such as how a view of a tree through a hospital patient's window improves recovery times (Ulrich 1984). Urban forestry programs exist because, left on their own, communities will not properly nurture their urban forest and miss out on these large potential returns.

In municipal governments, urban and community forestry programs are often shoe-horned into administrative groups with community services which results in unstable revenue. Trees in the urban community function as physical infrastructure similarly to utilities such as streets and sewers providing numerous essential benefits such as reduction of urban heat island effect and stormwater mitigation which translate into real economic impact and an impressive cost-to-benefit ratio (McPherson et al. 1997; McPherson et al. 2005; Nowak 2006). Municipalities often ignore how urban trees function, and many group their urban and community forestry program with or under parks, recreation, or other community services (public safety, social, cultural, and health)(Johnson 1982). The result is that funding is often unpredictable for urban and community forestry programs.

Federal funding has improved technical and educational assistance to urban and community forestry programs, but is too unstable to support long-term projects, facilities or salaries, and is not the intent of grant funding (HortScience, Inc. and The Aslan Group 2004). With the passage of the 1990 Farm Bill, federal funding was increased dramatically with the intent to enable State-level programs to provide financial assistance to local governments. This stimulus also increased technological improvements by the Federal-level program and increased support for scientific research; especially in the area of quantifying urban forest benefits in dollars (R. J Hauer, Casey, and Miller 2008; HortScience, Inc. and The Aslan Group 2004). The

results of this research rely on the state-level programs to convey educational and technical assistance and advice.

Assistance and advice, based on scientific research, may contribute towards high-functioning urban and community forestry programs in municipalities which could cause the community to greatly increase the real economic benefits their urban forest has to offer. This assistance comes from the state-level urban forestry program in three main forms.

- Financial assistance, usually in the form of grants.
- Technical advice from seasoned experts is especially useful for communities without their own urban forester on staff.
- Educational assistance and training for both experts and non-experts keeps these practitioners up to date on the latest tools and methods for managing their urban forest.

This assistance contributes to development of the six critical program elements of an urban and community forestry program. The six critical program elements presented in this research study were developed during a review of the literature on municipal forestry programs, and from the author's 5 years of experience as a professional municipal forester. Multiple references in the literature to these program elements were quite difficult to find and it is clear that a gap in the literature exists. However, the response rates to the survey questions posed by this research study show that these program elements are relatively common in Texas municipal forestry programs.

- Dedicated staff is required to manage a municipality's urban forestry program where they coordinate administrative processes and act as subject-matter experts.
- Strong municipal ordinances lay the foundation for standards of care of trees on public property, and sometimes even private property.
- Advocacy for urban forestry programs and the urban forest itself comes in many forms, but the two most prominent are tree boards/commissions and non-profit partner groups.
- Urban forestry management plans are becoming more common as practitioners discover how useful they are in setting and achieving goals, as well as garnering stakeholder buy-in.

- Inventories of trees allow practitioners to efficiently schedule proactive maintenance which has been shown[1] to provide the greater cost-benefit ratio.
- The urban and community forestry program's position relative to the top of the bureaucratic structure can influence support and funding.

In addition to how assistance and city size contribute to the six critical program elements, this study will also describe how varying levels of expenditures on urban forestry activities contribute to the development of those elements. Expenditure benchmarks originally developed by Kielbaso[2] in the 1970's for usage in nation-wide surveys of municipalities will also be employed here.

- Expenditures on urban forestry activities per capita
- Expenditures on urban forestry activities per tree
- Expenditures on urban forestry activities as a percent of total municipal budget

RESEARCH PURPOSE

The purpose of this research study was to describe how six critical program elements of urban and community forestry programs in Texas municipalities vary according to city size, expenditures, and assistance from Texas A&M Forest Service. The six critical program elements are 1) staffing levels, 2) tree ordinances, 3) advocacy, 4) urban forest management plans, 5) tree inventories, and 6) the program's status in the larger municipal structure. This information will act as baseline data which future Texas-specific studies can compare against.

This was accomplished by utilizing an online survey addressed to Texas urban and community forestry program managers, or other responsible party such as a city manager or parks department director where a urban and community forestry program manager is not known. The unit of analysis was Texas municipalities. This research is compelling because the ability to provide a higher level of service and collect on the high rate of return offered by urban forests depends fundamentally on these six critical program elements.

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[1] Miller and Sylvester (1981) showed a tree maintenance (pruning) cycle of four to five years to be optimum for street trees. Inventories greatly aid in the planning of such a maintenance cycle.
[2] The following literature was carefully examined regarding the expenditure benchmarks: Ottman and Kielbaso 1976; Giedraitis and Kielbaso 1982; J. Kielbaso, Haston, and Pawl 1982; J. J. Kielbaso et al. 1988; J. J. Kielbaso 1990; Tschantz and Sacamano 1995.

This research study reveals the current state of urban and community forestry programs in Texas. The analysis of the survey results utilized cross tabulation methods to compare results across municipalities of different sizes, and across municipalities of different funding levels.

<u>CHAPTER PREVIEW</u>

This paper is divided into six chapters. Chapter two provides the reader with the historical setting and background necessary to interpret the current urban forestry program context by discussing the state of urban forestry before and after the 1990 Farm Bill. Chapter three describes the six critical program elements, the three expenditure benchmarks, the three categories of assistance, and the cross tabulation tables which were utilized; these were developed based on a review of the existing scholarly literature. Chapter four describes the methodology used in this research study and shows how the descriptive categories are operationalized. Chapter five presents the highlights of the results of the survey and provides an analysis of the data. Chapter six presents the author's conclusions and suggestions for future research.

II. HISTORICAL SETTING

The purpose of this chapter is to provide the reader with the historical setting and background necessary to interpret the current urban and community forestry program context by discussing the state of urban forestry before and after the 1990 Farm Bill. The 1990 Farm Bill included several mandates that required new Federal programs for the purposes of providing guidance and support to state-level and local-level urban and community forestry programs. The funding attached to these mandates is responsible for an explosion of urban forestry activity at the local, state, and federal level, relative to the landscape before 1990. This chapter also discusses how the current funding and support chain from the federal government to the state government to municipalities operates.

Before the 1990 Farm Bill

Although much of the scientific research supporting urban forestry is relatively recent, some well-known examples of urban forestry planning do predate living memory (and continue to this day). Seen as otherwise unusable due to its swampy nature, New York's Central Park was set aside in the 1850's as a badly needed public greenspace in an otherwise already urban and noisy city. Influential people from as far away as London had been 'urging "the necessity of a great Park" for New York City' (Rosenzweig and Blackmar 1992, 15). The nearly 800 acres was cleared of infertile soil and rocks, and thousands of cubic yards of fertile topsoil brought in to support the nearly four million trees, shrubs, and plants the City installed before the park was completed in 1873 (Rosenzweig and Blackmar 1992). Today's value of this island of greenspace in the middle of one of the most densely populated urban environments in the world cannot be overstated.

New York City was not alone in planning for the protection and conservation of the urban forest. The State of Massachusetts has long had a culture of 'Tree Wardens' who care for trees on public land such as parks, commons, squares, and streets and even put such a requirement of cities with populations greater than 10,000 into State law in the late 1890's (Ricard 2005).

Arbor Day, a holiday where communities are encouraged to plant and care for trees, was founded by J. Morton Sterling in 1872 in Nebraska City, Nebraska. It is estimated that over one million trees were planted that first year. By the 1920's, every state in the United States had passed a law declaring a certain day Arbor Day[3]. Arbor Day is now an *international* holiday recognized by countries around the world that celebrate it in their own way, and at the time of year most appropriate for planting trees in that locale.

Federal efforts to increase forestry production date back about 100 years, but largely ignored urban forests. The Weeks Act of 1911 allowed the Forest Service to acquire new forest land to protect watersheds for the purposes of preserving navigable waterways, citing the rights over that property given to the Federal Government by the Commerce Clause of the U.S. Constitution (Weeks 1911, 2008). The Clarke-McNary Act of 1924 expanded the Weeks Act by breaking down additional roadblocks which had been preventing the Federal government from purchasing forest land. It also provided support for states to create state-level forestry agencies for the purpose of cooperating with landowners and farmers to reforest their private property (Clarke and McNary 1924, 2003).

Federal laws concerning forestry began to diversify further in the second half of the twentieth century to encompass more than just acquiring land and managing it for timber production. The Cooperative Forestry Assistance Act of 1978 expanded the authority of the Forest Service to include providing financial and technical assistance in many emerging areas of forestry including urban forestry[4]. About $3 million was made available annually for urban forestry grants administered to local programs through the Federal government's State and Private Forests program. This was the first time 'urban forestry' was mentioned by Federal law[5].

However, the impact of this Federal funding appears to have been minor. The results of a survey performed by Casey and Miller (1988) found that only 16 of 49 responding States (about 33%) were using the $3 million that had been made available to them as grants by the Cooperative Forestry Assistance Act of 1978. Only 5 of 46 respondents (about 11%) said that they provide financial assistance to communities in their state from state monies. One can reasonably conclude that if a state-level program was utilizing neither federal nor state funding,

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[3] Historical information about Arbor Day was sourced from the Arbor Day Foundation website (www.arborday.org, accessed 11/23/12)

[4] Informational sources in this section included the *Cooperative Forestry Assistance Act of 1978*

[5] Historical information in this section was sourced from the Forest History Society website (www.foresthistory.org, accessed 11/23/12)

little financial assistance was reaching the primary intended recipient – municipal U&CF programs.

The Effect of the 1990 Farm Bill

The Food, Agriculture, Conservation and Trade Act of 1990 (P.L. 101-624), more commonly known as the 1990 Farm Bill, had a primary focus of freezing and guaranteeing prices for America's farmers so they could plant their fields without fear of catastrophic loss as a result of weather phenomena and other natural events. The 1990 Farm Bill also included increased funding for the USDA Forest Service specifically for urban and community forestry efforts. Since spending on urban forestry was first included in the 1990 Farm Bill, it has also been included in the subsequent bills which were passed in 1996, 2002, and 2008.
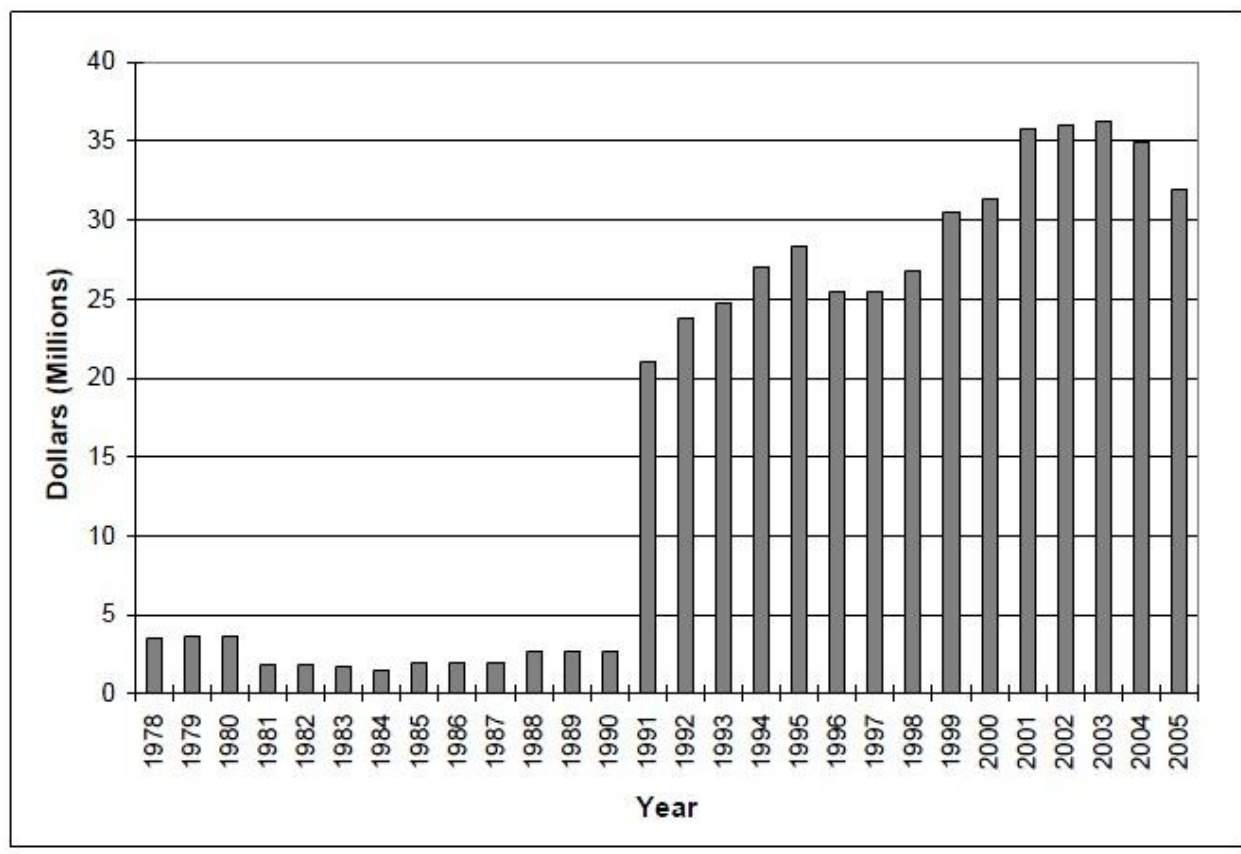
Figure 2.1 - Nominal Annual Funding of the USDA-Forest Service Urban & Community Forestry Program from 1978 to 2005. (Richard J. Hauer 2005, 8)

The first of many enormous impacts as a result of the 1990 Farm Bill was a dramatic and instantaneous change in funding (**Figure 2.1**). Federal funding for urban forestry through the Cooperative Forestry Assistance Act of 1978 had previously hovered around a stagnant $3 million annually from 1978 through 1990. However from 1991 – 2005, the United States Department of Agriculture Forest Service spent $440 million on urban forestry activities and research; an average of almost $30 million annually that represents a roughly 1,000% increase in Federal urban forestry funding (Richard J. Hauer 2005, 7 - 8).

