URBAN FOREST MANAGEMENT FOR MULTIPLE BENEFITS: AN ANALYSIS OF TREE ESTABLISHMENT STRATEGIES USED BY COMMUNITY TREE PLANTING PROGRAMS

by

Daniel C. Burcham

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Public Horticulture

Summer 2009

Copyright 2009 Daniel C. Burcham
All Rights Reserved
URBAN FOREST MANAGEMENT FOR MULTIPLE BENEFITS: AN ANALYSIS OF TREE ESTABLISHMENT STRATEGIES USED BY COMMUNITY TREE PLANTING PROGRAMS

by

Daniel C. Burcham

Approved:

______________________________
Robert E. Lyons, Ph.D.
Professor and Director, Longwood Graduate Program

Approved:

______________________________
Blake Meyers, Ph.D.
Chair of the Department of Plant and Soil Sciences

Approved:

______________________________
Robin Morgan, Ph.D.
Dean of the College of Agriculture and Natural Resources

Approved:

______________________________
Debra Hess Norris, M.S.
Vice Provost for Graduate and Professional Education
A garden in a street is not less absurd than a street in a garden; and he that wishes to have a row of trees before his door in town, betrays almost as false a taste as he that would build a row of houses for an avenue to his seat in the country.

James Stuart, 1771
ACKNOWLEDGMENTS

Robert Lyons, Ph.D.; Susan Barton, Ph.D., and Jared Liu for their assistance and guidance over the past 18 months.

My professional colleagues and friends of the Longwood Graduate Program, who have shared, continuously, their knowledge and experience.

This manual is dedicated to:

My family, Richard, Lori, and Brooke, who have loved, supported, and enriched my lifelong journey.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>ix</td>
</tr>
<tr>
<td>Chapter 1</td>
<td>1</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>12</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>12</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>25</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>25</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>36</td>
</tr>
<tr>
<td>RESULTS</td>
<td>36</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>91</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>91</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>123</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>124</td>
</tr>
<tr>
<td>Human Subjects Review Board Approval Letter</td>
<td>124</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>126</td>
</tr>
<tr>
<td>Participating Community Tree Planting Program Characteristics</td>
<td>126</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>150</td>
</tr>
<tr>
<td>Landscape Tree Cultivars Utilized by Participating Community Tree Planting Programs</td>
<td>150</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>160</td>
</tr>
<tr>
<td>Written Guidelines, Regulations, and Specifications Received from Participating Community Tree Planting Programs</td>
<td>160</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>174</td>
</tr>
<tr>
<td>Contacts Used to Elicit Survey Responses</td>
<td>174</td>
</tr>
<tr>
<td>APPENDIX F</td>
<td>179</td>
</tr>
<tr>
<td>Community Tree Planting Program Survey</td>
<td>179</td>
</tr>
<tr>
<td>APPENDIX G</td>
<td>184</td>
</tr>
<tr>
<td>Wholesale Nursery Survey</td>
<td>184</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>189</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1 Research Variables, Questions, and Items Included in 2009 Community Tree Planting Program Survey ........................................................................................................... 32
Table 2 Research Variables, Questions, and Items Included in 2009 Nursery Survey 33
Table 3 Community tree planting program questionnaire rate of response. .................. 82
Table 4 Tree planting success reported by community tree planting programs responding to the research questionnaire. ................................................................. 82
Table 5 Amount of trees planted by community tree planting programs responding to the research questionnaire. ................................................................. 82
Table 6 Tree establishment components reported by community tree planting programs responding to the research questionnaire. ........................................ 83
Table 7 Items enabling the achievement of tree planting goals in community tree planting programs responding to the research questionnaire. ........................ 83
Table 8 Method of tree acquisition used by community tree planting programs responding to the research questionnaire. ...................................................... 84
Table 9 Root packaging methods used by community tree planting programs responding to the research questionnaire. ...................................................... 84
Table 10 Average size of trees planted by community tree planting programs responding to the research questionnaire. ...................................................... 84
Table 11 Rating of the mixture of available species in nurseries by community tree planting programs responding to the research questionnaire. ...................... 85
Table 12 Species reported as hard to locate for purchase by community tree planting programs responding to the research questionnaire. ...................... 85
Table 13 Community tree planting programs responding to the research questionnaire that currently grow trees in-house. ............................................................. 86
Table 14 Number of nurseries utilized by community tree planting programs responding to the research questionnaire. ............................................................. 86
Table 15 Cross comparison of research variables: Written standards and community tree planting program success. ................................................................. 86
Table 16 Cross comparison of research variables: Amount of trees planted and species availability rating. ......................................................................................... 87
Table 17 Principle Component Analysis of the Community Tree Planting Program Survey ........................................................................................................... 87
Table 18 Nursery questionnaire rate of response. .......................................................... 87
Table 19 Categories of nurseries responding to the research questionnaire. ................. 87
Table 20 Nurseries reporting interaction with community tree planting programs. .... 88
Table 21 Sales distributions in nurseries responding to the research questionnaire. ... 88
Table 22 Perception of community tree planting program demand fluctuation by nurseries responding to the research questionnaire............................................. 88
Table 23 Methods of commercial interaction reported by nurseries responding to the research questionnaire. ......................................................................................... 89
Table 24 Root packaging methods used by community tree planting programs reported by nurseries responding to the research questionnaire. ........................................ 89
Table 25 Favorability of formal commercial interaction reported by nurseries responding to the research questionnaire. ............................................................ 90
Table 26 Methods of determining future community tree planting program demand by nurseries responding to the research questionnaire........................................... 90
LIST OF FIGURES

Figure 1 - Sample Size Formula (Dillman, 2009) ........................................................ 30
Figure 2 Logistical Regression Equation of Community Tree Planting Program
   Success and Principle Components ................................................................. 79
ABSTRACT
Community tree planting programs work to improve local and regional communities by managing trees in constructed landscapes. Trees planted by these programs provide many benefits accrued within the local ecology and valued by city residents. Although adequate research exists describing the nature, extent, and valuation of the amenities provided by urban trees, management strategies used to sustain these benefits is an area requiring additional investigation. This research examined tree establishment strategies used by community tree planting programs, which includes the selection, acquisition, and installation of trees.

The study utilized a mixed-methods sequential methodology approach for data collection. Research included eleven key informant interviews with community tree planting program managers in the Northeast and Mid-Atlantic United States. On-site visits were made to conduct semi-structured interviews, collect tree planting information, and observe tree establishment first-hand. In order to further investigate the nature of the tree establishment process from tree production to installation, a questionnaire was sent to professionals at community tree planting programs and nurseries.

Programs participating in this research collectively planted 26,383 trees, made possible through resident grant applications, volunteer coordination, internal effort, and cooperative planting strategies. Approximately 132 woody taxa were represented in this sum. Planting strategies were designed with specific management goals and objectives in mind to promote benefits and amenities provided by trees. The research data collected from community tree planting programs identified universal strategies
advancing tree establishment, including a well-defined program mission, reliable financial support, community involvement, program standards and policies, and a clear tree planting workflow. Programs were also affected by their working relationships with nurseries, and questionnaire results revealed an inverse relationship between a program’s tree planting success and three other variables, including the number of trees planted, number of nurseries utilized, and the number of methods used to acquire trees from nurseries.
CHAPTER 1

INTRODUCTION
The population of the United States grew from 76 million people in 1900 to 281 million people in 2000, an increase of more than 300% (Hobbs and Stoops, 2002), and this population is principally urban. In fact, from 1900 to 2000, the proportion of Americans living in cities grew from 28% to 80% (Hobbs and Stoops, 2002). In the middle of the 20th Century, academicians recognized the dramatic pace of urbanization and its impact on society, in part due to the research by Jean Gottmann who coined the term Megalopolis for the urbanized stretch of land between Washington, D.C. and Boston, MA (Gottmann, 1957). At the beginning of the 21st Century, almost one-third of Americans lived in large metropolitan areas with populations of five million or greater (Hobbs and Stoops, 2002).

Urban areas in the U.S. are growing rapidly in both size and influence; they contribute significantly to national economic productivity and cultural vitality. According to the Brookings Institution, the 100 largest U.S. metropolitan areas account for two-thirds of domestic employment and three-quarters of gross domestic product (Berube, 2007). In its Blueprint for American Prosperity, the Brookings Institution asserts that these metropolitan areas contain the essential drivers of national prosperity, including a majority of educated workers and essential physical infrastructure (Berube, 2007). Edward Bacon, an influential urban planner, suggests these massive cities are one of society’s greatest achievements resulting from a deliberate act of will. The final composition and form of cities reflect societal priorities, and several concepts have influenced this organization of urban areas throughout history. One regular element in the design of cities has been tree-lined
boulevards since André Le Nôtre’s bold extension of garden at Tuileries into the Champs Elysées in Paris (Bacon, 1967).

HISTORY OF TREES IN THE URBAN LANDSCAPE

Trees were present in ancient and medieval cities in small numbers, but they were mostly located within private gardens and other scattered locations. The few trees planted in public spaces during this time served a precise role, such as providing market shade or religious symbolism. A long, rich history of gardening has accompanied the development of Western civilization, but these gardens have been almost entirely separate from public space in a city. Early garden terms, *hortus conclusus* and *locus amoenus*, emphasized the separation of gardens from public spaces and their facilitation of tranquility within a natural, peaceful retreat. Walled medieval cities were considerably smaller compared to today’s modern cities, and for that reason, the surrounding natural landscape of the countryside was universally accessible by a brief walk (Lawrence, 2006).

Western urban areas developed significantly during the Renaissance, and new urban expansion often included tree plantings in public spaces. As Lawrence (2006) notes, “By 1780 there was hardly a town in Europe that did not have some sort of green promenade, and the larger cities typically had several.” The purposeful integration of trees in public urban spaces throughout history has primarily been a result of three motivations including aesthetics, power, and cultural tradition. These three themes are noticeable in the attractiveness of Parisian allées, military parades on
Berlin’s Unter den Linden, and the symbolism attributed to the American elm in the United States (Lawrence, 2006).

Historically, urban tree plantings incorporated a condensed selection of species into the landscape. Throughout North America and Europe, there was an early preference for elms (*Ulmus* spp.) and lindens (*Tilia* spp.). Over the course of the Eighteenth Century, tastes gravitated towards other species, including the European horsechestnut (*Aesculus hippocastanum*), Lombardy poplar (*Populus nigra* var. *italica*), and several maples (*Acer* spp.). Today, urban tree planting activity is common throughout Europe, its colonies, and elsewhere (Lawrence, 2006).

Historically, the responsibilities of planting, maintaining, and removing trees in the constructed urban landscape belonged to a variety of entities. French royalty oversaw the plantings along the Champs-Elysées in Paris, private entrepreneurs developed Gramercy Park in New York City, and the municipal government managed public plantings in several other cities (Lawrence, 2006). During the 1970’s, the need for specialized, systematic management of urban vegetation and green space in the U.S. contributed to the development of urban forestry as a profession (Johnston, 1996). Today, the work of planting and managing trees in the urban landscape is overseen largely by community tree planting programs. These programs frequently operate within the larger framework of municipal governments and non-profit organizations, and professionals holding advanced educational degrees and arboricultural certifications regularly staff these programs. Although tree planting programs have unique scopes, budgets, and missions, they share the common goal of
building community through planting trees, often by involving individuals or groups of people in the process.

BENEFITS OF TREES IN THE URBAN LANDSCAPE

Trees have proven benefits for urban residents, and the majority of these contributions enhance local social, economic, or environmental integrity. Several authors have published compilations of the benefits of city trees, including Chen and Jim (2008), Nowak and Dwyer (2000), and Tyrväinen et al. (2005). Trees have a positive impact on energy and carbon dioxide conservation, air quality, urban hydrology, noise reduction, ecological stability, landscape spaces, medical and psychological health, real estate values, economic development, and community well being (Dwyer et al., 1992). For example, urban trees reduce air pollution by lowering ambient air temperatures through active transpiration, removing air pollutants through particulate deposition on leaf surfaces, and reducing local building heating and cooling requirements and subsequent power plant emissions (Nowak et al., 2006). Trees collectively remove 711,000 metric tons of particulates, a $3.8 billion value, in cities throughout the U.S. (Nowak et al., 2006). In addition to providing environmental benefits, trees also enhance the local economy. Wolf (2005) discovered a positive relationship between consumer spending and urban forest amenities, defined as both wild and constructed vegetation. Shopping districts with adequately landscaped parking lots and public spaces are highly preferred by consumers to those without such plant life.
The environmental benefits (e.g. carbon sequestration, water absorption, and pollution reduction) of urban vegetation have been measured and compared to urban tree cover and total leaf area. One resulting model of this relationship, the Urban Forest Effects Model (UFORE), recently estimated the value of New York City’s urban forest to be $5.2 billion (Nowak et al., 2007). This dollar figure includes the market value of reduced air pollution, carbon sequestration, and reduced stormwater runoff within New York. Similar analyses have been conducted in major metropolitan areas throughout the Northeast and Mid-Atlantic U.S., and the tangible benefits derived from urban tree planting are encouraging.

Social scientists have also begun to understand the psychological benefits of trees in urban areas. Trees define the structure and layout of a neighborhood and often generate emotional connections; and a sense of place can be enhanced by the integration of trees and other plants into the landscape (Chenoweth and Gobster, 1990; Dwyer et al., 1991). Other social gains of urban tree planting include a heightened sense of community, homeowner empowerment, and the advancement of environmental responsibility and stewardship (Westphal, 2003).

Today, these recognized benefits have motivated individuals, organizations, and municipalities to embark on ambitious tree planting initiatives across the country. Professionals and advocates alike endorse the elevation of community tree planting to a universally accepted municipal priority; and several individuals suggest that city trees should be systematically managed comparable to other critical infrastructure, such as sanitation, energy, and transportation networks. The integration of “green
infrastructure” alongside traditional “gray infrastructure,” it has been suggested, is a critical component of urban planning and development, providing for the long-term accumulation of these arboreal benefits.

COMMUNITY TREE PLANTING PROGRAM EXPANSION

In 2006, the U.S. Conference of Mayors created the Community Trees Task Force, “In response to mayors’ increasing awareness of the value of urban forests and their increasing interest in ways that communities can be improved through expansion of community tree programs” (City Policy Associates, 2008). In 1994, approximately 33% of municipalities maintained non-profit partnerships to coordinate resources and management activities within the urban forest (Tschantz and Sacamano, 1994). The number of non-profit organizations that work in the urban forest is increasing, and greater than 85% were formed since 1970 (HortScience and Aslan Group, 2004). These groups and organizations have elevated tree planting to a visible scale.

A 2008 survey reported that 47% of cities had created specific goals to increase the total number of trees managed within their public landscapes. In addition, 124 cities reported spending an aggregate $131.9 million on community tree planting programs. Compared to other cities in the survey, Chicago and Milwaukee contributed the most funding to tree management with $27 million and $15 million budgeted, respectively (City Policy Associates, 2008).

U.S. cities have committed to the goal of enlarging the urban tree canopy according to their individual budget and size. New York City, for example, has
developed plans to integrate one million new trees into the city’s five boroughs by 2030. The Million Trees NYC initiative is one component of Mayor Michael Bloomberg’s PlaNYC, a 127-point strategy to make New York a more environmentally sustainable city (City of New York, 2007). Correspondingly, other cities have adopted ambitious tree planting goals, including the Grow Boston Greener initiative to plant 100,000 new trees in Boston, MA and the Trees 2020 initiative to plant 40,000 new trees in Providence, RI (City Policy Associates, 2008).

ISSUES FOR COMMUNITY TREE MANAGEMENT

Every community tree planting program coordinates several processes in order to successfully manage public trees. To support a vigorous population of trees, these programs plan and design planting areas, select species for individual sites, coordinate planting activity, perform regular maintenance and pest management, and remove hazardous trees in a timely manner. However, despite these common activities, each program is uniquely suited to the city it serves. In some programs, people work diligently to coordinate the sizeable planting activity in a centralized, professional manner, and with other programs the emphasis is on the inclusion of individuals or groups of people in environmental education and volunteer stewardship efforts.

One practical concern faced by all community tree planting programs is the need for biological diversity. An historical preference for visual uniformity in urban tree plantings, likely influenced by the French allée, resulted in entire districts planted with a single species (Trowbridge and Bassuk, 2004). This aesthetic preference,
combined with the exceptional adaptability of a few tree species, often led to their
dramatic prevalence and common representation in plantings. The heavy, often
exclusive, reliance on a small number of species contributed to the proliferation of
species-specific landscape pests. Elms were commonly planted in towns in the
Northeast and Midwest due to their favorable growth habit and environmental
tolerances; for example, approximately 45% of Chicago’s public trees were reported
as American elms in 1971 (Kuser, 2000; Schmid, 1975). Following the introduction of
Dutch elm disease (Ceratocystis ulmi) in 1930, approximately 56% of American elms
planted in cities were lost, with over 40 million elms dead within the entire U.S.
(Dreistadt et al., 1990; Stipes and Campana, 1981; USDA, 1977). An evaluation of
urban pest infestations over time often reveals a corresponding over abundance of one
or two tree species in the landscape; London plane tree (antracnose), linden (aphid
infestations), and oak (bacterial leaf scorch) are commonly planted in the urban
landscape and affected by serious pests, some bordering epidemic proportion
(Trowbridge and Bassuk, 2004; Sherald, 2007; Zuparko and Dahlsten, 1994). The loss
of the American elm in public landscapes projected the issue of invasive landscape
pests into public concern, and professionals now regularly plan and work to prevent
similar dramatic losses of a single species on this scale.

Several scientists have suggested that increasing interspecific and intergeneric
diversity is key to limiting urban landscape pest and disease susceptibility (Bassuk,
1990; Endress, 1990; Santamour, 1990). However, embracing the concept of diversity
benefits more than well-founded concerns about pest infestations. Diverse urban
vegetation also provides an effective reserve of local and regional biodiversity (Alvey, 2006; Cornelius and Hermy, 2004). Professionals have also recognized that a continuous application of one tree across a heterogeneous urban landscape does not sufficiently recognize the variety of characteristics describing each planting site (Trowbridge and Bassuk, 2004). Recently, programs have adopted and supported the “Right plant, Right place” viewpoint, which emphasizes matching the best tree species to the unique dimensions of each planting site.

Several metrics can assist programs with the evaluation of their species richness, including Simpson’s diversity index and the Shannon-Weiner Index (Rowntree, 1984). Other research suggests an alternative to such metrics, namely adherence to a simple rule, whereby a population should be limited to containing no more than 10% of one species, 20% of one genus, and 30% of one family (Galvin, 1999). Although a consistent definition of “reasonable diversity” and a way to measure it does not currently exist in the literature, awareness of this issue and recognition of its importance is increasing.

One barrier to achieving greater diversity in the urban landscape that is frequently mentioned by community tree planting program managers is the mixture of available species within nurseries. Gardescu (1976) stated that nursery stock availability is a fundamental problem, ultimately inhibiting species selection during design processes. Miller and Bates (1978) reported that several Wisconsin communities had difficulty locating sufficient species adapted to urban conditions in the nursery inventory. Trowbridge and Bassuk (2004) also recognize the importance
of considering nursery availability when selecting trees for use in the urban landscape, and they suggest that knowledge of species availability in nurseries is necessary in order to avoid contractor substitutions. Although the intention to increase species diversity in the urban forest is common to most community tree planting programs, the methods utilized to interact with nurseries to fulfill this goal are not well understood.

Several activities, including (1) identifying sites for planting, (2) evaluating sites and selecting species, (3) acquiring trees from nurseries, and (4) landscape installation, comprise the tree establishment process and the resulting urban forest composition (Miller, 1997). These processes require thorough consideration of many complex variables during decision-making, which in turn affect the outcomes seen in the urban forest (Gerhold and Porter, 2000).

Given the increase in community tree planting activity and the importance of integrating site-appropriate species into the landscape, this thesis research seeks to understand the current practices utilized by community tree planting programs to establish trees in the urban landscape to meet their respective planting goals. These activities support the tree planting goals of these programs and are critical to their long-term success. This research will holistically document, evaluate, and analyze (1) the tree establishment process composed of the aforementioned four activities and (2) the nature of these programs’ interaction with nurseries.
CHAPTER 2
LITERATURE REVIEW
Tree planting, maintenance, and removal comprise the primary management activities overseen by community tree planting programs (Miller, 1997). Planting includes identifying opportunities for planting, site assessment, species selection, tree acquisition from nurseries, and, finally, tree installation (Miller, 1997; Sellmer and Kuhns, 2000). This management activity of tree planting programs is the focus of this thesis research, and relevant literature is presented in this chapter.

IDENTIFYING OPPORTUNITIES FOR PLANTING

Vegetation composition assessments provide valuable information to identify available planting sites within an urban landscape. In order to systematically plan and manage urban vegetation, municipalities frequently complete inventories of their arboreal resources; in a 1994 survey, 78% of municipalities indicated they had spent money on an urban forest inventory (Tschantz and Sacamano, 1994). These records provide a current account of the individual trees being managed, and the information can be used to plan, schedule, and coordinate management activities (Bassett, 1978). Programs utilize a variety of methods to analyze the structure and dimension of the urban forest, including ground-based inventories and aerial-based imagery analyses obtained from satellites or aircraft (Jim, 2008; Walton et al., 2008).

Ground-based inventories can be derived from a census of an entire tree population; however, many organizations utilize more cost-effective random-sampling techniques (Maco and McPherson, 2002). Some organizations have enlisted volunteers to complete extensive inventories, and a study in Brookline, MA reported favorable results
from an inventory completed with the assistance of trained volunteers (Bloniarz, and Ryan, 1996). The high costs associated with physically visiting each tree specimen regularly can limit organizations from including privately owned trees in their inventories, and, therefore, many inventories limit data collection to publicly owned trees (Maco and McPherson, 2002). Information collected during an inventory often includes species composition, size measurement (e.g., height, trunk diameter), physical condition (e.g., subjective health evaluation, percent crown dieback), and geographic location of trees (Nowak et al., 2008). A sample of 14 municipal inventories completed between 1996 and 2006 revealed an average of 22.78% canopy coverage and 42.07 trees per acre across each city (Nowak et al., 2008). In the same sample, some of the most common trees included *Liquidambar styraciflua* (American sweetgum), *Acer platanoides* (Norway maple), *Fagus grandifolia* (American beech), and *Ailanthus altissima* (tree of heaven) (Nowak et al., 2008).

Aerial-based inventories gather and analyze aircraft or satellite imagery to depict current canopy coverage and spatial distribution of trees for a defined area (Walton et al., 2008). Information can be derived from aerial photographs, medium-resolution satellite imagery and low-resolution satellite imagery when the datasets are classified using Geographical Information System (GIS) software (Walton et al., 2008). Height measurements of vegetation can also be integrated into datasets through airborne LIDAR (laser ranging) data collection (Walton et al., 2008). The encompassing nature of aerial imagery permits these datasets to include trees located on all land types, including public and private; and this inclusive strategy provides a more comprehensive assessment of the
urban forest composition (Nowak, 2008). However, aerial-based assessments cannot include discrete information, such as the species or physical condition of individual trees, and Nowak (2008) suggests integrating these two data types, aerial-based and ground-based, to provide a more comprehensive measurement of urban vegetation. Several researchers have described the potential usefulness of including such inventories and analyses in the systematic management of city trees, specifically in the evaluation of potential planting locations (Miller, 1997; Phillips, 1993; Wolowicz and Gera, 2000).

Miller (1997) suggests that communities should establish full-stocking goals, where cities strive to fill every available street side planting location with a tree. Full stocking goals reference the available linear feet of municipal roadway and tree spacing standards, along with other placement restrictions, described in city ordinances. However, the achievement of full-stocking goals depends on the availability of funding, annual mortality rates, and the number of vacant planting sites. Once determined, full stocking goals can assist communities in determining how many trees to plant per year and, approximately, how many years it will take to reach full capacity (Miller, 1997).

While full stocking goals reference tree spacing along roadways, professionals have also utilized urban tree canopy (UTC) analyses, which reference shade canopy viewed from aerial cameras, to plan the development of urban vegetation. Current tree canopy measurements are calculated using remotely sensed infrared images, which display vegetation as bright red colors in the near-infrared light spectrum. Possible urban tree canopy, a term defined as any geography not currently containing trees that could potentially accommodate future planting, can also be calculated using aerial-based
imagery (Still, 2008). Combined, these metrics describe the current and potential future state of urban vegetation. Aerial-based imagery has been used to calculate current amounts of tree canopy in several eastern U.S. communities, including Annapolis (41% current tree canopy), Baltimore (20%), Boston (29%), Burlington, VT (43%), New York City (24%), and Providence (23%) (Galvin et al., 2006a; Galvin et al., 2006b; Grove et al., 2006; Still, 2008). The variability in cities’ geography, topography, and natural ecological classification limits the comparison of UTC metrics between different urban areas. For example, Pittsburgh, PA, with its naturally undulating topography, supports much greater vegetation growth on hillsides inhospitable for urban infrastructure and greater initial UTC measurement. Comparatively, New York City lacks hillside niches supporting tree growth and its coastal plain topography provides a much lower initial UTC measurement.

Numerous cities have utilized the results of UTC studies to adopt formal tree planting (also, urban tree canopy) goals to restore tree canopy to desirable levels. In a 2008 survey, 47% of responding cities created specific goals to increase the total number of trees managed within their public landscapes (City Policy Associates, 2008). For example, Providence, RI has instituted a tree planting goal, called Trees 2020, positing a 7% increase in urban tree canopy by the year 2020 as a formal planting objective (City Policy Associates, 2008).

In order to realize UTC goals, or similar tree planting goals, organizations must develop implementation plans to realize their final target population (Galvin et al., 2006). Miller (1997) suggests that inventories gain utility and dynamism when used to prioritize
future planting activity. Several municipalities have modified the UTC metrics, existing and possible UTC, to represent geographic areas (e.g., census tracts, neighborhoods, land parcel) and assign planting priorities to these specific locations (Galvin et al., 2006). In this prioritization scheme, areas with the greatest disparity between current and potential canopy levels receive the highest priority.

