

**Raleigh, North
Carolina: *An
Assessment of
Municipal Tree
Utilization and the
Urban Forestry
Program***

Prepared by:
Dovetail Partners

July 2015



Scope of Project and Background

This project examined both urban tree utilization in the Raleigh metropolitan area, and the City of Raleigh's Urban Forestry program. Parts I and II of this report focus on urban tree utilization; Part III deals with Raleigh's urban forestry program. Part IV includes case studies and appendices for both urban tree utilization and urban forestry.

The urban tree utilization assessment was informed by the following facts and perspectives. America's urban forests provide diverse and essential benefits and services to communities. When trees are removed, the wood is most often mulched, composted, or sent to a landfill site. But urban forests offer the potential for enhanced utilization with estimates of annual availability ranging from over 16 to 38 million green tons.

Barriers to urban tree utilization include technical and logistical constraints, availability of processing facilities, and market considerations. Perhaps the most significant barrier to urban trees entering the wood processing stream may be the prevalent idea that urban trees are suitable only for low-value products. Many urban forestry programs, as well as urban residents, are not fully aware of the opportunities and benefits.

Across the U.S., urban forestry programs are typically located in either a Department/Division of Public Works or a Department/Division of Parks. In Raleigh, the Parks Division has responsibility for the management of the urban forest. The assessment of the Urban Forestry program included a review of the sustainability of the City's processes for urban tree program planning and implementation. Specifically, the assessment was informed by a review of program materials; a site visit including staff interviews, City tour, and observation of on-the-ground program activities and outcomes; and a survey of internal and external stakeholders for the identification of program strengths and weaknesses.

The two assessments, urban tree utilization and urban forestry program, provide recommendations and action steps for the City. These project outcomes provide a pathway to enhance the utilization of urban trees through a strong and robust urban forestry program.

Report prepared by:

S. Bratkovich, K. Fernholz
Dovetail Partners, 528 Hennepin Ave, Suite 703
Minneapolis, MN 55403
www.dovetailinc.org

Project completed with support from North Carolina Urban and Community Forestry Grant Program

July 2015

Table of Contents

Scope of Project and Background	2
Table of Contents	3
Executive Summary	5
Part I.	10
Introduction	10
Raleigh Background	11
Raleigh Urban Tree Utilization Activities	12
Tree Service Firms/Private Arborists	12
Log Yards/Loggers	14
Wood Residue Recyclers (Mulch and Compost)	14
Communities/Universities	15
Niche Urban Tree-Based Businesses	17
State Agencies/State Universities	19
Non-Profits	20
State-based Initiatives and Programs	20
Summary of Urban Tree Utilization in the Raleigh Area	21
Part II.	22
What is an Industry or Business Cluster?	22
The Cluster Model Applied to the Raleigh Metropolitan Area Urban Tree Utilization	24
Feasibility Analysis	24
Education, Technical and Research Support	24
Supportive Government Actions including Grants	25
Supporting and Complementary Industries	26
Entrepreneurship and Innovation	26
Access to Raw Materials, Markets and Transportation Needs	27
Leadership, Commitment and Collaboration	27
Business Climate	28
Recommendations for Advancing Urban Tree Utilization Clustering in the Raleigh Area	29
Bottom Line	32
Part III.	32
Urban Forestry Program Assessment	32
Description of Assessment Design	32
Assessment Findings: On-site Visit and Document Review	35

Assessment Findings: Survey Results	36
Tree planting	46
Management planning.....	46
Forest products and services	47
Community engagement	48
Historic sites and resources	48
High-conservation value forests	49
Environmental impact.....	49
Monitoring system.....	50
Summary and Conclusions from Survey Rankings.....	51
Conclusions and Recommendations	51
Part IV.....	54
Case Studies.....	54
References	58
Appendix 1. Issues and Interventions for Raleigh, NC, pertaining to Urban Tree Utilization	63
Appendix 2. Internal Survey.....	64
Appendix 3. External Survey	67

Executive Summary

This project included an assessment of the urban tree utilization capacity and the urban forestry program for the City of Raleigh, North Carolina. The assessments included interviews and site visits focused on the urban tree utilization capacity in the Raleigh area plus a review of the sustainability of the City's processes for urban tree program planning and implementation. Both assessments provide recommendations to support continued enhancements.

The city of Raleigh is located in Wake County, in central North Carolina. The population of Wake County in 2013 was approximately 975,000. The median household income, and the per capita income, for the county, is above both the state and national averages.¹

Raleigh's population (over 431,000) is growing rapidly. The City is at the heart of the burgeoning Raleigh-Durham Research Triangle sprawl. Of 83 U.S. metro areas, Raleigh-Durham had the third worst sprawl index in 2009. Raleigh, a city with extensive forest cover, has a large wood feedstock and typifies the waste and energy issues faced by other sprawling communities in North Carolina and the SE U.S. (Lawler2011).

Raleigh is the state capitol of North Carolina and is the headquarters of the North Carolina Forest Service and roughly 200² other state agencies and offices. The city is home to seven colleges and universities including North Carolina State University (NCSU)³ and the NCSU Department of Forestry and Environmental Resources and NCSU Department of Forest Biomaterials.

A review of current urban tree utilization activities in Raleigh lead to the following observations about the existing capacity and service providers. Currently within the Raleigh area:

- *Innovative and entrepreneurial tree service firms are exploring tree utilization options* – Since trees must be removed (transported off-site) and trucked for disposal and/or utilization, some firms are looking at tree utilization as a “cost-avoidance” strategy.
- *Niche and Related (wood utilization) businesses are present in the Triangle area* – There are numerous businesses that traditionally “fly under the radar” of the larger corporations and the public-at-large.
- *A critical mass of urban wood enthusiasts exists* – This includes producers as well as users and the host of intermediaries involved in the process. Private and public entities as well as not-for-profit groups play a key role.
- *Markets are diverse; tree resources are available* – Raleigh's population is growing (customers!) and the city is geographically situated in an area that procures (and produces) a host of traditional forest products. In addition, urban tree niche-markets exist.

¹ See Wake County Economic Development at <http://www.ncgov.com/government/agencies/index.aspx>.

² See NC Government Agencies at <http://www.ncgov.com/government/agencies/index.aspx>.

³ NCSU is home to approximately 34,000 students and 2,000 faculty.

- *Woodyards exist in/near Raleigh and the greater metropolitan area* – Outlets for urban saw logs and pulpwood are located in the Triangle region. Raleigh can boast that it has woodyards (log buyers) in/near the metropolitan area.
- *The city of Raleigh is pursuing wood utilization activities* – Raleigh has an urban forestry program, and a solid waste site, both of which are attuned to wood utilization efforts.
- *Urban tree utilization is a topic of interest to many in the public/private sector* – In addition to the city of Raleigh, other examples are faculty at North Carolina State University, the North Carolina Forest Service, the North Carolina Department of Environment and Natural Resources, the city of Durham, Duke University (private university), and many others.
- *Yard waste (including urban trees) are banned from Municipal Solid Waste and Construction & Demolition Landfills* LCID (land clearing and inert debris) landfills are the only legal disposal sites for yard waste, thus enhancing utilization efforts.

Based on the above observations, the following recommendations support the further development of urban tree utilization “clustering” in the Raleigh Area:

- *Conduct a feasibility study* – This study should include a comprehensive inventory of tree removals, including leaves, limbs and branches (tree pruning residue), and a categorization of these removals (saw logs, pulpwood, firewood, etc.) by the entity conducting the removal (city, tree service firms, utility companies, homeowners, etc.). The protocol conducted in southeast Michigan (MacFarlane 2009), is a model worth to consider for the Raleigh metropolitan area.
- *Evaluate economic conditions, existing infrastructure, labor resources and other factors that impact the overall business climate* – This effort can be included in the feasibility study if time and resources permit; if not, a separate analysis should be conducted. For example, potential “loopholes” in the current system should be investigated including the role of LCID landfills (are LCIDs helping the “problem” or hindering progress on better urban tree utilization?).
- *Collaborate with stakeholders from industry, government, and supporting individuals and organizations* – The key is to get buy-in from various stakeholders and develop a vision for utilization of urban trees including next-steps and action items. There is a wealth of resources available in the Triangle region including technical, educational, and research information; these resources need to be capitalized on, and collaboration is an important first step.
- *Assist stakeholder groups in sharing key information* – At least four groups view urban tree utilization from a distinct perspective. State regulators, city managers (including municipal foresters), LCID owners/operators, and producers/users (tree care companies for ex.) all have different “missions” and all “control” key information. Better communication is needed between the groups.
- *Engage the leadership of a key organization to coordinate activities, facilitate development, and gain policy support* – The leader or champion does not necessarily have to possess a utilization background but should strongly support the utilization effort and should have the ability (and time!) to use his or her position to “rally the troops.”

- *Secure funding* – Financial resources, both private and public, are important to support feasibility studies, technology development, workforce training, capital investment, applied research and other project components. Funding sources can include national, state, or local.
- *Focus on education and engagement of entrepreneurial thinking and innovation* – Support the creation of a position with the assigned duties of “urban wood utilization.” A person in this capacity can efficiently focus on education and training opportunities for arborists (log manufacturing, grading, transport, etc.), assist and encourage start-up urban wood businesses, conduct utilization-based feasibility studies, and become a focal point for technical/hands-on utilization activities.
- *Nurture supporting and complementary industries* – An important task of either the utilization champion, urban wood specialist, or key stakeholder(s) is to facilitate partnerships and relationships (formal or informal) between the numerous industries (and organizations) that are in the cluster.
- *Recognize the differences in types of clusters and act accordingly* – One strategy for cluster development is to select or nurture one of four models as a starting point, or build upon what already exists. This can help focus efforts and provide a framework for collaborative work. (Raleigh appears to be in the early stages of a Marshallian cluster –one that is typically comprised of small and medium-sized companies that trade their products and services with other cluster members)
- *The City of Raleigh has the potential to lead the way on urban tree utilization* – Since the sale of wood products (mulch, compost, firewood, saw logs) finances (in part) the NeighborWoods tree planting program, it behooves the city to seek additional markets and/or higher prices for their wood-based sales. Also, Raleigh should investigate the possibility of cooperating with adjacent cities (Durham for ex.) on log storage sites, wood products, marketing initiatives, etc. An “answer” to a “problem” might be contained in an adjoining county or municipality.
- *Develop a city (county) list of small saw mills, loggers, timber buyers, and forest product manufacturers.* A directory is needed for “small” timber users in the area. The list should be specific to Raleigh and/or Wake County (or the Triangle area). Minnesota (Twin Cities), Michigan (Detroit) and Illinois (Chicago) have produced a list for specific metropolitan areas.
- *Building code issues should be addressed* – Using wood produced from local and/or city-based trees for structural purposes can be problematic. The state of Wisconsin has addressed this issue by “certifying” mills to produce structural lumber on a small or part-time basis. Adopting the Wisconsin model is one solution to the building code issue (on small lumber batches) in North Carolina.