Another impact of the 1990 Farm Bill was the creation of the National Urban and Community Forestry Advisory Council (NUCFAC). NUCFAC's vision statement [6] is as follows: "NUCFAC seeks to generate resolve, support, and capacity in all of the nation's communities to ensure safe, sustainable, and healthy urban forests within human-dominated ecosystems."

The primary functions of NUCFAC are to 1) develop a national urban and community forestry action plan, 2) evaluate the implementation of that plan and 3) develop the requirements of eligibility each state must meet to apply for financial assistance. Hauer and Johnson (2008) summarize the current requirements of state eligibility. States should:

1) Have an urban and community forestry program coordinator - to provide leadership.
2) Implement volunteer and partnership coordination - to leverage support and increase local involvement.
3) Create an urban and community forestry council - to advise the urban and community forestry program coordinator and to coordinate diverse stakeholders.
4) Develop a state urban and community forestry program strategic plan (5-year plan) - to provide direction to accomplish programmatic objectives and goals.

These requirements of eligibility were a dramatic change from the way many state-level urban and community forestry programs were operating before the 1990 Farm Bill. In 1988, Casey and Miller (1988, 141) had found that only 32 states had specialized 'urban and community forestry program coordinators' as outlined by requirement #1 listed above. If the

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[6] The vision statement of NUCFAC was sourced from the TreeLink website (www.treelink.org/nucfac/vision.html accessed 11/30/11)

other 18 states had functioning programs at all, they were administered by "various forestry personnel whose primary job responsibilities include traditional forest management, forest fire prevention and control, and/or forest pest management"(Casey and Miller 1988, 144).

By contrast, Hauer and Johnson (2008) found from the results of a survey (conducted in 2002) that all 50 states now had a full-time urban and community forestry (U&CF) program coordinator. "Only 26.8% of states believe they would have established a full-time U&CF coordinator if federal assistance to states had not been expanded in 1991, and all of these states [the 26.8%] had a full-time coordinator before 1990" (R. J Hauer and Johnson 2008, 77). Dedicated staff with a guaranteed budget and a state-level advisory council would work together to develop a 5-year strategic plan for the state U&CF program. The 1990 Farm effectively created state-level programs to act as a resource for local-level managers in every state.

Another result of the 1990 Farm Bill included the creation of the Federal Urban and Community Forestry Program (Federal UCF Program), as a new part of the existing State & Private Forestry section of the USDA - Forest Service. This program acts as the federal-level point of contact for the state-level programs, and holds states accountable to the requirements of eligibility established by NUCFAC, as previously discussed. The mission statement[7] of the Federal UCF Program is as follows: "Sustain the trees and forests where people live, work and play". The purpose of the Federal UCF Program included providing financial assistance through grants to local units of government, non-profits, and other local community tree groups for urban and community forestry projects (P.L. 101-624).

This new approach to providing assistance to local urban forestry programs has proven successful. The existing State & Private Forestry pipeline is utilized to distribute funding from the federal level to the state level with varying amounts per state based on an allocation formula. State-level urban and community forestry programs then distribute funding to local municipalities in the form of grants and other project support. Other forms of assistance can be equally as valuable including technical advice, or educational assistance and training. During 2001, 11,133 communities of the 27,824 that were eligible received some type of assistance regarding urban forestry activities, representing about 40% of the 'geographic locations of more

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[7] The mission statement of the Federal Urban and Community Forestry program was sourced from its own website (www.fs.fed.us/ucf, accessed 11/30/11)

than 100 people' in the 50 United States and 9 territories (HortScience, Inc. and The Aslan Group 2004, 13).

Technology Transfer

      Possibly the greatest achievement of the Federal UCF Program and NUCFAC, aside from requiring dedicated staff in each state while simultaneously providing the funding for that staff, may be the creation and dissemination of tools intended for use by local communities to improve their urban and community forestry programs. These tools are often created by partnerships between the Federal UCF Program and others, and are then often made available for free to the public; this is commonly referred to as 'technology transfer'.

      i-Tree is a package of free software available to municipalities that aids in the quantification of environmental benefits provided by their urban forest; it puts a value on the urban forest in terms of real dollars. The software was developed by the Federal UCF Program, Davey Tree Expert Company, Arbor Day Foundation, Society of Municipal Arborists, International Society of Arboriculture, and Casey Trees. From humble beginnings simply quantifying environmental benefits in terms of real dollars using a model called Urban Forest Effects (UFORE), the current i-Tree software suite has now expanded to include 9 different analysis tools and 3 utility programs. From its inception, this software suite has proven to be an invaluable tool for communities to quantify the environmental services their urban forest provides and has been used in over 8,200 communities in 42 countries across the planet from Mexico to Malaysia[8]. Putting a dollar value on the services provided and costs deferred by the urban forest allows policy makers to directly compare publicly owned trees to other publicly owned utilities such as water and wastewater, and electrical service. Before the benefits provided by urban forests were able to be quantified in dollars, this was a much more difficult comparison to make than it is now.

      Another product created as a result of Federal funding for urban and community forestry efforts is the Tree Board University; an 8-course, web-based instructional program for board members, volunteers, and professionals who serve on or work with community tree boards. The role of a community tree board is usually to provide guidance and oversight of the community's urban forestry program. This specialized instruction has proven to be very important because a

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[8] Information in this section was sourced from the iTree website(www.itreetools.org, accessed 12/06/11)

tree board is usually composed of members of the general public, not subject-matter experts. Tree Board University is designed to make the tree board as efficient, effective, and organized as possible through education on the following topics: partnerships, collaboration, marketing and communication, urban forestry planning and more[9].

Texas A&M Forest Service – Urban Forestry Program

The Texas A&M Forest Service – Urban Forestry Program is the State of Texas agency that houses the state-level urban and community forestry program coordinator; a position that is required to meet the eligibility requirements for funding from the Federal government. Texas has one of the most interesting approaches to meeting the Federal Urban and Community Forestry Program's requirements of any of the 50 states; the Texas Forest Service is chartered by the Texas Legislature, however it is operated as a division of Texas A&M University instead of a Department of the State government the way the Texas Parks and Wildlife Department is operated.

The state-level program's mission[10] is "to help build self-sustaining urban forestry and tree care programs in Texas communities". The state-level program fulfills this mission by helping municipalities develop program elements such as tree ordinances and tree inventories. The state-level program offers three primary categories of assistance to municipalities: financial assistance such as grants, technical advice to both resource professionals and laymen, and educational or training opportunities. Tools such as those previously discussed in the Technology Transfer section are often involved in all three instances of assistance.

Measuring the Impact of Federal Funding

States must meet certain criteria to be eligible for Federal urban forestry funding. As discussed previously, the four criteria for eligibility are 1) have an urban and community forestry program coordinator, 2) implement volunteer and partnership coordination, 3) create an urban and community forestry council, and 4) develop a state program strategic plan (5-year plan). Meeting these four criteria in itself could be considered an accomplishment; however the intent

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[9] Information in this section was sourced from the Tree Board University website (http://treeboardu.org/, accessed 11/23/12)

[10] The mission statement of the Texas A&M Forest Service – Urban Forestry Program was sourced from its own website (http://texasforestservice.tamu.edu/main/article.aspx?id=1279, accessed 11/26/12).

is to increase urban forestry activity at the local level. Therefore states must also report on accomplishments at that level generated or impacted by their state-level urban and community forestry program.

The Community Accomplishment Reporting System (CARS) is an electronic database operated by the Federal government that collects and stores information reported annually by each state-level program. The information collected is used to rank communities against criteria outlined in the Performance Measures Accountability System (PMAS) that measures the outcomes of Federal urban forestry funding.

A portion of the PMAS criteria are commonly referred to as SOAPs which is an abbreviation for Staff, Ordinance, Advocacy, and Plan ("Federal UCF SOAPs Definitions" 2012). These four elements of a local-level urban and community forestry program represent the most critical urban forestry activities. Another outcome reported includes the number of communities that receive various types of assistance from the state-level urban forestry program. Together, the SOAPs and the quantity of assistance received represent two of the best and most commonly used methods for measuring urban forestry activity in the literature.

CHAPTER SUMMARY

This chapter provided a synopsis of the policy history in the United States affecting municipal urban and community forestry programs including federal laws that preceded the 1990 Farm Bill, the dramatic changes caused by the 1990 Farm Bill, and how the current funding and support chain from the federal government to the state government to municipalities operates. The next chapter is a review of the existing literature on municipal urban and community forestry programs.

III. CONCEPTUAL FRAMEWORK

The first purpose of this chapter is to examine the existing scholarly literature on municipal urban and community forestry programs in the context of the four factors (categories) this research study seeks to describe; 1) the Critical Elements of an Urban and Community Forestry Program, 2) the Expenditure Benchmarks, 3) Assistance from the Texas A&M Forest Service, and 4) City Size. The second purpose of this chapter is to present how the six cross tabulation tables are supported by the literature. Finally, a conceptual framework table is presented linking the literature to the descriptive categories.

LITERATURE REVIEW

1. Urban and Community Forestry Program Elements

The Urban and Community Forestry Program Elements category seeks to determine the existence of specific administrative processes and functions that the literature shows are critical to urban and community forestry programs in municipalities. As a starting point, this research study uses the four critical program elements outlined in the Performance Measures Accountability System ("Federal UCF SOAPs Definitions" 2012) that state-level programs use in annual performance measure reporting to the Federal Urban and Community Forestry Program. Those four elements are commonly referred to as Staff, Ordinance, Advocacy, and Plan and abbreviated as the SOAPs.

Several previous studies that utilized surveys to gather data on municipal urban and community forestry programs have examined several of the SOAPs including Schroeder et. al. (2003) which examined how Staff, Ordinance, and Advocacy vary according to city size. Ries et al. (2007) used cross tabulation tables to represent how Staff, Ordinance, and Advocacy vary according to whether or not the city received assistance from the state-level urban and community forestry program. Rines (2007) examined all four SOAP elements and added an additional two elements supported by his review of the literature: inter-agency communication and Tree City USA status.

In addition to the four SOAP elements, this research study examines the existence and/or status of another two key program elements supported by the literature which are the existence of a tree inventory, and the position of the urban and community forestry program within the larger municipal structure.

1.1 Staff[11]

The Staff subcategory quantifies staffing levels in the municipal urban and community forestry (U&CF) programs. An appropriate amount of dedicated and qualified staff is critical to an U&CF program to coordinate the administrative processes and activities necessary to run a program. These include: supervision of in-house maintenance crews or contracted maintenance crews, subject-matter expert advising other city departments whose actions affect trees, liaison to the tree board or tree commission, budget oversight, point of contact for homeowners and other stakeholders with concerns about the urban forest, maintenance of tree inventory, public education and outreach, enforcement of tree ordinance regulations, etc. An expected average response regarding amount of staff would equal roughly 25,000 residents per 1 staff member. A more appropriate average would be closer to 25,000 residents per 2 or 3 staff members, depending on how much tree maintenance work is contracted out instead of performed in-house.

The existence of a professional staff member is the first program element represented in the SOAPs ("Federal UCF SOAPs Definitions" 2012). The intent is that the individual responsible for the advancement of the U&CF program and the management of the urban forest resource itself is a professional with the training and necessary experience. The requirement is that the individual is employed, contracted, or volunteers at least part-time and holds 1) a degree in urban forestry or a closely related field, and/or 2) International Society of Arboriculture Arborist certification or equivalent professional certification. However, the survey question used in this study only focuses on the quantity of staff, not the qualifications of those staff. Also, while Ries et al. (2007) asked if a qualified individual was on staff or the

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[11] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester.

city had the ability to contract with one, the survey question used in this study only focuses on in-house staff, not contractors.

1.2 Tree Ordinance[12]

"Forestry ordinances to be effective must do three things: provide authority, define responsibility, and establish minimum standards for management" (Miller 1988, 155). A tree ordinance usually mandates the creation of a tree board and/or an urban forester position. The ordinance also establishes the authority of the tree board and/or urban forester and outlines regulations and standards of care affecting trees on public property, and sometimes even trees on private property. It usually outlines penalties associated with breaking regulations established by the tree ordinance, and penalties for interfering with the duties of the urban forester.

The Tree Ordinance subcategory determines the existence of a tree ordinance, and whether that ordinance regulates the care of public trees, private trees, or both. "Municipal forestry programs exist as a reflection of community interest in urban forestry and operate as specified by ordinance" (Miller 1988, 154). A tree ordinance is critical to an U&CF program because it establishes rules and regulations concerning the urban forest, and assigns responsibility to one or several parties. It shows that a community is concerned about the management of the urban forest, and is often the first accomplishment when a community is establishing a new urban and community forestry program. Even very small municipalities that may not have the resources necessary to have a tree inventory or dedicated staff can develop and adopt a tree ordinance.

The existence of a tree ordinance is the second program element represented in the SOAPs elements ("Federal UCF SOAPs Definitions" 2012). The intent is that the planting, maintenance, and removal of public trees, and in some cases private trees, is regulated and those regulations are routinely enforced by some mechanism. The requirement is often met with a single 'tree ordinance' in many municipalities. The form this ordinance or other regulation takes, however, can vary widely from state to state, and may not be limited to one

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[12] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester, including coordinating with the Tree Board to provide official recommendations on ordinance changes to the City Council of La Porte, IN, as well as drafting amendments to development code.

piece of code. 'Tree ordinances' usually regulate trees on public property while 'tree protection ordinances' typically regulate trees on private property, especially concerning the removal of large trees or requirements to protect trees during development and construction activities. 'Tree protection ordinance', which regulate private trees, are usually separate code from a 'tree ordinance'. This subcategory is constructed to determine the existence of both tree ordinances and tree protection ordinances.

1.3 Advocacy[13]

The Advocacy subcategory takes into account the existence of a tree board and/or of a non-profit organization that works closely with the Urban and Community Forestry (U&CF) program. Advocacy is critical to an U&CF program because advocates help staff communicate and network in methods and forums where staff is prohibited from doing so; this is especially important during budget decisions. "Funding may be easy to obtain during good economic times, but when a municipal government needs to cut costs the programs that are suggested most often are those perceived by the public and elected officials as having a low priority. A community aware of the public tree program and knowledgeable as to the benefits provided will place that program in a higher priority when allocating funds" (Miller 1988, 312). Staff speaking out in favor of their own U&CF program alone could be seen as less credible because they represent their own self-interest. Tax-paying citizens and other stakeholders may not be subject-matter experts, but they have authority to speak in favor of municipal programs that maintain the urban forest where they live and work.