Miller (1997) poses an alternative, suggesting that the assignment of planting priorities must integrate local community values in addition to inventory data. For example, he recommends that neighborhoods with low community support for tree planting or disruptive construction projects must receive a lower planting priority. Recognizing the impact of community values on tree planting priorities, Getz et al. (1982) reported that inner-city Detroit residents preferred to prioritize tree planting in public spaces within residential neighborhoods compared to privately owned spaces.

SITE ASSESSMENT AND SPECIES SELECTION

Research has emphasized several criteria that should be considered during species selection for urban landscapes, including a species’ native habitat (Ware, 1994), anticipated maintenance requirements (Chapman, 1981), community values and preferences (Ames, 1980), root growth beneath sidewalks (D’Amato et al., 2002a), drought tolerance (Coder, 1999), salt tolerance (Dirr, 1976), cold hardiness (Pellett, 1994), pest resistance (Santamour, 1977), long-term infrastructure conflicts (Trowbridge and Bassuk, 2004), and tolerance of soil stresses (Steiner, 1980). These criteria,
considered collectively, provide a basis for considering the most important factors when selecting species for urban sites.

More comprehensively, Clark et al. (1990) proposed developing a species profile for specific environments to describe plant characteristics relevant to urban settings. A complete profile should include information regarding an individual plant’s nomenclature, growth and development, culture and management, and landscape value (Clark et al., 1990). Several comprehensive species profiles, also called plant fact sheets, are available in print (Gerhold et al., 1993) and online (Gilman and Watson, 1993) format.

These selection criteria, however, don’t capture the dynamic nature of the species selection process in terms of the timeline, workflow, or organizational structure utilized to guide species selection in community tree planting programs. Several authors have outlined a comprehensive method of selecting species for urban environments, including Gerhold and Porter (2000), Miller (1997), Saebo et al. (2005), and Trowbridge and Bassuk (2004). Plant selection software is also available for urban landscape conditions (Gerhold and Porter, 2000).

Gerhold and Porter (2000) suggest a five-step selection process that considers the tree’s purpose in the landscape, the unique site conditions affecting the selection, and arboricultural practices that will affect the tree during its growth. Following these considerations, a list of selection criteria should be developed and matched to the known characteristics of available candidate trees (Gerhold and Porter, 2000). It is also advisable to consult detailed horticultural and botanical references, such as Dirr (1998), Gerhold et
al. (1993), and Wandell (1994), to review descriptions of potentially applicable species (Gerhold and Porter, 2000).

Miller (1997) suggests a species selection model that emphasizes the importance of site, social, and economic factors. Site factors include cultural considerations (e.g. utilities, physical structures, surface cover), environmental considerations (e.g. temperature extremes, pests and diseases, soil conditions), and social factors, referring to the unique community or neighborhood values inherent to the site (Miller, 1997). Trees contain emotional and psychological meaning for many cultures and individuals (Altman, 1994). For example, lindens (Tilia spp.) are commonly planted in one Milwaukee neighborhood because residents frequently make wine using linden flowers. Through the use of this model, trees will be matched to the unique characteristics of both site and community; and an open-ended approved species list should be created for a specific geography. The list should serve as a guiding framework and initial point of consideration during species selection (Miller, 1997).

Trowbridge and Bassuk (2004) report that, prior to site assessment, professionals should develop a vision that describes how the plant will be used to serve the function of the local landscape. The uses of plants in urban areas, according to Trowbridge and Bassuk (2004) include wind mitigation, noise reduction, spatial definition, wildlife habitat, and recreation (Trowbridge and Bassuk, 2004). Following initial site planning, Bassuk (1998) emphasizes the importance of site assessment before selecting species for installation. Site considerations must include a combination of above ground (e.g., exposure, physical barriers, temperature extremes) and below ground (e.g., rooting space,
soil texture, soil pH, drainage) characteristics (Bassuk, 1998). These characteristics should then be matched to a species fulfilling the defined landscape function. Those criteria requiring attention during species selection in urban areas include a plant’s physical dimensions, hardiness, sun/shade tolerance, soil moisture tolerance, soil pH compatibility, salt tolerance, pest and disease susceptibility, transplant success, cost and availability, maintenance issues, native habitat, and assimilation into established diversity standards (Trowbridge and Bassuk, 2004).

The effectiveness of these selection models, however, depends on the ability of the user to make sound judgments about a proposed site and species selection (Gerhold and Porter, 2000). The species selection process could be improved by more effectively integrating published research, cultivar performance data from urban areas, and indications from existing trees and inventory data about plant and site compatibility (Gerhold and Sacksteder, 1982). Research describing the relative acceptance of species selection models and selection criteria among community tree planting programs is currently not available.

TREE ACQUISITION FROM NURSERIES

In 2002, the greenhouse and nursery sector of the environmental horticulture industry contributed $26.05 billion to the U.S. economy, a figure calculated by summing the values of nursery industry sales, income, jobs, and value added economic contributions. This same sector employed 261,408 people during 2002 (Hall et al., 2005). In 2006, the sales revenue from nursery stock alone reached approximately $4.65 billion.
(USDA, 2007), and sixteen categories of plants were sold in nurseries, including deciduous trees and shrubs, broadleaf and narrowleaf evergreen shrubs, evergreen trees, azaleas, roses, herbaceous perennials, flowering potted plants, vines and groundcovers, flowering annuals, vegetables and herbs, Christmas trees, tree fruit, foliage, and propagated material (Brooker et al., 2000, 2005). Categories of plants used by community tree planting programs include deciduous and evergreen trees, with gross national sales for deciduous trees alone amounting to $786.9 million during 2003, and $896.8 million during 2006 (USDA, 2007). The 2006 figure represented a 13.96% increase in gross national deciduous tree sales compared to the 2003 figure. Historically, landscape tree sales have experienced similar increases; from 1991-1996 landscape tree sales at the national level increased at an annual rate of 3.3% (National Gardening Association, 1997).

A 1997 study reported that between 1991 and 1996, an average of 109.3 million landscape trees were shipped annually (National Gardening Association, 1997). The same study reported that municipalities represented an average of 3.67% of the nursery consumer base during the same five-year time period (National Gardening Association, 1997). The proportion of nursery demand sustained by municipalities between 1991 and 1996 was significantly smaller compared to other consumer categories, including garden centers (31.53%), contractors (24.67%), re-wholesalers (17.88%), general merchandisers (15.41%), and other sources (3.87%) (National Gardening Association, 1997). Over the five years of this study, the average annual growth rate of sales to landscape contractors increased the greatest (11.2%) followed by those destined for municipalities (7.1%)
The 1997 National Gardening Association report, sponsored by the American Nursery and Landscape Association and the USDA Forest Service, is the only research study available describing municipal demand for landscape trees. Studies conducted by Brooker et al. (1996, 2000, 2005) did not attempt to measure nursery sales distribution to municipalities or other types of community tree planting programs.

A 2005 study reported seven root-packaging methods commonly utilized in nurseries, including bare-root, balled and potted, balled and burlapped, processed balled, container, field grow bags, and in-ground containers (Brooker et al., 2005). Container grown (63.3%), balled and burlapped (16.3%), and bare root (7.2%) represented the most frequently requested packaging methods during 2003 (Brooker et al., 2005). However, these statistics represent all plant material sales within nurseries during this time period, and no reports currently indicate the sales distribution of various root-packaging methods specifically for community tree planting programs.

During 2003, nursery transactions occurred most frequently in the form of telephone orders (46.1%) and in-person orders (44.0%). Nursery transactions were also reported in smaller frequency as trade show orders (4.3%), mail orders (3.8%), and Internet sales (1.9%). Twenty-eight percent of respondents indicated they sold plant material with contracts (Brooker et al., 2005).

D’Amato et al. (2002b) published a report detailing the existence of difficult-to-locate species in the nursery industry. Between 1995 and 2000, Ohio urban forestry professionals indicated an increase in demand for 13 species and a decrease in demand
for 17 species (D’Amato et al., 2002b). Gardescu (1976), Miller and Bates (1978), and Trowbridge and Bassuk (2004) also mention nursery availability as a factor that frequently limits species selection. Several communities have established their own tree nurseries in order to compensate for difficult to locate species (Tate, 1984).

TREE INSTALLATION

Tree planting “best practices” have been published in numerous accessible formats, including reference guides (Elmendorf et al., 2006), checklists (Reynolds and Ossenbruggen, 1998), and books (Trowbridge and Bassuk, 2004; Watson, G.W. and E.B. Himelick, 1997). These best practices were developed by research evaluations of transplant success and its relationship to plant size (Struve et al., 2000), planting depth (Wells et al., 2006), seasonal timing (Harris and Bassuk, 1994; Watson and Himelick, 1982), root packaging (Buckstrup and Bassuk, 2000), soil amendments (Harris and Bassuk, 1993), and irrigation rates (Gilman et al., 1998). Contractors, program staff, and volunteers have all been reported as participants in the tree planting process (Page, 1985; Austin, 2002). Struve (2009) suggests that the establishment of plants in the landscape depends on the complex interaction of a chain of events during tree production, transportation, installation, and aftercare phases.

Several authors report the importance of specifying tree quality guidelines and installation standards, including the American Standard for Nursery Stock, ANSI Z60.1 (Page, 1985; Trowbridge and Bassuk, 2004). These specifications should be used to accept or reject nursery stock during the delivery of plant material and ensure proper
landscape installation. However, information regarding the current status and utility of such specifications is not available. Additionally, research describing the effectiveness of organizational frameworks guiding the installation process is also not available.
CHAPTER 3
MATERIALS AND METHODS
RESEARCH DESIGN

Mixed methods research design requires the collection and analysis of qualitative and quantitative data in a single study, extending the information with more complementary, meaningful interpretation (Jick, 1979). The epistemological assumption grounding this inquiry is subjectivist; the assumption acknowledges that the phenomenon of interest is a chain of events controlled, directed, and experienced by people. Its components and outcomes are direct consequences of choices made by people involved in the process. A mixed methods research strategy was selected for this thesis due to the complex anthropogenic nature of the tree planting process in constructed urban environments, and the ability of each data type to capture components of the phenomenon.

The sequential exploratory research design, a method of mixed-methods inquiry, consists of a preliminary stage of qualitative data collection and analysis followed by a secondary stage of quantitative data collection and analysis. The qualitative and quantitative findings are combined and compared during the final interpretation following their initial, separate collection and analysis. A detailed outline of the selected methodology is provided.

QUALITATIVE DATA COLLECTION

The qualitative research component consisted of semi-structured interviews with recruited participants. Targeted participants were professionals having experience selecting, acquiring and installing trees into the public urban landscape. The study was
bound geographically to the 11 states (Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont) and one district (District of Columbia) that comprise the Northeast and Middle Atlantic regions of the United States. Participants were purposefully selected and recruited to obtain first-hand information about the tree establishment process. In order to stratify the purposefully selected sample by state, one participant per state (and district) was recruited for inclusion in the research. The principal investigator and supporting Graduate Committee identified potential sites for participant recruitment. Professionals included in the study occupied a variety of professional positions, including, for example, municipal arborists, directors of tree planting, directors of urban forestry, and tree program directors.

Qualitative data collected included interview recordings, interview notes and transcripts, organizational documents, and descriptive tree planting information. Semi-structured interviews took place in person within the workplace of each participant. The principal investigator used an interview protocol that consisted of 15 standardized questions to guide the conversation during interviews. Each interview protocol contained a heading, opening statements, 15 key research questions, and space for recording the investigator’s reflective notes and comments. Interviews were recorded on a digital voice recorder and later transcribed into written form by the principal investigator. The interview protocol, along with supplementary research information, was submitted to the University of Delaware Human Subjects Review Board. The approval letter received from the Human Subjects Review Board for this study has been included in Appendix A.
Semi-structured interviews were also conducted with six nurseries identified by participating community tree planting programs as sources of useful plant material. Participants were recruited purposefully after being identified by community tree planting programs and these six semi-structured interviews were conducted similarly over the phone.

The identities of participants and supporting organizations remained confidential between the principal investigator and professionals. Consequently, all participants were issued a four-digit numeric identifier, ranging between 1001 and 1023, for accurate record keeping. Several descriptive details concerning the tree planting program were recorded, including the geographic location of the program, program structure, and staff size, for public reporting. Written organizational documents collected during the study included nursery contracts and/or specifications, planting specifications, site assessment checklists, and approved species lists.

Descriptive tree planting information collected included planting totals, installed quantities of species, and useful cultivars planted by the program during calendar year 2008. Individual species, their frequencies, and world origin were recorded and analyzed in spreadsheet format. All data gathered during this portion of the study was catalogued according to each participant’s unique numeric identifier.

QUALITATIVE DATA ANALYSIS

Initially, the qualitative data was organized into groups according to its source. Interview recordings were transcribed and interview field notes were typed into reports.
for each organization. All transcribed data and related organizational documentation were reviewed for initial overall meaning by identifying common phrases and ideas among participants. All documents were read separately and general topics of discussion covered during the interviews were recorded (Creswell, 2003).

Following this initial review, a detailed coding process was used to separate and organize the topics and ideas into meaningful categories, with similar categories clustered together and organized into main themes. Particular attention was given to themes relating to processes, activities, and strategies utilized to select, acquire, and install landscape trees in the constructed urban landscape successfully. The coding results were subsequently used as a framework for discussing the variations among participants. A detailed narrative of the settings encountered and observed during the study and the interconnected themes observed among programs was constructed (Creswell, 2003).

QUANTITATIVE DATA COLLECTION

Qualitative coding served as the foundation for constructing two surveys distributed to community tree planting program managers and nursery professionals within the same geographic boundaries. Surveys determined the distribution of coded themes and ideas and generated supporting inferences about their use and acceptance.

Data were collected during February 2009 using a cross-sectional survey distributed with self-administered electronic questionnaires during February 2009 (Dillman, 2009). The sample frames for the two surveys included: (1) community tree planting programs in the Northeast and Mid-Atlantic Regions of the United States and (2)
nursery enterprises selling landscape trees in the Northeast and Mid-Atlantic Regions of the United States. The sample frame list of potential participants was gathered for each survey with support from trade and professional associations, including the Alliance for Community Trees (http://www.actrees.org) and the American Nursery and Landscape Association (http://www.anla.org). These sample frames were modified with additional individuals known to have sufficient relevant experience by the principal investigator and the supporting Graduate Committee.

The targeted sample sizes for the community tree planting program survey (151) and nursery survey (108) were calculated using Dillman’s (2009) suggested sample size formula (Figure 1). In this equation, \( N_s \) represents the necessary sample size, \( N_p \) represents the estimated size of the population, \( p \) represents the estimated response proportion for a two-alternative question, \( B \) represents the amount of sampling error, and \( C \) represents the Z statistic associated with the selected confidence level. Although the total sizes of the populations of interest for this bounded geography was unknown, the researcher proposed an estimated total figure of 250 community tree planting programs and 150 nurseries based on experience during the period of qualitative data collection.

\[
N_s = \frac{(N_p)(p)(1 - p)}{(N_p - 1)(B/C)^2 + (p)(1 - p)}
\]

Figure 1 - Sample Size Formula (Dillman, 2009)

The sampling design for this study was a single-stage randomized sample. The participants listed in each sample frame were numbered, and individuals were selected
randomly until the appropriate number was attained. The researcher utilized a random numbers table to select individuals (Excel, 2004). The surveys were pilot tested with five relevant participants, ensuring instrument comprehensibility, and their input and feedback was incorporated into the survey prior to distribution.

Individuals selected in the sampling stage were invited to participate in the study via email invitation that provided an electronic link to the web-based survey instrument. Approximately two weeks after the initial survey invitation was delivered, another email invitation was distributed to those participants lacking responses. Individual responses were collected on a secure web server where they were viewed only by the principal investigator. Survey respondents remained completely anonymous.

The community tree planting program survey was composed of content sections, including tree planting activity, planting process, organizational support, and tree acquisition (Table 1). Responses were measured with continuous scales, categorical responses, categorical scales, multiple choice responses, and open-ended questions. Additional items contained in the survey instrument included a survey invitation letter, initial instructions for participants, and closing instructions (Appendices E and F).
Table 1 Research Variables, Questions, and Items Included in 2009 Community Tree Planting Program Survey

<table>
<thead>
<tr>
<th>Content Variable Name</th>
<th>Research Question</th>
<th>Item(s) on Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Planting Activity</td>
<td>How much planting activity did the organization manage during 2008?</td>
<td>See Questions: 1, 2</td>
</tr>
<tr>
<td>Planting Process</td>
<td>What organizational components gave structure to the planting process?</td>
<td>See Question: 3</td>
</tr>
<tr>
<td>Organizational Support</td>
<td>Which organizational components contributed to planting activity success?</td>
<td>See Question: 4</td>
</tr>
<tr>
<td>Tree Acquisition</td>
<td>How did the organization acquire trees?</td>
<td>See Questions: 5, 6, 7, 8, 9, 10, 11</td>
</tr>
</tbody>
</table>

The nursery survey had content sections including sales distribution, community tree sales, methods of commercial interaction, subjective rating of commercial interaction, and demand anticipation (Table 2). Responses were measured by a variety of formats, including continuous scales, categorical responses, categorical scales, multiple choice responses, and open-ended questions. Additional components in the survey
instrument included a survey invitation letter, initial instructions for participants, and closing instructions (Appendices E and G).

**Table 2 Research Variables, Questions, and Items Included in 2009 Nursery Survey**

<table>
<thead>
<tr>
<th>Content Variable Name</th>
<th>Research Question</th>
<th>Item(s) on Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Distribution</td>
<td>How much of total nursery sales are for community tree planting programs?</td>
<td>See Questions: 1, 2, 3</td>
</tr>
<tr>
<td>Community Tree Sales</td>
<td>How has demand from community tree planting programs changed?</td>
<td>See Questions: 4</td>
</tr>
<tr>
<td>Methods of Commercial</td>
<td>How were trees sold to community tree planting programs?</td>
<td>See Questions: 5, 6</td>
</tr>
<tr>
<td>Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating of Commercial</td>
<td>What are nurseries’ opinions of formal commercial interaction?</td>
<td>See Questions: 7</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Anticipation</td>
<td>How do nurseries anticipate demands from community tree planting programs?</td>
<td>See Questions: 8</td>
</tr>
</tbody>
</table>
QUANTITATIVE DATA ANALYSIS

The total rate of response was reported in table format for each survey.

Descriptive statistics relating survey responses were compiled in table format.

Descriptive statistics were computed to provide an overview of all of the research questions in the survey instrument, and included the mode, standard deviations, and range of responses, when appropriate, for each variable in the associated questions.

Chi-square Goodness-of-Fit tests were performed to evaluate the relationships between recorded survey categorical data (Ott and Longnecker, 2001). Following cross-comparison of categorical responses, principle component analysis was performed, a useful method of data examination that reduces collected variables into a smaller number of principal components (artificial variables) accounting for a large amount of variability in the observed response categories. Principle components were derived based on highly correlated response categories. Therefore, the first principal component accounts for the maximum amount of recorded variability, the second accounts for secondary variability not accounted by the first component, etc., and each of the resulting principal components is uncorrelated (Jolliffe, 2002). Principle component analysis was performed on questions two through ten on the community tree planting program survey, except for questions six and eight, which collected data unsuitable for this type of statistical analysis. Following the derivation of the principal components, these were compared to question one, a subjective rating of the program’s tree planting success, using logistical regression (Ott and Longnecker, 2001). This comparison of the principle components (independent variables) against the subjective rating of success (dependent variable)
provided insight on those variables having the greatest impact on community tree planting program success.
CHAPTER 4

RESULTS
RESEARCH INTERVIEW RESULTS

RESEARCH PARTICIPANT DESCRIPTIONS AND CONTEXT

This research included semi-structured interviews conducted with 11 community tree planting program managers throughout the Northeast and Mid-Atlantic regions of the United States. Professionals overseeing tree establishment within both municipal and non-profit organizations were included in this research. Several programs operated within a larger organizational structure alongside companion programs, including community gardening, park restoration, horticultural education, and public landscaping programs. Several programs, however, existed and operated autonomously. All participating community tree planting programs, regardless of their formal name, will be collectively referred to as “programs” in order to maintain confidentiality.

PROGRAM 1004

This program employed 19 professionals and performed its tree planting activity within its city limits. The program installed 905 trees, mostly measuring 1 ¾” – 2” balled and burlapped stock, representing approximately 57 taxa during 2008. This program maintained an approved species list of approximately 27 species, and 48.2% of the trees installed were selected from this approved species list. The most frequently planted species during 2008 included Ulmus americana L. ‘Princeton’, Nyssa sylvatica Marsh., and Betula nigra L. The program used three strategies to encourage tree planting, including grant application, tree reimbursement, and commemorative tree planting strategies.
Grant Application Planting Strategy

In this strategy, a community group must apply for competitive funding. The group must meet several eligibility requirements, including a minimum number of participants, minimum number of proposed locations for trees, and approved access to planting locations. Eligible planting locations include housing complexes, parks, schoolyards, church property, community gardens, and street locations. Groups must also designate specific individuals to provide regular irrigation and maintenance for each tree, and these individuals sign pledges indicating their willingness to care for the planted tree(s) for a specific time period (approximately two years).

The program often utilizes a specific timeline to structure the application, review, and planting process during fall and spring seasons. The community groups receive funding based on their ability to meet basic requirements and, if approved, meet with a program staff member who assists with planning, design, and species selection. The community group collectively designs the practical and aesthetic composition of their planting space, including the type and number of species to be installed. The program normally provides technical guidance while the community groups design their planting project. Participants must attend an organizational meeting prior to any tree planting in order to review the design, species, tree installation procedures, and other necessary details. The program may also promote the planting event to encourage additional volunteer involvement in tree installation. Prior to planting, the program communicates expectations to all volunteers, including where to meet, what to wear, what to bring, an
outline of events, and inclement weather plans. In most cases, the program provides the materials necessary for tree planting, including shovels, mulch, and trees.

On the morning of planting, volunteers gather at the site, fill out necessary paperwork (including liability release forms), and receive a planting team assignment. The program staff welcomes the volunteers and generally delivers important reminders regarding safety, equipment handling, and locations of each team’s planting area. Volunteers then assemble with their planting teams at their site to review the proper planting techniques, as demonstrated by a specified team leader who covers aspects of site preparation, tree handling, tree placement, backfill, staking, watering and mulching. After the review, the team divides into small groups of two to three people and installs the trees. In order to promote social interaction and reflection, groups are encouraged to provide a celebratory meal following the tree planting.

Reimbursement Planting Strategy

In this strategy, homeowners are encouraged to purchase trees at a participating nursery and install the tree at home. Homeowners then submit required paperwork detailing the type, size, and location of the tree to the program’s office. Trees must be purchased within a specific timeframe and be accompanied by a receipt from an approved nursery source. Homeowners must sign an agreement, which compels them to water and care for the tree for a specific period of time (approximately two years). This agreement may also specify that a program representative may inspect the tree when requested. The
homeowner ultimately receives a refund for either the total cost of the tree or a predefined percentage of cost.

PROGRAM 1005

This program employed two professionals who managed trees within the city’s municipal boundaries. This program planted 79 trees, as both 2” – 2.5” balled and burlapped and 1” – 1.5” bare root stock, representing approximately 24 taxa during 2008. The program maintained an approved species list containing approximately 55 species and 93.67% of trees installed were selected from this list. The most frequently planted species during 2008 included *Prunus incisa × campanulata*, *Cornus mas* L., and *Ginkgo biloba* L. The program established trees in the city using two tree planting strategies, including coordinated volunteer plantings and internally controlled effort.

Volunteer Planting Strategy

In this strategy, staff works closely with community members, allied community organizations, and local government representatives to coordinate volunteer tree planting events. Planting opportunities originate with supporting commitments from civic organizations, community businesses, and other volunteer groups. The program generally assists the group with planning, determining tree totals, identifying the area for planting, and obtaining funding. Community input is integral to the entire planning process. The program, however, oversees and approves final tree selection and acquisition. Funding
for the event is assembled from a variety of sources, including private foundations, government grants, and program fundraising.

The program may solicit additional volunteers in order to provide needed physical labor. Before the planting, the organization communicates expectations to volunteers, including where to meet, what to wear, what to bring, an outline of events, and inclement weather plans. On the morning of planting, volunteers gather at the site and receive initial instructions. The program staff welcomes the volunteers and delivers important reminders regarding safety, equipment handling, and the location of each team’s planting area. Following these initial remarks, program staff provides instructions on proper tree planting techniques, including site preparation, tree handling, tree placement, backfill, staking, watering and mulching. The program’s tree planting specifications are provided to each team for their own reference along with necessary supplies, including shovels, pruners, mulch, etc. The teams then divide into small groups of two to three people and plant the trees. Following planting, groups are encouraged to participate in a celebratory meal to interact socially and reflect on their work.

Internally Controlled Planting Strategy

In this strategy, staff oversees and controls all aspects of tree establishment. In determining where to plant trees, the program receives written homeowner requests and establishes internal priorities. Its internal priorities are determined using inventory and census data describing the number of people per tree and median household income. Neighborhoods with the greatest ratio of people to trees and the lowest median household
income receive the most urgent planting priority. Tree planting occurs during spring and fall seasons, and program staff coordinates effort to assess planting sites and select species. The species selection process is guided by the program’s approved species list, and community input is essential to the selection of appropriate trees for (Appendix D). Funding for tree plantings are provided by a variety of sources including government grants, program fundraising, and private foundation grants.

Tree installation is completed by landscape contractors and formally structured by a written legal contract, which describes the terms and conditions of work to be completed, such as tree installation specifications, an expected timeline for planting, and labor requirements. The landscape contractors must locate and purchase required trees at local nurseries. Tree installation specifications, contained in the contract, provide detailed guidelines for site preparation, tree handling, tree placement, backfill, staking, watering, mulching, and clean up. The terms of the contract frequently require a guarantee period for tree survival (approximately two years). Following the period of work, program staff visits the planting location(s) to review and approve the condition of the tree.