From the entirety of the **urban forestry management program assessment** process – including the review of documents, on-site visits and interviews, and complete survey results – the following summary to programmatic strengths and opportunities is provided.

Strengths:

- Attracting talent, passion, skills in workforce and service providers
- Appropriately staffed, well-trained, experienced and professional individuals – emphasis on good science-based practices
- Leveraging legacy as the City of Oaks
- Innovative, comprehensive programs – from tree planting, inspection, removal, disposal/utilization
- Diverse lands and appropriate management approaches to fit them – ROWs, greenways, nature preserves, parks
- Awareness of importance of communications between departments

Opportunities:

- Updating and receiving approval of Manual, including the addition of technology improvements via CityWorks
- Establishing funding stability and long-term strategies and objectives for NeighborWoods program
- Exploring new market opportunities for urban wood, including potential for biomass, bioenergy

Since this assessment was undertaken, it is important to note that the City has accomplished the updating of the City Tree Manual and the tree ordinance (as of March 2015).

The City also has the opportunity to explore some of the newest ideas that are emerging in the practice of urban forestry. These ideas include establishment of “food forests” in urban areas, utilizing fruit and nut trees as appropriate and in collaboration with community partners; engaging with woodworkers and other artists to utilize urban wood resources in special events or as part of an extended effort; incorporating additional wildlife considerations into the urban forest (e.g., nest boxes, food plots, etc); providing training opportunities about how to maximize the economic value of removed trees (e.g., log bucking lengths, grading systems, etc.); and utilizing diverse vegetation management techniques to get desired outcomes (e.g., use of prescribed fire, Integrated Vegetation Management in rights-of-way, etc.). The City could also consider participating in the newly emerging urban forestry programs, including the Urban Forest Sustainability & Management Assessment program or the development of the SCS Salvaged Wood & Fiber Standard.

The City of Raleigh currently has an exceptional urban forestry program. It is thoughtful, comprehensive, and effective. Although there are always opportunities for improvement, perhaps the strongest recommendation for the City is to continue doing what it is already doing well and maintain its commitment to its urban forest resource.

NEXT STEPS

There are four “next steps” that Raleigh can undertake as a “leader” in urban tree utilization and urban forestry.

1. Develop a strategic plan for the urban forestry program. The recommendations and opportunities from this report can be used as a basis for the plan.
2. Establish a structure for measuring progress for the urban forestry program. This includes clearly defining the roles and responsibilities of staff members as well as a schedule of review milestones.
3. Develop a strategic plan specific to the NeighborWoods program. This plan should include the economic sustainability of the program as well as the role that urban tree utilization plays in the program.
4. Hold regular meetings of stakeholders involved with urban tree utilization. These meetings should include Triangle area arborists, urban foresters, small sawmill and dryer operators, loggers, wood yard owners, LCID operators, state regulators, municipal managers, small wood-based business owners, and so forth. Ideally, the meetings would be held at a “neutral” location to encourage maximum participation.

Conclusions

The City of Raleigh is situated in the midst of a strong forestry and forest products industry. Raleigh’s population is expanding rapidly as well as the entire Research Triangle area. Raleigh, and the surrounding area, is home to many firms currently utilizing urban trees beyond the traditional products of firewood and mulch/compost. However, there is still a considerable amount of tree waste entering LCID landfills. Capturing these wastes “before the gate” for the highest value helps meet the growing needs for fiber and wood products for a growing population.

Raleigh has many of the key ingredients of an urban tree utilization cluster. A feasibility analysis (including a wood waste plan), and better collaboration with municipalities and key groups (such as urban foresters, private arborists, sawmillers, lumber dryers, wood artisans, furniture builders and such) are two of the actions needed to move Raleigh to a higher level of urban tree utilization.

The City of Raleigh currently has an exceptional urban forestry program. It is thoughtful, comprehensive, and effective. Although there are always opportunities for improvement, perhaps the strongest recommendation for the City’s urban forest management program is to continue doing what it is already doing well and maintain its commitment to its urban forest resource.

Next steps include convening meetings for key utilization stakeholders, developing a strategic plan for the urban forestry program and the NeighborWoods program, and establishing a structure for measuring progress of urban forestry program staff members.

Part I.

Introduction

There are nearly an estimated 4 billion urban trees⁴ in the U.S., with another 70 billion or so growing in metropolitan areas.⁵ In fact, 30 percent of all forestland in the U.S. is in a metropolitan area. Between 1997 and 2002, there was a 5 percent increase (more than 5 million acres) in forests in major metropolitan areas as developed lands in the U.S. expanded. Also, estimates from the U.S. Census Bureau show a 130-percent increase in census-defined urban area between 1960 and 2000 (Alig et al. 2010).

Urban land in the U.S. is projected to grow from about 3-percent in 2000 to over 8-percent in 2050, an area larger than the state of Montana. Focusing on just forestland, the amount subsumed by urbanization between 2000 and 2050 is projected to be over 29 million acres, an area approximately the size of Pennsylvania (Nowak and Walton 2005).

According to the Natural Resources Conservation Service (NRCS), the largest increases in U.S. developed area between 1982 and 1997 were in the South. North Carolina added more developed area than did the country's most populous state, California (Alig et al. 2010).

In the Southeast, the area from Richmond to Atlanta (sometimes called the urban Piedmont Crescent), has witnessed a concentration of development. Consequently, the urban areas of the Piedmont (along the I-85 and I-40 corridors) are expected to experience extremely fast growth (Alig et al. 2010). According to Terando et al. 2014, urban areas in the Southeastern U.S. could double in size by 2060 unless there are significant changes to land development, creating an urban "megapolis" stretching from Raleigh to Atlanta.

From a national perspective, the number of trees, and hence the volume of wood, removed annually from urban and community forests is significant (the removal can be due to land conversion, insect and pest damage, storm events, hazard trees, etc.). Removal estimates range from 16 to 38 million green tons per year. Even the lower value of these estimates is comparable to total annual harvests from America's National (U.S. Forest Service-managed) Forests (Bratkovich et al. 2008).

⁴ Urban areas as defined by the Census Bureau include (1) urbanized areas with a population of 50,000 or more and a minimum density of 1,000 people/sq. mi., (2) places that contain some urbanized areas within their boundaries, and (3) places with at least 2,500 people and located outside of urbanized areas. Also, areas totally surrounded by urbanized areas but not within an urbanized area are considered to be an urban area (Nowak et al. 2001).

⁵ Metropolitan areas as defined by the Office of Management and Budget defines metropolitan areas by county, not places (except in the six New England states). Metropolitan areas have one or more large core populations that are socially and economically linked to adjacent counties. For example, the New York metro area—the largest in the country—covers 36 counties in New York, Connecticut, New Jersey and Pennsylvania (Sherrill 2003).

Raleigh Background

The city of Raleigh is located in Wake County, in central North Carolina. The population of Wake County in 2013 was approximately 975,000. According to Wake County Economic Development, the median household income, and the per capita income, for the county, is above both the state and national averages.⁶

Over 80 firms are listed as Wake County timber buyers by the North Carolina Forest Service (8/21/14 update).⁷ The firms range from logging companies (22) to wood dealers/suppliers (32) to sawmills (11). Wood yards (8), pulp and paper mills (4), and oriented strand board/fiber board mills (4) are also included on the list. A crate manufacturer, planer mill, plywood mill, and veneer mill round out the 80+ firms.⁸

Raleigh's estimated population in 2013 was over 431,000,⁹ with growth rates consistently above the national average. The area's foremost companies include IBM, Cisco Systems, SAS Institute and Lenovo. Raleigh is home to many statewide organizations and groups including the North Carolina Museum of History, North Carolina Museum of Art and the North Carolina Museum of Natural Sciences.

Raleigh is the state capitol of North Carolina and is the headquarters of the North Carolina Forest Service and roughly 200¹⁰ other state agencies and offices. The city is home to seven colleges and universities including North Carolina State University (NCSU)¹¹ and the NCSU Department of Forestry and Environmental Resources and NCSU Department of Forest Biomaterials. The North Carolina Association of Professional Loggers is also headquartered in Raleigh.

Raleigh's population is growing rapidly and the city is at the heart of the burgeoning Raleigh-Durham Research Triangle sprawl. Of 83 U.S. metro areas, Raleigh-Durham had the third worst sprawl index in 2009. Raleigh, a city with extensive forest cover, has a large wood feedstock and typifies the waste and energy issues faced by other sprawling communities in North Carolina and the SE U.S. (Lawler2011).

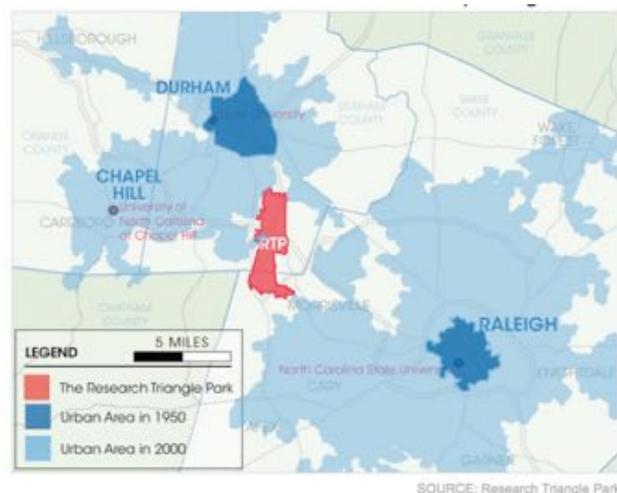


Figure 1. Map of Raleigh and Research Triangle

⁶ See Wake County Economic Development at <http://www.ncgov.com/government/agencies/index.aspx>.