Program funding isn't the only area where advocates can assist an U&CF program. Concerned stakeholders can attend public meetings, including city council meetings, to speak out for or against key policy decisions. Tree boards can make official recommendations on policy to city council and/or city mayors and city managers. Non-profit organizations can raise and spend funds in ways that city staff is allowed to.

The third program element represented in the SOAPs ("Federal UCF SOAPs Definitions" 2012) is the existence of either 1) a board or commission of citizens appointed by local

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[13] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester, including 2 years as an ex-officio member of the City of La Porte, IN Tree Board and 5 years of coordinating with non-profit volunteer groups

elected officials to advise policy makers on needed tree ordinances, policies, and management, or 2) a volunteer citizen group that advocates for tree planting, management and preservation. The intent is that "community residents and program stakeholders are informed, educated, and engaged in the development and implementation of a sound community forestry program at the local level" ("Federal UCF SOAPs Definitions" 2012, 2).

1.4 Management Plan[14],[15]

An effective urban and community forestry (U&CF) program should have a comprehensive/master urban forest management plan. An urban forest management plan is a planning document that addresses the basic four planning steps in the context of the urban forest within a municipality:

1) What do we have?
2) What do we want?
3) How do we get what we want?
4) Feedback

An urban forest management plan is critical to an U&CF program because it sets goals and priorities for staff to work towards, allowing for efficient allocation of time and resources. Staff can also utilize goals to identify gaps in service delivery and the associated gaps in funding, which allows for better-justified budget requests. Goals and their reporting mechanisms enable staff to show concrete progress and accomplishments, which can help a municipal U&CF program preserve funding levels during budget cuts.

 "Management objectives should be defined based on an understanding of public attitudes, perceptions, and knowledge, a review of the agents of change, and the expressed needs and concerns of the community (client)" (Miller 1988, 177). A management plan is more powerful when goals and priorities are established by staff, the tree board, and even concerned citizens. Goals and priorities established by staff alone, though they may be subject-matter experts, may be seen as arbitrary without the buy-in or perspective of the tree board and the general public.

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[14] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester, including 2 of which were spent as the primary author and project lead of the City of Austin's current effort to develop a Comprehensive Urban Forest Management Plan
[15] Information sources in this subcategory include Introduction to Natural Resource Planning by Charles Yoe (2013)

The existence of a management plan is the fourth program element represented in the SOAPs ("Federal UCF SOAPs Definitions" 2012). "Possessing, using and periodically updating a management plan demonstrates a community's commitment to the comprehensive management of its community tree and forest resources"("Federal UCF SOAPs Definitions" 2012, 1). Important components of the plan may include short-term and/or long-term goals regarding replanting, prioritization of reactive maintenance and hazard tree reduction, programming of cycle pruning or other proactive maintenance, or larger land use planning concerns. A comprehensive management plan may take many names and forms, but the definition requires that the recommendations in the plan are based on some type of professional resource assessment and/or tree inventory.

1.5 Tree Inventory[16]

A robust urban and community forestry (U&CF) program knows the urban forest resource it is managing. It obtains baseline information on the urban forest through a tree inventory. A tree inventory is a database of trees that includes information on individual trees such as location (either represented spatially or listed as an address), size, species, condition and health, previous maintenance activity, and other information useful to programming of maintenance cycles or tree planting plans. A computer-based, comprehensive tree inventory should be regularly updated and utilized for the purposes of prioritization of work, programming of proactive tree maintenance cycles, and/or setting goals outlined in the management plan such as tree planting goals. Proactive tree maintenance cycles where trees are regularly pruned every 4 or 5 years have been shown to provide the greatest economic benefit to a municipality (Miller and Sylvester 1981).

Note that this is stricter than the fourth SOAPs requirement (1.4 Management Plan) and the two are not mutually exclusive. The fourth SOAP requires that management plans be based on some type of professional resource assessment and/or tree inventory. Resource assessments may utilize aerial or satellite imagery usually for the purposes of determining canopy coverage and canopy gaps across the entire managed area. This is a stark contrast to a well-maintained comprehensive inventory that may be utilized for monthly or even weekly

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[16] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester.

work planning. "An inventory is an important tool for maintaining street trees, scheduling work, and developing long-term plans" (Reeder and Gerhold 1993, 15). This quote exemplifies that a tree inventory may be used for long-term planning as is the intent of an urban forest management plan, but is also used towards more short-term effects such as to schedule work.

A tree inventory is critical to an urban and community forestry program for the same reasons an inventory of utility lines is critical to an electric utility agency; if you don't know what you have, then you don't know what you need. This information is necessary for budgeting for contracted maintenance or programming of in-house maintenance, efficient routing of maintenance crews for both routine work and emergency response, knowledge of vulnerabilities (diseases and pests of trees), long-term planning for facility turnover (tree removal and re-planting), and probably most importantly developing a budget for the entire urban and community forestry program. "Management of any resource begins with an inventory of that resource, and urban forest management is no exception" (Miller 1988, 87).

1.6 Program Position within the City[17]

The position of the urban and community forestry (U&CF) program within the larger municipal structure can greatly affect the status given to that program's budget. According to R. Thompson et. al. (1994, 11), "as basic as it sounds, careful attention to the position/level and structure of the urban forestry organization is critical and can pay rich dividends. Urban foresters must recognize the close link between organizational position and budget continuity (i.e., line item status)." Conversations about budget, and the flow of the money itself, trickle down from the top of the organization; the closer a program is to the top of the organization, the fewer stops the money makes along the way.

Position within the city structure directly relates to perceived relevance. To be most effective, the U&CF program manager needs to be able to coordinate his/her program's efforts with other agencies of the city. This requires communication at the executive level. Johnson (1982) found that it was likely politically challenging to establish a U&CF program

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[17] Information sources in this subcategory include the Author's 5 years of experience as a professional municipal forester.

at this level, but successful examples did exist including the Forestry Bureau of the City of Milwaukee.

Urban forestry programs operating as their own department are rare, and are instead usually located within another department. The two most common homes for urban forestry programs are street maintenance departments such as Public Works, and Parks and Recreation Departments (City Policy Associates 2008). This subcategory will attempt to determine where municipal urban forestry programs are housed and their position relative to the top of the organization.

2. **Expenditure Benchmarks**

The Expenditure Benchmarks category examines how each responding city compares against three commonly used benchmarks of expenditures on urban forestry activities. Each benchmark compares expenditures on urban forestry activities against the responding city's relative size; population size, tree population size, or total budget size. This allowed for direct comparison between cities. These benchmarks are:

2.1) Expenditures on urban forestry activities per capita

2.2) Expenditures on urban forestry activities per tree

2.3) Percentage of total city budget dedicated to urban forestry activities

All three expenditure benchmarks were seen in nation-wide research studies using surveys of municipal forestry programs conducted in 1974 [18], 1980 [19], and 1986 [20]. The expenditure benchmarks above listed as 2.1 and 2.3 were both used in a similar 1994 [21] nation-wide study.

2.1 Expenditures on Urban Forestry Activities per Capita

The Expenditures on Urban Forestry Activities per Capita subcategory examines the total amount of money a community spends on urban forestry activities per capita (resident). This is the most commonly used of the three expenditure benchmarks. This expenditure benchmark was first established in 1974 as one of four standards a community must meet to

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[18] Information in this section sourced from Ottman and Kielbaso (1976)
[19] Information in this section sourced from Giedraitis and Kielbaso (1982) and J. Kielbaso, Haston, and Pawl (1982)
[20] Information in this section sourced from J. J. Kielbaso et al. (1988) and J. J. Kielbaso (1990)
[21] Information in this section sourced from Tschantz and Sacamano (1995)

be awarded Tree City USA status by the Arbor Day Foundation. The amount of $2 per capita was set at that time and has never been updated since, though it is still used today. If the value of $2 per capita is adjusted for inflation, it increases to $9.38 in 2012 dollars.

Also in 1974, Ottman and Kielbaso (1976, 5) conducted the first nation-wide survey of municipal urban and community forestry programs and found an average of $1.63 was spent on urban forestry activities per capita. In 1980[22] the average had increased to $2.19 per capita. In 1986[23] the average had increased to $2.60 per capita. And in 1994 (Tschantz and Sacamano 1995, 199) the average had decreased slightly to $2.49 per capita.

2.2 Expenditures on Urban Forestry Activities per Tree

The Expenditures on Urban Forestry Activities per Tree subcategory considers the total amount of money a community spends on urban forestry activities per tree. Ottman and Kielbaso (1976, 5) found the nation-wide average across cities of all population categories to be $8.70 per tree. In 1980[24] the average had increased to $10.78 per tree. And in 1986[25] the average had decreased slightly to $10.62 per tree. This expenditure benchmark was not calculated in Tschantz and Sacamano's (1995) study.

When the expenditure ratings from 1974, 1980, and 1986 are adjusted for inflation[26] to 2012 dollars, the ratings are actually $40.52, $30.40, and $22.25 respectively. Adjusting for inflation reveals a sharp downward trend over time.

2.3 Percentage of Total City Budget Dedicated to Urban Forestry Activities

The Percentage of Total City Budget Dedicated to Urban Forestry Activities subcategory examines the portion of the responding city's total budget dedicated to urban forestry activities. Ottman and Kielbaso (1976, 5) found the nation-wide average across cities of all population categories to be 0.54% of total city budget spent on urban forestry activities. In

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[22] Information in this section sourced from J. Kielbaso, Haston, and Pawl (1982, 253) and Giedraitis and Kielbaso (1982)

[23] Information in this section sourced from J. J. Kielbaso et al. (1988, 5) and J. J. Kielbaso (1990)

[24] Information in this section sourced from J. Kielbaso, Haston, and Pawl (1982, 253) and Giedraitis and Kielbaso (1982)

[25] Information in this section sourced from J. J. Kielbaso et al. (1988, 5) and J. J. Kielbaso (1990)

[26] All inflation adjustments were performed on the U.S. Bureau of Labor Statistics online inflation calculator

1980[27] the average had increased to 0.81%. In 1986[28] the average had decreased to 0.49%. And in 1994 (Tschantz and Sacamano 1995, 199) the average had decreased even further to 0.31%.

3. Assistance from State-level Program[29]

The Assistance from State-level Program category determines the quantity of assistance received by municipalities from the Texas A&M Forest Service.

In a survey of Utah communities, Kuhns et. al. (2005, 287) found that 53% of respondents had sought assistance from Utah State University County Extension service and 36% had sought assistance from the state-level urban and community forestry program, Forestry, Fire and State Lands – Urban and Community Forestry. However, the study stopped short of attempting to categorize and collect data on the types of assistance received.

In a study of municipal urban and community forestry programs, Ries et al. (2007) utilized a survey to gather data that asked similar questions regarding how much assistance was received. However, whereas Ries et al. utilized at least seven specific examples of assistance, this study will utilize three broad categories of assistance: Financial, Technical, and Educational and Training.

In a study of Illinois municipal urban and community forestry programs that distributed a survey to collect information, Schroeder et al. (2003) asked questions about what type of state assistance was desired. The most frequent answer was assistance in "applying for community forestry grant funds" which represents a need for both technical advice in applying for the grant and the financial assistance the grant would provide if awarded. Other frequent answers included occasional access to a trained forester (technical assistance), workshops for employees and volunteers (educational assistance), and assistance in conducting tree inventories (technical assistance).

Assistance comes in the form of financial aid such as grants, technical advice on developing critical program elements, or education and training. Targeted assistance from Texas A&M

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[27] Information in this section sourced from J. Kielbaso, Haston, and Pawl (1982, 253) and Giedraitis and Kielbaso (1982)

[28] Information in this section sourced from J. J. Kielbaso et al. (1988, 5) and J. J. Kielbaso (1990)

[29] Information sources in this category include the Author's 5 years of experience working as a professional municipal forester, working closely with the State Urban Forestry Program of both Indiana and Texas.

Forest Service may be necessary for the successful implementation of critical program elements. Results will likely show that communities with dedicated urban forestry staff receive all three types of assistance and advice from Texas A&M Forest Service more often than those communities without dedicated staff, regardless of City population. Financial aid is likely targeted towards small and medium sized communities, instead of larger ones; one or two grants a year, in addition to scholarships to attend conferences would be on the high end. Technical advice is the most easily accessible of the three service types since the cost is free and minimally requires only a phone call or email; communities with newly established programs likely reach out five or 10 times annually. Education and training programs are likely attended more frequently by those communities with larger budgets; there is the potential for one employee to attend three or four conferences annually.

3.1 Financial Assistance

The Financial Assistance subcategory examines the quantity of financial assistance received by the municipality from Texas A&M Forest Service. Since 1991, Texas A&M Forest Service has utilized public outreach grants to distribute over $2.6 million[30] to programs at the local level. Recipients include cities, counties, schools, and non-profit groups. Texas A&M Forest Service also commonly awards scholarships to municipal employees to attend educational workshops and conferences.

3.2 Technical Assistance

The Technical Assistance subcategory examines the quantity of technical assistance received by the municipality from Texas A&M Forest Service. This includes tools developed by the Federal Urban and Community Forestry Program or the National Urban and Community Forestry Advisory Council such as the i-Tree software suite; a set of tools for assessing and managing publicly-owned trees. Texas A&M Forest Service also commonly acts as an advisor when communities are developing tree ordinances or management plans.

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[30] Information in the section was sourced from the Texas A&M Forest Service – Urban Forestry Program website (http://texasforestservice.tamu.edu/main/article.aspx?id=1279 accessed 2-23-13)

3.3 Educational and Training Assistance

The Educational and Training Assistance subcategory records the quantity of education and training received by the municipality from Texas A&M Forest Service. This includes the annual Texas Tree Conference that is co-sponsored by Texas A&M Forest Service, the Texas Chapter of the International Society of Arboriculture, and the Texas Urban Forestry Council. Texas A&M Forest Service also coordinates several one-day workshops and the Oak Wilt Certification program.