PROGRAM 1006

This program employed three professionals and planted trees within its city’s boundaries. This program planted 850 trees, representing approximately 48 taxa, during 2008 and maintains an approved species list of approximately 46 species; 70.4% of trees installed were selected from their approved species list. Trees installed by this program were mostly 2” – 2 ½” balled and burlapped stock, but the program was also
experimenting with smaller (1 ½” – 2”) bare root stock. The most frequently planted species during 2008 included Malus spp. Mill., Cercis canadensis L., and Acer × freemanii. The program used a volunteer planting strategy to incorporate trees into the landscape.

Volunteer Planting Strategy

In this strategy, staff works closely with community members, allied community organizations, and local government representatives to plan volunteer tree planting events. Opportunities begin with supporting commitments, in the form of labor and funding, from civic organizations, community businesses, or other volunteer groups. Representative leaders of the group work closely with the program to coordinate the details of the tree planting event, and the program coordinates the amount of trees to be installed, the area for planting, and additional funding. Community input is integral to the planning process, but the program oversees the final selection and acquisition of trees from local nurseries. Program staff acquires trees through local nurseries using existing commercial relationships. Funding for the planting is assembled from a variety of sources, including private foundations, government grants, and program fundraising.

The program may request additional volunteer assistance to provide extra assistance during the tree planting. The program communicates expectations to volunteers leading up to the event, including where to meet, what to wear, what to bring, an outline of events, and inclement weather plans. In this instance, the program provides tools, plants, and other equipment necessary for planting. The nurseries deliver the
requested balled and burlapped trees early in the morning before the planting. On the morning of the event, volunteers gather at the site, receive planting team assignments, and put on safety vests provided by the program. After everyone has arrived, the program offers a welcoming message and delivers important reminders to volunteers concerning safety, equipment handling, and the location of each team’s planting area. After these remarks, volunteers assemble at the planting location to review proper planting techniques. A team leader demonstrates the planting procedure, including site preparation, tree handling, tree placement, backfill, staking, watering and mulching. After this review, the team divides into small groups of two to three people and installs the trees. In order to promote social interaction and reflection, groups are encouraged to provide a celebratory meal following the tree planting.

PROGRAM 1008

The program planted 188 trees representing 12 taxa in a community nursery as 1 ½” - 2” bare root stock during 2008. The most commonly planted species included *Syringa reticulata* (Bl.) Hara, *Ulmus* spp. Hybrids, and *Betula nigra* L. The program supported a municipal tree planting program with a community-based nursery staffed entirely by volunteer labor.

Community Nursery Tree Production Strategy

In this strategy, volunteers organize collective effort to support small-scale production of landscape trees at a community nursery. This program works
collaboratively with several civic organizations, municipal agencies, a local university, and community members to produce valuable landscape trees of adequate size and quality for a municipal tree planting program. Municipal representatives select desirable tree species and program volunteers develop a crop production schedule producing the desired number, size, and variety of trees available at defined intervals.

Each spring, the volunteers organize a large-scale event to plant approximately 100 trees in the community nursery. The volunteers obtain the desired trees from liner production nurseries as small bare root stock. The event organizers communicate expectations to other volunteers, including the scheduled planting date, what to wear, what to bring, an outline of events, and inclement weather plans. On the morning of planting, volunteers from the surrounding community arrive and assist with the tree installations in evenly spaced nursery rows. The trees are installed directly into 18-inch root control bags (e.g. Smart Pot-In Ground™) that have been placed in the surrounding soil. Volunteers coordinate their effort to prune the bare root stock, install the trees into the bags, mulch the soil, and stake the trees. Throughout the year, the volunteers divide responsibility for various tasks, including watering and pruning, among the group’s members. Each tree is grown for several years (approximately 3-5) until reaching the desired size for landscape installation. The program obtains funding for the nursery volunteer planting primarily through internal fundraising. During the tree planting event, local musical entertainment and food are offered to the volunteers in order to promote social interaction and cohesion surrounding the activity.
Municipal government employees harvest the trees from the nursery and, most frequently, install the trees around the community. The program also organizes an early spring tree lifting event in order to assist the municipality with hand-digging during the spring planting season. Occasionally, the program organizes large volunteer planting events similar to those described for other programs, such as Program 1006.

PROGRAM 1009

This program planted trees within its municipal boundaries. The program employed two professionals and organized its tree planting work, primarily, through a grant application planting strategy.

Grant Application Planting Strategy

In this strategy, the program makes an announcement about the opportunity for a community tree planting event. Upon the receipt of adequate funding, the program encourages community groups to submit applications for the tree planting opportunity. Community groups must meet several eligibility criteria, including commitment for a minimum number of participants (approximately ten) and trees (approximately 20). The application process is handled on a case-by-case basis and applications are generally approved if there is adequate funding. Once approved, a program representative will meet with the community members to discuss and confirm the planting locations, select species, and a date for planting. The species are generally selected from an approved species list authored by the program. Following this initial discussion, program staff will
review the application, planting locations, and species. Slight revision to planting plans may be made by the program, if necessary. After the plan is confirmed, the program acquires the trees from a local nursery using existing commercial relationships. Leading up to the event, the program communicates expectations to volunteers, including where to meet, what to wear, what to bring, an outline of events, and inclement weather plans.

On the morning of planting, the trees are delivered and placed by the nursery at the planting sites prepared by program staff. After the volunteers arrive, they receive instructions from program staff about proper tree installation, including site preparation, tree handling, tree placement, backfill, staking, watering and mulching. After the review, volunteers divide into small teams and complete the plantings.

PROGRAM 1010

This program planted trees within the municipal limits of its home city. During 2008, this program planted 44 trees, in the form of 2” – 2 ½” balled and burlapped stock, representing approximately 16 taxa during 2008, and the most commonly planted species included *Malus* spp. Mill., *Acer rubrum* L., and *Acer saccharum* Marshall. The program employed two professionals and organized its tree planting work, primarily, through a volunteer planting strategy.

Volunteer Planting Strategy

In this strategy, staff works closely with members of the community, including civic organizations and volunteer groups, and the municipal government to organize tree
planting events. Planting opportunities originate with supporting commitments from several sources, including civic organizations, community businesses, and other volunteer groups. Community input is essential to the planning process, and the program and volunteer groups collectively determined the amount of trees to be installed, planting sites, and desired species. The program, however, confirms the final selection and acquisition of the trees from local nurseries with which the program maintains commercial relationships. These nurseries provide information on species currently available for harvest, and the program utilizes this information to select species for planting as bare root material. Funding for the tree planting is provided through private foundation grants.

Leading up to the event, the program communicates expectations to volunteers, including where to meet, what to wear, what to bring, an outline of events, and inclement weather plans. On the morning of planting, volunteers gather at the site and the program delivers important reminders to volunteers regarding safety, equipment handling, and planting team assignments. The program reviews the tree installation process, including site preparation, tree handling, tree placement, backfill, staking, watering and mulching. After this review, the group divides into small teams of two to three people and installs the trees.

PROGRAM 1011

This program plants trees within the city’s municipal limits exclusively on public land. The program planted 21,025 trees representing approximately 62 taxa during 2008
and maintained an approved species list of approximately 52 species. Approximately eighty-five percent (84.9%) of trees installed by the program were selected from the approved species list, and the most frequently planted species included *Zelkova serrata* (Thunb.) Mak., *Styphnolobium japonicum*, and *Quercus palustris* Muenchh. The program employed 15 professionals to support its mission and organized its tree planting work, primarily, through an internally controlled planting strategy. This program installed trees mostly in the form of 2 ½” – 3” balled and burlapped material.

**Internally Controlled Planting Strategy**

In this strategy, program staff oversees all of the aspects of tree establishment. In determining where to plant trees, the program receives written requests from residents and establishes internal priorities. Its internal priorities are determined using inventory and census data describing canopy coverage and population density. Therefore, areas with the lowest amount of tree canopy and the greatest population density receive the most urgent planting priority. Tree planting occurs during both spring and fall seasons, and the program staff assesses planting sites, selects species, and acquires plants from nurseries. An approved species list authored by program staff contains information on frequently used species, including important criteria for consideration during species selection (Appendix D). Program staff occasionally refines the tree planting location after evaluating each site, slightly adjusting the location to better accommodate infrastructure or pedestrian access. Staff uses spacing guidelines contained in a site assessment checklist in order to limit future infrastructure conflicts (Appendix D). Plants are
acquired from nurseries via contract growing, a process structured by a formal written agreement outlining the terms and conditions of landscape tree production. The contract, authored by program staff, contains explicit quality controls and crop production requirements, including information describing desired species, size, pruning, and harvesting standards.

Tree installation is performed by landscape contractors and formally structured by a written contract, which describes the terms and conditions of work to be completed, including tree installation specifications, expected timeline for planting, and labor requirements. Tree installation specifications contained in the contract outline the requirements for site preparation, tree handling, tree placement, backfill, staking, watering, mulching, and site clean-up. The terms of the contract frequently require a guarantee period for tree survival (approximately two years). Following the installation, program staff visits the planting locations to review the condition of the tree and approve the work.

PROGRAM 1015

This program plants trees within several communities throughout the state. This program planted 515 trees, representing approximately 27, taxa during 2008, and the most frequently planted species included *Parrotia persica* C.A. Mey, *Aesculus × carnea* Hayne., and *Acer campestre* L. Most trees in this program were installed as 2 ½” – 3” balled and burlapped stock. The program employed six professionals and organized its tree planting work, primarily, through a coordinated volunteer planting process.
Volunteer Planting Strategy

In this strategy, staff works with community members, allied community organizations, and local government representatives to plan tree planting events. Tree planting opportunities arise with supporting commitments from civic organizations, community businesses, and other volunteer groups. Community input is actively sought during the identification of planting locations and tree species. The program, however, oversees the final selection and acquisition of the trees from local nurseries with which the program holds existing commercial relationships. The program maintains a close relationship with several local nurseries to obtain desired plant material. Nursery representatives provide staff with species availability lists, and the species selection process is strongly influenced and informed by those species on the list. Program staff also works with nursery trade representatives to obtain availability lists from established commercial networks. Funding for the tree planting is provided through various private foundation grants, government funds, and program fundraising.

Leading up to the planting, the program communicates expectations to volunteers, including where to meet, what to wear, what to bring, an outline of events, and inclement weather plans. On the morning of the event, volunteers gather at the site and begin to prepare the sites for planting. The volunteers collectively remove old stumps, clear debris, and remove soil from the planting site in preparation for the tree planting. While the volunteers prepare each site, program staff works with nursery and municipal representatives to deliver each tree to the planting site(s) throughout the neighborhood.
After this initial work, the program offers a welcoming message and delivers important reminders concerning safety, equipment handling, and locations of each planting site. Subsequently, the group assembles to review the proper planting techniques. The team leader demonstrates proper planting techniques, frequently referring to the organization’s tree planting specifications, and covers the process for tree handling, tree placement, backfill, staking, watering and mulching. After this review, the group divides into small teams of two to three people and installs the trees. The program staff, volunteers, and others often share a celebratory meal following the event to reflect on their collective achievement.

PROGRAM 1019

This program employed six professionals and planted trees within its city’s municipal boundaries. The program planted 210 trees representing approximately 32 taxa as 2 ½”- 3” balled and burlapped stock during 2008. The most frequently planted species included 

- *Acer rubrum* L.,
- *Acer × freemanii*, and
- *Corylus colurna* L. The program organized its tree planting work, primarily, through cooperative, commemorative, and internally controlled planting processes.

Cooperative Planting Strategy

In this strategy, community members review the program’s approved species list, purchase a tree from an approved local nursery, and request the program’s assistance in proper tree installation. The program limits the total number of participants in this
program each year, and receives applications during a similar time frame each spring. The homeowner generally works with the assistance of program staff to select an appropriate planting location on their property. When consulting with homeowners, the program staff uses the site assessment checklist and approved species list for guidance during decision making. After selecting an appropriate species for their yard the homeowners purchase the tree at an approved local nursery. These retail nurseries are often conveniently located within the city limits and provide high-quality stock at discounted prices for participating homeowners.

After the homeowner purchases the tree at the nursery, they submit an application to the program outlining the type of tree purchased, quantity of trees, and preferred planting location(s). Homeowners also request the assistance of the local utility company in marking underground utilities and mark the desired location of the tree on their property. Following the receipt of required paperwork, the program picks up the tree from the nursery and installs it according to the program’s specifications. After program staff installs the tree, homeowners commit to maintaining and watering the plant for a minimum number of years (approximately two).

**Commemorative Planting Strategy**

In this strategy, memorial tree plantings are offered to commemorate local people or events holding personal meaning for community members. Application forms are completed and submitted, along with the associated fees, by community members to the program. Trees are usually planted in areas populated with other memorial trees, termed
“Memorial Tree Groves,” or alongside other public tree plantings. Trees are installed and maintained by program staff, and these trees may or may not be accompanied by plaques, markers, or signs indicating their commemoration. Fees acquired through the application process are used for the associated material, tree(s), and long-term maintenance.

**Internally Controlled Planting Strategy**

In this strategy, program staff controls all of the aspects of tree establishment, including site assessment, species selection, nursery acquisition, and installation. In determining where to plant trees in the city, the program receives written and verbal requests from community members and establishes internal priorities. These internal priorities are established with input from program staff and municipal government representatives regarding areas requiring additional tree cover. Tree planting occurs during spring season only, and the program acquires trees from local nurseries using existing commercial relationships. Lists of desired species are sent to nurseries each fall to solicit estimated availability, and the nursery containing the most requested species usually provides the agreed amount the following spring. Program staff completes tree installations according to the program installation specifications (Appendix D).

**PROGRAM 1022**

This program employed three professionals and planted trees within the city’s limits. The program installed 1,607 trees representing approximately 43 taxa during 2008 and maintains an approved species list containing approximately 47 species; 87.1% of
Trees installed by the program were selected from their approved species list. Trees were installed as both 2½” - 3” balled and burlapped and 1½” – 2” container grown stock. The most frequently planted species during 2008 included Acer rubrum L., Platanus × acerifolia (Ait.) Willd., and Gleditsia triacanthos L. var. inermis (L.) Zab. The program exclusively used an internally controlled planting strategy.

**Internally Controlled Planting Strategy**

In this strategy, program staff controls all aspects of tree planting and establishment. In determining where to plant trees in the city, the program received written requests from community members and established internal priorities. The program used inventory and census data to establish planting priorities based on canopy cover and median household income. Therefore, neighborhoods with the lowest amount of canopy cover and the lowest median household income will receive the most urgent planting priority. The program also establishes priorities based on the locations of recently removed dead, diseased, or hazardous trees. Tree planting occurs during both spring and fall, and the staff coordinates their effort to assess planting sites and select appropriate species prior to these planting seasons. Program staff refers to the approved species list containing important criteria for consideration during decision making (Appendix D). Planting sites are assessed using site assessment checklists, containing spacing guidelines established by several municipal departments to limit potential infrastructure conflicts (Appendix D).
Tree installation is completed by landscape contractors and accompanied by a written contract, which describes the terms and conditions of work to be completed, including tree installation specifications, anticipated timeline for planting, and labor requirements. Landscape contractors awarded with tree planting contracts are responsible for acquiring trees, whereby the landscape contractors identify nurseries from which they would like to purchase trees and provide the information to the program. A program staff member travels to each nursery to ensure the availability of high-quality plant material and identify the desired trees. Tree installation specifications, contained in the contract, outline the requirements for site preparation, tree handling, tree placement, backfill, staking, watering, mulching, and clean up; the terms of the contract frequently require a guarantee period for tree survival (approximately two years). Following the installation, program staff visits the planting locations to review the condition of the tree and approve the work.

PROGRAM 1023

This program employed three professionals and planted trees within the city’s municipal boundaries. This program planted 964 trees representing approximately 51 taxa during 2008. The program maintains an approved species list of approximately 47 species, and 82.16% of trees installed by the program were selected from the approved species list. The most frequently planted species during 2008 included *Gleditsia triacanthos* (L.) var. *inermis* (L.) Zab., *Prunus serrulata* Lindl., and *Platanus × acerifolia* (Ait.) Willd. The program organized its tree planting, primarily, through homeowner
facilitation and grant application planting strategies. This program planted trees in the form of 1 ¼” – 1 ½” container grown and 2 ½” – 3” balled and burlapped stock.

Homeowner Facilitation Strategy

In this program, staff members facilitate tree planting by providing professional advice and low-cost trees to homeowners. The program encourages community members to apply for tree planting assistance from program staff, and program staff meets with homeowners to assist with site and species selection after these requests have been received. Homeowners are encouraged to acquire and plant the trees on their own following this initial assistance, and the program distributes educational materials to guide homeowners during tree planting. Homeowners are able to purchase trees at a reduced cost, grown as containerized 1¼”– 1½” caliper trees, during spring and fall each year. These trees are acquired by program staff directly from liner production nurseries throughout the United States through a bid solicitation process, whereby program staff considers homeowner interest and need when determining the type and quantity of species to order. These trees are obtained in advance of homeowner requests each season, and the trees are obtained in general standardized quantities to establish a baseline amount of species available for homeowner planting. Once the trees have been obtained, the program distributes them to homeowners at a reduced cost. The homeowners finally install the trees using the installation specifications, program staff assistance, or a landscape contractor.
Grant Application Planting Strategy

In this strategy, a group of community members and homeowners apply for funds awarded for tree planting. The group must meet several eligibility criteria in order to qualify for this program, including a minimum number of participants, trees, and planting locations. Community members must obtain permission to plant on private land, when applicable; however, planting is primarily supported at street locations. The program maintains a list of preferred neighborhood areas in order to prioritize those most in need, and these preferences are based on canopy cover and census data. Community members applying for funding must also designate specific individuals to oversee maintenance and watering for each tree, and these individuals are required to sign pledges indicating their willingness to take care of the planted tree(s) for a specific time period (approximately two years). Applicant groups must specify an individual leader charged with communicating program information and updates to group members.

The application, review, and approval process has deadlines before the fall and spring planting seasons. The organization provides details to each community group about tools, clothing, and other equipment recommended for tree planting. The groups receive funding based on the submission of necessary paperwork by required deadlines and satisfaction of eligibility criteria. Program staff works with the community group to evaluate site conditions and select species. Following planning, the community group and program confirm a date for the installation, and the program may promote the planting event to other volunteers within the community for additional assistance. Leading up to the planting, the program communicates expectations to the group leader, including
where to meet, what to wear, what to bring, an outline of events, and inclement weather plans.

On the morning of planting, volunteers gather at the planting site and prepare the planting holes. Volunteers divide responsibility for planting among those in attendance and form small teams of two to three people. After the trees arrive, the program offers welcoming message to volunteers and delivers important reminders regarding safety, equipment handling, and similar topics. Program staff demonstrates proper tree planting techniques, frequently referring to the program’s installation specifications, and staff reviews the process for site preparation, tree handling, tree placement, backfill, staking, watering and mulching. Following these initial remarks, volunteers assemble with their planting teams at each site and install the trees.

KEY INFORMANT INTERVIEW RESULTS

These interviews were used to identify current tree establishment practices at community tree planting programs of varying size, levels of activity, and geographic location. The following major themes were revealed from key informant interview data analysis and are categorized into the following major areas:

Program Mission

Financial Support

Community Support

Tree Planting Standards and Policies

Tree Planting Workflow
PROGRAM MISSION

All programs indicated that their explicit or implied mission included the management and improvement of urban trees. A source of variation among programs, however, was the management strategy used to achieve this goal and other mission-related objectives. Programs recognized that trees provide multiple benefits and developed strategies for tree establishment that reflected the derivation of one or more of these benefits, including environmental and social amenities. Programs developed an informal hierarchy of environmental and social needs for their city and devised program objectives and strategies that contributed to their resolution. For example, a program emphasizing the amelioration of urban air pollution levels would implement explicit strategies seeking the timely reduction of gaseous and particulate air pollution.

Environmental Benefits

[When planting], we have a preference for a large shade tree… simply because of the environmental impact.

There is a criterion that 60% [of trees being planted] need to be shade trees… That’s one program specification that we’ve tried to push.

Social Benefits

Well, the unique thing about [our program] is that we actually get the community groups involved in planting and maintenance so there is a lot more ownership… We’ve had a very good success rate and very low mortality rate because of the aftercare.
We believe it’s important to consider the community benefits. We are interested in understanding why these trees are so important to people in urban areas… How do these trees improve an actual individual person compared to the environment? Does it change a community if you go in with volunteers and plant trees in an area versus just going in with a bunch of contractors and doing the planting? We’re not really sure, but we’re interested in capitalizing on any of those social benefits.

FINANCIAL SUPPORT

Programs consistently reported that funding for tree planting correlated directly with mission achievement. Participants suggested that funding source consistency and reliability was crucial to support the long-term focus of their programs. Contrasting, several programs reported that limited funding impeded tree planting efforts the most. Each program utilized a distinctive funding mix, including monies from the U.S. Department of Housing and Urban Development, U.S. Forest Service, municipal governments, state governments, private foundations (e.g. the Home Depot Foundation), internal fundraising, and restricted private endowments. Requirements associated with funding sources regularly affected the tree planting process. Most notably, programs indicated the requirements associated with performance accountability and evaluation. Although some programs viewed this requirement negatively, several programs suggested that a strong performance accountability and evaluation system provided an opportunity to justify tree planting expenditures. Storing and reporting information related to budgets and productivity, including the number, types, and locations of trees installed, for example, was one common method for meeting performance accountability requirements.
The biggest thing is money. The size of the contracts and the number of staff people we have working on the project… It boils down to budget and capacity. That’s the biggest thing, we need more money for contracts and more money for staffing.

Funding is always the key, without funding you don’t do anything. So, I think to really get funding going, you can’t stand there and wait for municipal dollars or state dollars or federal dollars to fall from the sky. We’re lucky because we have had a nearly stable affluent community that has supported our efforts fairly consistently over the years.

COMMUNITY SUPPORT

Several programs involved citizens in planning future activities, solicited resident input during species selection, and integrated community members in hands-on installation and maintenance activities. Participating programs reported three categories of community support, including organizational partnerships, government endorsement, and citizen stewardship, which contributed to tree planting success.

Organizational Partnerships

… because we’re so diversified we don’t really have any single organization holding our progress still. A previous problem that we have dealt with in the past is being reliant on one key partner or agency and having turnover within that organization… Now that we have such a diverse group of community support that we’re often not limited.

I think the private-public partnerships have been part of our most successful programs… We actually had some business leaders stand up and say, “We give to the tree fund every year and we like that connection.”
Political Endorsement

I think we know that the street tree planting program is a high priority within the city government. We’ve been told that and we’ve heard the mayor say that.

The capacity of the city government has been a huge asset to our program. They have helped in very large projects, like developing an approved species list, and during volunteer tree planting events they always help out, dig the holes, and provide equipment.

The adoption of the tree planting goal, a partnership between the City government and other non-profits, has increased our visibility and success. The fact that the City has promoted the goal really helps our credibility.

Citizen Environmental Stewardship

We’re finding out that, a lot of the time, the survivability rate isn’t affected by the tree species but more often by the level of care it receives in the community. I’ve only been here two years, but I can tell the communities that stand out in terms of stewardship and those that haven’t been caring for their trees. Aftercare is really the key variable.

The problem that we’ve already encountered from our first seasons of planting is that, with a top-down planting effort, you also need to build in a stewardship effort. Planting trees is an easy thing, but getting them to survive, getting them adopted is a more important thing. We’ve done our fair share of top-down planting, found out that it wasn’t that successful and said, “Okay, let’s back off a little bit and build our stewardship program.”

They [community members] are big supporters of the tree program. I guess all of the civic associations support everything we do. They’re at the heart of everything we do, which is build community. You can get things done in a more sensible way with all kinds of help from these groups. Instead of just planting one tree, you can plant a whole block and make all kinds of progress.
TREE PLANTING STANDARDS AND POLICIES

Participating programs maintained detailed documents describing their tree planting efforts to ensure adherence to municipal, organizational, and program regulations.

Site Evaluation Checklists

Three programs referred to standardized site evaluation criteria during the tree planting process. Site evaluation checklists frequently addressed minimum spacing requirements (e.g. distance between trees and utilities, distance between two trees), planting area dimensions (e.g. root zone requirements), and lists of potential regulations (e.g., ADA handicap accessibility requirements) (Appendix D).

We have all of these general rules that the city proclaims on spacing and what species should go where… as general as only small trees go under wires and larger trees go in areas without obstructions, to something very specific like staying so many feet away from a driveway.

You have to consider how the trees impact access. How they impact sidewalks for maintenance crews to gain access during the winter to plow, during the summer mowing season, and how they limit access to buildings for the fire department.

Approved Species List

Six participating organizations maintained approved species lists, ranging from 11 to 55 species. These lists guided tree selection and were consulted by program staff and by community members. The average approved species list contained 46 tree species. Listed species accounted for an average of 77.73% of all trees installed by participating
programs, revealing the open-ended nature of these lists. Approved species lists frequently included content related to species identification (e.g. botanical name, common name, appropriate cultivars), plant growth and development (e.g. mature size, growth rate, transplanting season, habit/form description), environmental tolerances (e.g. pH, salt, compaction, and drought tolerance), environmental sensitivities (e.g. pest and disease susceptibility, fall transplant hazards), and ornamental characteristics (e.g. flower characteristics, fall color, fruit characteristics) (Appendix D).

We have the recommended list of street trees, and it’s divided into a list of small, medium, and large trees. We have this on our Web site and we hand these out to people so that they can refer to it. It does have a short description of each tree… So, that’s the starting point.

Our species list, for the sake of project sanity we have narrowed our planting list fairly dramatically from our first few seasons of planting. We went through a period of time where we were pretty open to planting anything groups wanted, and now we’ve honed that to a list of probably 20 or 30 species with an emphasis on medium and large shade trees.

I started tweaking the list and it came about through incorporating trees that would do well in urban settings… The list originally was a little vague… Now it’s grown to about 50 species.