⁷ See NC Forest Service at http://www.ncforestservice.gov/Managing_your_forest/timber_buyers.htm.

⁸ Helnin et al. 2012 noted that the forest industry has long been a major component of North Carolina's economy. As cities and municipalities continue to grow, managing urban forests and their related waste is a critical component of forest management.

⁹ See US Census Bureau at <http://quickfacts.census.gov/qfd/states/37/3755000.html>.

¹⁰ See NC Government Agencies at <http://www.ncgov.com/government/agencies/index.aspx>.

¹¹ NCSU is home to approximately 34,000 students and 2,000 faculty.

Raleigh Urban Tree Utilization Activities

There are a number of urban tree utilization activities occurring in Raleigh and the Research Triangle area. The following section summarizes some of these activities.

Tree Service Firms/Private Arborists

J & D Tree Pros, Inc., based in Apex, NC, specializes in tree removal with a crane, stump grinding, and high-risk tree removal (<http://jdtreepros.com/index.php>). John and Dan McMains founded the company in 1996, although the family has been in the tree industry since 1975.

John and Dan bought their first crane in 2003, and a year later, bought a second crane (dedicating one crane to J & D's commercial division and one to residential). The cranes enable the firm to practice their "No Impact Tree Removal" technique which, according to their website, helps insure the least amount of damage to the property and increases crew safety.

J & D Tree Pros currently does about \$2 million in sales annually with 22 employees in the field. The company's goal, said Dan, "We try to recycle all wood."

Typically, the firm generates two trucks per day of logs. The log trucks go to a chip site that has a log yard. Logs are sorted at the yard including a check for metal. "Metal logs," according to Dan, are sold for firewood, and the hardwoods, pine, and pulp are loaded onto trailers. Dan said, "We work with a "middleman" who backs up to the trailers and drives away." Unsold logs are converted to chips, and eventually to colored and plain mulch.

Dan said, "Sometimes a city has the only virgin wood around. Urban wood is sometimes one of a kind. For example, it is sinful to chip black walnut."

Dan also is currently storing large logs in a pond. He said, "Someday they might be worth a lot."

Bartlett Tree Experts was founded in 1907 and has nearly 100 offices worldwide. The Raleigh office is managed by Jeff Kish (<http://www.bartlett.com/locations/raleigh-nc/jeff-kish>).

Storage space is the main challenge for utilization efforts for Bartlett in Raleigh. Time is also an issue. Jeff said, "Sometimes it's easier [quicker] to run to a dump with our logs." Currently, Bartlett delivers a sizable quantity of wood to the Raleigh (city) site, about one log truck per day. Bartlett also generates chips and most of these are donated in the Raleigh area (eliminates the tipping fee).

In a typical year, Bartlett (Raleigh office) spends about \$30-40,000 on wood waste. Typical tipping fees range from \$35 to \$75 per truck. The tipping fee at the local Rowland Landfill is \$45 per load.¹²

¹² Rowland Landfill is an LCID (land clearing and inert debris) landfill. LCID landfills (there are four in Wake County) are exempt from the 1989 Senate Bill 111 (and subsequent legislation) which bans yard waste from landfills. LCID's are

Steve Johnston, regional manager for Bartlett in Atlanta, echoes the comments of Jeff Kish. Steve said, “There is no room in Raleigh to bring stuff.” Steve noted, “It always boils down to logistics – moving from point A to point B and then maybe to point C.”

Everett Tree Service – Jimmy Everett is the owner of Everett Tree Service based in Raleigh and serving the Research Triangle area. The company operates a 10-person crew and is involved in tree and stump removal, tree trimming, storm recovery, mulch production and more.

Everett often sells his better quality logs (from tree take-downs) to a log yard in the Raleigh area – both hardwoods and pine. (See the case study later in this report for additional information on Everett Tree Service).

Skillen Tree Care – Mike Skillen is the owner/operator of Skillen Tree Care. His neighbor owns a sawmill that Skillen uses to mill (and recycle) as much wood as possible. Mantel pieces and shelving are two products Skillen has made from tree removals. Skillen also delivers some logs to Triangle Forest Products (see below). He admits he has to do a better job on the marketing of wood products. His goal is to build rustic furniture in the future.

Skillen estimates that 60% of his tree removals either are milled or delivered to a log yard for further processing; another 20% goes to firewood, with the remaining 20% landfilled. Some of the landfill material is now converted to a soil amendment. An arborist, per Skillen, needs equipment to move logs (tractor trailer and crane for example) in order to efficiently “tree cycle.” Or, according to Skillen, obtain a mill that can be brought to the tree/log, thus eliminating the need to move logs.

Skillen noted that he is paid to prune and remove trees, not sell wood products. If he works with a long-term client, then money derived from wood sales might go to the cost of the job. The trend today, said Skillen, is to recycle more and waste less.

Dunn Tree Service – Bradley Dunn has operated a week-end tree service company for 17 years; his day job is a full-time position with the city of Raleigh.

Dunn estimates that 90% of the trees his tree service removes are usable for saw logs. His estimate for city-work trees is 50 to 55%.

Dunn stacks logs at his farm and saws them whenever time permits (perhaps 3 days/week). He removes and cuts both softwoods and hardwoods. Dunn is in the process of obtaining a new band mill from Alabama. All advertising has been word-of-mouth for lumber sales as well as his tree service business. Dunn usually stays 4-6 months behind and he said, “I haven’t been caught up in 17 years.”

Dunn said, “Some weekends I’ll bring home 15-20 logs. I bought my first mill to get rid of logs.” He doesn’t use a metal detector to “look” for nails and other foreign objects. He said, “If I damage a blade, I just swap it out for another. The cost is about \$28 for a new blade.”

explained in more detail later in this report. For the N.C. Division of Waste Management definition of an LCID landfill, see <http://portal.ncdenr.org/web/wm/sw/rules/rulelist>.

Dunn is proud that nothing from his tree removals ends up in a landfill. “For logs that can’t be sawn,” Dunn said, “another man chips the logs and hauls the chips to a power company. People even pick up my sawdust for bedding at their horse farms.”

Dunn admitted, “More tree care firms should do what I am doing.”

Log Yards/Loggers

American Woodyards, LLC, in Raleigh (across from the fairgrounds), (<http://www.americanwoodyards.com/Home.aspx>) is a locally owned woodyard focusing on custom-cut and specialty lumber. The company buys delivered pulpwood and saw timber from a variety of suppliers such as tree services (arborists), grading and clearing contractors, landscape companies, and homeowners. Although the company buys logs from tree service firms, they do not buy residential trees and do not pick up logs from homes and businesses.

American Woodyards has a firewood processor and sells the wood, by the pound, to the general public. They also sell mantel pieces, brackets and corbels for interior and exterior uses, pergola materials, bar tops, slabs, and beams of various sizes and species. A small lumber dryer enables the firm to sell kiln dry lumber, in addition to custom-cut lumber.

One of the goals of American Woodyards, per their website, is to “prevent wood from either being dumped into landfills or burned [in the field] to make way for development.”

Triangle Forest Products Inc. has a woodyard in Cary, NC. (off highway 55 between Raleigh and Durham). According to their timber buyer, “We get lots of wood from tree service guys.”

Triangle Forest Products buys all of their saw logs and pulpwood on a weight basis. Triangle does not do tree take-downs.

Triangle’s specification sheet lists various species they purchase including “grade” pine/poplar/red oak/white oak/walnut/hickory/pecan, saw log yellow pine/oak/ash/maple/walnut/, sweet and black gum, red cedar, and hardwood and pine pulpwood. Anyone cutting trees for delivery to Triangle’s woodyard should adhere to their current minimum diameters and lengths (potential timber sellers need to call and ask for a specification sheet).

Wood Residue Recyclers (Mulch and Compost)

Mulch and compost are big business in Raleigh and the surrounding area. For example, Raleigh is home to the North Carolina Nursery and Landscape Association (<https://ncnla.memberclicks.net/>), 919-816-9119. Many members of NCNLA sell mulch and other products into the Raleigh market. Also, the North Carolina Composting Council president is on the faculty at NCSU (Rhonda Sherman at sherman@ncsu.edu) plus the technical advisor to the National Mulch and Soil Council is with NCSU (Bill Fontero at 919-515-5368). Consequently, there is a vast knowledge base relating to mulch and composting in Raleigh.

A web-based search identified numerous companies in the Raleigh area that sell mulch, compost, and related landscape supplies. Some of these firms sell both bagged and bulk products while others sell only in bulk.

The Mulch Masters (Raleigh and Apex locations) is an example of a large firm that has served the Research Triangle area since 1994 (<http://themulchmasters.com/index.html>). The company specializes in decorative mulches, hardwood mulches (triple and double shredded bark), long-needle pine straw, compost and soil. The Mulch Masters is a member of the NCNLA and the National Mulch and Soil Council (NMSC). According to Bob LaGasse, Executive Director of the NMSC, firms like The Mulch Masters deal in truckload quantities of mulch (plus they seek a continuous flow of raw material), not individual trees that are often removed in a homeowner situation. Also, LaGasse noted, “Tree service firms usually cut trees into parts but tree parts are not desired by members of my association.”

Lineberger Tree Service is an example of a small firm that deals in mulch (<http://www.linebergertree.com/home.php>). In addition to the standard specializations of a tree service firm (tree pruning and removal, stump grinding, etc.), Lineberger’s also sells mulch and landscape supplies.