4. <u>City Population</u>

The size and components of urban forestry programs vary by city population. Clearly, cities like Dallas have very different needs and resources than smaller municipalities like San Marcos. Hence, city size is used as a descriptive marker. The population of a municipality is a common measure of its size, and is more well-suited for the purposes of this research study than economic activity or physical size measurements such as square miles or road miles. In a state-wide survey of Oregon's municipalities, Ries et. al. (2007) found that urban and community forestry activity increased as population increased. Separating cities into size classes is a common practice in related survey research. This information is necessary to create the variables described in section 2 - Expenditure Benchmarks.

<u>REFINING THE DESCRIPTIVE PICTURE</u>

This study describes characteristics of municipal urban and community forestry (U&CF) programs taking into account multiple dimensions. This section previews the dimensions previously discussed that are paired for descriptive purposes.

5.1 Program Elements X City Size

Program Elements and City Size are compared to demonstrate how the six critical program elements vary according to city size. Ries et al. (2007) found that U&CF program activity increased as city population increased. This finding was consistent with results of other studies of municipal forestry programs by Reeder and Gerhold (1993) and Schroeder et. al. (2003).

Although full-time staff may be out of the reach of smaller communities with small budgets, adoption of a tree ordinance requires only a small amount of research and possibly some technical assistance from the Texas A&M Forest Service. Similarly, advocacy in the form of a tree board or a non-profit group does not depend on the amount of funding available, but only on the will of the constituency.

5.2 Program Elements X Expenditure Benchmarks

Program Elements and Expenditure Benchmarks are compared to show how the six critical program elements vary according to the three expenditure benchmarks. The greater number of critical program elements represented in a municipal forestry program, the more robust and comprehensive its approach to managing the urban forest; but how is the presence of those critical program elements linked to the three expenditure benchmarks? This comparison demonstrates how critical program elements such as those utilized in some surveys [31] vary according to expenditure benchmarks such as those utilized in other surveys [32] of municipal urban and community forestry programs.

5.3 Program Elements X Assistance

Program Elements and Assistance are compared to display how the six critical program elements vary according to the quantity of assistance received from Texas A&M Forest Service. Does more assistance from Texas A&M Forest Service coincide with the increased presence of the six critical program elements? In a survey of Oregon communities, Ries et. al. (2007) performed a side by side comparison of cities that reported they had received assistance from the state-level program and those that didn't. Those cities that reported they had received assistance clearly showed a greater presence of critical program elements including a tree ordinance, a tree board, and access to qualified staff, when compared to those cities that didn't receive assistance.

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[31] Information in this section was sourced from Schroeder et al. (2003) and Rines (2007)
[32] Information in this section was sourced from Ottman and Kielbaso (1976), Giedraitis and Kielbaso (1982), Kielbaso (1990), and Tschantz and Sacamano (1995).

5.4 Assistance X City Size

Assistance and City Size levels are contrasted to establish how the quantity of assistance received from Texas A&M Forest Service varies according to city size. Do smaller cities lean on Texas A&M Forest Service more often than larger cities for assistance such as grants or advice on technical issues such as ordinance development?

In a survey of Oregon communities, Ries et. al. (2007) used specific examples of the types of assistance respondents reported receiving and compared results across small, medium, and large cities. It was found that large cities reported receiving several examples of assistance more often than medium or small cities such as sending staff to a state-hosted workshop and the annual state-hosted conference, receiving technical advice over the phone or by email, using the state website, and even receiving grant funding.

5.5 Expenditure Benchmarks X City Size

Expenditure Benchmarks and City Size levels are contrasted to determine how each city's score against three expenditure benchmarks vary according to city size. Are larger communities putting more into their municipal forestry program than smaller communities? The three expenditure benchmarks are all relative to the size of each city. This allows for an apples-to-apples comparison of cities of varying sizes. These expenditure benchmarks are utilized in nationwide surveys of municipal urban and community forestry programs conducted by Ottman and Kielbaso (1976), Giedraitis and Kielbaso (1982), Kielbaso (1990), and Tschantz and Sacamano (1995). The results of these previous studies will act as a reference point, but will not contribute to direct comparison.

5.6 Expenditure Benchmarks X Assistance

Expenditure Benchmarks and Assistance compared to show how each city's scores against three expenditure benchmarks vary according to the quantity of assistance received from Texas A&M Forest Service. Do better expenditure benchmark ratings coincide with increased assistance from Texas A&M Forest Service? This cross tabulation table will bridge the gap between the efforts of Ries et. al. (2007) to examine the effects of state assistance and the efforts of Ottman and Kielbaso (1976), Giedraitis and Kielbaso (1982), Kielbaso (1990),

and Tschantz and Sacamano (1995) to compare cities of varying size by creating expenditure benchmark variables.

CONCEPTUAL FRAMEWORK TABLE

This descriptive study uses categories as its conceptual framework (Shields 1998; Shields and Tajalli 2006; Shields and Rangarajan 2013). The descriptive categories organize the characteristics of urban and community forestry programs into four main factors. These factors are derived from the literature review and provide a framework for developing the survey instrument used to collect information on Texas municipalities.

The four key factors are summarized in table 3.1, in addition to the literature which provides the justification for the framework as linked to the appropriate category.

Table 3.1: Conceptual Framework – Descriptive Categories linked to the Literature

Descriptive Categories	Literature
I. U&CF Program Elements	
1.1. Staff Credentials and Certifications	Schroeder at al. 2003, Ries etl al. 2007, Rines 2007, Federal UCF SOAPs Definitions 2012
1.2. Tree Ordinance	Miller 1988, Schroeder at al. 2003, Ries et al. 2007, Rines 2007, Federal UCF SOAPs Definitions 2012
1.3. Advocacy	Miller 1988, Schroeder et al. 2003, Ries et al. 2007, Rines 2007, Federal UCF SOAPs Definitions 2012
1.4. Management Plan	Miller 1988, Schroeder et al. 2003, Rines 2007, Federal UCF SOAPs Definitions 2012, Charles Yoe 2013
1.5. Tree Inventory	Miller and Sylvester 1981, Miller 1988, Reeder and Gerhold 1993
1.6. U&CF Program Position	Johnson 1982, R. Thompson et al. 1994, City Policy Associates 2008
II. National Benchmarks	
2.1. Expenditures on Urban Forestry Activities per Capita	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso et al. 1982, Kielbaso et al. 1988, Kielbaso 1990, Tschantz and Sacamano 1995
2.2. Expenditures on Urban Forestry Activities per Tree	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso et al. 1982, Kielbaso et al. 1988, Kielbaso 1990, Tschantz and Sacamano 1995
2.3. Percentage of Total City Budget Dedicated to Urban Forestry Activities	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso et al. 1982, Kielbaso et al. 1988, Kielbaso 1990, Tschantz and Sacamano 1995
III. Assistance from State-level Program	
3.1. Financial Assistance	Schroeder at al. 2003, Kuhns et al. 2005, Ries et al. 2007
3.2. Technical Assistance	Schroeder at al. 2003, Kuhns et al. 2005, Ries et al. 2007
3.3. Educational and Training Assistance	Schroeder at al. 2003, Kuhns et al. 2005, Ries et al. 2007
IV. City Size	

4. City Population	Ries et al. 2007
Cross Tabulation Tables	Literature
5.1. Program Elements X City Size	Reeder and Gerhold 1993, Schroeder et al. 2003, Ries et al. 2007
5.2. Program Elements X Expenditure Benchmarks	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso 1990, Tschantz and Sacamano 1995, Schroeder et al. 2003, Rines 2007
5.3. Program Elements X Assistance	Ries et al. 2007
5.4. Assistance X City Size	Ries et al. 2007
5.5. Expenditure Benchmarks X City Size	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso 1990, Tschantz and Sacamano 1995
5.6. Expenditure Benchmarks X Assistance	Ottman and Kielbaso 1976, Giedraitis and Kielbaso 1982, Kielbaso 1990, Tschantz and Sacamano 1995, Ries et al. 2007

CHAPTER SUMMARY

In this chapter, the major factors that play a role in a municipal U&CF program were discussed. The four major factors are the six critical program elements, the national expenditure benchmarks, assistance received from Texas A&M Forest Service, and city population. This chapter also previewed the six pairs of factors that will be examined together and represented as cross tabulation tables. The next chapter discusses the specific details of the methodology employed, and presents an operationalization table that shows how each factor is operationalized into a survey question.

IV. METHODOLOGY

The first purpose of this chapter is to discuss the chosen research technique and chosen statistical analysis technique. The second purpose of this chapter is to discuss related survey research. The third purpose of this chapter is to discuss the operationalization and present the operationalization table.

OPERATIONALIZATION

This study utilized a survey instrument directed at municipal urban and community forestry (U&CF) program managers, or other municipal employees, from 241 Texas municipalities. Each question on the survey corresponds to a specific subcategory from the conceptual framework table. See table 4.1 for the details of how the survey questions were constructed.

I.   **Demographics**

The Demographics section of the survey asks questions designed to gather necessary data for two of the categories in conceptual framework; the three expenditure benchmarks and city size (population).

A. **City Population**

The City Population subsection determines the population of the responding city. This information was used to create the expenditure benchmark of total expenditures on urban forestry activities per capita. This information also acts as one of the four categories in the conceptual framework.

B. **City Budget**

The City Budget subsection determines the total budget of the responding city for Fiscal Year 2012. This information was used to create the expenditure

benchmark of total expenditures on urban forestry activities as a percentage of total city budget.

C. U&CF Program Budget

The U&CF Program Budget subsection determines the responding city's total expenditures on urban forestry activities for Fiscal Year 2012. This information was used to create all three expenditure benchmarks. Many large municipalities have a line item budget associated with an urban forestry program or division within a larger department. However responsibility for public trees, and therefore spending on urban forestry activities, may still be spread out across more than one division or department within a city. Many small municipalities don't have an established 'program' in the sense of a division of a work unit or department, though they still spend money on urban forestry activities.

For these reasons and more, assessing the actual amount a city spends on urban forestry activities can be difficult. This research study attempted to determine the amount spent on all urban forestry activities in a city, not just one program's budget line item. This practice is also seen in the reporting requirement when applying for Tree City USA status as awarded by the Arbor Day Foundation.

D. Tree Population

The Tree Population subsection determines the total number of publicly-owned urban trees in the responding city. This information was used to create the expenditure benchmark of total expenditures on urban forestry activities per tree. The number of trees a municipal urban and community forestry (U&CF) program is responsible for is critical information when assessing a city's efforts to manage those trees. The scope of properties an U&CF program may have jurisdiction over varies widely from just street trees, to street trees and park trees plus trees in any number of other public spaces including police and fire stations, libraries, airports, golf courses, cemeteries, etc. The most important distinction for the purposes of this research study is between trees that the program is responsible for, and those trees that the program is responsible for and manages as urban trees for risk.

An example would best illustrate this point, because the assessment is subjective and will vary across municipalities. The City of Austin, Urban Forestry Program per city code is responsible for all trees on city-owned property. However, the program's sample inventory includes only street trees and parks trees on which the program regularly performs maintenance while omitting trees located at city-owned cemeteries, golf courses, libraries, police and fire stations, libraries, and the airport. The inventory also omits trees in the approximately 15,000 acres of city-owned greenbelts, nature preserves, wildlife sanctuaries and other natural areas, as well as omitting trees on the approximately 35,000 acres of city-owned watershed protection lands. The sample inventory allows the program to estimate it has approximately 300,000 street and park trees and would likely reply to this inquiry with that number because that is the program's de facto scope of responsibility. That is the number this research study was attempting to determine.

II.   U&CF Program Elements

The U&CF Program Elements section asks questions designed to determine the existence of the six critical U&CF program elements.

A. Staffing Level

The Staffing Level subsection of the survey asks a question designed to determine the quantity of staff at each municipality. 'Staff' is defined as the number of full-time equivalents that are employed to the manage of the urban forest. This question was open-ended, allowing respondents to write in a value of zero or greater in increments of 0.25 referring to the number of full-time equivalents.

B. Tree Ordinance

The Tree Ordinance subsection of the survey asks three questions regarding tree ordinances. The first question is designed to determine if an ordinance exists that prescribes either a tree board or forestry department to write a management

plan; as described in the conceptual framework this is the critical element of a tree ordinance.

This subsection then asks two questions designed to determine the existence of a 'tree ordinance' and the existence of a 'tree protection ordinance'. Both ordinances have been described previously in the conceptual framework, and both are 'yes or no' questions.

C. Advocacy

The Advocacy subsection of the survey asks two questions designed to determine the existence of 1) a tree board or tree commission, and also 2) a non-profit tree advocacy group. Both forms of advocacy have been described previously in the Literature Review chapter, and both are 'yes or no' questions.

D. Management Plan

The Management Plan subsection of the survey asks four questions designed to determine the existence of a management plan and the nature of that management plan. An urban forestry management plan has been described previously in the Literature Review chapter. All four questions are closed-ended, with only two choices each.

E. Tree Inventory

The Tree Inventory subsection of the survey asks six questions designed to determine the existence of a tree inventory, and the nature of that tree inventory. Tree inventories and their significance are described in the conceptual framework. Three questions are asked concerning street tree inventories, and three more questions are asked concerning park tree inventories.

This subsection also asks six questions concerning the nature of maintenance programming in the city; three questions each for streets trees and park trees. The first question asks whether or not the trees are on a proactive maintenance cycle. If the respondent selects 'yes', the next questions ask the length in years of the proactive maintenance cycle and whether the work is performed in-house, contracted out, or a combination of both.

F. U&CF Program Position within the City Structure

The U&CF Program Position within the City Structure subsection of the survey asks several questions designed to determine the location of the U&CF Program within the larger municipal structure. One questions seeks to determine the position of the U&CF Program relative to the top of the organization, while the other question seeks to determine whether the U&CF Program is independent, or housed in another department and if so which one.

III. Assistance from the State

A. Financial Assistance

The Financial Assistance subsection of the survey asks one question designed to determine the quantity of financial assists the responding city has received from the Texas A&M Forest Service – Urban Forestry Program. Financial assistance will be defined as any grant, scholarship, reimbursement, or other mechanism by which money or goods of monetary value (such as trees) pass from Texas A&M Forest Service to the municipality. Assistance from Texas A&M Forest Service on filing a grant application where the money comes from a third party such as the Federal Urban and Community Forestry Program would count as Technical Assistance, not Financial Assistance.