**Nursery Specifications**

Nursery specifications were used by three programs and generally distributed to commercial nurseries as written contracts and formal agreements. These documents included information regarding requested species (e.g. scientific name, quantity), plant material quality (e.g. ANZI Z60.1 quality standards, nomenclatural standards, labeling),
plant condition (e.g. root structure, crown structure, contaminated stock), production specifications (e.g. crop timing, liner spacing, pruning, watering, staking, fertilizing, plant provenance, expected labor input), harvesting (e.g. furnished size of trees, seasonal timing), and tree preparation and delivery (e.g. root packaging, transportation, tagging, inspection) (Appendix D).

We’ll be dictating what trees we’ll need and when they’ll be delivered. All the way down to the number of trees per season, exactly to what specifications they should be grown, how high they should be limbed up, what the head should look like, what the root ball should look like, etc. So, this switch is all about control over what we’re after and getting what we want. It’s not only about getting the right species for the plantings we’re trying to do and we know we’ll need, but it’s greater control over the quality of trees we’re receiving.

We also demand quality material from the nurseries that don’t meet our specifications. So several of our foresters regularly reject trees that are delivered at lower quality from the nurseries.

Installation Specifications

All programs developed tree installation specifications that were officially adopted and approved by the organization and, occasionally, the municipal government. These specifications were distributed in both educational and contractual written form and referenced by in-house staff members, landscape contractors, and/or volunteer groups during the tree planting process. Tree planting specifications frequently included material specifications (e.g. plant quality, backfill, mulch, soil amendments, stakes, ties, watering bags), planting guidelines (e.g. seasonal timing, site preparation, tree handling, tree
preparation and placement, backfill, staking, watering, mulching), and site finalization (e.g. cleanup, labeling) (Appendix D).

We give them handouts [planting specifications] and then plant, mulch and water all of them, but we make sure the whole process is complete.

The majority of our time is spent on contract management. We work with contractors to get these trees planted according to our specifications and timelines.

TREE PLANTING WORKFLOW

Programs managed their tree planting efforts systematically. The installation process required exact coordination between several individuals, groups, and organizations. Although each program structured this process uniquely, four activities were common among all programs, including, in order, identifying opportunities for planting, site assessment and species selection, tree acquisition, and lastly tree installation (Miller, 1997). In this process, specific individuals, groups, and organizations ensured that all activities conformed to program standards and specifications. Completing these four activities was not strictly linear and could overlap. The program’s productivity was frequently referenced as a function of the effectiveness, efficiency, and equity of this workflow. The justification for the composition of each activity in this workflow can be found in the program mission.
Identifying opportunities for planting

The identification of potential planting sites was often supported by previously completed analyses of the urban forest structure. These analyses utilized tree inventories and aerial image-based canopy studies, which enabled programs to examine current levels of tree distribution and canopy coverage within a specific geography; these figures were used to promote the utility of tree planting work within the city. These analyses provided information on the current status of the environment and opportunities for planning its future development. Tree planting goals, expressed as a number, and canopy cover goals, expressed as a percentage, were frequently established as a result of structural analyses. Five program participants have established tree planting and/or canopy goals (Appendix B).

However, structural analyses and goals often did not provide day-to-day guidance on where to focus tree planting efforts. Programs used several procedures to identify planting opportunities within the community, often enlisting individuals both within the program and the community to identify potential planting sites. Community members initiated tree planting efforts through grant applications, permit applications, written requests, and cost reimbursement programs. Programs initiated tree plantings through internal priorities and replacement of dead trees.

There are a couple of ways that we get planting requests. The most generic one is that anytime we close out a removal for a location, our maintenance system automatically generates a planting request for that same location. The second way we receive requests is from the city residents. If any citizen calls and requests a tree in front of their house, we’ll come out and plant one whether there was one in front of the house already or not. The third way, which is becoming more and
more popular, is targeting some of the downtown areas and low canopy coverage areas for planting. Part of the initial inventory displayed neighborhoods that have low canopy areas… We’ve prioritized areas with the lowest canopy coverage and lowest income first.

Well, we realized that we’re going to have these two different kinds of planting schemes – the kind where people want them and then the other [program] priority plantings. So we decided that in areas where people aren’t requesting [trees], we’re going to base our priorities on population density and canopy cover equally weighted. So we take those areas that have the fewest trees and the areas that have the most people and weighted them exactly the same to figure out where the priorities lie.

Certain block planting locations have been chosen based on asthma rates. [They] are called Trees for Public Health (TPH) neighborhoods. Every borough has one and a research study was conducted to find out the areas that have the highest childhood asthma rates. Those areas, some are bigger than others, have automatically been given a higher planting priority than the others in our block-planting program. Every season they are being planted until they become fully stocked.

Well, with the community tree planting program, the premise is that it’s a grass roots tree planting. They’re going to receive, plant, and take care of those trees. So it definitely is a dialogue in that situation. The tree rebate program is entirely a do-it-yourself thing where the homeowner buys and plants the tree, submits some paperwork to our office, and then we would refund them $50 or the cost of the tree, whichever is less.

**Site assessment and species selection**

Program staff, community members, and landscape horticulture professionals assisted with site evaluation and species selection at individual locations. Approved species lists and site evaluation checklist documents were frequently used during the decision making process. Programs emphasized species selection criteria according to their mission and geographic location. Selection criteria highly prioritized included...
physical conflicts (e.g. utilities and infrastructure), community input (e.g. solicited citizen feedback), aesthetics (e.g. flower, fruit, fall color, bark), insects and diseases (e.g. emerald ash borer, Asian long horned beetle, bacterial leaf scorch), and utilitarian contributions (e.g. wildlife habitat, public health, stormwater mitigation, economic development). Programs reported spending the least amount of time on species selection during the tree planting workflow. During 2008, programs installed a total of 26,387 trees, and the total planting activity within each organization ranged between 44 and 21,025 trees. The most frequently planted species included Zelkova serrata, Gleditsia triacanthos var. inermis, Quercus palustris, Styrchnolobium japonicum, and Prunus serrulata Lindl. The most commonly planted genera included Prunus spp., Quercus spp., Zelkova spp., Tilia spp., and Gleditsia spp. The most commonly planted families included the Roseaceae, Fagaceae, Ulmaceae, Tiliaceae, and Caesalpiniaceae. Programs regularly installed landscape tree cultivars exhibiting consistent, predictable performance in urban conditions, and they frequently used those categorized as compact, columnar, urban tolerant, and ornamental selections (Appendix C). Although programs recognized the importance of avoiding the installation of potentially invasive species, the programs included in this research planted 572 Pyrus calleryana cultivars, including ‘Aristocrat,’ ‘Cleveland Select,’ and ‘Redspire.’ Programs also planted Phellodendron amurense, a species considered aggressive by some experts, in several instances during 2008.

All the species selection is left up to the forester, but it’s also subject to the principles of the program. The guidelines help to guide those decisions that they’re making on a case-by-case basis throughout the city. Everything is site-specific, so every location is visited at least twice, really, before the final decision
is made on where trees get placed, and what tree is going to go there. Once they’re there, they spend at least a couple of minutes looking at each site, looking at what’s going on, how people are walking by, how big of a tree pit they can create or whether they can make an existing pit bigger. Then [they select] what type of tree will survive best in that particular location given the plethora of infrastructure conflicts that you could come across. Everything from really narrow sidewalks… to really narrow tree lawns.

I normally do all of the species selection and I have several things that I need to accomplish before the tree planting occurs. The first one is site evaluations and I normally go to the site before I meet with the community group to do some preliminary work. I take notes on what side the wires are on and how big the sidewalk is, etc. Then, I kind of have an idea of what I can offer the residents. At the community meeting, I take a black binder with all of the trees that I know are being offered by nurseries, divide them by short and large trees, and I say, “You can pick from these trees.”

So, we give that [species] list and break it out by large, medium, and small trees, and we arm our citizen foresters and project organizers with that information. We allow each group to make a first cut at their design… after they’ve considered their physical space and aesthetic style. Some of the groups check in with us and discuss some of the selections. They may check in and say, “Hey, I need a tree for a wet spot. What should I put in there?” Then we, in house, review all of the plants and in some cases… approve some things and replace others.

**Tree acquisition**

Participating programs obtained trees from a reliable commercial source of high-quality plant material, including wholesale nurseries, liner nurseries and program-owned growing facilities. Interaction with wholesale nurseries was mostly based on informal commercial exchange, which was based on the geographic accessibility of businesses, established professional relationships, and the predictability of nursery output. A small group of programs obtained their plant materials via formal commercial exchange with
wholesale nurseries, using written contracts, negotiated terms of sale, and bid solicitations.

Programs utilizing program-owned growing facilities obtained tree liner stock from primary production nurseries utilizing informal commercial exchange. These liners were grown according to the quality standards of the program and transplanted after achieving the desirable size. One in-house nursery relied entirely on volunteer support to grow tree liners for two to three years prior to planting them in permanent locations throughout the community.

Six nurseries identified by participating programs reported increasing commercial interaction with community tree planting programs. These nurseries identified several existing obstacles to optimal interaction, including challenges resulting from difficult crop timing, unique plant material demands from programs, and exceedingly low prices for plant material. These nurseries suggested that programs represented a small proportion of their overall customer base, and their unique demands for plant material were difficult to accommodate in small, inconsistent quantities.

We’ve worked with a variety of nurseries over the seasons, and those relationships were determined by the quality of the planting stock, their ability to deliver in a timely manner, and cost… all of those factors and some others. So now we’re at the point that we have one or two nurseries that we’re really fond of and we have a good relationship with. We actually entertained the idea of contract growing… for a while but it eventually came back to a gentleman’s agreement. We came up with a list of common trees that they wanted to grow and the quantities were ample enough so that we could purchase sufficient quantities and they could still service their other vendors. But there was nothing in writing or formal between the two of us, you know, they bring us down for steaks every once in a while and they come up to visit and we take them out for steaks. And it works and it’s been great.
The bottom line is that we spent years, ever since the tree program started, like 30 years there was this system of acquiring trees based on relationships. We had these relationships to find our trees, and I don’t think any season ever reported every single tree we were after. Especially during the past few years when our species list has grown somewhat significantly. It’s just because our demand is very unique and we’re acquiring trees really, in the big scheme of things, that aren’t commercially viable… it’s just that they’re really hard to sell, and if the nurseryman is already guessing which species he’s going to have to sell, you’ll find it very hard to convince him to sell something he know will be difficult. So, now we’re switching to contract growing and we’ll be dictating what trees we’ll need and when they’ll be delivered… This formal contractual obligation requires, with very strict terms, products these nurseries will be providing.

Each spring, we plant about 100 bare root trees into our community nursery and grow them on for a number of years. The city’s forester removes at least 130-140 trees as 2.5” B&B material each year. We grow these species on to size, acclimate them to our environment, and it’s all managed by a core group of about 20-30 volunteers. The majority of the city’s trees for street planting come from this community nursery.

Tree Installation

Programs installed trees using contract, volunteer, or in-house professional labor, which followed written program installation specifications; adherence to these specifications was guaranteed using a number of methods. Programs installed the majority of their trees as balled and burlapped 2” – 2 ½” caliper stock. A smaller proportion of programs installed container grown and bare root 1” – 2” caliper stock. Programs reported allocating the majority of their time completing this activity in this workflow. When landscape contractors were involved, programs used written contracts that were compiled using external legal counsel. The contracts addressed the scope of work and performance, expected time of completion, compensation and method of
payment, and acknowledgment of labor wages and regulations. In addition to these terms and conditions, the contracts included program installation specifications, the location of work, and the number of plants to be installed. Program staff consistently reviewed and inspected the work completed by contractors in fulfillment of the contractual agreement.

Several programs utilized in-house, skilled professionals to install trees. These professionals had the necessary equipment to successfully install trees into the landscape, and they adhered to program installation specifications via staff training, professional development, and administrative oversight.

A number of programs utilized volunteer groups to install trees. These installation events were coordinated, planned, and executed by program staff and community members. The attendance levels at events were set and maintained by the program in order to provide a meaningful experience for volunteers and to reach an appropriate ratio of staff to volunteers for instruction. The events typically began with volunteer registration, followed by the assembly of groups of 5 to 15 people with an assigned group leader, usually a program staff member. The volunteer groups observed one complete installation process by program staff who simultaneously discussed the process and answered volunteer questions. The volunteers then separated into small groups of two to three members and installed the trees. After the installation, several programs organized celebratory meals for all of the community members at the planting site. A review of work completed was commonly presented during this celebratory meal, along with information about the program, its mission, and future volunteer opportunities.
We’re pushing towards requiring the community group to provide some refreshments or a barbecue to celebrate the tree plantings. It’s not written in stone yet but we’re certainly promoting the idea and strongly encouraging it. Just a way to reward the volunteer efforts, and really, it’s about an investment of $200 for thousands of dollars worth of staff time and trees.

We organize our volunteers into groups. One or two of us will go with the delivery guy to the street and he’ll run all of the trees to all of the homes in the two-block area or whatever it is. We’ll rent one of the mini-excavators on tracks to limit damage on the lawns and dig the holes with that machine. Then, all of the plantings are done by hand with volunteers.

Well, contractors do all of the installations. Every detail is spelled out from which tree should go where to the backfill soil specifications to what type of stakes should be used. And we hire contract managers to provide on-site supervision of the installation process. These guys basically watch the contractors and record their progress, problems with the way they plant the tree, and their adherence to the contract. After each tree is planted we go around and inspect every tree. We confirm that it’s alive and figure out, if it’s not, why it died and select a more appropriate species.

**RESEARCH QUESTIONNAIRE RESULTS**

**Community Tree Planting Program Questionnaire Results**

A questionnaire was sent to staff at community tree planting programs within the Northeast and Mid-Atlantic regions of the United States. Questions were aimed at program success, level of activity, and tree planting strategies, and the rate of response for the questionnaire was 37.1% (Table 1). A copy of this questionnaire, including complete results, can be found in Appendix 6.
Program staff was asked how successful they were at achieving their respective tree planting goals during 2008. Only 1.8% of respondents indicated that they had no successful goal attainment during 2008, while 98.2% reported achieving some level of success (Table 2).

Staff was asked to estimate the number of trees planted by their program during 2008, and the majority (55.4%) reported planting 300 or fewer trees. Other programs indicated planting between 301 and 600 trees (19.6%) and 1,200 trees or greater (16.1%), while only five programs (9.0%) reported planting between 601 and 1,200 trees (Table 3).

When asked about the existence of selected components in their tree establishment process, the majority of respondents reported the inclusion of approved species lists (92.9%), community input (89.3%), a formal approval process (89.3%), nursery specifications (76.8%), site assessment checklists (78.6%), and tree installation specifications (92.9%) in the tree planting process (Table 4). On average, each surveyed staff member reported approximately five of these components were included in the planting process. The majority of respondents reported that community support and stewardship (85.7%), municipal government capacity (80.4%), political support (85.7%), program capacity (82.1%), program partnerships (82.1%), and sufficient funding (75.0%) enabled them to achieve their respective planting goals (Table 5). On average, each respondent indicated approximately five of the listed items contributed to tree planting goal attainment.
When asked about their tree acquisition process, a slight majority of program staff obtained trees through traditional commerce (51.8%), while other respondents reported the use of bid solicitation (37.5%), advanced ordering (33.9%), and negotiated sales (33.9%). Contract growing was the least frequently employed method of obtaining trees (7.1%) (Table 6).

In terms of root packaging, most respondents reported their use of balled and burlapped trees (58.5%). Container grown (18.6%) and bare root (10.4%) landscape trees represented a smaller proportion of all trees installed by the surveyed programs (Table 7).

Program staff was asked about the most frequently installed tree size in their program, and most reported an average caliper size between 2” and 2 ½” (46.4%). Respondents also reported utilizing caliper sizes ranging between 1 ½” and 2” (28.6%) and 2 ½” and 3” (21.4%). Few respondents utilized caliper sizes ranging 3” or greater (3.6%) (Table 8).

When asked about the adequacy of available species at nurseries, the majority of respondents rated the species mix as “somewhat adequate” (39.3%) with the second most popular response being “somewhat inadequate” (26.8%) (Table 9).

In an open-ended question, program staff was asked to comment on difficult-to-locate species within the nursery trade, and 55.4% of the survey pool replied. Their responses ranged from short, one-word responses to several sentences. The tree species most frequently listed as consistently difficult to locate for purchase were *Nyssa sylvatica*, *Corylus colurna*, *Ginkgo biloba*, *Gymnnocladus dioicus*, and regional native species in general (Table 10).
When asked if trees were grown “in-house” using internal funds and resources, the majority of program staff indicated that they were not (80.4%), but some organizations did so (19.6%) (Table 11). As for the total number of nurseries utilized to obtain needed trees, most programs reported using between two and three nurseries (48.2%). Fewer programs reported utilizing between four and five nurseries (25.0%), six or greater nurseries (17.9%), or one nursery (8.9%) (Table 12).

Cross comparison analysis failed to produce significant conclusions regarding several research variables. Pearson’s Chi-Square test revealed no significant relationship between the reported use of written standards and policies (e.g., approved species lists, site assessment checklists) and program success, defined as the achievement of annual planting goals. Additionally, comparison of the amount of trees planted by an organization and their evaluation of the mixture of available species in nurseries also failed to reveal a significant relationship (Table 13, Table 14).

Principal component analysis revealed three new constructed variables that collectively explained 54.1% if the total variance. The first principal component (PC1) represents survey questions two, five and eleven, which asked the total amount of trees planted, number of nurseries utilized, and methods of commercial acquisition (Table 15). Collectively, these variables explain the tree acquisition process. The second principal component (PC2) represents survey questions three and ten, which asked about the inclusion of specific components in the tree planting process and using internal funds and resources to grow trees (Table 15). These principal component weights were opposite, suggesting that programs with a highly documented and regulated tree establishment
process were much less likely to grow trees in-house. The third principal component (PC3) represents survey questions four and eight, which asked about the support received from various specific entities and the adequacy of available species in nurseries (Table 15). Utilizing the results of the principal component analysis, each of the 56 responses was weighted in order to represent the new reduced variables. Comparing question one (rating of success) with the principal components revealed a significant difference only among the PC1 responses. A two-sample t-test for the scores of PC1 between those indicating greater success and those indicating less success revealed a very significant difference between the two groups (p=0.0049).

Logistical regression comparing the three principal components to survey question one, a subjective rating of success, produced the following regression equation. Here, p can be interpreted as the probability that a community tree planting program will be successful.

\[
\text{Log} \left( \frac{p}{1-p} \right) = -0.7128 - 0.7164(\text{PC1}) - 0.2825(\text{PC2}) + 0.0576(\text{PC3})
\]

Figure 2 Logistical Regression Equation of Community Tree Planting Program Success and Principle Components

Wholesale Nursery Questionnaire Results

The total rate of response for this questionnaire was 31.5% (Table 13), whereby nurseries were asked about their total sales overall, and the frequency and nature of their interaction with community tree planting programs. The questionnaire and complete results can be found in Appendix 7. All questionnaire respondents were classified as
wholesale nurseries (100%), with 13 (38.2%) reporting interaction with community tree planting programs during 2008 (Table 14, Table 15). When asked to categorize their total landscape tree sales among five categories, responding nurseries attributed the majority to landscape contractors (50.3%) with other sales to garden centers (13.1%), re-wholesalers (11.5%), community tree planting programs (7.8%), and mass merchandisers (4.0%) (Table 16).

When asked about the volatility of community tree planting program demand, and the majority of nurseries (53.8%) reported that their sales to community tree planting programs neither decreased nor increased during 2008. However, some nurseries reported their interaction with community tree planting programs had slightly increased (23.1%) (Table 17). The majority of nurseries reported that their interaction with community tree planting programs could be classified best as “traditional commerce” (46.2%), while fewer reported bid fulfillment (30.8%), negotiated sales (15.4%), and re-wholesale distribution (7.7%) as the predominant method of commercial interaction with tree planting programs. No nurseries reported using contract growing as a method of commercial interaction with tree planting programs (Table 18).

Nurseries were also asked about root packaging methods that were requested by community tree planting programs, and nurseries reported distributing trees to programs mostly as balled and burlapped material (50.0%). However, smaller proportions of sales to community tree planting programs were reported as container grown (27.0%) and bare root (9.7%) material (Table 19).
The majority of nurseries reported that they “somewhat favor” (46.2%) formal growing arrangements between themselves and community tree planting programs, while other categories received fewer responses, including “neither oppose nor favor” (30.8%), Table 20).

Regarding the prediction of future demand from community tree planting programs, nurseries reported a mixed strategy to predict demand from community tree planting programs, including program recommendations (46.2%), analysis of historical sales figures (46.2%), nursery industry recommendations (53.8%), and horticultural and/or forestry research reports (46.2%) (Table 21).
### Tables

**Table 3** Community tree planting program questionnaire rate of response.

<table>
<thead>
<tr>
<th>Number of respondents</th>
<th>Response percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>37.1%</td>
</tr>
</tbody>
</table>

**Table 4** Tree planting success reported by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely successful</td>
<td>12</td>
<td>21.4%</td>
</tr>
<tr>
<td>Very successful</td>
<td>24</td>
<td>42.9%</td>
</tr>
<tr>
<td>Somewhat successful</td>
<td>17</td>
<td>30.4%</td>
</tr>
<tr>
<td>Slightly successful</td>
<td>2</td>
<td>3.6%</td>
</tr>
<tr>
<td>Not at all successful</td>
<td>1</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

**Table 5** Amount of trees planted by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 or fewer</td>
<td>31</td>
<td>55.4%</td>
</tr>
<tr>
<td>301-600</td>
<td>11</td>
<td>19.6%</td>
</tr>
<tr>
<td>601-900</td>
<td>2</td>
<td>3.6%</td>
</tr>
<tr>
<td>901-1,200</td>
<td>3</td>
<td>5.4%</td>
</tr>
<tr>
<td>1,200 or greater</td>
<td>9</td>
<td>16.1%</td>
</tr>
</tbody>
</table>
Table 6 Tree establishment components reported by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Yes</th>
<th>Percentage</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Species List</td>
<td>52</td>
<td>92.9%</td>
<td>4</td>
<td>7.1%</td>
</tr>
<tr>
<td>Community input</td>
<td>50</td>
<td>89.3%</td>
<td>6</td>
<td>10.7%</td>
</tr>
<tr>
<td>Formal approval process</td>
<td>50</td>
<td>89.3%</td>
<td>6</td>
<td>10.7%</td>
</tr>
<tr>
<td>Nursery specifications</td>
<td>43</td>
<td>76.8%</td>
<td>13</td>
<td>23.2%</td>
</tr>
<tr>
<td>Site assessment checklist</td>
<td>44</td>
<td>78.6%</td>
<td>12</td>
<td>21.4%</td>
</tr>
<tr>
<td>Tree installation specifications</td>
<td>52</td>
<td>92.9%</td>
<td>4</td>
<td>7.1%</td>
</tr>
</tbody>
</table>

Table 7 Items enabling the achievement of tree planting goals in community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Yes</th>
<th>Percentage</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community support and stewardship</td>
<td>48</td>
<td>85.7%</td>
<td>8</td>
<td>14.3%</td>
</tr>
<tr>
<td>Municipal government capacity</td>
<td>45</td>
<td>80.4%</td>
<td>11</td>
<td>19.6%</td>
</tr>
<tr>
<td>Political support</td>
<td>48</td>
<td>85.7%</td>
<td>8</td>
<td>14.3%</td>
</tr>
<tr>
<td>Program capacity</td>
<td>46</td>
<td>82.1%</td>
<td>10</td>
<td>17.9%</td>
</tr>
<tr>
<td>Program partnerships</td>
<td>46</td>
<td>82.1%</td>
<td>10</td>
<td>17.9%</td>
</tr>
<tr>
<td>Sufficient funding</td>
<td>42</td>
<td>75.0%</td>
<td>14</td>
<td>25.0%</td>
</tr>
</tbody>
</table>
Table 8 Method of tree acquisition used by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional commerce</td>
<td>29</td>
<td>51.8%</td>
</tr>
<tr>
<td>Contract growing</td>
<td>4</td>
<td>7.1%</td>
</tr>
<tr>
<td>Advanced ordering</td>
<td>19</td>
<td>33.9%</td>
</tr>
<tr>
<td>Bid solicitation</td>
<td>21</td>
<td>37.5%</td>
</tr>
<tr>
<td>Negotiated sales</td>
<td>19</td>
<td>33.9%</td>
</tr>
</tbody>
</table>

Table 9 Root packaging methods used by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Average Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balled and burlapped</td>
<td>58.5%</td>
<td>40.35</td>
</tr>
<tr>
<td>Container grown</td>
<td>18.6%</td>
<td>29.37</td>
</tr>
<tr>
<td>Bare root</td>
<td>10.4%</td>
<td>23.53</td>
</tr>
</tbody>
</table>

Table 10 Average size of trees planted by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5”-2.0”</td>
<td>16</td>
<td>28.6%</td>
</tr>
<tr>
<td>2.0”-2.5”</td>
<td>26</td>
<td>46.4%</td>
</tr>
<tr>
<td>2.5”-3.0”</td>
<td>12</td>
<td>21.4%</td>
</tr>
<tr>
<td>3.0” or greater</td>
<td>2</td>
<td>3.6%</td>
</tr>
</tbody>
</table>
Table 11 Rating of the mixture of available species in nurseries by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Inadequate</td>
<td>2</td>
<td>3.6%</td>
</tr>
<tr>
<td>Somewhat inadequate</td>
<td>15</td>
<td>26.8%</td>
</tr>
<tr>
<td>Neither inadequate nor adequate</td>
<td>6</td>
<td>10.7%</td>
</tr>
<tr>
<td>Somewhat adequate</td>
<td>22</td>
<td>39.3%</td>
</tr>
<tr>
<td>Very adequate</td>
<td>11</td>
<td>19.6%</td>
</tr>
</tbody>
</table>

Table 12 Species reported as hard to locate for purchase by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Frequency of Response</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td><em>Nyssa sylvatica</em></td>
</tr>
<tr>
<td>5</td>
<td>Native species</td>
</tr>
<tr>
<td>4</td>
<td><em>Corylus columa</em></td>
</tr>
<tr>
<td>4</td>
<td><em>Ginkgo biloba</em></td>
</tr>
<tr>
<td>4</td>
<td><em>Gymnocladus dioicus</em></td>
</tr>
<tr>
<td>3</td>
<td><em>Eucommia ulmoides</em></td>
</tr>
<tr>
<td>2</td>
<td><em>Carya spp.</em></td>
</tr>
<tr>
<td>2</td>
<td><em>Celtis occidentalis</em></td>
</tr>
<tr>
<td>2</td>
<td><em>Koelreuteria paniculata</em></td>
</tr>
</tbody>
</table>
Table 13 Community tree planting programs responding to the research questionnaire that currently grow trees in-house.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>11</td>
<td>19.6%</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
<td>80.4%</td>
</tr>
</tbody>
</table>

Table 14 Number of nurseries utilized by community tree planting programs responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>5</td>
<td>8.9%</td>
</tr>
<tr>
<td>2-3</td>
<td>27</td>
<td>48.2%</td>
</tr>
<tr>
<td>4-5</td>
<td>14</td>
<td>25.0%</td>
</tr>
<tr>
<td>6+</td>
<td>10</td>
<td>17.9%</td>
</tr>
</tbody>
</table>

Table 15 Cross comparison of research variables: Written standards and community tree planting program success.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square</th>
<th>P-Value</th>
<th>Degrees of Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Species List</td>
<td>2.393</td>
<td>0.1219</td>
<td>1</td>
</tr>
<tr>
<td>Site Assessment Checklist</td>
<td>1.358</td>
<td>0.2440</td>
<td>1</td>
</tr>
<tr>
<td>NurserySpecifications</td>
<td>1.178</td>
<td>0.2778</td>
<td>1</td>
</tr>
<tr>
<td>InstallationSpecifications</td>
<td>0.215</td>
<td>0.6426</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 16 Cross comparison of research variables: Amount of trees planted and species availability rating.