Nature’s Green Releaf of Franklinton, NC, is operated by Frank Franciosi. The firm is owned by Novozymes North America Inc., and specializes in a compost product(s) based on enzymes and microorganisms (<http://www.naturesgreenreleaf.com/>). Yard trimmings and clean wood by-products are used as raw materials and processed into soil conditioners and mulch for the commercial horticulture marketplace. Currently, Nature’s Green Releaf buys yard waste from five municipalities in the Triangle area, and sells its products to 10 local firms, most of them being mulch distributors.

Communities/Universities

City of Raleigh: Solid Waste Center – The city of Raleigh (2013) has operated a yard waste recycling center since 1992. The center recycles yard waste that is collected by city crews as part of the City’s curbside yard waste collection program. Also, the center collects “tree waste” that is generated by city crews via tree removals, tree trimming, etc. At the center, items such as grass clippings, shrubbery trimmings, leaves, limbs, logs, brush, pine straw, and hay are recycled into wood chips, mulch and compost which are available for purchase. In addition to yard waste collected by city crews, the center also accepts yard waste from the public for a fee as long as the yard waste was generated inside of the Raleigh city limits.

The solid waste center is operated as a “partial enterprise” (30 acres at the main site with another 10-acre site attached). Residential and commercial materials are kept separate at the site with a daily intake of about 100 tons. Only leaves are converted to mulch whereas wood goes to both mulch and compost. Three to four permanent employees staff the site.

The solid waste site charges a tipping fee of \$25/ton (commercial and non-commercial vehicles); and wooden pallets are accepted. Small logs are chipped (on-site) and converted to mulch. Mulch (and/or chips) is sold to the public at \$25 for 2 ½ cubic yards (\$2 per bag/can or \$25 per pick-up load). For comparison purposes, private firms often sell mulch for \$30 per yard.

Mulch that is windrowed and screened (6-8 month cycle) is sold for compost at \$30 per yard (\$3 per bag/can or \$30 per pick-up load). Colored wood chips are sold at \$5 per bag/can or \$50 per pick-up load.

A majority of the logs received at the solid waste site are sold to firewood businesses; the profit from firewood sales is used to buy trees for the NeighborWoods program (\$30,000-40,000 per year goes to this program). Large logs (saw logs) are sold to firms like American Woodyards (see earlier description); recently, the sale of saw logs totaled approximately \$10,000 per year. The city is interested in selling more “large trees” in the future; this would directly result in more money available for tree planting through the NeighborWoods program.

City of Raleigh: Urban Forestry Program – Zach Manor is the Urban Forester for Raleigh’s Parks and Recreation Department. Zach oversees 15 full-time staff in the Urban Forestry program.

Urban wood from city of Raleigh tree removals is converted to (1) mulch and chips which typically are used in parks, (2) firewood (see above), and (3) lumber (see above). Some material is also used in erosion control and education. Sometimes the best logs result from a storm event. Utilization has been a priority in Raleigh since 2001. Profit from the sale of any wood goes to the NeighborWoods program for tree planting with a goal of 1,500 trees per year (see above).

Two big challenges for Raleigh’s urban forestry program center on development, and FEMA reimbursement. Raleigh is experiencing rapid development (includes redevelopment) which means new street trees (boulevard trees) are constantly being planted. On development sites over two acres in size, the newly planted trees are overseen by the Planning Department, not the Urban Forestry Department. Although the Planning Department employs foresters, the situation is not ideal for a comprehensive urban forestry program when foresters are divided between two departments. A second challenge, following a disaster such as a hurricane, is that FEMA reimbursement precludes utilization. FEMA is focused on “reduction” which dampens utilization strategies.

City of Durham – Alex Johnson has been the urban forestry manager for Durham since 2007. His duties include managing tree maintenance, preservation, and replacement in city parks, facilities, and rights-of-way. Eight full-time employees are on his staff; in addition, he has forged multiple partnerships with neighborhoods, corporations and non-profits. Prior to the Durham position, he was an urban forester for the city of Raleigh. Alex currently serves as the past chair of the not-for-profit North Carolina Urban Forest Council.

In 2012, Durham hosted a North Carolina Urban Wood Conference on the campus of Duke University. Alex provided the welcome and introductory remarks for this statewide meeting. Over the years Alex has promoted better utilization of urban trees but realizes it is a hard sell if a profit motive is missing. He said, “If folks could make a buck then maybe we would see more interest.”

Duke University, Durham, NC – Katie Rose Levin is the Natural Resources Manager for Duke University. She reported that Duke has an urban tree policy, developed in 2013, and is based on an inventory of over 14,000 trees. One initiative in the policy is to keep most wood (removed trees) out of the landfill. For example, in the past, pine trees have been donated to the Duke Forest, where they

are milled and the lumber is sold. Another initiative is to use Duke-generated wood for various campus projects including the renovation of Cameron Stadium.



Figure 2. Duke University logs awaiting sawing at the Quartersawn Oak company
(Photo courtesy of Harry Watt, NCSU)

Levin noted that large oaks are difficult to “tree cycle” although the tree cycling program on campus is expanding. Sometimes trees are given to companies like Quartersawn Oak (see below), or donated to church communities for playgrounds (oak cookies or rounds), or donated to campus community members for firewood. Chips of all species are used on trails in the Duke Forest or on the Duke Farm as well as for mulch on campus.

Levin said that she works with many small arborists to seek methods of better utilizing downed Duke trees. She said one of her challenges is “room to store wood”; if another community had tree storage space then she speculated that Duke could work cooperatively with

them. She noted that her biggest challenges are probably “time” and “contacts.” “Time” since tree removals are likely only 10% of her job on a daily basis – small part of her program. “Contacts” in that connecting users with Duke University is a never-ending challenge (she noted that wood carvers, say, might use small pieces of wood, but she would rather donate to a “group” rather than individuals). She sees an opportunity to create a hub (community-based clearinghouse is one example) around urban trees so that urban wood enters a “system” once the tree is taken down. She is also trying to engage students in the idea that urban wood could be good for fund raising.

Two things are certain with Levin: anything done in the Raleigh (Triangle) area should benefit Durham; and she would love to have a blue print on building an urban wood supply chain. Levin said, “A first step in this direction is building a database of people who will take wood donations of various kinds.”

Niche Urban Tree-Based Businesses

LynchCo, LLC, owned and operated by Roy Lynch of Raleigh, has been in business for over 16 years. The firm serves central North Carolina and offers custom milling of logs at the customer’s site to the customer’s specifications. For the past 10 years, Lynch has used a Wood-Mizer LT70 hydraulic portable sawmill. The mill can handle logs 20 feet in length and diameters up to 36 inches.

Lynch said, “My business model is to take the mill to the site. I do this 98 percent of the time. My ideal situation is to park the mill at someone’s yard or driveway inside the beltway. The customer plus one helper is what I like to see. They help me with the sawing.” Lynch does not cut or “drop” trees. He said, “The arborist – tree guy – does this.”

Lynch has seen an uptick in business, a direct result, he believes, in his website (<http://www.lynchconc.com/home.html>). “Now I’m doing a lot of sawing in Wake and surrounding counties,” he said. “A lot of city folks are calling me when they take down a big walnut or oak or pine.”

Recently, Lynch partnered with a friend to start another company called M&L Lumber Co. The mill used by the start-up is a stationary machine and cuts mostly railroad ties.

The Quartersawn Oak Company – Owned and operated by Scott Smith, The Quartersawn Oak Company is part of Whispering Pines Farm, a small farm-based business near New Hill, NC. They specialize in quartersawn milling and drying lumber, primarily oak and sycamore, along with milling and drying tree width slabs up to six feet wide of oak and black walnut. They also mill custom timbers for timberframe structures (up to 58 feet long).

Their milling equipment includes a Baker 3638D narrow kerf bandmill, a Peterson swing-blade circular mill, and a dedicated slabber that was designed and built by Scott and a friend.

A business niche is that they “tree cycle” whenever possible – working with local tree service companies to recycle logs into lumber rather than the having the wood discarded in a landfill.



Figure 3. Quartersawn Oak Company project with Meredith College (Photo courtesy of Scott Smith)

One of The Quartersawn Oak Company’s more notable customers is the North Carolina Museum of Natural Sciences in Raleigh. Smith said, “We did the tree cycling for The Nature Research Center museum expansion as well as the new NC DENR headquarters building. We used oak, pecan and hickory trees that had to be removed for the project, along with what was reputed to be the oldest magnolia tree in Raleigh (which was dying and had to be removed regardless of the construction). Working with the architects, owner representatives and contractors, together we were able to give the trees new life by incorporating their wood into the facilities built at that

location.” Smith also works closely with Duke University in Durham to tree cycle dying trees as well as those that have to be removed for construction. He also worked closely with Meredith College in Raleigh on a 75 inch diameter black oak that was dying and had to be removed for the safety of the students.

Smith noted that tree service firms call him when they have an extraordinary (30-72 inch diameter) large tree (it saves the tree service folks from hauling and paying to dispose of the tree at the dump, so the log is given to Smith). High quality “grade” logs are sometimes delivered to Smith (and Smith usually pays for these logs).

Smith said his biggest challenge with tree service companies is “lead time and log quality.” “I usually don’t have much notice when a tree comes down. When the tree service company has the ability to deliver the log(s) it helps a lot, but the trade off is that we don’t have the opportunity in advance to determine the quality of the log and if it will produce good lumber.” Another challenge for Smith is metal frequently found in “yard trees.” He said, “My out-of-pocket expenses are high when we hit nails, I-bolts, spikes or other objects embedded in trees. Stain in the wood caused by the metal can also be a challenge.”

Smith said there is an opportunity for more customer awareness about “tree cycling” (and recycling in general). Folks who are “connected” to the environment should want to see tree cycling expand, according to Smith. Also, tree service folks find it advantageous when they can avoid dump fees per Smith. He said, “Tree service firms need the equipment (knuckleboom loaders and brush trucks for example) to haul the logs. Otherwise, the idea can be a big hassle to them.”