B. Technical Assistance

The Technical Assistance subsection of the survey asks one question designed to determine the quantity of technical assists the responding city has received from the Texas A&M Forest Service – Urban Forestry Program. Examples would include assistance filing a grant application, advice on drafting a tree ordinance, advice on forming a tree commission, a State employee sitting on an interview panel to hire a municipal forester, etc. Attendance at conferences or seminars hosted at least in part by Texas A&M Forest Service would count as Educational Assistance, not Technical Assistance.

C. Educational Assistance

The Educational Assistance subsection of the survey asks one question designed to determine the quantity of educational assists the responding city has received from the Texas A&M Forest Service – Urban Forestry Program. Scholarships to conferences would count as Financial Assistance, not Educational Assistance; though attendance at a conference or seminar hosted at least in part by Texas A&M Forest Service would count as Educational Assistance.

Table 4.1: Operationalization Table

Categories	Survey Questions
I. Demographics	
A. City Population	1) What is the name of your City? (Answer: open-ended)
	2) What is your City's population as of the most recent Census data? (Answer: open-ended and will be the number of the residents in that City)
B. City Budget	3) What was your City's annual budget during fiscal year 2012 in dollars? (Answer: open-ended and will be a dollar value)
C. U&CF Program Budget	4) How much did your City spend during fiscal year 2012 on Urban Forestry activities? (ex: tree planting, tree removals, tree pruning, urban forestry staff, tree care contracts, one-time special projects, etc) (Answer: open-ended and will be a dollar value)
D. Tree Population	5) How many trees are on public property in your City? (Answer: open-ended and will be a value or they will circle Don't Know).
II. U&CF Program Elements	
A. Staffing Level	6) How many full-time equivalent employees (FTEs) are dedicated to urban forestry in your City? (note: increments of 0.25 are acceptable for example an employee who spends half their time on urban forestry responsibilities would be

	0.50)? (Answer: open-ended and will be a value in increments of 0.25)
B. Tree Ordinance	7) Please check all the apply. Does a tree ordinance exist that: A) establishes either a tree board (commission), or a forestry department/urban forester position? (Answer: yes or no or don't know) B) provides guidance on planting, maintaining, and removing trees on public property (planting 10ft from fire hydrants, 20 ft from street corners, etc)? (Answer: yes or no or don't know) C) regulates the removal of large trees on private property (requires a permit)? (Answer: yes or no or don't know) D) requires trees on private property to be protected during construction? (Answer: yes or no or don't know)
C. Advocacy	8) Does a tree board or tree commission currently exist? (Answer: yes or no or don't know) 9) Does a non-profit group currently exist that regularly facilitates or donates tree planting or tree care on public property? (Answer: yes or no or don't know)
D. Management Plan	10) Is a Comprehensive/Master Urban Forest Plan mandated or required by your tree ordinance? (Answer: yes or no or don't know) 11) Does a Comprehensive/Master Urban Forest Plan currently exist? (Answer: yes or no or don't know) 12) If a Plan does exist, was it primarily written by in-house staff or contracted out? (Answer: in-house or contracted or don't know) 13) If a Plan does exist, is it updated regularly (every 2-5 years)? (Answer: yes or no or don't know)

E. Tree Inventory	14) A) Does a street tree inventory exist? (Answer: yes or no or don't know)
	B) If yes, is the street tree inventory a sample or comprehensive inventory? (Answer: sample or comprehensive or don't know)
	C) If yes, was the street tree inventory performed in-house or contracted? (Answer: in-house or contracted or don't know)
	15) A) Are street trees on a proactive maintenance cycle? (Answer: yes or no or don't know)
	B) If yes, how many years in length is the street tree maintenance cycle? (Answer: 3, 4, 5, 6, 7, or other open-ended, or don't know)
	C) Is street tree maintenance contracted, in-house, or both? (Answer: in-house or contracted or both or don't know)
	16) A) Does a park tree inventory currently exist? (Answer: yes or no or don't know)
	B) If yes, is the park tree inventory a sample or comprehensive inventory? (Answer: sample or comprehensive or don't know)
	C) Was the park tree inventory performed in-house or contracted? (Answer: in-house or contracted or don't know)
	17) A) Are park trees on a proactive maintenance cycle? (Answer: yes or no or don't know)
	B) If yes, how many years in length is the park tree maintenance cycle? (Answer: 3, 4, 5, 6, 7, or other open-ended, or don't know)
	C) Is park tree maintenance contracted, in-house, or both?
F. U&CF Program Position within the City	18) Counting up, if the Mayor/City Manager is #1, what number is the employee in charge of trees on public property? (for example: mayor #1, parks director #2, urban forester #3 - the answer would be 3) (Answer: 1, 2, 3, 4, 5, 6, 7, or other open ended or don't know)

	19) Where is the individual housed who is responsible for trees on public property? (Answer: Public Works Dept., or Parks and Recreation Dept., or Parks, Recreation, and Forestry Dept., or Street Dept. or Urban Forestry Department or other open ended or don't know)
III. Assistance from State-level Program	
A. Financial Assistance	20) In FY 2012, how many times has your U&CF Program received financial assistance from the Texas A&M Forest Service – Urban Forestry Program? (Answer: open ended value of the number of times assistance was received)
B. Technical Assistance	21) In FY 2012, how many times has your U&CF Program received technical assistance or advice from the Texas A&M Forest Service – Urban Forestry Program? ? (Answer: open ended value of the number of times assistance was received)
C. Educational and Training Assistance	22) In FY 2012, how many times has your U&CF Program received educational or training assistance from the Texas A&M Forest Service – Urban Forestry Program? (ex. Number of employees to attend annual conference) (Answer: open ended value of the number of times assistance was received)

HUMAN SUBJECTS PROTECTION

This study was reviewed by Becky Northcut, Director of Research Integrity and Compliance at Texas State University and was granted an exemption from full IRB review. See appendix A.

RESEARCH TECNIQUE

The research technique chosen for this research study was a survey which was built on the operationalization **Table 4.1** previously discussed. This instrument allowed for the collection of data from practitioners who have first-hand knowledge that isn't available to outside observers. Therefore, a survey that asks the practitioners questions directly is the only way this information could have been collected. The population was Texas municipalities.

A mailing list was developed by referencing two professional organization directories: the Texas Recreation and Parks Society and the Texas City Management Association. The survey was hosted on the website www.surveymonkey.com. The recipients generated from those two professional membership directories included 411 city managers, parks department directors and other executive-level parks department staff, and municipal foresters. Survey recipients in the Medium, Large, and Mega city size categories were not randomly chosen; an attempt was made to email the survey link to all Texas cities that would be classified in those size categories of which there are 70, 26, and 6 respectively. However, email addresses could only be secured for 50, 22, and 4 cities. Survey recipients representing 165 cities in the Small city size category were chosen at random from both of the previously mentioned professional membership directories.

The Texas A&M Forest Service – Urban Forestry Program was also contacted in an attempt to add as many municipal foresters to the mailing list as possible. This resulted in about 30 municipal foresters. Ultimately, a link to the survey was emailed to 441 various municipal employees representing 241 unique cities.

Figure 4.1 below shows the timeline over which survey recipients responded to the survey. The survey was open for about 17 days from February 20, 2013 until it was closed on March 9 2013. After each mailing, responses spiked then quickly plateaued.

Many of the related research studies found in the review of the literature analyze results within and across categories based on city population. Three population categories is the most common approach, with the category criteria varying from state to state. For Oregon communities, Ries et. al. (2007) created the following categories: small (<5,000), medium (5,000 – 25,000), and large (>25,000). For Utah communities, Kuhns et. al. (2005) utilized the following categories: small (<10,000), medium (10,000 – 50,000), and large (>50,000).

Texas is the second most populous state in the United States with a 2011 estimate of more than 25.5 million residents and more than 1,800 census designated places (U.S. Census Bureau). The size and scope of Texas may necessitate more than three city population categories. For a nation-wide survey, Kielbaso et. al.(1988) created nine categories with the smallest being 2,500 – 4,999 and the largest being >1,000,000. For Missouri, Treiman and Gartner (2004) created two categories for villages (<5,000 and 5,001 – 10,000) and seven categories for cities with the smallest being <5,000 and the largest being >250,000.

Texas is the second most populous state in the United States with a 2011 population estimate of more than 25.5 million residents and more than 1,800 census designated places[33]. The size and scope of Texas required more than three city size (population) categories. The survey required respondents to self-report their city's size, but not self-report into a size category. The four city size categories for this research study were Small (<29,000), Medium (30,000 – 99,999), Large (100,000 – 499,999), and Mega (>500,000).

Figure 4.1 – Survey Response Timeline

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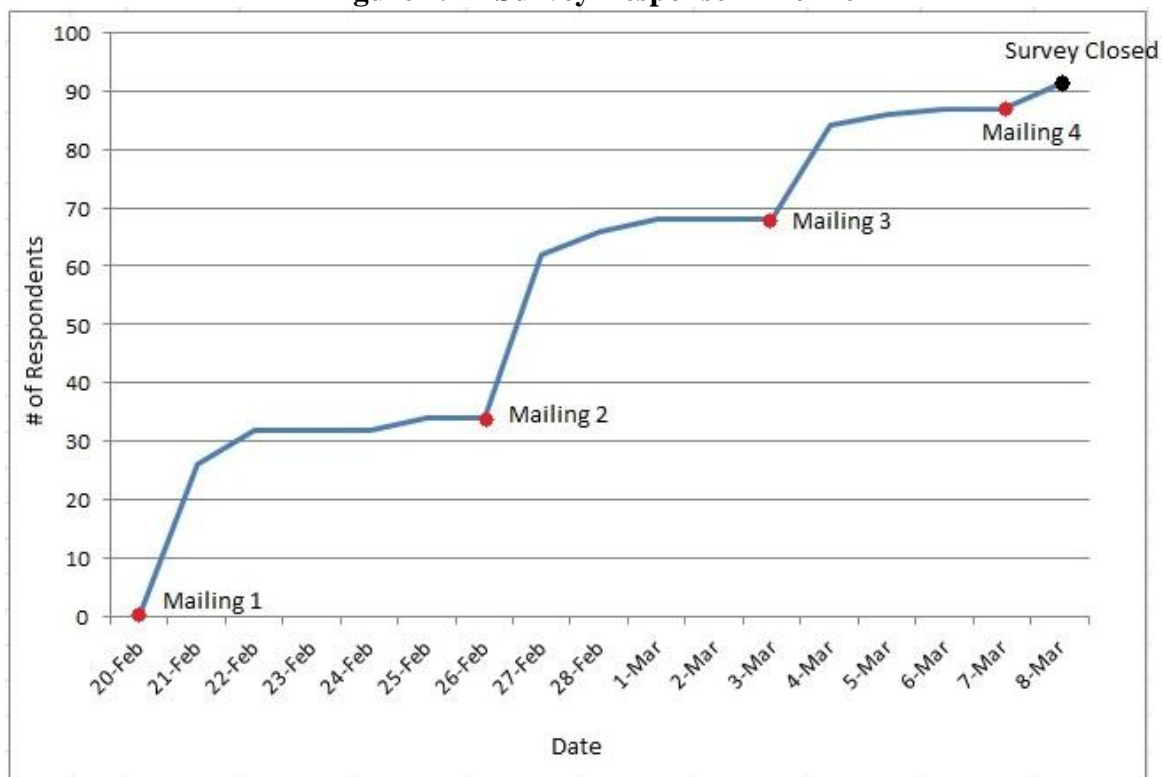
[33] This information was obtained from the United States Census Bureau (www.census.gov accessed 11/27/13)

CHAPTER SUMMARY

In this chapter, the chosen methodology was discussed in depth including the research instrument (survey) and the mailing list. This chapter also discussed previous research studies that utilized techniques similar to this research study. Finally an operationalization table was presented that links the literature to the data collection tool (a survey). The next chapter discussed the results of the survey.

V. RESULTS

This chapter presents the findings of the Texas municipal forestry program survey. This data addresses the foundation of this research study: describing how critical elements of a municipal urban and community forestry program vary according to city size, expenditures, and assistance from Texas A&M Forest Service.

1. DESCRIPTION OF RETURNED SURVEYS

The survey was sent to 441 Texas city managers, parks department directors and other executive-level parks department staff, and municipal foresters in 241 unique cities. Surveys were returned from 81 unique cities for a response rate of about 34% at the city level. Surveys were returned from 93 individuals for a response rate of about 21% at the individual level. Where more than one survey was returned representing the same city, duplicate responses were consolidated or eliminated. Responses from the city manager level tended to have more thorough information regarding budget questions while responses from department-level staff had more thorough information about program questions. Distributing surveys to city managers was intended to reduce potential bias by soliciting responses from more non-experts. While almost all department-level staff are also not urban forestry experts, they are more likely to directly manage urban forestry programs and urban forestry employees and so may be influenced through that greater proximity.

Responding cities ranged in size (population) from Hickory Creek at 3,200 residents to Houston at over 2.1 million residents. The size category of Small Cities (0 – 29,999) holds 38 cities, Medium Cities (30,000 – 99,999) holds 26 cities, Large Cities (100,000 – 499,999) holds 14 cities, and Mega Cities (500,000 and up) holds 4 cities. There are only a total of 6 cities in Texas that would classify as Mega Cities; Austin, Dallas, Houston, and San Antonio all responded to this survey while El Paso and Fort Worth did not for a response rate of 66.7% in that city size category. It is common knowledge in the Texas municipal forestry community that El Paso and Forth Worth each have at least one highly-trained urban forestry employee; however their email addresses were not successfully acquired during a moderate attempt via internet

searching and city website browsing. The survey was instead sent to parks department officials in both El Paso and Fort Worth which did not result in a survey response. **Table 5.1** shows population sampling rates and survey response rates for all city size categories.