<table>
<thead>
<tr>
<th>Chi-Square</th>
<th>P-Value</th>
<th>Degrees of Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.880</td>
<td>0.173</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 17 Principle Component Analysis of the Community Tree Planting Program Survey.

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>PC 1</th>
<th>PC 2</th>
<th>PC 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 11</td>
<td>0.553</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Question 5</td>
<td>0.546</td>
<td>0.205</td>
<td>0.364</td>
</tr>
<tr>
<td>Question 2</td>
<td>0.402</td>
<td>0.385</td>
<td>0</td>
</tr>
<tr>
<td>Question 3</td>
<td>0</td>
<td>0.556</td>
<td>-0.387</td>
</tr>
<tr>
<td>Question 10</td>
<td>0.111</td>
<td>-0.436</td>
<td>0.324</td>
</tr>
<tr>
<td>Question 8</td>
<td>-0.108</td>
<td>0.280</td>
<td>0.567</td>
</tr>
<tr>
<td>Question 4</td>
<td>0.257</td>
<td>-0.320</td>
<td>-0.529</td>
</tr>
<tr>
<td>Question 7</td>
<td>-0.381</td>
<td>0.353</td>
<td>0</td>
</tr>
<tr>
<td>Portion of Variance (%)</td>
<td>22.2</td>
<td>17.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Cumulative portion of Variance (%)</td>
<td>22.2</td>
<td>39.4</td>
<td>54.1</td>
</tr>
</tbody>
</table>

Table 18 Nursery questionnaire rate of response.

<table>
<thead>
<tr>
<th>Number of respondents</th>
<th>Response percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>31.5%</td>
</tr>
</tbody>
</table>

Table 19 Categories of nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale nursery</td>
<td>34</td>
<td>100%</td>
</tr>
<tr>
<td>Retail nursery</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>
### Table 20 Nurseries reporting interaction with community tree planting programs.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>13</td>
<td>38.2%</td>
</tr>
<tr>
<td>No</td>
<td>21</td>
<td>61.8%</td>
</tr>
</tbody>
</table>

### Table 21 Sales distributions in nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Average Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community tree planting programs</td>
<td>7.8%</td>
<td>10.41</td>
</tr>
<tr>
<td>Mass merchandisers</td>
<td>4.0%</td>
<td>15.49</td>
</tr>
<tr>
<td>Garden centers</td>
<td>13.1%</td>
<td>23.81</td>
</tr>
<tr>
<td>Landscape contractors</td>
<td>50.3%</td>
<td>38.46</td>
</tr>
<tr>
<td>Re-Wholesalers</td>
<td>11.5%</td>
<td>18.63</td>
</tr>
</tbody>
</table>

### Table 22 Perception of community tree planting program demand fluctuation by nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly decreased</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Slightly decreased</td>
<td>1</td>
<td>7.7%</td>
</tr>
<tr>
<td>Neither decreased nor increased</td>
<td>7</td>
<td>53.8%</td>
</tr>
<tr>
<td>Slightly increased</td>
<td>3</td>
<td>23.1%</td>
</tr>
<tr>
<td>Strongly increased</td>
<td>2</td>
<td>15.4%</td>
</tr>
</tbody>
</table>
### Table 23 Methods of commercial interaction reported by nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional commerce</td>
<td>6</td>
<td>46.2%</td>
</tr>
<tr>
<td>Contract growing</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Re-Wholesale distribution</td>
<td>1</td>
<td>7.7%</td>
</tr>
<tr>
<td>Bid fulfillment</td>
<td>4</td>
<td>30.8%</td>
</tr>
<tr>
<td>Negotiated sales</td>
<td>2</td>
<td>15.4%</td>
</tr>
</tbody>
</table>

### Table 24 Root packaging methods used by community tree planting programs reported by nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Average Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balled and burlapped</td>
<td>50.0%</td>
<td>46.56</td>
</tr>
<tr>
<td>Container grown</td>
<td>27.0%</td>
<td>40.30</td>
</tr>
<tr>
<td>Bare root</td>
<td>9.7%</td>
<td>27.05</td>
</tr>
</tbody>
</table>
Table 25 Favorability of formal commercial interaction reported by nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly oppose</td>
<td>1</td>
<td>7.7%</td>
</tr>
<tr>
<td>Somewhat oppose</td>
<td>1</td>
<td>7.7%</td>
</tr>
<tr>
<td>Neither oppose nor favor</td>
<td>4</td>
<td>30.8%</td>
</tr>
<tr>
<td>Somewhat favor</td>
<td>6</td>
<td>46.2%</td>
</tr>
<tr>
<td>Strongly favor</td>
<td>1</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

Table 26 Methods of determining future community tree planting program demand by nurseries responding to the research questionnaire.

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Yes</th>
<th>Percentage</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree planting program recommendations</td>
<td>6</td>
<td>46.2%</td>
<td>7</td>
<td>53.8%</td>
</tr>
<tr>
<td>Analysis of historical sales figures</td>
<td>6</td>
<td>46.2%</td>
<td>7</td>
<td>53.8%</td>
</tr>
<tr>
<td>Nursery industry recommendations</td>
<td>7</td>
<td>53.8%</td>
<td>6</td>
<td>46.2%</td>
</tr>
<tr>
<td>Horticultural and/or forestry research reports</td>
<td>6</td>
<td>46.2%</td>
<td>7</td>
<td>53.8%</td>
</tr>
</tbody>
</table>
CHAPTER 5

DISCUSSION
Several themes describing tree establishment strategies within community tree planting programs were illuminated by the data. The research interviews with program managers revealed detailed descriptions of useful tree establishment strategies, and the results of the two questionnaires validated several themes and concepts discovered in these research interviews. Although these themes were formulated using programs located in the Northeastern and Mid-Atlantic United States, the results of this study may be transferred to similar programs.

PROGRAM MISSION

There was variability in both design and structure of tree establishment strategies, resulting from intentional manipulations to include practices supporting desired community improvements. The program’s mission, a declaration of an organization’s “reason for being,” provided critical guidance in the design of establishment strategies. Although every program did not have a formal mission statement, all programs referenced self-initiated priorities when planning, setting goals, or developing policies.

All programs recognized that urban tree management and stewardship was integral to their mission, but these programs also identified specific urban vegetation processes and benefits, such as the reduction of air pollution or the provision of pleasant aesthetic experiences, as desirable work outcomes. These specific amenities and processes were selected for the resolution of community needs and used to devise detailed management strategies ensuring their accumulation within the community. While some programs, particularly non-profit organizations, provided a formally adopted
mission statement describing these priorities, other programs referenced informal priorities simply as management goals and objectives. Dwyer et al. (2003), suggested that program goals and objectives, defined as “urban forest benefits and functions the community wishes to sustain,” are critical components affecting urban forest sustainability.

The literature indicates two main benefit categories of urban trees, environmental and social. Environmental benefits include shading, wind control, pollution reduction, and stormwater runoff reduction. Social benefits include noise abatement, real estate value appreciation, and reduced mental fatigue. Some functions of the urban forest benefit both people and the environment. For example, permeable surfaces utilized for tree planting allow groundwater to be recharged during rainstorms, thereby replenishing drinking water resources (Zipperer and Pickett, 2001).

In sustaining environmental benefits, programs implemented regulations requiring the inclusion of large shade trees. These trees provide high leaf surface area supporting natural plant processes, including photosynthesis, respiration, transpiration, and shading, when compared to smaller trees. These natural processes occur at significantly higher rates in large trees and provide enhanced environmental benefits. Although space limitations, including narrow streets and limited soil volume, restricted the application of this regulation, programs installed large shade trees wherever accommodating space could be found in the course of their work.

Programs emphasized social benefits of urban trees, particularly those derived from active community involvement in tree establishment and stewardship. For example,
programs required that a celebratory meal follow volunteer tree plantings, providing an opportunity for community members and program staff to reflect on their collective tree planting achievements at the end of an event. Improving community cohesion and interaction during volunteer tree planting was frequently mentioned as an important outcome. Volunteers appreciated the opportunity to meet new community members and share the tree planting work in a common, visible public space. This perceived benefit was identified when some individuals in program 1006 remarked similarly, “In general, I think what they [the program] are doing is great. You can really tell that people are talking that have never interacted before and there’s going to be a lot of community ownership over these trees now. When people do these plantings, the trees really become part of the community.” Celebratory meals provided an informal forum for this affirmative interaction and conversation, and programs supporting these meals generally encouraged the community group to provide the food and supplies. In some instances, these provisions donated by community members were recognized as a matching contribution in addition to their intangible labor. Programs fostered further community interaction with musical entertainment, prize giveaways, group photographs, and children’s activities during volunteer tree plantings.

Programs also offered educational opportunities to community members on topics related to tree planting. These events provided information on tree planting, maintenance, and related topics, and programs viewed the interaction of community members during these events favorably. In several programs, community members were offered coursework leading to a proficiency certification in tree establishment and maintenance.
Individuals completing this coursework were offered opportunities to act as team leaders shepherding and instructing other volunteers during tree plantings.

One program promoted asthma rate reduction as a health benefit of urban trees, evidenced when the program developed prioritized planting locations based on the incidence of childhood asthma within their city. Program 1011 referenced their prioritization of neighborhood planting locations based on such criteria, “Certain block planting locations have been chosen based on asthma rates in children… every [neighborhood] has one, some areas are bigger than others, and they have automatically been given a higher planting priority than the others in our block planting program.”

A program’s mission and its resulting objectives provide the benchmark upon which program’s evaluate their success. Therefore, the definitions of program success are as varied as the composition and focus of each program’s internal mission. Instead of constructing a vague, encompassing definition of success, each program’s level of achievement should be referenced with their own unique goals and objectives in mind.

FINANCIAL SUPPORT

Several staff members mentioned the crucial nature of funding during research interviews, and a majority of responses (75.0%) to the community tree planting program questionnaire believed that sufficient funding contributed to the achievement of tree planting goals. Programs responding to the questionnaire also reported that their program (82.1%) and municipal government (80.4%) capacity, described in terms of staff size and professional experience, supported the achievement of tree planting goals. These
variables describing capacity are most likely tied to the funding available to each program and municipality. Research interviews revealed a wide array of funding sources utilized by community tree planting programs. The federal government, including the Departments of Agriculture, Housing, and Transportation, state governments, municipal governments, private foundations, private endowments, and corporate sponsorship were frequently reported as sources of income for tree planting activities. Government agency penalty fee funds and in-kind donations were less common funding sources. In 2002, a questionnaire distributed to urban and community forestry programs in 50 states indicated a similar funding source mix, specifically, the federal government, state government, private foundations, contracts/fees, and other sources (Hauer and Johnson, 2008).

Funding for tree planting efforts has increased significantly over the past twenty years. The Federal Government incorporated funding for urban and community forestry in the 1991 Farm Bill. Prior to this, the U.S. Forest Service supported urban and community forestry initiatives at a lower rate. Private foundation support has also greatly increased, and the Home Depot Foundation has been a consistent, national supporter of urban tree planting initiatives (Hauer, 2005). Several regional private foundations, including the William Penn Foundation in Philadelphia and Bloomberg Philanthropies in New York, support community tree planting initiatives. This combination of public and private funding has enabled municipalities and non-profits to plant and maintain thousands of trees every year. In this thesis research, eleven programs collectively installed over 26,000 trees during 2008 and utilized a diverse array of funding sources to
do so. Among these programs, supporting funding was consistently obtained from a diverse amalgamation of several sources, and these programs received comparatively small amounts of funding from local government sources. Instead, programs were compelled to seek competitive funding available from private foundations, federal government departments, and corporations. Similar studies have reported on this shift of funding away from municipalities towards nonmunicipal sources, and Tschantz and Sacamano (1994) reported that 94% of surveyed communities received funding from a community’s general fund in 1986 compared to 67% in 1994.

Restrictions and requirements associated with funding sources impacted the tree establishment process through, for example, mandatory cost sharing, performance accountability reporting, guidance over the selection of planting sites (whether in qualifying neighborhoods or in roadside rights-of-way), and via species selection guidelines. Program staff generally accepted these restrictions as an essential precaution for responsible fund distribution. Several programs, however, also viewed these requirements as a valuable opportunity to provide additional justification and validation of tree planting activity. Detailed records describing the program’s tree planting activity, normally obtained from their record system, was one source of data used for this illustration of effectiveness, efficiency, and equitability. Programs provided information about the number of trees planted and mission-related benefits obtained as a result of funding, and this communication was particularly helpful in building relationships with funding sources. These community tree planting programs must demonstrate utility and efficiency compared to other urban programs and services, and this justification of public
expense should be regularly articulated through measurements of cost-efficiency and beneficial contributions (Tate, 2000).

COMMUNITY SUPPORT

Organizational partnerships, political endorsements, and citizen environmental stewardship were reported as conditions for successful tree establishment during the research interviews. Interview participants defined “community support” using a variety of terms and definitions, but they shared common elements of approval, endorsement, and contributions given by individuals and organizations towards the program’s mission. Programs described the social context of the urban forest and its importance in their work, including anecdotal evidence of how individuals, groups, and organizations value amenities provided by urban trees. In addition, programs consistently indicated that community members played a critical supporting role in the achievement of mission-related objectives.

Several programs reported that organizational partnerships enabled their tree planting success. These formal and informal partnerships existed between organizations sharing a common, often environmentally related, goal; and these organizations, in turn, participated in mutually beneficial planning and action. In this study, these partnerships were observed between programs and environmental non-profit organizations, community development organizations, local businesses, and government agencies. The interview participants suggested that the benefits of organizational collaboration included increased efficiency through coordinated resources, heightened public awareness through
peer networks, and greater credibility through demonstrated effectiveness. Program 1004 reported that its success increased greatly as a result of diversified organizational partners, “because we’re so diversified we don’t really have any single organization holding our progress still.” Program 1010 echoed, “We have been able to do all of this work because of our partners. Without the funding from one organization or the community networks of another, we wouldn’t be able to pull this tree planting off.”

Program interviews also reported that political endorsement was critical to their tree planting success. The top-down acknowledgment of a program’s value from a public official was frequently mentioned as beneficial to the achievement of tree planting goals. Program 1011 indicated that this connection was particularly important, “I think we know that the [program] is a high priority within the city government. We’ve been told that and we’ve heard the mayor say that.”

Participating programs suggested that political endorsements resulted in a dramatic increase in the program’s credibility, and this endorsement could relieve the program of its traditional focus on mission justification. After the programs had communicated the value of their mission and received political endorsement, participants suggested they were able to focus intensely on mission-related objectives. An analysis of the politics surrounding twelve urban and community forestry programs revealed a relationship between inadequate funding and “a lack of political constituencies to support them,” and this relationship is supported by the findings of this thesis research. The same report indicated that political support and funding were directed towards municipal
services valued by “influential constituencies” in communities, further indicating the political effect on the distribution of public urban services (Johnson, 1982).

Citizen environmental stewardship was also mentioned as a critical form of community support. This contributed to the achievement of several common mission-related objectives, including homeowner education and awareness, community-based tree stewardship, and community social development. These goals were often realized simultaneously in the field while program staff outlined the merits of tree planting, along with practical planting and maintenance techniques, with community members during volunteer tree planting events. Interview participants suggested that these informal discussions provided the catalyst for increased community interest and engagement.

Several programs also mentioned community stewardship of public trees as another condition affecting long-term tree survivability. Staff members suggested that the involvement of community members in tree installation produced greater community ownership of the trees, and the resulting increased community ownership produced higher levels of care and maintenance delivered to the tree. As program 1015 reported, “We’re finding out that, a lot of the time, the survivability rate isn’t affected by the tree species but more often by the level of care it receives in the community. I’ve only been here two years, but I can tell the communities that stand out in terms of stewardship and those that haven’t been caring for their trees. Aftercare is really the key variable.” Program 1006 offered additional organized opportunities for tree stewardship through regularly scheduled pruning activities, informally called “pruning parties,” where residents meet program staff to prune newly planted public trees within a specific
neighborhood. The pruning activities were typically followed by a group meal at a local restaurant, offering an opportunity for social interaction and cohesion among group members concerned for the stewardship of public trees.

Responses to the community tree planting program questionnaire supported these findings. The respondents believed that community support and stewardship (85.7%), political support (85.7%), and program partnerships (82.1%) enabled their achievement of tree planting goals. In addition, 89.3% of programs indicated the inclusion of community input in the tree establishment process.

A study from inner-city Detroit indicated, “Tending to local residents, as well as the trees, in neighborhoods can have positive impacts on tree survivorship, community development, and improved relationships between foresters and the public.” The report also indicated that community members were equally motivated by desires to work with nature and other people during tree plantings (Austin, 2002). Similarly, community involvement can improve public awareness, build relationships with local elected officials, and expand the productivity of a tree program. Volunteers expand the program by providing additional skill sets, diverse perspectives and experience, and new personal contacts (Nichnadowicz, 2000). The positive impact of community support reported by these authors corroborates similar findings in this thesis research.

TREE PLANTING STANDARDS AND POLICIES

Programs included several written documents that collectively structured decision-making and quality assurance in the tree establishment process. These written
documents outlined principles related to site evaluation, species selection, nursery acquisition, and tree installation to ensure program adherence to recognized best practices. The formal names of these documents varied slightly among programs, however, they will be uniformly referred to in this study as an approved species list, site assessment checklist, nursery specifications, and installation specifications. The interviewed programs adopted these documents in varying degrees and approximately six programs utilized approved species lists, four used site assessment checklists, four maintained nursery specifications, and seven employed installation specifications.

All programs noted the importance of a thorough and complete site analysis as an initial step in the tree establishment process, and four programs utilized a detailed reference checklist in order to ensure the scrutiny of important criteria during this activity. The site assessment checklists contained, for example, minimum distances between trees and physical infrastructure in order to limit future conflicts. These distances limited foreseeable conflicts between trees and streetlights, traffic signs, and fire hydrants, but programs indicated the most important consideration related to minimum vertical space under utility wires. These checklists also contained minimum dimensions and possible configurations for a planting site, which were used to evaluate the capacity of each site for adequate belowground soil volume. Planting site configurations, including a single tree pit, continuous tree pit, median planting, and lawn planting, were described in this checklist indicating the preferred site classifications encountered in a city.
Program 1011 specifically mentioned the value of a site assessment checklist, “The guidelines help to guide those decisions that they’re making on a case-by-case basis throughout the city. Everything is site specific, so every location is visited at least twice, really, before the final decision is made on where trees get placed. We have all of these general rules that the city proclaims on spacing… In the site [assessment checklist] there are all of those specific measurements related to spacing and infrastructure.”

A majority of interviewed programs utilized an approved species list, a record of tree species deemed appropriate for urban planting. The lists are typically broken down into categories according to mature tree size (small, medium, and large), with categorical separations based on the vertical space permitted underneath various utility wires found throughout the city. These lists were referenced in many cases by the program staff and homeowners during species selection. In addition to the list of species names, the lists contained a brief description of the tree, including habit, ornamental characteristics, environmental tolerances, and environmental sensitivities. As program 1005 indicated, “Well, [species selection] all starts with the recommended list of street trees, and it’s divided into a list of small, medium, and large trees. We have it on our web site and we hand it out to people so they can refer to it and read through it. It has a short description of the tree, so someone who doesn’t know that much about trees can find out about whether it has flowers, fruit, what its growth habit it like, that kind of thing.”

The findings of this thesis study suggest that approved species lists are not only important in avoiding the selection of inappropriate species, but they are also helpful in incorporating less familiar species into the urban forest. However, these lists must be
updated frequently to contain current species information resulting from formal research and informal observations. The lack of an overall recommended species list has led to the domination of the urban forest by a few popular species that are widely known and familiar to program staff (Chen and Jim, 2008). Gerhold and Sacksteder (1982) agree on the importance of an approved species list, but suggest that the value of the lists are limited by the inadequacy of available research describing species performance in challenging urban environments.

The site assessment checklist and approved species list enable program staff to examine each site and make sound decisions based on a comprehensive set of criteria. The desirability of this structured decision-making process was frequently mentioned during research interviews. While assessing sites and selecting species, professionals must consider numerous complex variables and predict the future use of the site, and these decisions are not only complicated but they have long-lasting implications for the local community. Given the complicated nature of these decisions and the long-term consequences of improper choices, the utility of these documents in assuring proper decision-making was consistently referenced by research programs.

Herbert Simon (1982), a behavioral economist, wrote that individuals frequently lack the capacity to consider all of the potential alternatives in decision making and, therefore, make decisions based on drastically simplified choices. According to Simon (1982), one such person is a “satisficer,” an individual seeking a satisfactory outcomes rather than an optimal solution during decision making. It could be interpreted that community tree planting program professionals may similarly reduce site assessment and
species selection decisions to a comprehensible level and, as a result, ignore important
criteria. Given the potential for the accrual of benefits over several decades as a result of
proper decision-making, professionals are best served to include such documents in order
to ensure a strong decision-making process at each planting site.

Similar motivations encouraged programs to incorporate nursery production and
tree installation specifications into the tree establishment process for quality assurance.
Programs in this study regularly contracted external firms to assist with tree production
and installation tasks and offered these detailed specifications within a contract for work.
However, these documents were also distributed to firms and volunteers to communicate
expectations without legally binding contracts. In nursery production, these specifications
formulated the grounds upon which programs rejected trees failing to meet production
standards, and/or similarly withhold payment from landscape contractors failing to install
trees according to specifications. Nursery specifications generally included sections
concerning plant names, labeling, quality standards, expected timeline for production,
harvesting, and transportation. Installation specifications described materials and
procedures utilized in the tree planting process. See Appendix D for a complete overview
of the documents collected from research interview programs.

Research interview programs indicated that these specifications were essential in
high quality tree establishment. The intricate urban tree establishment process could be
greatly improved with the consistent application of quality assurance specifications;
although no studies in the United States report on the existence of such standards, a
European study indicated that the Netherlands, Belgium, Austria, Germany and France
created standards and regulations to describe the quality of nursery stock and establishment techniques (Pauleit, et al., 2002). As Struve (2009) writes, “Transplant success and tree establishment depend on a chain of events from propagation, to production, to harvest, to shipping, to maintenance on the job site, to transplanting techniques, to aftercare. Failure to follow proper practices as any step in this sequence will compromise transplant success and establishment.” Interviewed programs also indicated that these specifications were useful when shared with homeowners and other community members, and several programs provided accessible tree planting instructions in order to ensure homeowner compliance with tree establishment best practices.

These specifications were written by programs to ensure that best practices are reflected in the process at each critical step; and the results of the community tree planting program questionnaire indicated that the majority of programs utilized each of these specifications, including an approved species list (92.9%), site assessment checklist (78.6%), nursery specifications (76.8%), and tree installation specifications (92.9%).

TREE PLANTING WORKFLOW

Programs designed a tree planting workflow that reflected program mission-related objectives and community needs. The composition of this workflow contained, primarily, four activities (Miller, 1997), including identifying opportunities for planting, site assessment/species selection, nursery acquisition, and landscape installation.

The volume of trees planted by research interview programs varied between 44 and 21,025 during 2008 (mean = 2,639, median = 682.5). However, program 1011
installed over 21,000 trees and represented a significant outlier compared to other programs. Removing this number from the data set produced a range of trees installed between 44 and 1,607 and more appropriate measures of central tendency (mean = 596, median = 515). The population size of each city correlated strongly (r = 0.999) with the overall level of planting activity, and this statistic accounted for approximately 99% of the variation (r^2 = 0.998) in the number of trees planted when including program 1011 in the data set. However, the influence of population size decreased slightly after the removal of the outlier from the dataset (r^2 = 0.728). The level of activity within a program can safely be interpreted as a function of the size of the city in which it operates. However, the program’s mission, funding sources, and community support, as suggested by the research interviews, also affected the overall level of planting within a program.

The types of trees installed by research interview programs varied, both in terms of species, size, and root packaging. These programs installed approximately 132 different species representing 31 families, native to various parts of the world (41.1% Asian, 11.9% European, 0.4% Middle Eastern, 46.57% North American). These trees were installed with balled and burlapped, bare root, and containerized root packaging methods. Although each program reported planting various forms of root packaging and sizes, the majority of programs installed balled and burlapped 2” – 2½” caliper stock. Participants indicated that these trees had greater transplant survival rates in the urban environment, and the staff suggested this was due to the appropriate ratio of caliper and root ball size. Programs pointed out that trees with this caliper range responded aptly to planting site conflicts, including pedestrian and automobile impacts, while maintaining a
root ball size that was manageable during installation. In a study examining caliper size and posttransplant growth, it was reported that trees measuring 1 ½” – 2” inch caliper trees had greater survival rates compared to 3” – 4” inch caliper trees (Struve, et al. 2000).