Green Hybrid Homes – Tom O’Dwyer is the owner/operator of Green Hybrid Homes. O’Dwyer harvests trees on-site, mills logs with a portable Wood-Mizer (another individual owns the mill), and then stickers the wood for air-drying. O’Dwyer estimates he works with yellow pine 98% of the time. His business model, as far as tree cycling, is to use tree take downs in the “next house” so he can work with dry wood. Sometimes he can use rough-sawn green (wet) wood for a mantel piece (say) in an existing home.

O’Dwyer said that if a consumer wants to be cost-effective, they can go to a lumberyard and buy good material. However, he believes that using local trees combined with local labor is a win-win situation regarding the environment and the economic impact at the local level. He contends this practice is good for local farmers and small mill owners.

In addition to taking trees down, sawing, and drying lumber (he doesn’t “buy” trees but rather charges the customer for “labor”), O’Dwyer can provide wide boards, greater than 11 ½ inches (widths that can’t be found at the local big box store which tend to sell narrow boards). O’Dwyer contends that producing wide boards can be a cost-effective strategy.

One problem O’Dwyer has encountered is using local lumber for structural purposes (building code issues). Another barrier, per O’Dwyer, is demand for tree cycled products. According to O’Dwyer, there is an existing supply of urban trees that can be converted to products. However, a barrier is simply getting urban trees on the ground and then milling them into lumber. He noted that sometimes one tree/log makes it uneconomical whereas many logs can be economical (although he is amazed at the size (massiveness) of urban trees in the Chapel Hill area where he recommends selective harvesting). O’Dwyer said that for his purposes (construction, remodeling, etc.) 13-15 feet is the ideal length of lumber so a “long truck” is needed. He emphasized that transport, milling and storage are key.

State Agencies/State Universities

North Carolina Department of Environment and Natural Resources (NCDENR) – Scott Mouw oversees the Division of Environmental Assistance and Customer Service (DEACS) within the NCDENR. “Our division,” says Scott, “functions as the state recycling department.” The DEACS works with municipalities (like Raleigh) as well as private firms on a range of topics including recycling and solid waste, permitting, energy and water efficiency, recycling education campaigns, and small business environmental assistance. According to Scott, most urban trees do NOT go to landfills except for LCID’s which are designed to be disposal sites. Many LCID’s grind organic matter into mulch or compost. For more information, see <http://portal.ncdenr.org/web/deao/>.

North Carolina Forest Service (NCFS) – Nancy Stairs leads the urban and community forestry program for the NCFS. Headquartered in Raleigh, the program supports urban forestry in North Carolina by (1) administering a cost-share federal grant program for municipalities, local governments, non-profits, educational groups, and schools; (2) providing technical and/or educational assistance for a host of programs including Tree City USA, Arbor Day promotion, and educational information and training workshops; and (3) technical assistance with and through the county forest rangers in all NC counties. In 2014, more than \$46,000 was awarded to five communities/organizations in NC to support urban and community forestry projects.

In 2014, the NCFS, in cooperation with NCSU, hosted a series of webinars on various urban forestry topics. The first webinar in the series focused on “Urban Wood Resources” (<http://www.forestrywebinars.net/webinars/urban-wood-resources>).

For more information on the urban forestry program of the NCFS, see http://ncforestservice.gov/Urban/Urban_Forestry.htm.

North Carolina State University (NCSU) – With over 34,000 students, 8,000 faculty and staff, and 65 departments, NCSU is one of two land-grant institutions in the state that bring “higher education—including economic, societal and intellectual prosperity—to the masses.”¹³ Phil Mitchell (Department of Forest Biomaterials), Barbara Fair¹⁴ (Department of Horticultural Science), and Melissa McHale (Department of Forestry and Environmental Resources) are three faculty members keenly interested in better utilization options for urban trees. Another individual, who is no longer on the faculty, conducted numerous studies of urban wood waste during his tenure at NCSU.¹⁵ Also, Mark Davin, NCSU arborist, acknowledged that a large quantity of the tree removals (and pruning) on campus are chipped and used (recycled) throughout the University for trails, landscape plantings, etc.

Non-Profits

North Carolina Urban Forestry Council (NCUFC) – The mission of NCUFC is to advocate the sustainability of North Carolina’s urban forests through the use of economic, human, and environmental resources. One of the projects and initiatives of NCUFC is hosting a NC Urban Wood Group. Although the Group is still in its infancy, credit should be given to NCUFC for its foresight in sponsoring the organization. The NCUFC executive director is Leslie Moorman of Raleigh. For more information on NCUFC, see <http://www.ncufc.org/>.

State-based Initiatives and Programs

Senate Bill 111 in 1989 passed with support from both Democrats and Republicans. The long-term goal of SB111 was for at least 25 percent of the total waste stream to be recycled by January 1, 1993.¹⁶ One of the items banned from the waste stream in this sweeping legislation was yard waste¹⁷ – including urban trees. Tree take-downs that do end in landfills go to LCID landfills (Mouw, S. 2014).

¹³ See <http://www.ncsu.edu/about/>.

¹⁴ Barbara Fair is the current chair of the North Carolina Urban Forestry Council.

¹⁵ See references at the end of this report for Urs Buehlmann.

¹⁶ McLaughlin, M. and Carr, A. 1989. Recycling North Carolina’s Resources: The Long Campaign to Cut Tar Heel Waste. *North Carolina Insight*, Dec. 38 pp.

Raleigh has four LCID's (land clearing and inert debris landfills)¹⁸ serving the metro area plus one state-permitted city-operated yard waste composting facility. While mulch is produced in response to market demands, the practice, per Lawler 2011, is unresponsive to recent concerns over fossil fuels, CO2 emissions, and general sustainability. The entire Research Triangle area (including the counties of Wake, Durham, Orange, and Chatham) has a total of nine open LCID's (11 LCID's if Franklin and Johnston counties are included). Also, Wake County has five C&D (construction and demolition) and four MSW (municipal solid waste) landfills or transfer stations. See <http://portal.ncdenr.org/web/wm/sw/facilitylist>.

Summary of Urban Tree Utilization in the Raleigh Area

The above overview of Raleigh and sampling of its current tree utilization activities lead to the following observations:

- *Innovative and entrepreneurial tree service firms (private arborists) are exploring tree utilization options* – Since trees must be removed (transported off-site) and trucked for disposal and/or utilization, some firms are looking to “save money” by investigating options to reduce costs. Tree utilization can be a “cost-avoidance” strategy.
- *Niche and Related (wood utilization) businesses are present in the Triangle area* – Lumber, specialty cut boards, remodeling timbers, etc., are popular as more end-users seek alternatives to traditional products. Raleigh, and the surrounding Triangle area, have numerous niche and related wood utilization businesses that traditionally “fly under the radar” of the larger corporations and the public-at-large.
- *A critical mass of urban wood enthusiasts exists* – This includes producers as well as users and the host of intermediaries involved in the process. Private and public entities as well as not-for-profit groups play a key role.
- *Markets are diverse; tree resources are available* – Raleigh's population is growing (customers!) and the city is geographically situated in an area that procures (and produces) a host of traditional forest products. In addition, urban tree niche-markets exist. The urban tree canopy is expanding, especially as more homes are built in/around existing trees/forests.
- *Woodyards exist in/near Raleigh and the greater metropolitan area* – Outlets for urban saw logs and pulpwood are located in the Triangle region. Raleigh can boast that it has woodyards (log buyers) in/near the metropolitan area.
- *The city of Raleigh is pursuing wood utilization activities* – Raleigh has an urban forestry program, and a solid waste site, both of which are attuned to wood utilization efforts. One of these efforts is directly tied to tree planting in the city – a win-win situation for all parties.

¹⁷ *Yard Waste* is defined as *Yard Trash* (landscaping and yard maintenance: brush, grass, tree limbs, and similar vegetative material) AND *Land-Clearing Debris* including stumps, limbs, leaves, grass and untreated wood. For additional definitions, see <http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environment%20and%20natural%20resources/chapter%2013%20-%20solid%20waste%20management/subchapter%20b/subchapter%20b%20rules.html>.

¹⁸ “Land clearing and inert debris landfill” means a facility for the land disposal of land clearing waste, concrete, brick, concrete block, uncontaminated soil, gravel and rock, untreated and unpainted wood, and yard trash. (From NC Administrative Code; Subchapter 13B, Solid Waste Management; Section .0100, General Provisions; Definitions).

- *Urban tree utilization is a topic of interest to many in the public/private sector* – In addition to the city of Raleigh, other examples are faculty at North Carolina State University, the North Carolina Forest Service, the North Carolina Department of Environment and Natural Resources, the city of Durham, Duke University, and many others. Individuals within all of these organizations are seeking expanded urban tree utilization practices.
- *Yard waste (including urban trees) are banned from Municipal Solid Waste and Construction & Demolition Landfills* – The “loophole” in the law (Senate Bill 111 passed in 1989) is that yard waste can legally be delivered to LCID (land clearing and inert debris) landfills.

Part II.

What is an Industry or Business Cluster?

This section of the report introduces the concept of industry clusters, outlines the research-based cluster ingredients for success, and describes the clustering components of urban tree utilization in the Raleigh metropolitan area. Recommendations for starting or expanding urban tree utilization activities on a community-wide basis are offered.

By definition, industry clusters are groups of firms and/or organizations located within a defined geographic region who have developed cooperative links with one another through value and supply chains, labor, and use of similar inputs, technology, and complementary products. Another way of thinking about this concept, is that a cluster is any instance of closely located (i.e., geographic proximity) and closely aligned operations (i.e., high frequency or number of transactions, or closely related product lines). For a cluster to flourish, it is necessary that the parties involved receive a mutual benefit.

Clusters can be formally organized through trade associations, buyers groups, or cooperatives, or developed through an informal manner (e.g. via friends, families, or neighbors). Some clusters are developed intentionally through government intervention or actions by a development agency, while others evolve as a result of local entrepreneurs that discover, and seize, new market opportunities.

A benefit of clusters is that they often provide benefits of efficiency, enhanced productivity, and greater resilience to members due to the synergies and relationships they support. On the downside, clusters have been known to create conditions of co-dependence, which can limit any individual participant’s ability to innovate. Interdependence can also contribute to the quick demise of enterprises due to significant changes in economic, social, or environmental conditions.