Table 5.1 – Population Sampling Rates and Survey Response Rates by City Size

City Size	Category Population	Number Surveyed	Number Returned	Population Sampled (%)	Response Rate (%)
Small	1750	165	37	2.1	22.4
Medium	70	50	26	37.1	52.0
Large	26	22	14	53.8	63.6
Mega	6	4	4	66.7	100.0
All Sizes	1852	241	81	4.4	33.6

2. PROGRAM ELEMENTS

2.1 Staffing Levels

The quantity of staff dedicated to urban forestry activities increases as city size increases. **Table 5.2** shows that small cities had an average of 1 staff member dedicated to urban forestry activities; 12 of the 30 respondents in the small city size category indicated they have no staff dedicated to urban forestry activities at all while 5 of those 30 respondents replied they have a staff member with responsibilities split between urban forestry and something else, resulting in a 0.25, 0.50, or 0.75 full-time equivalent (FTE) calculation. Highland Park (pop. 8,842) is the smallest city to have at least 1 staff member dedicated to urban forestry activities.

In the Mega size category, Austin and Dallas each responded they have 35 dedicated staff members; this is the greatest number of staff recorded overall. San Antonio said they have 30 staff members and Dallas said they have 15 staff members.

The Population per Staff ratio in **Table 5.2** is an average of how many residents exist in a city compared to how many staff are dedicated to urban forestry activities in that city. There were no cities in the Large or Mega size categories that indicated they totally lack staff dedicated to urban forestry activities, however Frisco (Large category) had the single greatest Population per Staff ratio at about 263,000 (only 0.50 dedicated staff for a city with a population of 131,800). This exceeds the average Population per Staff ratio for the Large size category by

almost 400% and exceeds the next highest Population per Staff ratio by almost 100,000; Grand

Prairie (pop. 169,350) has a ratio of 169,350.

Table 5.2 – Average Number of Staff Dedicated to Urban Forestry Activities

City Size	Respondents	Average Staff	Capita per Staff
Small	30	1	8,608
Medium	18	1.4	46,181
Large	12	4.9	67,427
Mega	4	28.8	60,764
Overall	64	3.8	33,859

The Population per Staff ratios for the Medium, Large, and Mega size categories are all

relatively similar at between about 46,000 and 67,500; the weighted mean of the Population per

Staff ratio of these three size categories is about 55,000.

2.2 Ordinances

The survey asked respondents to indicate which if any of four key tree ordinance

components exist in their city. As discussed in the Literature Review chapter, a tree ordinance

should mandate the creation of a tree board and/or an urban forester position and outline

regulations and standards of care affecting trees on public property. Some communities even

regulate the removal of large trees on private property and regulate construction activities near

large trees on private property to prevent accidental damage.

Table 5.3 – Average Number of Cities with Four Key Tree Ordinance Components by City Size

City Size	Respondents	Tree Board or Employee (%)	Provide Guidance (%)	Regulate Private Trees (%)	Require Construction Protection (%)
Small	37	32.4	40.5	32.4	37.8
Medium	26	42.3	84.6	46.2	53.8
Large	14	64.3	50.0	57.1	57.1
Mega	4	50.0	75.0	75.0	75.0
Overall	81	42.0	58.0	43.2	48.1

Table 5.3 shows that an overall average of about 42% of responding cities indicated they have an ordinance that either establishes a tree board, or establishes an urban forestry department or employee position. About 57% of cities in all size categories responded that their ordinance provides guidance and/or standards of care regarding the maintenance of trees on public property, including almost 85% of Medium size category cities. Regulations regarding both the removal of trees on private property and the protection of trees on private property during construction increases as city size increases.

The only cities in the Small size category to indicate they possess all four key tree ordinance components are Kennedale and Southlake. There are 5 cities in the Large size category possessing all four components including Frisco. In the Mega size category both Austin and San Antonio possess all four key tree ordinance components. Houston's ordinance lacks a mandated tree board or required forestry employee, as well as a failure to require protection of trees on private property during construction activities. Dallas has only one - the requirement to protect trees on private property during construction activities.

2.3 Advocacy

The survey asked respondents two questions regarding advocacy for urban forestry activities in their community. As discussed in the Literature Review chapter, advocacy is critical to an urban and community forestry (U&CF) program because advocates help staff communicate and network in methods and forums where staff is prohibited from doing so. This plays an especially important role where advocates lobby high-level city officials concerning budget and staffing decisions in favor of the U&CF program. Advocates also help raise awareness of urban forestry activities in the community, as well as directly contributing to projects in several ways including coordination and fund raising. About 40% of all responding cities indicated they have a tree board or tree commission and about 40% of all responding cities indicated they work with a non-profit group that regularly facilitates or donates tree planting or tree care on public property in their community.

Table 5.4 clearly shows that the average number of cities featuring these two advocacy components increases as city size category increases. In the Mega city size category, San Antonio is the only city that doesn't currently have a tree board or tree commission, while all

cities in that size category possess a non-profit group. Addison and West University Place are the only two cities in the Small size category that responded that they possess both a tree board and a non-profit group.

Table 5.4 – Average Number of Cities with a Tree Board/Commission or a Non-profit Group

City Size	Tree Board		Non-profit Group	
	Resp.	**(%)**	**Resp.**	**(%)**
Small	37	29.7	37	29.7
Medium	26	38.5	26	38.5
Large	13	61.5	12	58.3
Mega	4	75.0	4	100.0
Overall	80	40.0	79	40.5

2.4 Management Plans

The survey asked respondents several questions about Comprehensive/Master Urban Forest Plans which, as discussed in the Literature Review, are critical to urban and community forestry programs because they set goals and priorities for staff to work towards which allows for efficient allocation of time and resources. Staff can also utilize those goals to identify gaps in service delivery and the associated gaps in funding, which enables better-justified budget requests. Goals and their reporting mechanisms enable staff to show concrete progress and accomplishments, which can help an urban and community forestry program preserve funding during budget cuts.

Positive responses were lower in this section than in any other of the six critical program elements; Comprehensive/Master Urban Forest Plans are indeed hard to come by. **Table 5.5** shows that only about 13% of all responding cities indicated they currently have a Plan including no cities at all in the Mega size category even though Austin has had a requirement for one stated in its public tree ordinance for over 20 years. Apart from Austin, the only other respondent that has an unfulfilled requirement is Hickory Creek, the smallest responding city at a population of 3,200; all other cities which are required to have a Plan currently have one in place. Cities in the Large size category had the highest average number of Plans in existence at about 33%, even though only about half that many have an ordinance-based mandate or requirement for a Plan.

Table 5.5 – Average Number of Cities with an Ordinance Requirement/Mandate for a Comprehensive/Master Urban Forest Plan and Average Number of Cities where such a Plan Exists

City Size	Plan Mandated?		Plan Exist?	
	Resp.	(%)	Resp.	(%)
Small	35	8.6	37	8.1
Medium	25	0.0	25	12.0
Large	12	16.7	12	33.3
Mega	4	25.0	4	0.0
Overall	76	7.9	78	12.8

Of those communities of any size category that do have a Plan, 60% indicated it was written primarily in-house while 40% indicated that responsibility was contracted out. Of those same communities, 80% responded that their Plan is updated every 5 years or more often, while 20% admitted their Plan is not updated regularly.

2.5 Street and Park Tree Inventories

The survey asked respondents a series of questions concerning both street tree and park tree inventories which, as discussed in the Literature Review chapter, are critical to urban and community forestry programs because "management of any resource begins with an inventory of that resource, and urban forest management is no exception" (Miller 1988, 87). Urban and community forestry programs utilize tree inventories for efficient budgeting, routing, planning, and scheduling.

Table 5.6 shows that of all responding cities, only about 20% indicated they currently have a street tree inventory and only about 22% indicated they currently have a park tree inventory. The average number of cities with either a street tree or park tree inventory increases as population increases, with only one exception where the average number of Mega size category cities with a park tree inventory is less than the average for the Large size category.

Table 5.6 – Average Number of Cities with Tree Inventories and Proactive Maintenance Cycles

City Size	Street Tree Inventory		Proactive Street Tree Maintenance Cycle		Park Tree Inventory		Proactive Park Tree Maintenance Cycle	
	Resp.	(%)	Resp.	(%)	Resp.	(%)	Resp.	(%)
Small	36	11.1	34	44.1	35	11.4	34	61.8
Medium	25	16.0	22	59.1	23	21.7	24	58.3
Large	11	45.5	12	50.0	12	50.0	12	75.0
Mega	4	50.0	4	0.0	4	25.0	4	0.0
Overall	76	19.7	72	47.2	74	21.6	74	59.5

As discussed in the Literature Review, proactive tree maintenance cycles where trees are regularly pruned every 4 or 5 years have been shown to provide the greatest economic benefit to a municipality (Miller and Sylvester 1981). This survey asked respondents a series of questions regarding proactive maintenance cycles of both street trees and park trees. Of all responding cities, about 47% indicated their street trees are on a proactive maintenance cycle with an average cycle length of 3.1 years. Almost 62% of all respondents utilize both contractors and in-house staff to perform proactive street tree maintenance, about 32% use in-house staff exclusively and about 6% use contractors exclusively. Almost 60% of Medium size category respondents currently have their street trees on a proactive maintenance cycle.

Of all responding cities, almost 60% indicated their park trees are on a proactive maintenance cycle with an average cycle length of 4.0 years. About 60% utilize both contractors and in-house staff to perform proactive park tree maintenance, and about 40% utilize exclusively in-house staff; no respondents use contractors exclusively to perform proactive park tree maintenance. Almost 62% of respondents in the Small size category and 75% of respondents in the Large size category currently have their park trees on a proactive tree maintenance cycle. No respondents at all in the Mega city size category indicated that either their street trees or their park trees are on any kind of proactive cycle.

2.6 Position and Location of Urban Forestry Program

One potential flaw in the distribution strategy of this survey is the failure to directly solicit public works department directors and other public works executive-level staff. As a result, urban forestry programs that reside in parks departments may be overrepresented in this

survey, while urban forestry programs that reside in public works departments may be underrepresented. Previous nation-wide studies (City Policy Associates 2008) that surveyed municipalities found an almost even split between which department housed the urban forestry program; parks department or public works department. This survey found that 69.3% of respondents indicated their urban forestry program is housed in the parks and recreation department and only 18.7% indicated that their public works department holds primary responsibility.

Table 5.7 – Departments Where Urban Forestry Programs are Located

Department	Respondents	Percent
Parks and Recreation Dept.	52	69.3
Public Works Dept.	14	18.7
Combined Responsibilities between both Parks and Public Works	4	5.3
Other	5	6.7
Total Respondents	75	100.0

Table 5.7 shows that together, Parks and Recreation and Public Works house the urban forestry program 88% of the time, with responsibilities being shared between those two departments another 5.3% of the time. The other 6.7% consisted of write-in answers such as Land Use and Planning type departments and others. Not one single instance of an independent Urban Forestry Department was recorded.

Table 5.8 – Position in Organization Relative to City Manager or Mayor

City Size	Respondents	Average
Overall	65	3.9
Small	29	3.4
Medium	21	3.8
Large	11	4.9
Mega	4	5

As discussed in the Literature Review chapter, the position of the urban and community forestry program within the city structure is directly related to perceived relevance which plays a key role in budget decisions. The survey asked respondents 'counting up, if the Mayor/City Manager is #1, what number is the employee in charge of trees on public property? (for example:

mayor #1, parks director #2, urban forester #3 - the answer would be 3).” **Table 5.8** shows that the average distance from the City Manager or Mayor increases as city size increases. These results are not surprising.

3. EXPENDITURE BENCHMARKS

As discussed in the Literature Review chapter, expenditure benchmarks allowed this research study to compare cities of varying sizes (population) against each other relative to their expenditures on urban forestry activities. This survey asked respondents a series of questions about the size of their city, their expenditures on urban forestry activities for fiscal year 2012 and their total annual city budget for fiscal year 2012. The two expenditure benchmarks represented in the cross tabulation table below are expenditures on urban forestry per capita ($ per capita) and expenditures on urban forestry as a percentage of the total city budget (% of total budget).

This survey also asked respondents ‘how many trees are on public property in your city?’ Of all questions asked of respondents in this entire survey, this question had the single poorest response rate at about 25% (22 of 82 respondents). The purpose of asking this question was to gather the necessary data to calculate the third expenditure benchmark discussed in the Literature Review chapter of ‘expenditures on urban forestry activities per public tree’ and abbreviated as ‘$ per tree’. As this response rate was significantly lower than all other response rates in the entire survey, $ per tree is omitted here from cross tabulation **Table 5.9a** and **Table 5.9b** because it would not be worthwhile to describe how Program Elements vary according to a poorly supported average of an expenditure benchmark. However, $ per tree is included later in this chapter in **Table 5.11** and **Table 5.14**.

Based on the answers to survey questions mentioned above, expenditure benchmark ratings were then calculated based on that information and are represented below in cross tabulation **Table 5.9a and 5.9b** compared against how those cities meet the definitions of the 2012 Federal Urban and Community Forestry Program’s SOAPs and this research study’s definition of tree inventory (support by the literature), as both are discussed in the Literature Review chapter.

Table 5.9a – How Program Elements vary according to Expenditure Benchmarks

Benchmark	Percent with at least 0.25 FTEs (staff)		Percent with Tree Ordinance		Percent with Advocacy - Board		Percent with Advocacy - Non-Profit Group	
	Reporting	(%)	Reporting	(%)	Reporting	(%)	Reporting	(%)
$ per Capita								
<$2	26	65.4	33	60.6	33	36.4	33	45.5
$2 - $9	23	91.3	26	69.2	26	65.4	25	52.0
>$9	9	88.9	9	66.7	9	33.3	9	33.3
Overall	58	79.3	68	64.7	68	47.1	67	46.3
Total % of Budget								
<0.001	18	61.1	22	54.5	22	31.8	22	50.0
.0011 - .0099	29	86.2	31	67.7	31	61.3	31	51.6
>0.01	8	87.5	8	62.5	8	50.0	8	37.5
Overall	55	78.2	61	62.3	61	49.2	61	49.2

Table 5.9a shows that cities with expenditures per capita ($ per capita) on urban forestry activities of between $2 and $9 had the highest averages of meeting minimum requirements (per Federal UCF Program SOAPs) in the categories of Staff, Tree Ordinances, and both Advocacy components; Advocacy – tree board and Advocacy non-profit group. These same cities also had the highest averages of meeting this research study's definition (supported by the literature) of a street tree inventory and a park tree inventory (**Table 5.9b**). In all these instances, cities in the $2- $9 per capita group outperformed the higher spending group of greater than $9 per capita cities; however the greater than $9 per capita group did outperform the $2 - $9 per capita group by almost 300% in meeting minimum requirements (per Federal UCF Program SOAPs) in the category of Management Plans.