The results of the community tree planting program questionnaire support these findings, where the majority of respondents (46%) indicated installing trees that measured 2” – 2 ½” in caliper and 58.5% of respondents installed balled and burlapped stock. These results indicate a unique preference for balled and burlapped material among community tree planting programs, separate from the main commercial preference for container grown plant material. Although bare root plant material represents a minority of total program demand, several programs were actively experimenting with bare root transplanting techniques. As these programs devise the processes to successfully protect root systems and transplant bare root trees with volunteer assistance, potential future demand for these trees may increase significantly.

Programs utilized at least one, and in some cases several tree establishment strategies reflecting the program goals and objectives. Programs electing to involve community members in the establishment process were motivated by educational and social objectives, including building environmental awareness among community members or cultivating greater community stewardship of environmental resources. Programs focusing on community involvement also solicited the input of community members for site identification, species selection, and landscape installation. The community was involved in locating potential planting sites through requests for tree
planting in their neighborhoods via grant applications, written requests, and collaborative planning.

Programs electing to locate planting sites without community input did so with the assistance of inventory data, or similar data sources, to situate trees based on social and vegetation-related data, such as canopy coverage and population density. However, these programs occasionally provided other opportunities for community input. Miller (1997) writes that given limited funding, priorities must be established in order to provide the greatest benefit from tree planting expenditures and these priorities must be established with a complete understanding of community values, and this is consistent with strategies utilized by programs examined in this research. A survey of Detroit community members revealed very specific preferences regarding the location for tree plantings. Specifically, community support was high for street tree plantings and low for industrial zones and parking lots (Getz, et al. 1982). Although several programs in this study chose to establish planting priorities internally, these priorities were established with knowledge of local preferences resulting from conversations with the community. The majority of programs, however, utilized community input to identify planting locations to encourage community support for tree planting.

Site assessment and species selection processes were similar for those programs interviewed in this research. One particular source of variability among research interview programs was the prioritization of criteria used to select species. Program staff, often with the assistance of community members, selected species using a general process described by program 1011, “Once they’re [at the site], they spend at least a
couple of minutes looking at each site, looking at what’s going on, how people are walking by, how big of a tree pit they can create or whether they can make an existing pit bigger. Then [they select] what type of tree will survive best in that particular location given the plethora infrastructure conflicts that you could come across.” Discussions during research interviews revealed, however, that programs applied dissimilar priorities in selection criteria when performing this task, and the criteria most frequently emphasized included ornamental characteristics, native origin of species, and site-specific infrastructure conflicts. Programs indicated these criteria were employed regularly during species selection, and these prioritized criteria reflected the input and opinions of local community members. Such trends revealed the subjective nature of the species selection process and its reliance on the expertise, experience, and input brought by the individual completing the task. The subjective “whim” involved in species selection could further burden efforts to integrate site-appropriate species into the landscape. Previously conducted research in the United States and Europe identified such variation in species selection practices and their outcomes (Pauleit, et al., 2002; Sommer, Cecchettini, and Guenther, 1992). Liabilities associated with improper species selection include, mainly, the introduction of invasive species, such as *Pyrus calleryana*, and decreased plant diversity in the landscape.

Programs encouraged community input during the site and species selection process in order to enhance the social benefits of trees. Program staff actively solicited community member input to identify planting locations and potential species, and programs suggested that this dynamic led to greater tree stewardship and community
ownership. Programs solicited community involvement through a number of formal strategies, including a planning and review meeting scheduled in advance of the planting event. Program 1004 required community members to develop an initial design for the site in order to develop further ownership of the trees. Nine research interview programs reported that community input was essential in the selection of proper species. For example, program 1005 reported that each neighborhood within the city, “definitely has preferences related to what type of trees they prefer, and lots of neighborhoods, for example, couldn’t imagine what it would be like without their huge sycamores. We definitely have neighborhoods that prefer a certain ‘look,’ actually it’s an avoidance of things like ginkgos. We try to make people happy. You know, you come in here thinking it’s about the trees and it’s certainly not. It’s about the people.” Research conducted in Fresno, CA supports this connection between involved residents and satisfaction with both the trees and community, reporting that residents participating in tree planting events derived more satisfaction from the trees and the neighborhood than those not participating (Sommer et al., 1994).

Program staff, volunteers, and contractors were all involved in tree installation observed during the research interviews. Several programs explained that volunteer coordination for tree planting consumed substantial time and resources, however the educational and social benefits of tree planting events for the community were viewed as outweighing requisite inputs. When faced with seasonal time constraints, programs completed the installation activities internally or with the assistance of landscape contractors.
Plant acquisition from nurseries was consistently identified as a complication during the research interviews. Programs mentioned that nursery inventories frequently contained inadequate species quantities and varieties for their specific needs. Program 1022 further explains this issue, “It really boils down to what I can get out of the nurseries. Every nursery has the red maples, London planes, and honey locusts. You know, here’s our breakdown, and all of the big guys on the pie chart… they have those [trees]. Every year, I go around and ask them whether they have any filberts, and they’re always like, ‘Nope, don’t have any of those… maybe next year.’ Then they never fill the request, and it’s because it’s something out of their comfort zone.” A staff member at program 1011 further elaborates, “The bottom line is that we spent years, ever since the street tree program started, there was this system of acquiring trees based on relationships. We had these relationships to find our trees, and I don’t think any season ever reported every single tree we were after. It’s just because our demand is very unique and we’re acquiring trees that, in the big scheme of things, aren’t commercially viable. The perfect example is probably the hardy rubber tree, you know, a very urban tolerant tree that any nurseryman would doubt his ability to sell to a landscaper because it’s kind of a dog. Maybe it’s interesting to a plant nerd, but there’s not much else going on.”

Responses to the community tree planting program questionnaire suggested some disagreement on this subject; the majority of respondents rated the mixture of species available in nurseries as somewhat adequate (39%) while the category receiving the second most responses was somewhat inadequate (27%). In response to an open-ended question about any species difficult to locate in nurseries, over half (55%) of
questionnaire respondents provided text responses, and their answers provide some insight on those species most difficult to locate in the nursery trade. Several studies originating from The Ohio State University have published lists of trees desired by community tree planting programs that are not commonly found in nursery inventories (D’Amato, et al. 2002, 2008).

In order to effectively obtain trees, programs utilized one or two nurseries with which they had established a relationship based on trust and consistent interaction. A staff member at program 1004 elaborates this point, “We’ve worked with a variety of nurseries over the seasons, and those relationships were determined by the quality of the planting stock, their ability to deliver in a timely manner, and cost… all of those factors and some others. So now we’re at the point that we have one or two nurseries that we’re really fond of and with which we have good relationships.” Responses collected from the community tree planting program questionnaire similarly indicated that the majority of programs utilized between two and three nurseries (48%) and few utilized more than six nurseries (18%). This selective interaction with reliable wholesale nurseries to acquire adequate stock was consistent among research interview programs, and this appears to be a component of tree planting programs previously unarticulated in scientific literature.

The community tree planting program questionnaire indicated that programs used several methods of commercial interaction in the tree acquisition process, including contract growing (7%), traditional commerce (52%), bid solicitation (38%), advanced ordering (34%), and negotiated sales (34%). In a questionnaire distributed to wholesale nurseries, the response indicated that traditional commerce occupied the majority (46%)
of nursery interactions with community tree planting programs. This category, representing basic, relationship-based interaction, further clarifies the abundant application of this method of commercial interaction between nurseries and community tree planting programs. Programs interviewed clearly indicated that the traditional method of commercial interaction limited successful tree acquisition. However, the relative effectiveness of other methods was not determined in this study, including negotiated sales, advanced ordering, bid solicitation, and contract growing.

In an attempt to circumvent challenges faced in tree acquisition, one research interview program developed a contract growing process where the program determined terms and conditions of tree production. However, the program reported several problems associated with this method of interaction; particularly some nursery reticence towards engaging in formalized, contract growing. It appeared, at least in part, that personal relationships continue to play a part in the dynamic between programs and wholesale nurseries, and these relationships are a principal determinant of the efficacy of the commercial relationship between the two entities.

Another program initiated its own volunteer-run community tree nursery in order to skirt difficulties in the tree acquisition process. The volunteers worked closely with municipal staff to provide desired tree species at scheduled times, and the municipality was able to rely solely on this nursery for trees and, as a result, avoid the challenges of commercial acquisition. However, limited funding and lack of professional expertise moderated overall productivity. In addition, the sustainability of the community-operated nursery would not be possible without the commitment and dedication of a small group
of volunteers. In the community tree planting program questionnaire, respondents similarly indicated that most programs (80%) were not growing trees using internal funds and resources.

Questionnaire responses received from wholesale nurseries confirmed some of the anecdotal observations of program staff, such as the occupation of a small proportion of nurseries’ overall demand by community tree planting programs. Only 38% of nurseries surveyed indicated they had interacted with community tree planting programs within the past year, and, of that proportion, programs occupied only 8% of the average total nursery demand. Additionally, the majority of responding nurseries indicated that program demand for trees had remained steady (54%). The occupation of this small portion of total nursery sales likely inhibits the ability of nurseries to respond to program species requests. It may be necessary for more programs to utilize contract growing (Barton et al., 2009) in order to resolve this issue, and, fortunately, a majority (46%) of surveyed nurseries indicated they somewhat favored the use of more formal commercial interaction.

Research interviews with nurseries indicated that the small representation of total demand, low prices associated with bid solicitation, and the long-term nature of tree production limited a nursery’s ability to respond to community tree planting program requests. Establishing and cultivating relationships with nurseries could likely provide more formal communication between community tree planting programs and nurseries regarding future crop planning and, potentially, greater success.
Community Tree Planting Program Questionnaire

The community tree planting program survey was sent to 151 professionals employed within the Northeast and Mid-Atlantic regions of the United States. The questionnaire received an overall response rate of 37.1%.

Although cross comparison of responses revealed no significant relationships between categories, principal component analysis (Jolliffe, 2002) provided a useful interpretation of the questionnaire data. Principle component analysis, devised by Karl Pearson, transforms several likely correlated variables into fewer uncorrelated variables, referred to as principle components. In the community tree planting program survey, the first question was coded as the dependent variable, indicating the achievement of annual planting goals and relevant program success during 2008. All of the remaining questions were coded as independent variables and compared to the first question. Therefore, the data collected for the dependent variable in the survey was removed from the principle component analysis, and three principle components were produced from the analysis of the remaining data. The first principle component (PC1) represented survey questions numbers two, five and eleven and accounted for 22.2% of the variation in survey responses. The second principle component (PC2) represented survey question numbers three and ten and accounted for 17.2% of the variation in survey responses. The third principle component (PC3) represented survey questions number four and eight and 14.7% of total variation in survey responses. When accounted for cumulatively, 54.1% of the variance expressed in survey responses was represented by these two principle
components. Therefore, these three principle components controlled nearly 55% of the variation in survey responses.

After completing the principle component analysis, responses were weighted according to the principle component coefficients, and these responses treated as new, uncorrelated independent variables for comparison. Logistic regression was used to compare these independent variables (PC1, PC2, and PC3) to the program’s level of tree planting success during 2008. The results indicate that PC1 and PC2 are both negatively correlated with the outcome of the regression equation, which can be interpreted as the possibility for tree planting success. PC3, contrastingly, positively related with the dependent rating of success. However, it was determined that only PC1 has a statistically significant relationship with the dependent variable (p=0.01). This analysis demonstrates that the amount of trees planted, the number of nurseries utilized, and the total number of commercial interaction methods employed between programs and nurseries, considered collectively, have a significant inverse relationship with the amount of tree planting success experienced during 2008 by programs responding to the research questionnaire.

The causal factor(s) behind this relationship cannot be confirmed with the data collected in this study; however, the themes identified from research interviews may provide clues about the nature of this relationship. Hypothetically, it is logical to assume that as programs plant more trees, subsequently interacting with more nurseries in diverse ways, the programs may have reached the capacity of their traditional commercial relationships with nurseries. In order to accommodate greater efficiency at higher levels of productivity, programs may increasingly be required to engage in more formal
commercial interactions with nurseries, including contract growing. At high levels of activity, informal, relationship-based nursery production and distribution networks may be detrimental to the ability of programs to attain their respective mission-related objectives. However, this explanation is presented strictly as a potential explanation based on observations gathered during research interviews, and further research will be required in order to elucidate the basis of this relationship.

CONCLUSIONS AND RECOMMENDATIONS

The programs included in this thesis research contain several promising elements worth noting. Although the programs included in this study were driven to achieve diverse goals, several common strengths and needs existed within organizations vastly different in their composition, focus, and scale of activity. Community tree planting programs, at their most basic level, strive to improve local communities by integrating vegetation into constructed landscapes largely devoid of such amenities. Although program’s tree establishment strategies diverge from this common goal, programs design their respective tree planting processes to positively contribute to the landscape experienced by local residents.

Although every program did not recognize a formal mission-statement, programs should work collaboratively with their staff, local community, and other stakeholders to develop a mission statement for their community tree planting program. This mission statement should be widely recognized and accepted by those individuals and groups of people directly affected by the urban forest, and the resulting priorities should be actively
incorporated into the tree establishment process in order to ensure the achievement of desired goals. Although it may not be appropriate for programs to establish a formal mission statement, this research suggests that it may benefit the program to develop formalized goals. The formalized goals provide regular direction and focus for the daily activities of these community tree planting programs, especially when they are comprehensible, justified, and widely accepted by all program stakeholders.

Several programs in this thesis research also indicated that adequate funding correlated directly with their goal-attainment. Although there was no consistency in the mixture of funding sources utilized by these programs, programs suggested that adequate funding could be obtained through transparent and consistent expense justification. These programs built credibility by maintaining accurate records and providing timely information to their funding sources. The costly materials, professional expertise, and labor required in ambitious tree establishment processes must be offset through considerable budget allocations, and these programs must aggressively compete with other municipal programs and services to obtain sufficient funding. Program leaders should commit to collecting information describing their expenditures and provide reports comparing cost efficiency and relative benefits obtained through their work.

Communities, and its residents, are the foundation of every program. Individuals and groups of people provide the support, funding, and recognition sustaining every community tree planting program. In several instances, program interviews revealed they frequently focused on people and urban forest amenities enhancing their lives. Correspondingly, individuals have demonstrated increased interested in the environment
surrounding their communities, and these people have offered their time and other resources to improve the condition of this natural resource in their neighborhood.

Programs should welcome opportunities to benefit individuals, groups of people, and communities through community engagement and volunteer integration. Previous research has demonstrated the positive effect of such inclusion, and this thesis research supports socially motivated tree establishment processes and the accompanying rewards offered to people.

Research interview programs and survey responses consistently indicated the value and utility of program regulations and written specifications. These documents improve the quality of tree establishment by ensuring that professionals and homeowners consider critical issues when planting trees, and they offer excellent quality assurance during the tree production and installation process. Species selection, tree acquisition, and tree installation were consistently identified as problem areas in research interviews, and professionals suggested these documents improved quality currently lacking in tree establishment. These documents also elucidate the justifications for the way in which things are done; community members and volunteers frequently express interest, even disagreement, with the way trees are established in their communities and these documents provide clear logic for their work’s design. These documents should be accompanied by a clear method of enforcement (e.g. work inspections, bonus incentives), which ensures that the program’s standards and regulations will be utilized.

In addition to structuring the tree establishment process to reflect mission-related objectives, programs should structure this process in a lucid format to increase
acceptance and support of their work. Programs should use a simple, clear method that considers environmental and social needs of their community when selecting sites for planting. In site assessment and species selection, the perspective of community members should be incorporated in an efficient manner. Research interview participants often viewed this as a time-consuming process; however, the proven rewards of community involvement suit the goals of nearly all programs and should be supported in a way that does not inhibit the tree establishment workflow.

Interaction with wholesale nurseries viewed in this thesis research suggests the imperative nature of relationship-based interaction. Although the research interviews and surveys provided clear information on the difficulty experienced during tree acquisition, and the numerous ways in which programs sought to resolve this issue, it appeared essential that programs build rapport between themselves and commercial nurseries in order to overcome obstacles during tree production, harvesting, and transport. Specifications detailing the desired tree production standards were only moderately successful when coldly mandated by community tree planting programs. Instead, those experiencing greater success provided appropriate incentives and support to elicit a positive nursery response. It appears, similarly, that mutually beneficial relationships may be required between programs and landscape contractors in order to obtain desired installation standards.

Lastly, volunteer effort and support in the tree establishment process appeared to be one of the greatest assets of community tree planting programs. Several tree planting events observed in this research attracted dozens of community members interested in the
merits of planting trees. However, programs should develop formal methods for handling such volunteers and, especially, providing them with accurate, clear information on the activity. Citizens consistently exhibited sincere interest in the tree planting process and it was frequently outside the capacity of the program to provide enriching, useful information. Programs should carefully plan demonstrations and provide accurate information to arm their volunteers with the knowledge required to expand and steward the urban forest in a high quality manner. These volunteer tree planting events present innumerable opportunities for building community and financial support, and programs should take advantage of the local human resources willing to commit themselves to their mission.
APPENDICES
APPENDIX A

HUMAN SUBJECTS REVIEW BOARD APPROVAL LETTER
July 24, 2008

Daniel C. Burcham
Longwood Graduate Program
126 Townsend Hall

Dear Mr. Burcham:

Subject: An analysis of urban and community forestry financial support, species selection, and technology transfer (XMP 297)

The above-referenced proposal, which you submitted for Human Subjects Review Board approval, will qualify as research exempt from full Human Subjects Review Board review under the following category:

Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects, AND (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please note that under university and federal policy, all research, even if exempt, must be conducted in accordance with the Belmont Report, copies of which are available from this office. Changes in this project must be approved in advance by the Human Subjects Review Board.

Sincerely,

[Signature]

Elizabeth Duggins Pelosi
IRB Administrator
APPENDIX B

PARTICIPATING COMMUNITY TREE PLANTING PROGRAM

CHARACTERISTICS
Organization No.: 1022

Total planted: 1,607

Planting/Canopy Goal: 100,000 new trees by 2020 (6% canopy increase)

Approved Species List: Yes

Size of List: 47

Installed Trees Represented on List: 1,399 (87.06% of total)

Site Assessment Checklist: Yes

Nursery Specifications: Yes

Installation Specifications: Yes

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1022

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>249</td>
<td>18.35%</td>
</tr>
<tr>
<td>Europe</td>
<td>191</td>
<td>14.08%</td>
</tr>
<tr>
<td>Middle East</td>
<td>1</td>
<td>0.07%</td>
</tr>
<tr>
<td>North America</td>
<td>916</td>
<td>67.50%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
### Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1022

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer rubrum</em> L.</td>
<td>313</td>
<td>19.48%</td>
</tr>
<tr>
<td><em>Platanus × acerifolia</em> (Ait.) Willd.</td>
<td>94</td>
<td>5.85%</td>
</tr>
<tr>
<td><em>Gleditsia triacanthos</em> L. var. <em>inermis</em> (L.) Zab.</td>
<td>91</td>
<td>5.66%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>441</td>
<td>27.44%</td>
</tr>
<tr>
<td><em>Quercus</em> spp.</td>
<td>182</td>
<td>11.33%</td>
</tr>
<tr>
<td><em>Platanus</em> spp.</td>
<td>94</td>
<td>5.85%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sapindaceae</em></td>
<td>447</td>
<td>27.82%</td>
</tr>
<tr>
<td><em>Fagaceae</em></td>
<td>232</td>
<td>14.44%</td>
</tr>
<tr>
<td><em>Roseaceae</em></td>
<td>129</td>
<td>8.03%</td>
</tr>
</tbody>
</table>
Organization No.: 1008

Total planted: 188

Planting/Canopy Goal: No

Approved Species List: No

   Size of List: N/A

   Installed Trees Represented on List: N/A

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: No


Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1008

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>40</td>
<td>27.97%</td>
</tr>
<tr>
<td>Europe</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>103</td>
<td>72.03%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
### Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1008

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Syringa reticulata</em> (Bl.) Hara</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td><em>Ulmus</em> spp. Hybrids</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td><em>Betula nigra</em> L.</td>
<td>20</td>
<td>10.64%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td><em>Syringa</em> spp.</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td><em>Ulmus</em> spp.</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oleaceae</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td>Sapindaceae</td>
<td>30</td>
<td>15.96%</td>
</tr>
<tr>
<td>Ulmaceae</td>
<td>30</td>
<td>15.96%</td>
</tr>
</tbody>
</table>
Organization No.: 1015

Total planted: 515

Planting/Canopy Goal: No

Approved Species List: No

Size of List: N/A

Installed Trees Represented on List: N/A

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: No

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1015

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>173</td>
<td>41.59%</td>
</tr>
<tr>
<td>Europe</td>
<td>49</td>
<td>11.78%</td>
</tr>
<tr>
<td>Middle East</td>
<td>62</td>
<td>14.90%</td>
</tr>
<tr>
<td>North America</td>
<td>132</td>
<td>31.73%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
### Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1015

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Parrotia persica</em> C.A. Mey</td>
<td>62</td>
<td>12.04%</td>
</tr>
<tr>
<td><em>Aesculus × carnea</em> Hayne.</td>
<td>54</td>
<td>10.49%</td>
</tr>
<tr>
<td><em>Acer campestre</em> L.</td>
<td>49</td>
<td>9.51%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>166</td>
<td>32.23%</td>
</tr>
<tr>
<td><em>Parrotia</em> spp.</td>
<td>62</td>
<td>12.04%</td>
</tr>
<tr>
<td><em>Aesculus</em> spp.</td>
<td>54</td>
<td>10.49%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sapindaceae</em></td>
<td>220</td>
<td>42.72%</td>
</tr>
<tr>
<td><em>Roseaceae</em></td>
<td>114</td>
<td>22.14%</td>
</tr>
<tr>
<td><em>Hamamelidaceae</em></td>
<td>62</td>
<td>12.04%</td>
</tr>
</tbody>
</table>
Organization No.: 1010

Total planted: 44

Planting/Canopy Goal: No

Approved Species List: No

Size of List: N/A

Installed Trees Represented on List: N/A

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: No

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1010

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>5</td>
<td>15.63%</td>
</tr>
<tr>
<td>Europe</td>
<td>2</td>
<td>6.25%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>25</td>
<td>78.13%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
## Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1010

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Malus</em> spp. Mill.</td>
<td>10</td>
<td>22.73%</td>
</tr>
<tr>
<td><em>Acer rubrum</em> L.</td>
<td>6</td>
<td>13.64%</td>
</tr>
<tr>
<td><em>Acer saccharum</em> Marshall</td>
<td>5</td>
<td>11.36%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>13</td>
<td>29.55%</td>
</tr>
<tr>
<td><em>Malus</em> spp.</td>
<td>10</td>
<td>22.73%</td>
</tr>
<tr>
<td><em>Ulmus</em> spp.</td>
<td>4</td>
<td>9.09%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roseaceae</td>
<td>15</td>
<td>34.09%</td>
</tr>
<tr>
<td>Sapindaceae</td>
<td>13</td>
<td>29.55%</td>
</tr>
<tr>
<td>Ulmaceae</td>
<td>5</td>
<td>11.36%</td>
</tr>
</tbody>
</table>
Organization No.: 1009

Total planted: N/A

Planting/Canopy Goal: No

Approved Species List: Yes

    Size of List: 11

    Installed Trees on Approved Species List: N/A

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: Yes
Organization No.: 1011

Total planted: 21,025

Planting/Canopy Goal: 1,000,000 new trees (20% canopy increase)

Approved Species List: Yes

Size of List: 52

Installed Trees Represented on List: 17,859 (84.94% of total)

Site Assessment Checklist: Yes

Nursery Specifications: Yes

Installation Specifications: Yes

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1011

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>8400</td>
<td>45.40%</td>
</tr>
<tr>
<td>Europe</td>
<td>2212</td>
<td>11.95%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>7892</td>
<td>42.65%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Taxonomic Identification</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Zelkova serrata</em> (Thunb.) Mak.</td>
<td>2145</td>
<td>10.20%</td>
</tr>
<tr>
<td><em>Styphnolobium japonicum</em></td>
<td>1460</td>
<td>6.94%</td>
</tr>
<tr>
<td><em>Quercus palustris</em> Muenchh.</td>
<td>1448</td>
<td>6.89%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Prunus</em> spp.</td>
<td>3667</td>
<td>17.44%</td>
</tr>
<tr>
<td><em>Quercus</em> spp.</td>
<td>2571</td>
<td>12.23%</td>
</tr>
<tr>
<td><em>Zelkova</em> spp.</td>
<td>2145</td>
<td>10.20%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roseaceae</td>
<td>5182</td>
<td>24.65%</td>
</tr>
<tr>
<td>Fagaceae</td>
<td>2571</td>
<td>12.23%</td>
</tr>
<tr>
<td>Ulmaceae</td>
<td>2371</td>
<td>11.30%</td>
</tr>
</tbody>
</table>
Organization No.: 1006

Total planted: 850

Planting/Canopy Goal: No

Approved Species List: Yes

Size of List: 46

Installed Trees Represented on List: 598 (70.35% of total)

Site Assessment Checklist: Yes

Nursery Specifications: No

Installation Specifications: Yes

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1006

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>127</td>
<td>22.84%</td>
</tr>
<tr>
<td>Europe</td>
<td>141</td>
<td>25.36%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>275</td>
<td>49.46%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
### Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1006