Types of Clusters

There are four descriptive categories of clusters.

- *Marshallian clusters* are typically local small and medium-sized companies that trade their products and services with other cluster members.
- *Hub and spoke clusters* include one or several large companies serving as anchor companies interacting with numerous small suppliers.
- *Satellite platform clusters* consist of large companies with multiple branch locations that act independently.
- *State anchored clusters* are based on an anchoring institution such as a university, government agency or military installation.

Examples of well-known clusters throughout the U.S. include the high technology-oriented (computer) industry in Silicon Valley, California; the automotive industry in and around southern Michigan;¹⁹ the movie production industry in and around Hollywood; and the Research Triangle Park cluster in North Carolina (and Raleigh is a part of this research cluster!). On a smaller scale, wood-based clusters include the Amish furniture industry in Holmes County, Ohio; the Forest Industry Park in Ladysmith, Wisconsin; and the wooden boat cluster in Port Townsend, Washington.

Ingredients for a Successful Cluster:

In 2008, the U.S. Endowment for Forestry and Communities commissioned a study to examine the status of, and opportunities for, business clustering within the U.S. forest products sector and other closely aligned sectors.²⁰ One of the outcomes of this study was a summary and description of *ingredients* for a successful industry cluster. The ingredients for success include:²¹

- ✓ Feasibility analysis
- ✓ Education, technical and research support
- ✓ Supportive government actions including financial grants
- ✓ Supporting and complementary industries
- ✓ Entrepreneurship and innovation
- ✓ Access to raw materials, markets and transportation networks
- ✓ Leadership, commitment and collaboration
- ✓ Business climate

In any given cluster, certain ingredients will be more important or critical for success than others. For example, *entrepreneurship and innovation* might be the critical ingredient for a business person developing a new product in an untapped market which can lead to a wave of similar industries in a geographic region. Likewise, *leadership, commitment and collaboration* spearheaded by a champion (individual or group) are often vital to jump-start a cluster such as in the case of an industrial park development. Regardless of the critical key to success, most successful industry clusters will exhibit most, if not all, of the above *ingredients* during their development and initial expansion.

¹⁹ The auto industry has been one of the most recognized industry clusters in the U.S. For decades, hundreds of firms clustered around this core industry to provide supporting services and product. Today, some of the shortcomings of clusters can be illustrated within this industry sector.

²⁰ The complete report is available at the U.S. Endowment website: <http://www.usendowment.org/>. An additional summary report is available from Dovetail Partners at: http://www.dovetailinc.org/reports/Forest-Based+Economic+Clusters_n300?prefix=%2Freports.

²¹ Because clusters can initially form and grow in different ways (via entrepreneurship, government intervention, cooperatives, etc.) the elements or *ingredients for success* can vary from the above list and include other ingredients such as private financing (private investment), labor resources, and overall infrastructure including availability of utilities, buildings, building sites, work force, etc.

The Cluster Model Applied to the Raleigh Metropolitan Area Urban Tree Utilization

The following section highlights the above *ingredients for success* with a brief explanation of the ingredient (element) adapted from the U.S. Endowment report (*in italics*). This explanation is followed by a description of activities related to the city of Raleigh (and greater metropolitan area) urban tree utilization.

Feasibility Analysis

A feasibility analysis serves as a starting point for activities leading to the development of new, or expansion of existing, business clusters. To capture market potential, the analysis should include assessment of a region's economic conditions, raw material supply, labor resources, existing infrastructure, potential markets and development opportunities—including types of new industries that would complement existing firms.

A host of studies, including feasibility-type analyses, have been conducted since 2000, many with a statewide emphasis, and some looking at a region or city (like Raleigh). The list of studies include scrap wood (Buehlmann and Kincaid 2001), wood residuals (Buehlmann and Murphy 2002), wood waste (Mouw and Buehlmann 2003), pallets (Buehlmann and Fluharty 2004), and municipal biomass (Lawler 2011). Numerous presentations resulting from the findings of these studies have been made to professional audiences as well as the general public. However, only the last of the above-cited studies specifically investigated urban or community trees and then, only as a yard waste source, and only for one specific end use (electricity generation).

For example, the most recent feasibility analysis was published in 2011 titled “Assessing Potential of Municipal Biomass for Renewable Energy” (Lawler 2011). The study was conducted by Megan Lawler at North Carolina State University as partial fulfillment of the requirements for the degree of Master of Science. The study concluded that it would *not* be feasible to use municipal biomass residues in Wake County exclusively for electricity production.

Education, Technical and Research Support

Education, technical and research support is important for the growth of a business cluster. The role of public and private universities, community and technical colleges, public agency outreach programs, and training activities sponsored by trade organizations are vital.

The Research Triangle area is home to three large universities – North Carolina State University (NCSU), Duke University (Duke), and the University of North Carolina (UNC). NCSU confers undergraduate and graduate degrees in both forestry and forest biomaterials (wood products); the university also has urban forestry professionals on their faculty. Duke has a graduate program in

forestry within the Nicholas School of the Environment. UNC has three departments under the general heading of The Environment.

These universities, plus the headquarters of the North Carolina Forest Service, provide a good foundation for technical, educational and research support. Also, a branch of the U.S. Forest Service, Southern Research Station, is located in Raleigh (Research Triangle area).

For many years, the Research Triangle area, has hosted both traditional forestry and urban and community forestry workshops and seminars. These events demonstrate that the Raleigh area has the educational opportunities, technical expertise, and research capacity that is necessary to support a growing urban tree utilization cluster.

Supportive Government Actions including Grants

North Carolina,²² in general, and the city of Raleigh in particular, have provided government actions that spurred better utilization options for “wood waste” including urban trees.

Statewide, Senate Bill (SB) 111 in 1989 (and amended in 1993 by SB 59) banned disposal in landfills of *yard waste*, lead acid batteries, used oil, aluminum cans and antifreeze (effective January 1, 1993). In 2005, certain bars and restaurants were required to recycle beverage containers with a disposal ban on those containers effective 2008. Wooden pallets, oil filters, oyster shells, and plastic bottles were banned from disposal effective 2009. The latter bans were supported by commodity demand and job creation arguments whereas earlier bans focused on issues like landfill capacity and disposal safety. Since inception, the “original” bans have diverted over 12 million tons of material from disposal.

One of the spin-offs of statewide bans is that local governments tend to receive more volume of banned materials including pallets, plastic bottles, and oil filters. Another spin-off is that there is an increased development of collection programs [at the local level] and development of recycling businesses and jobs, leading to an uptick in market development. For example, the yard waste ban resulted in local governments (statewide) creating collection programs that diverted, in recent years, from 500,000 to 700,000 tons yearly (from near zero collection/diversion a few decades ago). A key lesson is that bans (like SB 111) are effective in declaring “commodity” status to certain materials (and a transition from waste management to materials management). Also, enforcement of bans can be an issue (not a magic bullet) and successful bans require both presence and development of infrastructure. Finally, grants play a big part in the success of any ban.²³

The city of Raleigh has numerous standards and activities that impact city trees (adopted by City Council in 1991 and updated in 2012). These documents contain a wealth of information on tree planting, tree selection, master plans, etc. Chapter 6 of the 2012 document covers tree removal policies.

Another positive action is that the city of Raleigh has operated a yard waste recycling center since 1992 (see above). Also, nearby counties have supported the reuse and recycling of woody debris.

²² North Carolina was the first Southern state to adopt Renewable Portfolio Standards that require the generation of electricity from renewable resources including biofuel (Lawler 2011).

²³ The discussion in this section (on statewide bans) is taken from Mouw (undated-b) and Mouw (2015).

Orange County, for example, has an ordinance for recycling wood from construction and demolition sites (Heinen et al. 2012).

Supporting and Complementary Industries

Business clusters often provide benefits of efficiency, enhanced productivity, and greater resiliency to members due to the synergies and relationships they support.

There are numerous industries that either directly or indirectly support one another regarding urban tree use in the Raleigh area. One example is the wood yards that accept trees from private arborists. This is a win-win situation for both parties. The wood yards benefit as they receive a raw material that can be sawn and/or dried (for lumber), split (for firewood), or re-sold (for saw logs or pulpwood). The arborists benefit by having a location to dump tree removals and/or sell logs (the latter being more desirable from an arborist's point of view).

Another example, and again a win-win situation for all parties, are private tree firms (arborists) delivering logs to a small manufacturer (mill owner) who, in turn, sell lumber to a private citizen. This "chain of activity" from arborist to mill owner to customer is an excellent example of supporting and complementing industries. This "connection" is key to cluster development and success.

Entrepreneurship and Innovation

Entrepreneurial thinking by the leadership of cluster businesses, governments and supporting organizations is crucial to success. Entrepreneurship is instrumental in helping identify niche markets, stimulating innovativeness, and in developing competitive advantage.

Entrepreneurship and innovation can develop in many sizes and forms. In fact, the different methods and approaches employed by entrepreneurs and innovators is a strength of this business cluster key ingredient. The following examples (all noted earlier in this report) from the Raleigh area highlight how one item – urban saw logs – is dealt with from different perspectives.

Everett Tree Service sells their better quality logs to a local wood yard. As is true of all tree service companies (private arborists), the firm gets paid for tree removal, tree trimming, etc., rather than wood marketing (sales). Consequently, it is in the firm's best interest to reduce costs or turn-a-profit wherever possible. Jimmy Everett's model is to sell logs since the trees need to be removed from the site.

Another model is the one employed by Dunn Tree Service. Albeit a part-time business, Bradley Dunn owns a portable mill that he uses to saw lumber from his tree removals. Sales of the lumber primarily go to the general public (private citizens). Dunn's business model is different from the Everett model, although both have a similar objective of reducing costs and/or generating revenue.

A third model is the one employed by Roy Lynch. Lynch does not remove (harvest) trees but rather brings his portable mill directly to the homeowner. Lynch then saws lumber, on an hourly rate, from trees that have been taken down by a tree service (arborist). Lumber sawn by Lynch is "owned" by the homeowner.