Table 5.9b shows that cities that spend greater than .01% of their total city budget (Total % of Budget) on urban forestry activities outperformed all other respondents by about 400% or more in meeting minimum requirements (per Federal UCF Program SOAPs) in the category of Management Plans.

Table 5.9b – How Program Elements vary according to Expenditure Benchmarks

Benchmark	Percent with Management Plan Reporting	(%)	Percent with Street Tree Inventory Reporting	(%)	Percent with Park Tree Inventory Reporting	(%)	Position Average
$ per Capita							
<$2	32	6.3	31	16.1	32	9.4	3.6
$2 - $9	25	16.0	25	40.0	24	45.8	4.3
>$9	9	44.4	8	0.0	8	12.5	4.3
Overall	66	15.2	64	23.4	64	23.4	3.9
Total % of Budget							
<0.001	21	4.8	20	10.0	21	19.0	3.8
.0011 - .0099	31	12.9	31	32.3	30	33.3	4.0
>0.01	8	50.0	7	14.3	7	0.0	4.1
Overall	60	15.0	58	22.4	58	24.1	3.9

4. ASSISTANCE FROM THE STATE

As discussed in the Literature Review chapter, the Texas A&M Forest Service assists local-level urban and community forestry programs through three primary categories: Financial assistance, Technical advice, and Educational assistance and training. This survey asked respondents the quantity of assistance received from Texas A&M Forest Service in each of the three categories. These results are represented below in cross tabulation **Table 5.10a and 5.10b** compared against how those cities meet the minimum Program Element requirements of the 2012 Federal Urban and Community Forestry Program's SOAPs and this research study's definition of tree inventory (supported by the literature), as both are discussed in the Literature Review chapter.

Cities that did receive Financial assistance from Texas A&M Forest Service had a higher average of meeting the minimum requirements (per Federal UCF Program SOAPs) in the Program Elements categories of Staff, Tree Ordianances, Advocacy – Tree Board (**Table 5.10a**). Those same cities also had a higher average of meeting minimum Federal requirements in the category of Management Plans by over 400%, and had a higher average of meeting this research study's definition of Street and Park Tree Inventories (**Table 5.10b**). Only one Program Element was inconsistent; cities that didn't receive Financial assistance from Texas A&M Forest Service

had a slightly higher average (about 30%) of meeting Federal requirements in the Program Element category of Advocacy – Non-Profit Group than those cities that did receive Financial assistance (about 29%).

Table 5.10a – How Program Elements vary according to Receiving Assistance from the State

Assistance	Percent with at least 0.25 FTEs (staff)		Percent with Tree Ordinance		Percent with Advocacy - Board		Percent with Advocacy - Non-profit Group	
	Reporting	(%)	Reporting	(%)	Reporting	(%)	Reporting	(%)
Financial								
Did	7	100.0	7	71.4	7	42.9	7	28.6
Didn't	33	69.7	44	50.0	44	31.8	44	29.5
Technical								
Did	28	92.9	30	63.3	30	50.0	30	50.0
Didn't	21	57.1	29	41.4	29	27.6	29	17.2
Educational								
Did	25	92.0	28	67.9	28	57.1	28	39.3
Didn't	23	65.2	30	43.3	30	30.0	30	26.7

In both groups of cities that did receive Technical advice or did receive Educational assistance and training, those cities that did receive assistance from Texas A&M Forest Service outperformed those cities that didn't receive assistance in all Program Element categories; both Federal SOAPs minimums and definitions outlined by this research study.

Cross tabulation **Table 5.11** shows that in expenditure benchmarks '$ per capita' and 'total % of city budget', those cities that did receive assistance from Texas A&M Forest Service outperformed those cities that didn't receive assistance, in all three assistance groups; Financial, Technical, and Educational. The expenditure benchmark of $ per tree is included here, despite the previously mentioned poor response rates on survey questions that contribute to the calculation of this expenditure benchmark.

Table 5.10b – How Program Elements vary according to Receiving Assistance from the State

	Percent with Management Plan		Percent with Street Tree Inventory		Percent with Park Tree Inventory		Position	
Assistance	Reporting	(%)	Reporting	(%)	Reporting	(%)	Reporting	Average
Financial								
Did	7	42.9	7	28.6	7	57.1	7	4.7
Didn't	44	9.1	44	11.4	43	11.6	35	3.7
Technical								
Did	30	16.7	30	30.0	28	28.6	28	4.0
Didn't	29	10.3	29	6.9	29	10.3	24	3.8
Educational								
Did	28	21.4	28	35.7	27	29.6	27	4.1
Didn't	30	10.0	30	3.3	30	6.7	24	3.6

Table 5.11 – How Expenditure Benchmarks vary according to Receiving Assistance from the State

	$ per Capita		$ per Tree		% of City Budget	
Assistance	Reporting	Average	Reporting	Average	Reporting	Average
Financial						
Did	7	$10.01	2	$96.04	7	1.05%
Didn't	36	$4.24	10	$36.75	31	0.36%
Technical						
Did	29	$6.14	12	$27.93	28	0.53%
Didn't	22	$3.68	6	$59.02	18	0.34%
Educational						
Did	27	$6.96	10	$36.61	26	0.73%
Didn't	25	$2.87	7	$51.42	21	0.25%

5. CITY POPULATION

As discussed in the Literature Review chapter, urban and community forestry activity often increases as city size (population) increases. Urban and community forestry activity can be measured by the existence of the six critical Program Elements and are represented in cross tabulation **Table 5.12a and 5.12b** compared against city size. **Table 5.12a** shows that as city size increases, the average number of cities meeting minimum Federal requirements increases in the Program Elements categories of Staff, Tree Ordinance, and Advocacy; both advocacy – tree board and advocacy non-profit group. **Table 5.12b** shows a similar trend between Small, Medium, and Large size category cities across the Program Elements categories of Management Plans and both Street and Park Tree Inventories. However, **Table 5.12b** shows that Mega size category cities completely fail to meet Federal minimum requirements for Management Plans and have a poorer average rate of compliance than Large cities in the category of Park Tree Inventories.

Table 5.12a – How Program Elements vary according to City Size

City Size	Percent with at least 0.25 FTEs (staff)			Percent with Tree Ordinance		Percent with Advocacy – Board		Percent with Advocacy – Non-profit Group	
	Reporting	(%)	Population per Staff	Reporting	(%)	Reporting	(%)	Reporting	(%)
Small	17	56.7	8,608	38	39.5	37	29.7	37	29.7
Medium	13	72.2	46,181	26	84.6	26	38.5	26	38.5
Large	12	100.0	67,427	14	50.0	13	61.5	12	58.3
Mega	4	100.0	60,764	4	75.0	4	75.0	4	100.0
All Cities	46	71.9	33,859	82	57.3	80	40.0	79	40.5

Table 5.12b – How Program Elements vary according to City Size

City Size	Percent with Management Plan		Percent with Street Tree Inventory		Percent with Park Tree Inventory		Position from top leadership	
	Reporting	(%)	Reporting	(%)	Reporting	(%)	Reporting	Average
Small	37	8.1%	36	11.1%	35	11.4%	29	3.4
Medium	25	12.0%	25	16.0%	23	21.7%	21	3.8
Large	12	33.3%	11	45.5%	12	50.0%	11	4.9
Mega	4	0.0%	4	50.0%	4	25.0%	4	5.0
All Cities	78	12.8%	76	19.7%	74	21.6%	65	3.9

Table 5.13 shows that the average number of cities in the size categories of Small, Medium, and Large that received any assistance from Texas A&M Forest Service during fiscal year 2012 increases as city size increases. The average number of times those same cities received assistance also increases as city size increases. The average number of cities in the Mega size category that received any assistance and the average number of times those cities received assistance is very similar to the results of the cities in the Large size category.

Table 5.13 – How Receiving Assistance from the State varies according to City Size

City Size	Financial Assistance			Technical Assistance			Educational Assistance		
	Reporting	(%)	Av. Times	Reporting	(%)	Av. Times	Reporting	(%)	Av. Times
Small	26	7.7	0.1	28	32.1	1.0	26	30.8	0.7
Medium	13	7.7	0.2	17	52.9	1.5	18	55.6	1.4
Large	9	33.3	0.6	10	90.0	4.0	11	72.7	2.2
Mega	3	33.3	0.7	4	75.0	3.8	3	66.7	3.7
Overall	51	13.7	0.2	59	50.8	1.9	58	48.3	1.3

Cross tabulation **Table 5.14** describes how three expenditure benchmarks vary according to city size, including expenditures per public tree that as previously noted suffered from less than desirable response rates. Small and Large size category cities shared comparable $ per capita rates at $6.71 and $6.21 respectively, while Medium and Mega size category cities shared comparable $ per capita rates at $2.11 and $2.06 respectively. Small and Medium size category cities shared comparably $ per tree rates at $39.06 and $51.78 respectively. Small and Large size category cities shared comparable total % of city budget rates at 0.58% and .00687 respectively.

Mega size category cities had the lowest rates of all three expenditure benchmarks, relative to the other three city size categories.

Table 5.14 – How Expenditure Benchmarks vary according to City Size

City Size	$ per Capita		$ per Tree		Total % of City Budget	
	Reporting	Average	Reporting	Average	Reporting	Average (%)
Small	28	$6.71	7	$39.06	24	0.58
Medium	23	$2.11	7	$51.78	21	0.29
Large	13	$6.21	6	$18.52	12	0.69
Mega	4	$2.06	2	$6.58	4	0.08
Overall	68	$4.78	22	$34.55	61	0.47

CHAPTER SUMMARY

The purpose of this chapter was to present the results of the municipal forestry program survey. The response rates for at least the Medium, Large, and Mega city size categories were such that the results can be generalized across the entire population of Texas cities in those size categories. The next chapter will discuss the highlights of the results as they relate to the purpose of this research study.

VI. CONCLUSION

This chapter provides a summary of the findings of this research study as they relate to the stated purposes of determining how critical elements of urban and community forestry programs vary according to city size, expenditures and assistance from the Texas A&M Forest Service. Also discussed is how current expenditures by Texas municipalities compare to historical benchmarks.

Recommendations for future research are also included. Recommendations are based on the findings of the literature review, the results of the survey conducted for this research study, and the author's 5 years of experience as a professional municipal forester.

SUMMARY OF RESEARCH

This research study describes how six critical municipal forestry program elements in Texas municipalities vary according to city size, expenditures on urban forestry activities, and the quantity of assistance received from Texas A&M Forest Service. Utilizing cross tabulation tables, this study went beyond the original purpose statement by also describing how expenditures on urban forestry activities vary according to city size and the quantity of assistance received from Texas A&M Forest Service, and how the quantity of assistance received from Texas A&M Forest Service varies according to city size.

Highlights
Program Elements

- Tree **Ordinances** and both types of **Advocacy** are relatively common.

- Amount of **Staff** were lower than expected.

- **Management plans** are uncommon. There is a strong connection between high expenditures and having a management plan.

- **Inventories** are uncommon. Many municipalities have their street trees or park trees on a proactive maintenance cycle without an accompanying inventory of those trees.

Expenditure Benchmarks

- **Expenditures per capita** rates are low compared to the findings of related literature and represent a continued downward trend.

- **Expenditures as a percentage of total municipal budget** are lower than most historical benchmarks, especially in Large and Mega cities.

Assistance from Texas A&M Forestry Service

- As city size increases, the average number of cities receiving assistance increases, and the frequency of that assistance also increases; this is true for **all three types of assistance**.

- There is a strong connection between cities which receive **assistance** and cities which have the critical elements of an urban and community forestry program.

Program Elements

The six critical program elements presented in this research study were developed during a review of the literature on municipal forestry programs, and from the author's 5 years of experience as a professional municipal forester. Multiple references in the literature to these six program elements were quite difficult to find, however the response rates to survey questions show that these program elements are relatively common in Texas municipalities.

Ordinances and **Advocacy** both shared high averages. Responses to questions regarding the four key components of tree ordinances and tree protection ordinances ranged from about 40% - 57%. Additionally, about 40% of all responding cities have a tree board and about 40% have a non-profit group that regularly donates or facilitates tree planting or maintenance on public property. Both ordinances and advocacy as described in this research study require absolutely no initial monetary investment; only the volunteered time of concerned stakeholders.

Strong tree ordinances and tree protection ordinances lay the foundation of a solid urban and community forestry program and are usually the first step when a community looks to invest in its urban forest. Ordinances can regulate trees on both public and private property that serves to stop unnecessary loss of existing trees, which is more important than planting new trees when attempting to increase urban forest canopy or improve urban forest health. Strong ordinances also should require the creation of both a tree board composed of concerned and interested stakeholders who volunteer their time, and an urban forester employee position. Requiring a tree

board builds the advocacy component right into city code. Requiring an urban forester employee position in city code helps prevent the loss of that position during tough economic conditions.

Regarding **Staff**, about 40% of responding cities in the Small city size category have at least 0.25 FTEs dedicated to urban forestry activities in their municipality which seems favorable considering many of these small cities likely have fewer than 80 employees total including civil service (police and fire). About 74% of responding cities in the Medium city size category and 100% of responding both Large and Mega size cities have at least 0.25 FTEs dedicated to urban forestry. From the literature, a 'residents per staff' ratio of about 25,000:1 was expected, but the weighted mean was about 55,000:1.

As expected **Management Plans** and **Tree Inventories** were less common overall than **Ordinances**, **Advocacy**, or dedicated **Staff**. Management plans and inventories are more complicated to produce than ordinances or advocacy groups, and almost certainly require dedicated staff. Across the Small, Medium, and Large city size categories, averages of cities with both Plans and Inventories increased as city size increased; Mega size cities don't follow this pattern very closely as 0% have management plans though their performance in the Street Tree Inventory category is highest overall and their performance in the Park Tree Inventory category is second highest overall. Cities in the Large size category dominated the Management Plans category at about 33% and fared well in both Street Tree and Park Tree Inventory categories at about 46% and 50% respectively.