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Malus</em> spp. Mill.</td>
<td>85</td>
<td>10.00%</td>
</tr>
<tr>
<td><em>Cercis canadensis</em> L.</td>
<td>66</td>
<td>7.76%</td>
</tr>
<tr>
<td><em>Acer × freemanii</em></td>
<td>56</td>
<td>6.59%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>128</td>
<td>15.06%</td>
</tr>
<tr>
<td><em>Malus</em> spp.</td>
<td>85</td>
<td>10.00%</td>
</tr>
<tr>
<td><em>Cercis</em> spp.</td>
<td>66</td>
<td>7.76%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapindaceae</td>
<td>169</td>
<td>19.88%</td>
</tr>
<tr>
<td>Roseaceae</td>
<td>142</td>
<td>16.71%</td>
</tr>
<tr>
<td>Ulmaceae</td>
<td>94</td>
<td>11.06%</td>
</tr>
</tbody>
</table>
Organization No.: 1019

Total planted: 210

Planting/Canopy Goal: No

Approved Species List: No

Size of List: N/A

Installed Trees Represented on List: N/A

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: No

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>57</td>
<td>30.81%</td>
</tr>
<tr>
<td>Europe</td>
<td>20</td>
<td>10.81%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>108</td>
<td>58.38%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
## Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1019

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer rubrum L.</em></td>
<td>20</td>
<td>9.52%</td>
</tr>
<tr>
<td><em>Acer × freemanii</em></td>
<td>20</td>
<td>9.52%</td>
</tr>
<tr>
<td><em>Corylus colurna L.</em></td>
<td>10</td>
<td>4.76%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer spp.</em></td>
<td>60</td>
<td>28.57%</td>
</tr>
<tr>
<td><em>Quercus spp.</em></td>
<td>15</td>
<td>7.14%</td>
</tr>
<tr>
<td><em>Corylus spp.</em></td>
<td>10</td>
<td>4.76%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapindaceae</td>
<td>60</td>
<td>28.57%</td>
</tr>
<tr>
<td>Roseaceae</td>
<td>30</td>
<td>14.29%</td>
</tr>
<tr>
<td>Corylaceae</td>
<td>20</td>
<td>9.52%</td>
</tr>
</tbody>
</table>
**Organization No.:** 1023

**Total planted:** 964

**Planting/Canopy Goal:** 40,000 new trees by 2020

**Approved Species List:** Yes

  **Size of List:** 47

  **Installed Trees Represented on List:** 792 (82.16% of total)

**Site Assessment Checklist:** Yes

**Nursery Specifications:** Yes

**Installation Specifications:** Yes

---

**Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1023**

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>284</td>
<td>34.26%</td>
</tr>
<tr>
<td>Europe</td>
<td>89</td>
<td>10.74%</td>
</tr>
<tr>
<td>Middle East</td>
<td>13</td>
<td>1.57%</td>
</tr>
<tr>
<td>North America</td>
<td>443</td>
<td>53.44%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Taxonomic Identification</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gleditsia triacanthos</em> (L.) var. <em>inermis</em> (L.) Zab.</td>
<td>65</td>
<td>6.74%</td>
</tr>
<tr>
<td><em>Prunus serrulata</em> Lindl.</td>
<td>57</td>
<td>5.91%</td>
</tr>
<tr>
<td><em>Platanus × acerifolia</em> (Ait.) Willd.</td>
<td>55</td>
<td>5.71%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>117</td>
<td>12.14%</td>
</tr>
<tr>
<td><em>Prunus</em> spp.</td>
<td>112</td>
<td>11.62%</td>
</tr>
<tr>
<td><em>Quercus</em> spp.</td>
<td>102</td>
<td>10.58%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roseaceae</td>
<td>260</td>
<td>26.97%</td>
</tr>
<tr>
<td>Sapindaceae</td>
<td>143</td>
<td>14.52%</td>
</tr>
<tr>
<td>Fagaceae</td>
<td>102</td>
<td>10.58%</td>
</tr>
</tbody>
</table>
Organization No.: 1004

Total planted: 905

Planting/Canopy Goal: 40% canopy coverage by 2035

Approved Species List: Yes

Size of List: 27

Installed Trees Represented on List: 436 (48.18% of total)

Site Assessment Checklist: No

Nursery Specifications: No

Installation Specifications: Yes

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1004

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>64</td>
<td>7.57%</td>
</tr>
<tr>
<td>Europe</td>
<td>17</td>
<td>2.01%</td>
</tr>
<tr>
<td>Middle East</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>North America</td>
<td>764</td>
<td>90.41%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
### Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1004

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ulmus americana</em> L.</td>
<td>177</td>
<td>19.56%</td>
</tr>
<tr>
<td><em>Nyssa sylvatica</em> Marsh.</td>
<td>129</td>
<td>14.25%</td>
</tr>
<tr>
<td><em>Betula nigra</em> L.</td>
<td>114</td>
<td>12.60%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ulmus</em> spp.</td>
<td>199</td>
<td>21.99%</td>
</tr>
<tr>
<td><em>Nyssa</em> spp.</td>
<td>129</td>
<td>14.25%</td>
</tr>
<tr>
<td><em>Betula</em> spp.</td>
<td>114</td>
<td>12.60%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulmaceaea</td>
<td>203</td>
<td>22.65%</td>
</tr>
<tr>
<td>Cornaceae</td>
<td>144</td>
<td>15.91%</td>
</tr>
<tr>
<td>Betulaceae</td>
<td>114</td>
<td>12.60%</td>
</tr>
</tbody>
</table>
Organization No.: 1005

Total planted: 79

Planting/Canopy Goal: 20,000 new trees by 2020

Approved Species List: Yes

Size of List: 55

Installed Trees Represented on List: 74 (93.67% of total)

Site Assessment Checklist: No

Nursery Specifications: Yes

Installation Specifications: Yes

Native Origin of Trees (excluding hybrids) Planted during 2008 by Organization Number 1005

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>28</td>
<td>41.79%</td>
</tr>
<tr>
<td>Europe</td>
<td>13</td>
<td>19.40%</td>
</tr>
<tr>
<td>Middle East</td>
<td>3</td>
<td>4.48%</td>
</tr>
<tr>
<td>North America</td>
<td>23</td>
<td>34.33%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Most Frequently Planted Species, Genera, and Families during 2008 by Organization Number 1005

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Prunus incisa × campanulata</em></td>
<td>11</td>
<td>13.92%</td>
</tr>
<tr>
<td><em>Cornus mas</em> L.</td>
<td>8</td>
<td>10.13%</td>
</tr>
<tr>
<td><em>Ginkgo biloba</em> L.</td>
<td>7</td>
<td>8.86%</td>
</tr>
<tr>
<td>Genus</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Prunus</em> spp.</td>
<td>14</td>
<td>17.72%</td>
</tr>
<tr>
<td><em>Cornus</em> spp.</td>
<td>8</td>
<td>10.13%</td>
</tr>
<tr>
<td><em>Acer</em> spp.</td>
<td>7</td>
<td>8.86%</td>
</tr>
<tr>
<td>Family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roseaceae</td>
<td>15</td>
<td>18.99%</td>
</tr>
<tr>
<td>Cornaceae</td>
<td>11</td>
<td>13.92%</td>
</tr>
<tr>
<td>Papilionaceae</td>
<td>8</td>
<td>12.60%</td>
</tr>
</tbody>
</table>
Combined Participating Organization Tree Planting Information

Number of Organizations: 10

Total planted: 26,387

Approved Species Lists: 6

Average Size of List: 46

Installed Trees Represented on Lists: 21,158 (77.73% of total)

Site Assessment Checklists: 4

Nursery Specifications: 4

Installation Specifications: 7

Native Origin of Trees (excluding hybrids) Planted during 2008 by Ten Participating Organizations

<table>
<thead>
<tr>
<th>World Region</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>9,427</td>
<td>41.10%</td>
</tr>
<tr>
<td>Europe</td>
<td>2,734</td>
<td>11.92%</td>
</tr>
<tr>
<td>Middle East</td>
<td>92</td>
<td>0.40%</td>
</tr>
<tr>
<td>North America</td>
<td>10,681</td>
<td>46.57%</td>
</tr>
<tr>
<td>Oceania</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
## Most Frequently Planted Species, Genera, and Families during 2008 by Ten Participating Organizations

<table>
<thead>
<tr>
<th>Taxonomic Identification</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Zelkova serrata</em> (Thunb.) Mak.</td>
<td>2,251</td>
<td>8.53%</td>
</tr>
<tr>
<td><em>Gleditsia triacanthos</em> (L.) var. <em>inermis</em> (L.) Zab.</td>
<td>1,591</td>
<td>6.03%</td>
</tr>
<tr>
<td><em>Quercus palustris</em> (Muenchh)</td>
<td>1,470</td>
<td>5.57%</td>
</tr>
<tr>
<td><em>Styphnolobium japonicum</em></td>
<td>1,470</td>
<td>5.57%</td>
</tr>
<tr>
<td><em>Prunus serrulata</em> Lindl.</td>
<td>1,210</td>
<td>4.59%</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Prunus</em> spp.</td>
<td>3,933</td>
<td>14.91%</td>
</tr>
<tr>
<td><em>Quercus</em> spp.</td>
<td>3,020</td>
<td>11.45%</td>
</tr>
<tr>
<td><em>Zelkova</em> spp.</td>
<td>2,251</td>
<td>8.53%</td>
</tr>
<tr>
<td><em>Tilia</em> spp.</td>
<td>1,691</td>
<td>7.89%</td>
</tr>
<tr>
<td><em>Gleditsia</em> spp.</td>
<td>1,591</td>
<td>6.03%</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roseaceae</td>
<td>5,960</td>
<td>22.59%</td>
</tr>
<tr>
<td>Fagaceae</td>
<td>3,079</td>
<td>11.67%</td>
</tr>
<tr>
<td>Ulmaceae</td>
<td>2,981</td>
<td>11.14%</td>
</tr>
<tr>
<td>Tiliaceae</td>
<td>2,083</td>
<td>7.89%</td>
</tr>
<tr>
<td>Caesalpiniaee</td>
<td>2,054</td>
<td>7.78%</td>
</tr>
</tbody>
</table>
APPENDIX C

LANDSCAPE TREE CULTIVARS UTILIZED BY PARTICIPATING COMMUNITY TREE PLANTING PROGRAMS
COMPACT SELECTIONS

*Acer campestre* L. 'Evelyn' PP4392

Queen Elizabeth™ Hedge Maple

*Acer × freemanii* A.E. Murray ‘Celzam’ PP7279

Celebration Freeman Maple

*Acer tartarticum* L. ssp. *ginnala* (Maxim.) ‘Ruby Slippers’

Ruby Slippers Amur Maple

*Fraxinus pennsylvanica* Marsh. ‘Johnson’

Leprechaun™ Green Ash

*Thuja occidentalis* L. ‘Smaragd’

Smaragd Arborvitae

COLUMNAR / UPRIGHT SELECTIONS

*Acer × freemanii* A.E. Murray ‘Armstrong II’

Armstrong Two™ Freeman Maple

*Acer × freemanii* A.E. Murray ‘DTR 102’ PP7655

Autumn Fantasy® Freeman Maple

*Acer × freemanii* A.E. Murray ‘Scarsen’ PP3109

Scarlet Sentinel™ Freeman Maple

*Acer rubrum* L. ‘Bowhall’

Bowhall Red Maple
Acer rubrum L. ‘Columnare’

Fastigiate Red Maple

Carpinus betulus L. ‘Fastigiata’

Fastigiate European Hornbeam

Ginkgo biloba L. ‘Magyar’

Magyar Ginkgo

Ginkgo biloba L. ‘PNI 2720’ PP2726

Princeton Sentry® Ginkgo

Pyrus calleryana Decne. ‘Cleveland Select’ PP2489

Chanticleer® Callery Pear

Quercus palustris ‘Pringreen’

Green Pillar® Pin Oak

Quercus robur L. ‘Fastigiata’

Skyrocket® Fastigiate English Oak

Styphnolobium japonicum ‘PNI 5625’ PP2338

Regent® Japanese Pagodatree

Tilia cordata Mill. ‘Chancole’ PP2712

Chancellor® Littleleaf Linden

Tilia cordata Mill. ‘PNI 6025’ PP2086 (narrow, tidy oval form)

Greenspire® Littleleaf Linden

Tilia cordata Mill. ‘Baileyi’ (narrow, open habit)

Shamrock™ Littleleaf Linden
*Zelkova serrata* (Thunb.) Mak. ‘Fastigiata’

Fastigiate Japanese Zelkova

*Zelkova serrata* (Thunb.) Mak. ‘Green Vase’ PP5080

Green Vase® Japanese Zelkova

*Zelkova serrata* (Thunb.) Mak. ‘Musashino’

Musashino Japanese Zelkova

FRUITLESS SELECTIONS

*Phellodendron amurense* Rupr. ‘PNI 4551’

Shademaster® Amur Corktree

URBAN TOLERANT SELECTIONS

*Acer miyabei* Maxim. ‘Morton’

State Street® Miyabe Maple

*Acer saccharum* Marshall ‘PNI 0285’ PP2339

Green Mountain® Sugar Maple

*Betula nigra* L. ‘BNMTF’

Dura-Heat™ River Birch

*Cercis canadensis* L. var. *texensis* ‘Oklahoma’

Oklahoma Redbud

*Celtis occidentalis* L. ‘Prairie Pride’ PP3771

Prairie Pride Common Hackberry
Celtis occidentalis × laevigata ‘Magnifica’ PP2795

Magnifica™ Hackberry

Gleditsia triacanthos (L.) var. inermis (L.) Zab. ‘Imperial’

Imperial Thornless Honeylocust

Gleditsia triacanthos (L.) var. inermis (L.) Zab. ‘Skycole’ PP1619

Skyline® Thornless Honeylocust

Gleditsia triacanthos (L.) var. inermis (L.) Zab. ‘Suncole’

Sunburst® Thornless Honeylocust

Gleditsia triacanthos (L.) var. inermis (L.) Zab. ‘True Shade’

True Shade® Thornless Honeylocust

Maackia amurensis Rupr. & Maxim. ‘Starburst’

Starburst Amur Maackia

ORNAMENTAL SELECTIONS

Acer × freemanii A.E. Murray ‘Jeffersred’ PP4864

Autumn Blaze® Freeman Maple

Acer rubrum L. ‘Autumn Flame’

Autumn Flame® Red Maple

Acer rubrum L. ‘Brandywine’

Brandywine Red Maple

Acer rubrum L. ‘PNI 0268’ PP2116

October Glory® Red Maple
Acer rubrum L. ‘Franksred’
Red Sunset® Red Maple

Acer rubrum L. ‘Sun Valley’
Sun Valley Red Maple

Acer truncatum × platanoides 'Keithsform' PP7529
Norwegian Sunset® Maple

Acer truncatum × platanoides ‘Warrenred’ PP7433
Pacific Sunset® Maple

Aesculus × arnoldiana ‘Autumn Splendor’
Autumn Splendor Buckeye

Aesculus × carnea ‘Briotti’
Ruby Red Horsechestnut

Aesculus × carnea ‘Fort McNair’
Fort McNair Red Horsechestnut

Amelanchier × grandiflora Rehd. ‘Princess Diana’ PP6041
Princess Diana Serviceberry

Amelanchier × grandiflora Rehd. ‘Cumulus’ PP3092
Cumulus® Serviceberry

Amelanchier laevis Wiegand ‘Majestic’ PP7203
Majestic Allegheny Serviceberry

Betula nigra L. ‘Cully’ PP4409
Heritage™ River Birch
Crataegus viridis L. ‘Winter King’

Winter King Hawthorn

Fraxinus americana ‘Chicago Regal’

Chicago Regal White Ash

Ginkgo biloba L. ‘Autumn Gold’

Autumn Gold Ginkgo

Ilex aquifolium × cornuta ‘Nellie R. Stevens’

Nellie R. Stevens Holly

Ilex × attenuata ‘Annie Armstrong’

Annie Armstrong Holly

Liquidambar styraciflua L. ‘Moraine’ PP4601

Moraine Sweetgum

Liquidambar styraciflua L. ‘Worplesdon’

Worplesdon Sweetgum

Magnolia acuminata × denudata ‘Elizabeth’ PP4145

Elizabeth Magnolia

Malus spp. Mill. ‘Adirondack’

Adirondack Crabapple

Malus spp. Mill. ‘Donald Wyman’

Donald Wyman Crabapple

Malus spp. Mill. ‘Princeton Cardinal’ PP7147

Princeton Cardinal Crabapple
Malus spp. Mill. ‘Lanzam’ PP8056
Lancelot® Crabapple

Malus spp. Mill. ‘Louisa’
Louisa Crabapple

Malus spp. Mill. ‘Purple Prince’ PP8478
Purple Prince Crabapple

Malus spp. Mill. ‘Prairiefire’
Prairie Fire Crabapple

Malus spp. Mill. ‘JFS-KW5’
Royal Raindrops® Crabapple

Malus spp. Mill. ‘Red Baron’
Red Baron Crabapple

Malus spp. Mill. ‘Jewelcole’ PP3267
Red Jewel Crabapple

Malus spp. Mill. ‘Snowdrift’
Snowdrift Crabapple

Malus spp. Mill. ‘Spring Snow’ PP2667
Spring Snow Crabapple

Prunus ‘Kwanzan’
Kwanzan Cherry

Prunus incisa × campanulata ‘Okame’
Okame Cherry
*Prunus* ‘Snow Goose’

Snow Goose Cherry

*Prunus × yedoensis* ‘Akebono’

Akebono Cherry

*Pyrus calleryana* Decne. ‘Aristocrat’

Aristocrat Callery Pear

*Pyrus calleryana* Decne. ‘Redspire’ PP3815

Redspire Callery Pear

*Syringa reticulata* (Bl.) Hara ‘Ivory Silk’

Ivory Silk Japanese Tree Lilac

*Tilia tomentosa* Moench. ‘PNI 6051’

Green Mountain® Silver Linden

*Zelkova serrata* (Thunb.) Mak. ‘Village Green’

Village Green Japanese Zelkova

**DISEASE / PEST RESISTANT SELECTIONS**

*Betula platyphylla* var. *japonica* ‘Whitespire’

Whitespire Japanese White Birch

*Platanus × acerifolia* ‘Bloodgood’

Bloodgood London Planetree

*Ulmus* ‘Morton Glossy’

Triumph™ Elm
Ulmus ‘Patriot’

Patriot Elm

Ulmus americana L. ‘Jefferson’

Jefferson American Elm

Ulmus americana L. ‘New Harmony’

New Harmony American Elm

Ulmus americana L. ‘Princeton’

Princeton American Elm

Ulmus americana L. ‘Valley Forge’

Valley Forge American Elm
APPENDIX D

WRITTEN GUIDELINES, REGULATIONS, AND SPECIFICATIONS
RECEIVED FROM PARTICIPATING COMMUNITY TREE PLANTING PROGRAMS
The following documents are compilations representing those collected from research participants during on-site interviews. This appendix contains four documents utilized by research programs, including an approved species list, site assessment checklist, tree installation guidelines, and nursery specifications. The sections included in each document were found in at least one of the participating programs’ original document, and each section contains a brief description paraphrasing the details mentioned or referenced in the original program document in order to maintain program confidentiality. Parenthetical information refers to a specific reference made by a program in the original document.
Introduction

Topics generally covered in a brief introduction included the importance of trees in communities, proper site-specific species selection, and the contact information for the sponsoring organization(s). Several organizations remind readers of required permits and/or approval processes to which potential tree plantings must adhere. The lists are most commonly divided into categories according to mature tree size (i.e., small, medium and large). The mature height distinctions are made to accommodate physical infrastructure conflicts frequently encountered during tree planting. A preference for large shade trees, along with a supporting explanation, is frequently noted in the introduction. An explanation of minimum plant growth characteristics required for success in the urban landscape (i.e., drought tolerance, soil compaction tolerance, pollution tolerance, cold hardiness rating) is also included in this section. The absence of certain species, e.g., *Ailanthus altissima*, may also be clarified in this section.

For more information on botanical nomenclature, please reference *Standardized Plant Names* published by the American Joint Committee on Horticultural Nomenclature.

**Large Trees**: Mature height greater than 50 feet

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Liriodendron tulipifera</em></td>
<td>Tuliptree</td>
</tr>
<tr>
<td></td>
<td>The Tuliptree grows into a pyramidal shape at maturity. This tree produces tulip shaped green and orange flowers each spring. This particular tree is sensitive to extreme drought and requires large physical space because it is subject to wind throw.</td>
</tr>
<tr>
<td><em>Quercus robur</em> ‘Fastigiata’</td>
<td>Skyrocket® English Oak</td>
</tr>
<tr>
<td></td>
<td>This cultivar of English Oak grows into an upright, fastigiate shape at maturity. This tree tolerates dry soils and should be planted in the spring season only.</td>
</tr>
</tbody>
</table>
Medium Trees: Mature height between 35 and 50 feet

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Corylus colurna</em></td>
<td>Turkish Filbert</td>
</tr>
<tr>
<td>The Turkish Filbert grows into a rounded shape at maturity. This tree tolerates a wide range of soil pH levels, but the species is sensitive to long periods of drought.</td>
<td></td>
</tr>
</tbody>
</table>

| *Ostrya virginiana* | Hophornbeam |
| The Hophornbeam received this common name because its flowers resemble those of the common hop used in the production of beer, *Humulus lupulus*. The tree grows into a rounded shape at maturity. The tree tolerates a wide range of soil pH levels, but the species is sensitive to dry soils. This tree should be planted in the spring season only. |

Small Trees: Mature height less than 35 feet (suitable for planting under utility wires)

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acer tartarticum</em> ssp. ginnala</td>
<td>Amur Maple</td>
</tr>
<tr>
<td>This small tree grows into a rounded shape at maturity and tolerates many common urban soil conditions, including drought, high salt concentration, and a wide range of soil pH levels.</td>
<td></td>
</tr>
</tbody>
</table>

| *Prunus × yedoensis* ‘Akebono’ | Akebono Cherry |
| The Akebono Cherry forms a rounded shape at maturity, and this particular cultivar exhibits much more cold hardiness than the straight species. The tree produces large pink flowers that bloom in late spring. |

Horticultural References:

SITE ASSESSMENT CHECKLIST
PROGRAM NAME
CITY, STATE

Name of Organization
Address
City, State, Zip Code

Introduction

In order to maximize long-term plant survival and health, the programs presented these points for consideration during the evaluation of potential planting sites.

Site Assessment

A. Spacing

The following spacing guidelines are compilations, resulting from community tree planting program document analysis, of municipal regulations and standards. These figures establish minimum spacing requirements along streets, sidewalks, and public rights-of-way. The location-specific figures were obtained from various municipal agencies and departments, including fire, transportation, public safety, public utilities, and public works departments, and the final ranges are representative of the variability among programs included in this study. Guidelines established by the Americans with Disabilities Act (ADA) were also referenced and followed by each program.

1. Trees should not be planted in front of building entrances in order to permit full access by safety and fire personnel.
2. The placement of underground utilities should be determined prior to planting, and planting on top of critical utilities or infrastructure should be avoided.
4. Minimum horizontal distance between the proposed site and other infrastructure:
   a. streetlights: 15-25 ft.
   b. stop signs: 30 ft.
   c. other traffic signs: 6 ft.
   d. parking meters: 5-7 ft. (behind)
   e. gas/water valves: 2-5 ft.
   f. oil fill pipes: 4 ft.
   g. coal chutes: 6 ft.
   h. fire hydrants: 5-10 ft.
   i. driveways: 7-10 ft.
   j. middle of street intersections (depending on direction of traffic): 20-40 ft.
   k. edge of pit to opposite physical obstructions: 4-6 ft.
   l. bus stops: 5 ft.
5. Minimum vertical distance between sidewalk and power lines: 15-25 ft.
6. Minimum sidewalk width (excluding curb): 6-9 ft. (39 in. minimum for ADA compliance)
7. All trees must be planted immediately adjacent to the street, but may be planted in lawn areas when sufficient space is available.
8. The planting site should be clear of drainage line from downspouts to sewer.

B. Dimensions

Programs frequently established formal requirements concerning single tree pit dimensions. These requirements were normally stated as a minimum dimension (length and width measurement) for single tree pit plantings. However, several programs included a stated preference for the largest feasible planting pit size that each site could accommodate. Programs also commonly presented a range of optimal tree pit dimensions that could be adopted in various locations. Planting pit depths were often not standardized; rather, programs recommended that the depth of the planting pit should accommodate the root packaging of the tree and reveal the root flare at the soil grade, or slightly (1-2 in.) above. The minimum planting site dimensions for the programs participating in this research are presented in Table 1.

| Range of Minimum Single Tree Pit Dimensions |
| Length       | 6-10 ft. |
| Width        | 3-4 ft.  |

C. Configuration

Several programs also indicated planting site configuration preferences. This information was used to assess the capacity of a location to accommodate various plant arrangements. Most programs devoted the majority of their time working with the single tree pit. The single tree pit represented the majority of site configurations for programs working in dense urban areas. However, programs granted a higher priority to other planting site configurations when they could be accommodated. Preferred planting site configurations are presented in order of preference, least to greatest, below.

1. Single Tree Pit: one tree planted adjacent to the street
2. Continuous Tree Pit: grouped plantings adjacent to the street
3. Median Planting: grouped plantings in traffic medians
4. Lawn Planting: single or grouped plantings in lawns
Introduction

Programs generally presented the topic of tree installation with a reminder that tree planting is an activity with long-term ambitions. In order to achieve long-term success, adherence to these standards and guidelines for tree planting is important. Topics covered in the introduction included a review of the importance of trees in communities and the benefits conferred to neighborhood residents, including environmental, aesthetic, economic, and social benefits. Some programs invoked the municipal ordinance that mandates all tree planting activity follow these guidelines, while other programs encourage volunteers and homeowners to follow these guidelines to maximize future benefits.