All of the above models, although different in implementation, highlight the diversity of entrepreneurship and innovation in a single product (urban saw logs) in a specific geographic region (Raleigh area).

Access to Raw Materials, Markets and Transportation Needs

Access to raw materials (inputs) and markets is crucial to cluster development and long-term viability. A dependable flow of raw materials and stable markets for products and services are key to sustainable clusters. An adequate transportation infrastructure is needed to ensure access to raw materials and markets.

Raleigh is surrounded by rural forests and traditional forest product markets. The Raleigh metropolitan area is growing, engulfing much rural forestland as the demand for new homes and businesses expand. Raleigh's most recent tree inventory tallied nearly 175,000 street trees in the urban environment. Coupled with the urban tree inventory in the Triangle Area, and the close proximity of rural forests, Raleigh has an ample supply of raw material (trees) to support a business cluster.

The Research Triangle area in 2013 had a population over 2 million.²⁴ Consequently, markets for landscape materials (compost and mulch), lumber, specialty wood products, etc., are strong. Producers of urban wood products can advertise, sell, and distribute their items to a large and growing population.

Raleigh is at the crossroads of two interstate highways (I-40 and I-64/264) which assist in moving raw materials and products to market in a relatively efficient manner.²⁵ Also, an international airport is conveniently located outside of Raleigh.

Leadership, Commitment and Collaboration

Leadership by a third party (industry, non-profit organization, public entity, etc.) is often needed to coordinate activities of stakeholders involved in developing a business cluster. An umbrella organization can help cluster businesses and organizations identify niche markets, assist with workforce training and development, seek financial resources, improve networking among cluster members, educate businesses about the benefits of clustering, and gain political support for the cluster. It is important that cluster stakeholders, representing industry, government, and supporting organizations work together to create a long-term vision for the cluster and use strategies and policies that support cluster development.

The leadership for better utilization options for urban trees has been spearheaded by the Urban and Community Forestry program of the North Carolina Forest Service (NCFS). Beginning with an urban tree utilization workshop in Asheville, followed by similar workshops (and exhibits) in Durham and Charlotte, and leading to an in-depth analysis of the urban forestry and wood utilization situation in

²⁴ Source: http://en.wikipedia.org/wiki/Research_Triangle. "The Triangle" (eight-county region) includes the cities of Raleigh and Durham and the towns of Cary and Chapel Hill.

²⁵ Interstates 85 and 95 (north-south routes) are also in the vicinity of Raleigh.

Raleigh, the NCFS has provided the spark on a statewide basis. Recently, the NCFS collaborated with various entities to host a series of webinars on urban forestry, including one webinar devoted to the urban wood resource.

The NCFS has engaged other groups, such as the NC Urban Forestry Council, in promotion and facilitation of urban tree use. Also, the NCFS is a known entity within the state; consequently, it didn't have to educate major players (like arborists and tree care firms) as to its role in stimulating better management (including utilization) of the urban and community forest.

The urban and community forestry program of NCFS, in addition to sponsoring urban tree utilization workshops (as noted above) has been active in a federal grants program, planning and policies for municipalities (including techniques of tree inventories and street master plans), basic tree care, urban storm cleanup, Tree City USA, and more.

At a local level, Warmth for Wake is a seasonal energy assistance outreach program that is co-sponsored by Wake County Human Services and the North Carolina Bankers Association. The *collaborative* effort is also supported by Everett Farms (Everett Tree Service) and the Solid Waste program of the City of Raleigh.²⁶ One aspect of the program is a free firewood delivery program to homes that can then offset their gas or electric heat consumption. Everett Farms (Tree Service) donates firewood, tools, manpower and a wood storage facility for the program. The City of Raleigh provides a project work site at its Yard Waste Facility.

Business Climate

A supportive business environment is crucial to the development and strength of business clusters.

Urban tree utilization is essentially a *recycling* activity since tree removals are diverted from the waste stream into useful products. Since recycling is typically considered a *green* activity, the utilization of discarded urban trees is recognized as a green behavior. The city of Raleigh has demonstrated over the years that it has adopted numerous green behaviors.

In 2007, Raleigh became the first LED City in the world. Two of the goals of the LED program are to reduce energy use and save money through lower maintenance costs.²⁷ The quote from the mayor of Raleigh in the accompanying sidebar sums up Raleigh's perspective—and green business environment—on this issue (see sidebar).

In addition, Raleigh earned the top spot in 2011 as the

Business Climate

"The economic benefits for municipalities to invest in LEDs are clear as they save energy, reduce environmental impact and improve the quality of light. As leaders in one of America's fastest growing cities, it's our civic responsibility to invest in the future and ensure the highest possible quality of life and safety for our citizens in generations to come. We believe that the cost savings and benefits of LED lighting are real and achievable today."

- Charles Meeker, Mayor, City of Raleigh

(Source: http://www.jmfproductions.com/creel/led/about_led_city.htm)

²⁶ See: <http://www.wakegov.com/humanservices/social/energy/Pages/warmthforwake.aspx>.

²⁷ In partnership with Duke Energy, Chapel Hill is currently a LED City.

nation's most sustainable mid-size community and placed fifth nationally in 2012 in offering eco-friendly services. Also, in 2012, Raleigh rated very high as one of the healthiest cities in the nation for women.²⁸

According to Mouw (2012), curbside recycling in North Carolina is at an all-time high (for fiscal years 2010 and 2011). Statewide, the range of materials collected is increasing, and solid waste disposal is down. Construction and demolition landfill recycled tonnage doubled between 2005 and 2011. In fiscal year 2011, 41 local governments, for example, reported collecting used cooking oil. For local governments across the State, electronics collection has nearly doubled from fiscal years 2008-2009 to fiscal years 2010-2011. There is an increase in the State in plastic bottle collection as well as pallet recovery. Also, North Carolina recycling employment trends are up.

Raleigh and Durham are both in the process of transitioning from bins to curbside carts. Chatam and Orange counties (the latter is Chapel Hill) are doing an excellent job with signage and education. Orange County now takes #2s and #5s (plastic containers) and Raleigh has a curbside mix. The Raleigh/Durham area has about one-half of R2 (electronics) certified recyclers in the State and one-half of e-Stewards certified recyclers in the State. Orange County is one of the top 10 recycling counties in fiscal year 2011 (Mouw 2012).

North Carolina, and in particular Raleigh, has a business climate that supports recycling of various products. Urban tree utilization has (and will continue to) benefit from this *green* business environment.

Recommendations for Advancing Urban Tree Utilization Clustering in the Raleigh Area

- *Conduct a feasibility study* – There have been numerous feasibility-type studies in North Carolina and the Raleigh area. However, these studies have either focused on wood waste such as pallets or scrap wood, or investigated urban tree use for only one market (e.g., bioenergy). What is needed is a comprehensive inventory of tree removals, including leaves, limbs and branches (tree pruning residue), and a categorization of these removals (saw logs, pulpwood, firewood, etc.) by the entity conducting the removal (city, tree service firms, utility companies, homeowners, etc.). The protocol conducted in southeast Michigan (MacFarlane 2007), is a model worth adopting and/or adjusting for the Raleigh metropolitan area.
- *Evaluate economic conditions, existing infrastructure, labor resources and other factors that impact the overall business climate* – This effort can be included in the feasibility study if time and resources permit; if not, a separate analysis should be conducted. For example, potential “loopholes” in the current system should be investigated including the role of LCID (land clearing and inert debris) landfills (are LCIDs helping the “problem” or hindering progress on better urban tree utilization?).

²⁸ See: <http://www.raleighnc.gov/government/content/PubAffairs/Articles/AccoladesRaleigh.html>.

Also, strategies that “make it pay” to better utilize urban trees should be carefully examined. Sometimes a “make it pay” or “make a buck” message is quickly dismissed when a producer (say, a tree service business) contemplates the additional expenses that his firm might incur to better utilize trees (bigger/longer trucks, portable mill, drying capabilities, etc.). Another method of describing this issue is to talk in terms of “cost-avoidance.” All firms, big or small, urban tree utilizers or non-utilizers, can relate to the message of cost-avoidance. Since tree service firms (one example) are not in the business of making wood products or salvaging tree parts, the concept of “cost-avoidance” might be an easier sell than scenarios describing a profit-center from tree utilization.

A public education campaign (tied into recycling awareness) and coupled with better markets for urban tree products is needed in the Raleigh area. For example, recycling messages (whether in suburban newspapers, bill boards, radio or television ads, etc.) should include urban trees in a list of recyclable items such as aluminum cans, beverage bottles, and newspapers. The same is true for the “buy local” movement – lumber and lumber products in addition to mulch, compost, and firewood – should be touted as a product that can be produced in the Raleigh area.

Since “lack of space” and “transportation costs” were common themes undermining innovative urban tree utilization, an idea would be to locate tree drop-off points (yards with free or reduced tipping fees) around Raleigh/Wake County. These public/private yards could become utilization centers (hubs) for log sorting and sales, log sawing, etc. (a person with experience in operating a log yard should be hired for this duty). Existing log yards should be contacted first to discuss the pros and cons of such a strategy.

- *Collaborate with stakeholders from industry, government, and supporting individuals and organizations* – The key is to get buy-in from various stakeholders and develop a vision for utilization of urban trees including next-steps and action items. There is a wealth of resources available in the Triangle region including technical, educational, and research information; these resources need to be capitalized on, and collaboration is an important first step.
- *Assist stakeholder groups in sharing key information* – At least 4 groups view urban tree utilization from a distinct perspective. State regulators, city managers (including municipal foresters), LCID owners/operators, and producers/users (tree care companies for ex.) all have different “missions” and all “control” key information such as costs, tax breaks, potential revenue, urban tree sources, how woody material is diverted from waste stream, etc. These groups often don’t share their unique perspective and information with other groups. Better communication is needed between the groups (for betterment of everyone).
- *Engage the leadership of a key organization to coordinate activities, facilitate development, and gain policy support* – The leader or champion does not necessarily have to possess a utilization background but should strongly support the utilization effort and should have the ability (and time!) to use his or her position to “rally the troops.” A local and respected urban forestry leader could fill this role. A staff/faculty member from one of the universities or colleges in the Triangle area is another possibility.