Communities in the highest '**$ per capita**' group (>$9 per capita) were about three times more likely to have a Plan than the middle $ per capita group ($2 - $9 per capita) and about seven times more so than the lowest $ per capita group (<$2). Similarly, communities in the highest '**% of total budget**' group (>1.0%) were about four times more likely to have a **Management Plan** than the middle % of total budget group (0.11% - 0.99%) and about ten times more so than the lowest % of total budget group (<0.1%).

However this pattern of higher expenditures coinciding with increased occurrence of accomplishing a program element didn't hold true for **Inventories**. In both $ per capita and % of total budget, cities in the middle expenditure group were more likely to have either type of tree inventory; in two instances the highest spending group was even outperformed by the lowest spending group.

The results show a strong pattern of an increase in the distance between the city manager or the mayor and the employee in charge of trees on public property. Respondents were asked "counting up, if the Mayor/City Manager is #1, what number is the employee in charge of trees on public property?" The results were an average of 3.4 in Small cities to 5.0 in Mega cities and ranged from nine different cities responding '2' to The Woodlands responding '9'.

Almost 70% of all responding cities indicated their urban forestry program is housed in their Parks and Recreation Department, including 100% of Mega cities and about 84% of Large cities. There were five cities that claimed the primary urban forestry responsibilities in their community are shared by the Parks and Recreation Department and the Public Works Department. Shared responsibilities may be a good choice for municipal forestry programs that struggle with convincing executive leadership to invest in what may appear to be an obscure nature program; if two departments cooperate and invest in urban forestry, they may generate more credibility.

Expenditure Benchmarks

This study's attempt to show how expenditure benchmarks vary according to city size has produced unexpected results as Small and Large cities had very similar '**$ per capita**' ratings (expenditures on urban forestry activities per resident) at $6.71 and $6.21 respectively. These two ratings are higher than any average ratings resulting from the nation-wide research studies of several authors including the highest at $2.60[34] per capita in 1986. However, as discussed in the Literature Review, if the Arbor Day Foundation's 1974 minimum requirement of $2 per capita is adjusted for inflation[35], it increases to $9.38 in 2012 dollars. Only 9 of 68 responding cities (about 13%) of any size category meet or exceed this adjusted value.

Medium and Mega cities had very similar $ per capita ratings at $2.11 and $2.06 respectively which are comparable to the 1980 [36] average of $2.19 per capita. However if the 1980 average is adjusted for inflation[37], it increases to $6.10 in 2012 dollars which means Medium and Mega

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[34] Information in this section was sourced from J. J. Kielbaso et al. (1988, 5) and J. J. Kielbaso (1990)
[35] All inflation adjustments were performed on the U.S. Bureau of Labor Statistics online inflation calculator
[36] Information in this section was sourced from J. Kielbaso, Haston, and Pawl (1982, 253) and Giedraitis and Kielbaso (1982)
[37] All inflation adjustments were performed on the U.S. Bureau of Labor Statistics online inflation calculator

cities in Texas today are both spending about 300% less on urban forestry per capita than the average U.S. city in 1980.

The most obvious pattern that can be described is that on average, Texas cities of any size are spending less on urban forestry per capita today than the average U.S. city was spending at any period previously recorded; 1974, 1980, 1986 and 1994. No clear pattern can be described between city size and ratings in the $ per capita category though it is interesting that Small cities had the highest $ per capita of any city size group.

A clear pattern exists where cities that do receive assistance from Texas A&M Forest Service have higher $ per capita ratings then those cities that don't receive assistance from Texas A&M Forest Service; Financial about 250% greater, Technical about 200% greater, and Educational about 200% greater.

Small and Large cities also had very similar '**% of total budget**' ratings (expenditures on urban forestry activities as a percentage of total city budget) at 0.58% and 0.69% respectively, which both fall in between Ottman and Kielbaso's[38] 1974 overall average of 0.54% and Giedraitis and Kielbaso's[1] 1980 overall average of 0.81% (inflation has no bearing on these ratings).

Medium cities had an average rating of 0.29%, which is lower than the lowest nation-wide overall average ever calculated of 0.31% (Tschantz and Sacamano 1995, 199). Mega cities had an average rating of 0.08%, which is about 4 times lower than the lowest nation-wide overall average which may partly explain all responding Mega cities' total lack of Management Plans and total lack of either street tree or park tree Proactive Maintenance Cycles. Further, Austin is the only Mega city to have indicated that it has both a street tree and a park tree inventory, however both of those are only sample inventories.

A clear pattern exists where cities that do receive **Assistance** from Texas A&M Forest Service have higher % of total budget ratings than those cities with don't receive assistance from Texas A&M Forest Service; Financial about 3 times higher, Technical about 150% greater, and Educational about 300% greater. No clear pattern can be described between city size and ratings in the % of total budget category.

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[38] Information in this section was sourced from Ottman and Kielbaso (1976, 5)

The third expenditure benchmark this study attempted to describe is '**$ per tree**' (expenditures on urban forestry activities per publicly-owned tree). It should be noted that only 22 of 82 respondents answered the survey question 'how many trees are on public property in your city' which was by far the poorest response rate of any question on the survey. Ottman and Kielbaso (1976, 5) found the nation-wide average across cities of all population categories to be $8.70 per tree ($40.52 adjusted[39] 2012), in 1980 [1] the average had increased to $10.78 per tree ($30.40 adjusted 2012), and in 1986 [2] the average had decreased slightly to $10.62 per tree ($22.25 adjusted 2012).

The average **$ per tree** rating for responding cities of all size categories is $34.55 which falls between the 1974 adjusted rating of $40.52 and the 1980 adjusted value of $30.40. Medium cities outperformed all previously recorded benchmarks at $51.78 per tree (7 respondents). Small cities spent $39.06 per tree (7 respondents) and Large cities spent $18.52 per tree (6 respondents). Mega cities (2 respondents) spent an average of $6.58 per tree and thereby failed to outperform any previously recorded $ per tree benchmark, whether adjusted for inflation or not.

Small, Medium, and Large Texas cities are spending on urban forestry at dollar per tree rates comparable to previously recorded benchmarks, while Mega cities are certainly not. Also there was no clear pattern in how $ per tree ratings vary according to the quantity of assistance received from Texas A&M Forest Service. No clear pattern can be described between city size and ratings in the $ per tree category.

Assistance from the State

There is a fairly strong connection between city size and the likelihood of receiving assistance from Texas A&M Forest Service. The average number of cities in a size category that received any assistance at all increased as city size increased. An additional pattern between city size and receiving assistance from Texas A&M Forest Service is that the average number of times assistance was received increased as city size increased. Therefore, it can be said that the greater in size a Texas city is, the more likely it is to receive any assistance from Texas A&M Forest Service, and that it will likely receive assistance more often than a smaller community; this is true for all three types of assistance.

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[39] All inflation adjustments were performed on the U.S. Bureau of Labor Statistics online inflation calculator

There is a strong pattern between a city receiving assistance from Texas A&M Forest Service and those cities which have the **Program Elements**; this speaks towards the primary function of Texas A&M Forest Service program which is to advise municipalities on implementing and maintaining these program elements. Cities that did receive assistance were more likely to have dedicated staff than those that didn't; however this statement (cross tabulation) could be reversed and it could be said that those cities with dedicated staff were more likely to attempt to receive assistance from Texas A&M Forest Service. Regardless, the original statement holds true for the program elements of ordinances, both types of advocacy (board and non-profit), management plans, and both types of inventories (street tree and park tree).

RECOMMENDATIONS FOR FUTURE RESEARCH

These recommendations are based on the findings of the literature review, the results of the survey conducted for this research study, and the author's 5 years of experience as a professional municipal forester.

This research study only attempted to describe facts, not opinions. Numerous research studies found in the literature that describe or examine municipal forestry programs asked practitioners their opinions on different topics using Likert-scale survey questions. This forces the subject to change from facts about municipal forestry programs to the opinions of municipal foresters. Future researchers may need to incorporate elements of both into their studies to address some of the recommendations presented in this section.

This research study was designed to describe four main factors instrumental to municipal forestry program management; program elements, expenditure benchmarks, assistance from Texas A&M Forest Service, and city size. The program elements chosen for this research study were drawn from the literature and the author's own experience. Replication in the future should consider adding public education and outreach in place of **Program Position** within the municipal structure; this research study ignored public education and outreach which is an important component in itself and has potentially significant effects on **Advocacy**. The element in this research study that described the position of the program within the larger municipal structure was interesting, but didn't offer particularly useful insights. Adding public education and outreach, to the five topics of staff, ordinance, advocacy, plans, and inventories would result

in the best possible parts of a municipal forestry program to describe or examine. Possible measurements of education and outreach include the presence of a volunteer training program, quantity of public presentations given, and quantity of social media presence.

The three expenditure benchmarks used in this research study were mirrored after those used by Kielbaso and several different renditions of graduate students in three nation-wide surveys conducted in 1974[40], 1980[41], and 1986[42]. Tschantz and Sacamano (1995) utilized two of those three expenditure benchmarks for their nation-wide survey. Together these four studies represent the most important baseline data regarding municipal forestry programs in the United States. Adjusting those ratings for inflation allows for reference against almost 40 years of change. A research study examining municipal forestry programs that didn't include these expenditure benchmarks would be seriously deficient. Additional benchmarks to consider including in future research are 'number of trees on public property per capita' and 'number of municipal forestry staff per total number of municipal staff'.

Several previous research studies that surveyed municipal forestry programs focused on how the actions of the state-level urban forestry program affected or assisted local-level programs. Municipalities are the resource managers and practitioners in the field of municipal forestry; state-level programs exist to advise and assist them (and other local-level managers) since state-level programs do not usually directly manage themselves. Since this advisory role is their primary function and they represent the primary pipeline by which funding and technology flow from the Federal program to the local-level, it is a very worthwhile effort to attempt to describe how successful they are in reaching municipal forestry programs. This research study grouped assistance into three broad categories based on the literature and the author's experience: Financial, Technical, and Educational. However, only quantity of assistance was addressed and no attempt was made to examine the quality of that assistance or the outcomes directly associated with that assistance. Future research examining the quality of that assistance would almost certainly have to be opinion-based. Any questions designed to examine the outcomes of that assistance could be based on the expected outcomes established by Texas A&M Forest Service program or the Federal Urban Forestry Program.

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[40] The 1974 study was conducted by Ottman and Kielbaso (1976)
[41] The 1980 study was conducted by Giedraitis and Kielbaso (1982)
[42] The 1986 study was conducted by J. J. Kielbaso et al. (1988)

In municipal forestry programs, as in any other kind of municipal program or service, everything is relative to the size of the city being served. City size (population) will continue to be an important variable in any research study that attempts to describe municipal forestry programs. Different categories of city size were created after survey responses were collected and were based on the results of one question: 'city population'. A logical pattern clearly presented itself at that point; requesting cities self-report themselves into pre-determined city size categories would have offered no benefit to this research study.

Responding cities of population between 0 and 5,000 residents were clearly lacking from this research study. Most communities this size likely don't have any staff dedicated to urban forestry activities; however city managers would be a good starting point for future contact. Communities this size, possibly under advisement from Texas A&M Forest Service, very well may have tree ordinances and a tree board. Due to their small size (population), small tree planting or maintenance projects may have a great effect on expenditure ratings such as $ per capita and may therefore offer surprising results.

FINAL THOUGHTS

This research study contributes to the context of urban and community forestry programs in Texas by taking the pulse of municipalities of varying sizes, politics, and geography. The main descriptive categories[43] of this research study were derived from a thorough review of the literature and the author's 5 years' experience in the municipal forestry industry. They are the most relevant topics that could be asked in a research study seeking to describe facts; questions which are designed to poll opinion would be added as well if this research study were repeated.

The expenditure benchmarks used here and pioneered by Kielbaso and others in the 1970's and 1980's will continue to be relevant, though less-so unless another nation-wide survey is performed; the last was performed almost 20 years ago. These ratios of expenditures per city size or expenditures per budget size allow for easy comparison in the present between survey respondents, and comparison against historic benchmarks dating back over 40 years.

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[43] See Shields and Rangarajan (2013) for a thorough discussion about using descriptive categories as a framework for social science research

The 1990 Farm Bill has resulted in a top-down funding scheme where state government's assist and provide grants to local governments; so unless that funding dries up Texas A&M Forest Service will always have at least one expert there to guide and assist layman and professionals. The number of municipalities tapping these experts for advice needs to increase dramatically or, put another way, Texas A&M Forest Service needs to continue expanding their reach by assisting more municipalities.

The program elements of staff, ordinances, advocacy, plans and inventories are the foundation of a well-rounded urban and community forestry program; the addition of public education and outreach would have been beneficial and relevant, but that element is probably the least critical when compared against the first five mentioned. The most surprising finding of the entire research study is certainly how many Texas municipalities have ordinances which regulate trees on *private* property, in addition to public tree regulations.

This information would certainly be interesting to municipal foresters and parks department executives, improving upon their already basic understanding of how they compare to their Texas peers. Comparing their expenditure ratings against other Texas cities of a similar size allows for direct comparison and can fuel budget increase requests.

City managers will also be interested in how they compare to Texas municipalities of a similar size. A common question posed by city managers concerning a very wide range of topics from public safety to refuse collection is 'are we doing better than our neighbors, or worse?' This research study allows Texas city managers to have this conversation about their urban and community forestry efforts for the first time, and draw meaningful comparisons with hard numbers on spending and real examples of the critical elements of a high-functioning program.

Texas A&M Forest Service will be interested to know the difference between how many municipalities they are assisting with urban and community forestry efforts, and how many more municipalities are engaged in urban and community forestry but they aren't reaching.

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Appendix A

Human Subjects Protection

From: "Northcut, Becky" <bnorthcut@txstate.edu>
Subject: Keith O'Herrin Exemption Request EXP2013Man0215 approved
Date: February 19, 2013 4:09:23 PM CST
To: "O'Herrin, Keith" <koherrin@gmail.com>

The exemption request submitted by Keith O'Herrin 2/11/13 has been been approved, effective 2/15/13.

Due to technical problems, Mr. O'Herrin's application was processed manually via email.

Becky Northcut
Director, Research Integrity & Compliance
Texas State University-San Marcos
601 University Drive, JCK 489
512.245.2314

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