Materials

1. Plants
   a. Nomenclature: Plants should be identified in accordance with the Standardized Plant Names published by the American Joint Committee on Horticultural Nomenclature (1942). The names of cultivated varieties (cultivars) should conform to nursery standards, and the originating nursery must certify registered cultivars.
   b. Digging: Plants should be dug immediately prior to their delivery. In the case of balled and burlapped material, the dimensions of the rootstock and accompanying soil must meet the standards established by the American Standards for Nursery Stock (ANZI Z60.1, published 1996), and the soil should be solid, firm, and unbroken.
   c. Form and Structure: The shape of the tree should be typical of the species and/or cultivar. Labeled trees must reflect the physical habit of the associated species. The plants should be of superior, specimen quality for landscape establishment. Trees should have a single, straight trunk growing from a healthy, vigorous root system unless specified by a program representative.
   d. Condition: The plants should be free of pests and diseases, and they should also be free of any mutilating pruning cuts, bark abrasions,
sunscald and/or wounds that have not callused. The trees should be limbed up to a minimum specified height (5-6 ft.).

e. Size: The trees should meet minimum caliper size (2.0 - 3.5 in.) measured according to common industry standards and practices (6 in. above the root flare). A maximum tree height may also be established for plantings (12-14 ft.).

f. Provenance: Trees should be cultivated from plant material of researched performance and predictability, preferably cultivars, which have been grown in comparable hardiness zones to their final location.

g. Species selection: Program representatives are granted the authority to perform, approve, and/or modify species selections. The approved species list should be referenced and utilized during the species selection process.

2. Backfill

a. Backfill used should be obtained from naturally formed topsoil and should be free of unacceptable particles and components (hard clods, stiff clay, hardpan, sods, partially disintegrated stone, lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards chips, sticks, etc.).

b. Backfill used for tree establishment should meet the following requirements:
   i. Source:
      1. Predefined depth (1 ft.) of topsoil containing no amount of subsoil obtained off-site.
      2. Soil removed from the planting site (existing conditions or amended)
   ii. Amendments: Soil conditioner or compost should be added to the backfill at the specified rate (1 bag per planting site).
   iii. Organic matter content: Backfill should contain an appropriate amount of organic matter (8-12%)
   iv. pH range: Backfill should exhibit moderate pH levels (6.0-7.0)
   v. Sieve analysis: Backfill used in the planting should pass appropriate sieve tests (Wash Test, ASTM Designation C-117 with 60%-100% passing specified sieve tests)
   vi. Clay content: Backfill should not contain an unacceptable amount of clay (ASTM Designation D-422 containing less than 60% clay passing specified sieve tests)
   vii. Electrical conductivity: Backfill should not contain an unacceptable amount of salt measured through electrical conductivity examination (Less than 1500 mhos/cm).
3. Mulch
   a. Mulch should be a natural forest product (shredded hardwood bark) containing less than a specified amount (2%) of debris, such as wood product waste. It should be composed of an agreeable species (pine, fir, cypress) and not exceed the maximum length after shredding (1.5 in.). Mulch should not exhibit pH levels greater than the specified amount (5.8-6.5).

4. Stakes
   a. All stakes should be constructed of the specified material (milled timber, rough sawn timber, steel) obtained from a reputable source approved by the program. The stakes should resist extensive deflection (less than 10%) and should not exceed the specified range of dimensions (6-8 ft. long and 2-3 in. wide).

5. Polypropylene straps
   a. Straps used for staking should be constructed from flat, woven material (Polypropylene) and be obtained from a reputable source approved by program staff (Deeproot® Arbortie™ material). The straps should not exceed the specified width (3/4 – 1 1/2 in.)

6. Water
   a. Water should be obtained from specified locations (on-site or off-site) approved by program staff and meet minimum requirements (free from oil, acceptable pH range, free from harmful impurities). Water should be transported and dispersed in approved equipment (hose, watering bucket, water wagon).

7. Irrigation bags
   a. Irrigation bags should be obtained from a reputable commercial source approved by program staff (Treegator®).

8. Mycorrhizal inoculants
   a. Mycorrhizal inoculants should be a granular product (PHC® Tree Saver®) obtained from a reputable source approved by program staff (Plant Health Care, Inc.). The product should be composed of a specified amount of ingredients (ectomycorrhizal and endomycorrhizal fungi, biostimulants, humic acids, soluble sea kelp extract, and a water absorbent medium).

9. Water Retention Additive
   a. Additives should be a granular product (polyacrylamide polymer of potassium base such as Terra-Sorb) obtained from an approved specified source (Plant Health Care, Inc.).
Planting Specifications

1. Planting seasons
   a. The range of dates acceptable for planting limit the available time each year when trees may be planted (March 15 – May 31 and August 15 – December 15). A preferable planting season, when applicable, should be utilized for species susceptible to additional transplant stress during certain times of the year.

2. Installation
   a. Tree handling
      i. Trees should be transported in order to limit injury and desiccation. When transported in closed vehicles, plants should receive adequate ventilation to prevent overheating. When transported in open vehicles, plants shall be protected by tarpaulins or other suitable cover material to prevent wind damage. Plants should be kept well watered until they are installed. During transportation, trees should be handled only by the root ball. All of these standards should be strictly adhered to while the plant is being transported from the nursery to the planting site.

   b. Preparation
      i. Material attached to the tree should be removed before installation, including nursery labels, rope, and trunk wrap. Dead and/or broken limbs should also be pruned prior to installation.
      ii. Locate the root flare and remove any soil covering this location on the trunk.
      iii. The full length of the planting pit should be excavated in a street planting, and an area twice as large as the root ball should be excavated in lawn or park plantings. The planting site should be excavated to a depth equaling the height of the tree’s root ball in order to reveal the tree’s root flare at, or slightly above, the finished grade.

   c. Placement
      i. The tree should be placed in the center of the planting pit by lifting it from the root ball and arranged as close to plumb as possible.
      ii. The depth should be tested and refined in order to reveal the root flare at the final surface grade after the soil has finished settling.
      iii. At least the top (50%-75%) of the wire, rope, and burlap should be removed from the root ball. The remaining burlap should be pulled back and arranged to avoid air pockets in the planting pit.

   d. Backfill
i. All stones, non-organic materials, and debris should be removed from the planting pit before backfilling. Backfill used should not be frozen or stiff, and the backfill should be firmed, with water or pressure, at even intervals (6-8”) during the backfill.

ii. If appropriate, mycorrhizal inoculant should be added in the final layer (6-8”) of topsoil.

iii. The backfill should reach its final level at a level even with the surrounding grade (ground, concrete, asphalt, etc.) and the root flare, or slightly below to accommodate a layer of mulch.

iv. A small basin should be revealed around the base of the trunk to help retain water around the root ball.

v. Soil should never cover the base of the trunk and should reach its final depth equal to the root flare.

3. Staking
   a. Staking should be performed immediately after backfilling at the planting site, and should be maintained during a specified period of time (1-2 years).
   b. The stakes should be driven to a minimum depth (30 in. consistently). Stakes should be placed in a consistent orientation (parallel to curb and opposite one another) at a minimum distance from the base of the trunk (8 in. - 1 ft.). The stakes should not be driven into the root ball or into major structural roots.
   c. The tree should be loosely affixed to the stakes using polypropylene straps, knotted around the stakes, at the appropriate location (under the lowest set of branches).

4. Watering
   a. Trees should be watered appropriately (20 gallons) at even intervals during backfilling in a safe manner avoiding harm to the plant, backfill erosion, or damage to surrounding conditions.

5. Mulching
   a. Mulch should be applied to the planting site after backfilling and watering has been completed at a uniform depth (2-4 in.) Care should be taken to avoid excessive mulch around the trunk of the tree and, in many cases, no mulch should be applied within a specified radius of the trunk (2-3”).

6. Finalization
   a. The condition of the planting site should be clean and safe after the tree installation.
NURSERY SPECIFICATIONS
PROGRAM NAME
CITY, STATE

Name of Organization
Address
City, State, Zip Code

Introduction
These specifications outline the production and delivery of desired landscape trees requested by the community tree planting program, and trees received by the program are required to meet the specified criteria through a variety of enforcement methods, including contracts and other agreements.

Nomenclature
Plants should be identified and labeled according to the *Standardized Plant Names* published by the American Joint Committee on Horticultural Nomenclature (1942). The names of cultivated varieties (cultivars) should conform to nursery standards, and the originating nursery must certify registered cultivars.

Labeling
Plants should be labeled with the genus, species, cultivar, and/or trademark name using a weather-appropriate tag. These names should correspond with those stored in the nursery database and/or plant availability list, and these materials should be prepared and checked before harvest.

Quality Standards
The plants should be grown in accordance with the standards set forth in the *American Standards for Nursery Stock* (ANZI Z60.1, published 2004), including root ball size and current shoot growth measurements. Trees should be given the opportunity to develop into robust, adequately lignified specimens able to stand erect without stakes. The trees should be free of defects and wounds resulting from damaging nursery conditions.

1. Pests and Diseases: Trees should be cultivated free of pests and diseases, and the leaves should exhibit characteristics typical of the season and species.

2. Canopy: The canopy should be representative of the species and/or cultivar, generally symmetrical, and evenly distributed. The live crown ration should meet the minimum acceptable measurement (50%). All branches should be acceptably smaller than the trunk (2/3 total diameter). Generally, there should be one dominant leader growing vertically through the crown. Excurrent trees, and those exhibiting excurrent growth patterns at youth, should adhere to these standards. Exceptions in the number of acceptable crown leaders can be made for primarily decurrent species. Examples of excurrent and decurrent species include *Ginkgo*
biloba and Gleditsia tricanthos var. inermis, respectively. Additional examples of these two categories could be provided as necessary.

3. Root System: The root system should be cultivated in a manner preserving its integrity. Several common conditions that should be avoided include roots that are circling the trunk and sharply bent. Certain unsatisfactory root conditions may be accepted if they are below a minimum quantity and size. Trees should be firmly rooted into the soil and root ball. The root flare, the point at which the highest root emerges from the trunk, should be visible and revealed at the soil surface. Trees should not have excess soil accumulation around the root flare during planting, cultivation, or harvesting.

4. Pruning: Trees should be pruned to maintain their natural shape and form. Broken, damaged and crossing limbs should be removed in order to encourage such growth. The use of sharp, clean pruning shears is strongly encouraged. Pruning should occur each year prior to the specified date (June 15).

Production Schedule:
All trees grown at the nursery will be maintained at their location for a minimum period (three years). The production schedule used for landscape trees requested by the community tree planting program should generally follow these guidelines:

i. Year one, liner planting: Liners should be field planted according to the standards established in American Standards for Nursery Stock (ANZI Z60.1, published 2004). The weather conditions during planting should be amenable to plant growth and should not be excessively hot or dry. The roots should be evenly distributed in the planting hole and covered with acceptable soil (sandy loam). The planting depth should be maintained to reveal the root flare at the soil surface.

ii. Year two, crown formation: The maintenance of proper row spacing and lower branches on the trunk is encouraged during this period. The tree should be encouraged, with these conditions, to form an adequate trunk taper and strength. Temporary branches along the trunk should be maintained at a size not exceeding the maximum specified (3/8 in.). A central leader should also be encouraged during this period.

iii. Year three, branch structure: Main branches should originate from the trunk in an even radial and vertical scale. The branch structure should represent the typical form of the species. The branches should not be formed at an excessively acute angle and should not exceed the minimum specified diameter compared to the trunk (2/3). The relationship between total tree height and the first branch should be preserved according to the American Standards for Nursery Stock (ANZI Z60.1, published 2004). These standards
related appropriate ranges of total tree height at various caliper sizes. The optimal live crown ratio (50%) should be maintained according to these specified height ranges, and the trees should be limbed up to a minimum height (60 in.) before harvest while maintaining this ratio.

Tagging:
The trees should be tagged and approved at the nursery prior to harvesting by an approved representative of the community tree planting program (staff, landscape contractor, volunteer).

Harvesting:
All trees should be harvested according to the root packaging method specified (bare root, balled and burlapped) using acceptable materials (twine, burlap, wire baskets) when appropriate. In the case of balled and burlapped (B&B) trees, the ball should be harvested in accordance with the American Standards for Nursery Stock (ANZI Z60.1, published 2004). B&B trees should have solid and firm root balls that are evenly watered. In every case, the trees should be harvested to preserve as many woody and fibrous roots as possible. Trees should be dug as close to the scheduled planting as possible, and the trees should not be actively growing at the time of digging.

Transportation:
Trees should be transported in order to limit injury and desiccation. When transported in closed vehicles, plants should receive adequate ventilation to prevent overheating. When transported in open vehicles, plants shall be protected by tarpaulins or other suitable cover material to prevent wind damage. Plants should be kept well watered until they are installed. Trees should be handled only by the root ball during transportation.
APPENDIX E

CONTACTS USED TO ELICIT SURVEY RESPONSES
First Contact - Community Tree Planting Program Survey E-mail Invitation

Greetings,

I am writing to invite you to participate in a research survey on community tree planting program effectiveness. The goal of this research is to identify key components of tree planting program effectiveness, especially in the area of plant acquisition. Daniel Burcham of the Longwood Graduate Program at the University of Delaware is conducting the study, and this survey is supported by the Alliance for Community Trees and the American Nursery and Landscape Association. This survey is being sent to approximately 150 tree planting program managers throughout the Mid-Atlantic and Northeastern regions of the United States.

As a participant in the survey, you are free to drop out of the study at any time, without penalty. After starting the survey, simply close the web browser before you press the final submission button. Any responses you previously made will not be included in the study.

The survey consists of eleven questions and should take less than five minutes to complete. The electronic survey will be available from January 30, 2009 until February 28, 2009; if you prefer to register a response on a paper survey, please contact the principal investigator, Daniel Burcham, to request that a paper copy be mailed to you.

Please click the link below to proceed.

{Survey Link}

Thank you,

Daniel C. Burcham
Louise Roselle Graduate Fellow
Longwood Graduate Program
University of Delaware
Newark, DE 19716
Tel: (302) 831-2517
Fax: (302) 831-3651
http://www.udel.edu/longwoodgrad
Second Contact - Community Tree Planting Program Survey E-mail Reminder

Greetings,

I am writing to remind you of the opportunity to participate in a research survey on community tree planting program effectiveness. If you have already responded to this request, thank you for your assistance!

The goal of this research is to identify key components of tree planting program effectiveness, especially in the area of plant acquisition. Daniel Burcham of the Longwood Graduate Program at the University of Delaware is conducting the study, and this survey is supported by the Alliance for Community Trees and the American Nursery and Landscape Association. This survey is being sent to approximately 150 tree planting program managers throughout the Mid-Atlantic and Northeastern regions of the United States.

As a participant in the survey, you are free to drop out of the study at any time, without penalty. After starting the survey, simply close the web browser before you press the final submission button. Any responses you previously made will not be included in the study.

The survey consists of eleven questions and should take less than five minutes to complete. The electronic survey will be available from January 30, 2009 until February 28, 2009; if you prefer to register a response on a paper survey, please contact the principal investigator, Daniel Burcham, to request that a paper copy be mailed to you.

Please click the link below to proceed.

{Survey Link}

Thank you,

Daniel C. Burcham
Louise Roselle Graduate Fellow
Longwood Graduate Program
University of Delaware
Newark, DE 19716
Tel: (302) 831-2517
Fax: (302) 831-3651
http://www.udel.edu/longwoodgrad
Greetings,

I am writing to invite you to participate in a research survey on nursery sales destined for use by community tree planting programs. The goal of this research is to document current levels of interaction occurring between nurseries and such programs. Daniel Burcham of the Longwood Graduate Program at the University of Delaware is conducting the study, and this survey is being supported by the American Nursery and Landscape Association. Results will be made available to all participants upon completion of the report. This invitation to participate in a web survey is being sent to 100 nursery professionals throughout the Mid-Atlantic and Northeastern regions of the United States.

The survey consists of eight questions and should take less than five minutes to complete. The electronic survey will be available from March 9 until March 30, 2009; if you prefer to submit a response on a paper survey, please contact the principal investigator, Daniel Burcham, to request that a paper copy be mailed to you.

Please click the link below to proceed.

{Survey Link}

Thank you,

Daniel Burcham
Louise Roselle Graduate Fellow
Longwood Graduate Program
University of Delaware
Newark, DE 19716
Tel: (302)831-2517
Fax: (302)831-3651
http://www.udel.edu/longwoodgrad
Second Contact - Nursery Survey E-mail Reminder

Greetings,

I am writing to remind you of the opportunity to participate in a research survey on nursery sales destined for use by community tree planting programs. If you have already responded to this request, thank you for your assistance!

The goal of this research is to document current levels of interaction occurring between nurseries and such programs. Daniel Burcham of the Longwood Graduate Program at the University of Delaware is conducting the study, and this survey is being supported by the American Nursery and Landscape Association. Results will be made available to all participants upon completion of the report. This invitation to participate in a web survey is being sent to 100 nursery professionals throughout the Mid-Atlantic and Northeastern regions of the United States.

The survey consists of eight questions and should take less than five minutes to complete. The electronic survey will be available from March 9 until March 30, 2009; if you prefer to submit a response on a paper survey, please contact the principal investigator, Daniel Burcham, to request that a paper copy be mailed to you.

Please click the link below to proceed.

{Survey Link}

Thank you,

Daniel Burcham  
Louise Roselle Graduate Fellow  
Longwood Graduate Program  
University of Delaware  
Newark, DE 19716  
Tel: (302)831-2517  
Fax: (302)831-3651  
http://www.udel.edu/longwoodgrad
APPENDIX F

COMMUNITY TREE PLANTING PROGRAM SURVEY
This survey investigates characteristics of community tree planting programs in the Northeast and Mid-Atlantic United States. Specifically, tree planting practices and the nature of commercial interaction with nurseries is being investigated. The goal of this research is to identify key components of tree planting program effectiveness. The study is being conducted by Daniel Burcham of the Longwood Graduate Program at the University of Delaware, and this survey is supported by the Alliance for Community Trees. Survey results will be analyzed and published around July 01, 2009 and distributed to professionals in relevant fields. Approximately 150 professionals are being invited to participate in this survey.

The questionnaire consists of eleven questions and will take you approximately five minutes to complete.

Individual responses will be collected on a secure web server. These data will remain confidential and viewed only by the principal investigator. Survey respondents will remain completely anonymous. The data will be destroyed after two years. The electronic survey will be available from February 02, 2009 until February 28, 2009; if you prefer to submit a response using a paper survey, please contact the principal investigator, Daniel Burcham, to request that a paper copy be mailed to you.

Your participation is entirely voluntary. To leave the study at any time, close the web browser before you press the final submission button at the end of the survey. Any responses you previously made will not be saved.

If you have any questions concerning the study, please contact the principal investigator Daniel Burcham, Longwood Graduate Program, University of Delaware at dburcham@udel.edu. For questions about your rights as a subject or about any issues concerning the use of human subjects in research, please contact the Chair, Human Subjects Review Board, University of Delaware at (302) 831-2136.

Thank you for participating. Your participation is greatly appreciated!
1. How successful has your community tree planting program been in the achievement of annual planting goals? Please record your response on the scale provided.

- Completely successful
- Very successful
- Somewhat successful
- Slightly successful
- Not at all successful

2. During 2008, approximately how many trees did your organization plant? Please select from the following ranges.

- 300 or fewer
- 301-600
- 601-900
- 901-1,200
- 1,200 or greater

3. Are the following components currently included in your tree planting process?

<table>
<thead>
<tr>
<th>Component</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved species list</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Community input</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Formal approval process (e.g., permit, review period, consent of organization)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Nursery specifications</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Site assessment checklist</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Tree installation specifications</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

4. In your own experience, have any of the following enabled you to achieve your planting goals?

<table>
<thead>
<tr>
<th>Component</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community support and stewardship (e.g., volunteers)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Municipal government capacity (e.g. adequate staff size)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Political support</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Program capacity (e.g., staff size, professional expertise)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Program partnerships (e.g., public-private)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sufficient funding</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
5. How do you currently acquire trees through nurseries? Please check all that apply.

____Traditional commerce
____Contract growing
____Advanced ordering (e.g., container-grown trees)
____Bid solicitation
____Negotiated sales

6. In 2008, approximately what proportion of all trees was purchased from nurseries in the following forms? Total responses must equal 100%.

____Balled and burlapped
____Container grown
____Bare root

7. In 2008, what was the average caliper size of trees planted by your program?

____1.5-2.0”
____2.0-2.5”
____2.5-3.0”
____3.0” or greater

8. How would you rate the inadequacy or adequacy of the mixture of species currently available for purchase in nurseries?

____Very inadequate
____Somewhat inadequate
____Neither inadequate nor adequate
____Somewhat adequate
____Very adequate

9. Are any species consistently difficult to locate for purchase?

If applicable, please record your response below.

________________________________________________________________

10. Do you currently grow trees using internal funds and resources (i.e., in-house)?

____Yes ____No
11. With how many nurseries do you currently interact?

___0-1
___2-3
___4-5
___6+

12. Please record any additional comments below:

________________________________________________________________

Thank you for completing the survey. Your professional expertise and insight is critical to the success of this research project. The results of this study will be published around July 01, 2009. If you would like to receive a copy of the results, please contact me via e-mail at dburcham@udel.edu. To learn more about the Longwood Graduate Program, please visit the Program's Web page at http://www.udel.edu/longwoodgrad.

Daniel C. Burcham
Louise Roselle Graduate Fellow
Longwood Graduate Program
University of Delaware
Newark, DE 19716
Tel: (302) 831-2517
Fax: (302) 831-3651
http://www.udel.edu/longwoodgrad
dburcham@udel.edu
This survey investigates nursery sales destined for use by community tree planting programs. The study is being conducted by Daniel Burcham of the Longwood Graduate Program at the University of Delaware. Survey results will be analyzed and published around July 01, 2009 and distributed to professionals in relevant fields. Approximately 100 nursery professionals are being invited to participate in this survey.

The questionnaire consists of eight questions and will take you approximately five minutes to complete.

Individual responses will be collected on a secure web server. These data will remain confidential and viewed only by the principal investigator. Survey respondents will remain completely anonymous. The data will be destroyed after two years.

Your participation is entirely voluntary. To leave the study at any time, close the web browser before you press the final submission button at the end of the survey. Any responses you previously made will not be saved.

If you have any questions concerning the study, please contact the principal investigator Daniel Burcham, Longwood Graduate Program, University of Delaware at dburcham@udel.edu. For questions about your rights as a subject or about any issues concerning the use of human subjects in research, please contact the Chair, Human Subjects Review Board, University of Delaware, (302) 831-2136.

Thank you for participating. Your participation is greatly appreciated!
1. Which of the following best describes your business?

____ Wholesale nursery
____ Retail nursery

2. Over the past year, have you sold any landscape trees specifically to community tree planting programs?

____ Yes
____ No

3. In 2008, approximately what proportion of your total landscape tree sales was distributed among the following categories? Total responses must equal 100(%).

____ Community tree planting programs
____ Mass merchandisers
____ Garden centers
____ Landscape contractors
____ Re-Wholesalers

4. Compared with previous years, have your sales destined for use within community tree planting programs increased or decreased during 2008?

____ Strongly decreased
____ Slightly decreased
____ Neither decreased nor increased
____ Slightly increased
____ Strongly increased

5. Which of the following categories best describes the nature of your transactions with community tree planting programs?

____ Traditional commerce
____ Contract growing
____ Re-Wholesale distribution
____ Bid fulfillment
____ Negotiated sales
6. In 2008, approximately what percentage of your total landscape tree sales was sold to community tree planting programs in the following forms? Total responses must equal 100(%).

____Balled and burlapped
____Container grown
____Bare root

7. To what extent do you oppose or favor formal growing arrangements with community tree planting programs (e.g., contract growing)?

____Strongly oppose
____Somewhat oppose
____Neither oppose nor favor
____Somewhat favor
____Strongly favor

8. Have you used any of the following methods to predict potential demand from community tree planting programs?

____Yes  ____No  Recommendations from tree planting program representative
____Yes  ____No  Analysis of historical sales figures
____Yes  ____No  Recommendations from nursery industry
____Yes  ____No  Horticultural and/or forestry research reports

9. Please record any additional comments below:

______________________________________________________________
Thank you for completing the survey. Your professional expertise and insight is critical to the success of this research project. The results of this study will be published around July 01, 2009. If you would like to receive a copy of the results, please contact me via e-mail at dburcham@udel.edu. To learn more about the Longwood Graduate Program, please visit the Program's Web page at http://www.udel.edu/longwoodgrad.

Daniel C. Burcham
Louise Roselle Graduate Fellow
Longwood Graduate Program
University of Delaware
Newark, DE 19716
Tel: (302) 831-2517
Fax: (302) 831-3651
http://www.udel.edu/longwoodgrad
dburcham@udel.edu
LITERATURE CITED


Coder, K.D. 1999. Tree selection for drought resistance. Warnell School of Forest Resources, University of Georgia, Athens, GA.


City’s present and potential urban tree canopy. Maryland Forest Service,
Annapolis, MD.

Gardescu, P. 1976. A landscape architect’s view of better trees for urban spaces. p. 135-
metropolitan landscapes. USDA Forest Service, Upper Darby, PA.


College of Agriculture, University Park, PA.

168. In: Kuser, J.E. (ed.). Handbook of urban and community forestry in the

Gilman, E.F. and D.G. Watson. 1993. 680 Tree Fact Sheets. Institute of Food and
ufld.edu/trees/index.html>

Gilman, E.F., R.J. Black, and B. Dehgan. 1998. Irrigation volume and frequency and tree

Gottmann, J. 1957. Megalopolis or the urbanization of the Northeastern seaboard.
Economic Geography 33(3):189-200.


Hauer, R.J. 2005. Urban forestry and urban forest capacity: defining capacity and models of capacity building. Univ. of Minn., PhD. Diss.


Sommer, R., C.L. Cecchettini, and H. Guenther. 1992. Agreement among arborists, gardeners, and landscape architects


disease, research and control. U.S. Department of Agriculture Forest Service
Report to the U.S. Congress, Washington, DC.

cover using airborne or satellite imagery. Arboriculture and Urban Forestry

Publishing, Gladstone, IL.

Ware, G. 1994. The right plant for the right place. American Nurseryman

Watson, G.W. and E.B. Himelick. 1982. Seasonal variation in root regeneration of

Watson, G.W. and E.B. Himelick. 1997. Principles and practices of planting trees and
shrubs. International Society of Arboriculture, Champaign, IL.

Effects of planting depth on landscape tree survival and girdling root formation.


Wolf, K.L. 2005. Trees in the small city retail business district: comparing resident and