- *Secure funding* – Financial resources, both private and public, are important to support feasibility studies, technology development, workforce training, capital investment, applied research and other project components. Funding sources can include national, state, or local. Programs directed at wood utilization and urban forestry efforts are obvious avenues for obtaining funding but broad-based recycling grants, small business loans, and bio-based energy programs (as examples) can also provide direct financial support for urban tree utilization.
- *Focus on education and engagement of entrepreneurial thinking and innovation* – Support the creation of a position with the assigned duties of “urban wood utilization.” A person in this capacity can efficiently focus on education and training opportunities for arborists (log manufacturing, grading, transport, etc.), assist and encourage start-up urban wood businesses, conduct utilization-based feasibility studies (see above), and become a focal point for technical/hands-on utilization activities.
- *Nurture supporting and complementary industries* – An important task of either the utilization champion, urban wood specialist, or key stakeholder(s) is to facilitate partnerships and relationships (formal or informal) between the numerous industries (and organizations) that are in the cluster. This effort should show cluster members how their businesses are interconnected and dependent on one another from procurement of raw materials (such as a boulevard tree) to production, marketing and distribution of end-products (such as mulch, firewood, lumber or furniture).
- *Recognize the differences in types of clusters and act accordingly* – One strategy for cluster development is to select or nurture one of four models as a starting point, or build upon what already exists (see earlier sidebar). This can help focus efforts and provide a framework for collaborative work. (Raleigh appears to be in the early stages of a Marshallian cluster –one that is typically comprised of small and medium-sized companies that trade their products and services with other cluster members).
- *The City of Raleigh has the potential to lead the way on urban tree utilization* – Since the sale of wood products (mulch, compost, firewood, saw logs) finances (in part) the NeighborWoods tree planting program, it behooves the city to seek additional markets and/or higher prices for their wood-based sales. Perhaps the city can lease (to a private entity) a parcel of public property where tree service firms can dump logs; in return, the city receives a cash payment, and the lessee can utilize the wood for their purposes.

The City of Raleigh should investigate the possibility of cooperating with adjacent cities (Durham for ex.) on log storage sites, wood products, marketing initiatives, etc. An “answer” to a “problem” might be contained in an adjoining county or municipality.

- *Develop a city (county) list of small saw mills, loggers, timber buyers, and forest product manufacturers.* A directory is needed for “small” timber users in the area. The mills, loggers, and others on a “small producer” list are often not included in a statewide directory of primary and secondary producers. A directory is the first step in compiling a list of drying facilities in the region (which was identified as a “need” for the area). The list should be

specific to Raleigh and/or Wake County (or the Triangle area). Minnesota (Twin Cities), Michigan (Detroit) and Illinois (Chicago) have produced a list for specific metropolitan areas.

- *Building code issues should be addressed* – Using wood produced from local and/or city-based trees for structural purposes can be problematic. The state of Wisconsin has addressed this issue by “certifying” mills to produce structural lumber on a small or part-time basis. Mills eligible to manufacture non-graded stamped lumber must earn continuing education credits. Adopting the Wisconsin model is one solution to the building code issue (on small lumber batches) in North Carolina.

Bottom Line

The City of Raleigh is situated in the midst of a strong forestry and forest products industry. Raleigh’s population is expanding rapidly as well as the entire Research Triangle area. Raleigh, and the surrounding area, is home to many firms currently utilizing urban trees beyond the traditional products of firewood and mulch/compost. However, there is still a considerable amount of tree waste entering LCID landfills. Capturing these wastes “before the gate” for the highest value helps meet the growing needs for fiber and wood products for a growing population.

Raleigh has many of the key ingredients of an urban tree utilization cluster. A feasibility analysis (including a wood waste plan), and better collaboration with municipalities and key groups such as urban foresters, private arborists, sawmillers, lumber dryers, wood artisans, furniture builders and such, are two of the actions needed to move Raleigh to a higher level of urban tree utilization. The latter (better collaboration...) is an action step that Raleigh can engage in immediately without an outlay of money. This action step would showcase Raleigh as a “leader” in urban tree utilization, and enhance the communication between key stakeholders.

Part III.

Urban Forestry Program Assessment

Included within the scope of the project was an assessment of the overall urban forestry program capacity and operations to identify and evaluate core strengths and opportunities. This assessment process was informed by several existing approaches to system evaluations and forestry assessments.

Description of Assessment Design

Urban forest assessments typically address the inventory and evaluation of the urban forest, including street tree inspections and records. However, in this project with the city of Raleigh, the objective was to evaluate the urban forestry program itself. To do this, three activities were undertaken:

- 1) a review of program materials (e.g., policies, accomplishment reports, communications, and other documents);
- 2) a site visit to interview staff, tour the city, and observe program activities and outcomes on the ground; and
- 3) a survey of internal and external stakeholders to gather their input into the identification of program strengths and opportunities.

The assessment design was informed by the facilitation and planning process used by Dovetail Partners, including application of the Mobius Model described below. The assessment design was also informed by experience with third-party forest certification systems. To date, third-party forest certification systems (including the programs of the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and American Tree Farm System) have generally been applied to rural forestry systems, including commercial forest management. However, a review of some of the standards for these programs (Table 1) illustrates that they may have broad applicability to the practice of forestry more generally.

Table 1. Principles for the FSC and SFI certification programs

FSC Principles	SFI Principles
<ol style="list-style-type: none"> 1. Compliance with Laws and FSC Principles 2. Tenure and Use Rights and Responsibilities 3. Indigenous Peoples’ Rights 4. Community Relations and Workers’ Rights 5. Benefits from the Forest 6. Environmental Impact 7. Management Plan 8. Monitoring and Assessment 9. Maintenance of High Conservation Value Forests 10. Plantation Management 	<ol style="list-style-type: none"> 1. Sustainable Forestry 2. Forest Productivity and Health 3. Protection of Water Resources 4. Protection of Biological Diversity 5. Aesthetics and Recreation 6. Protection of Special Sites 7. Responsible Fiber Sourcing Practices in North America 8. Legal Compliance 9. Research 10. Training and Education 11. Community Involvement and Social Responsibility 12. Transparency 13. Continual Improvement 14. Avoidance of Controversial Sources including Illegal Logging and Offshore Fiber Sourcing

In addition to the various forest certification programs, there are other certification and recognition programs that are directly applicable to urban forests and urban forest products. These include:

- *Tree City USA, Arbor Day Foundation and the National Association of State Foresters*

Raleigh has been a recognized Tree City for over 26 years. The program requires that the city have a Tree Board or Department; A Tree Care Ordinance; A Community Forestry Program with an annual budget of at least \$2 per capita; and an Arbor Day observance and proclamation. More information is available at: <http://www.arborday.org/>

- *Urban Forest Sustainability & Management Assessment, USDA Forest Service Centers for Urban and Interface Forestry*

This is a new program that can help urban forest programs benchmark their resources and program capacity. The results can provide direction for urban forest management programs and plans. The program has been tested in Georgia and the program developers are interested in working with additional beta testing sites. The audit process can be completed internally or with external auditor assistance and oversight. The program is compatible and complementary to Tree City designations.²⁹

²⁹ More information is available at: <http://www.srs.fs.usda.gov/compass/2015/04/22/urban-forestry-south-tests-new-urban-forest-sustainability-and-management-audit-system/>

- SCS Salvaged Wood & Fiber Standard, SCS Global Services

This program is currently under development and is being designed to define the responsible recovery of wood (and other biomaterials), including salvaged and reused materials. The proposed standard specifically defines and includes Urban Wood as an eligible material. Urban Wood is defined to include trees along streets, parks and green spaces, and from other urban areas. The standard provides a tracking process (chain of custody) and audit oversight that assures customers the product can be traced back to a salvaged source. Verified products can carry the SCS ecolabel. More information, including the current status of the proposed standard, is available by contacting SCS Global Services at: <http://www.scsglobalservices.com/>

Dovetail Partners has been involved in forest certification standard setting, auditing, and evaluations for many years. This experience was applied in the development of the urban forestry program assessment for this project and may help demonstrate the broader applicability of third-party forest certification systems to urban forestry situations.

There are a variety of formal collaborative processes. Regardless of which one is used, the concept of a good formal collaborative process has at its heart the old adage “measure twice, cut once.” Dovetail Partners has adopted a collaborative group process based on the work of William S. Stockton, Ph.D, Patrick O’Brien, and the Mobius Model™ (Figure 4). The approach has been applied for over twenty-five years and extensive research was used to develop it. The structure of the Mobius Model provides a guideline for the development of multi-group collaboration. Sometimes this approach is represented as a wheel (Figure 4.). The process includes six steps that are followed in a positive direction (clockwise), beginning with the assessment step, identified as *Well-Being* in Figure 4.



Figure 4. Mobius Model

There are six basic steps to the collaborative process.

- 1) Assessment of the situation for mutual understanding (Well-Being),
- 2) Identification of possibilities (Possibility),
- 3) Group commitment to certain possibilities (Commitment),
- 4) Development of a plan (Ability),
- 5) Selection of champions (Responsibility), and
- 6) Evaluation of progress and/or success (Recognition).

Although this process may seem similar to other models, the devil is in the details. The emphasis in collaborative processes is less on the plan portion (steps 4-6) and more on the incorporation of diverse opinions into the assessment, idea creation, and commitment stages (steps 1-3). An emphasis on the first three steps is used to ensure inclusion of differing perspectives in the final plan. By spending additional time coming to a mutual, shared understanding of the broader needs of the

varying groups, new possibilities arise that would not otherwise show up, including the potential to gain commitment from diverse participants, trust and respect for the process and greater happiness with the end result.

The urban forestry assessment project in Raleigh focused on the first two steps of the collaborative process. The assessment process included the use of a survey tool to gather as much input as possible from internal stakeholders (staff, etc) and external stakeholders and interest groups.

In addition to the collaborative process that was used to inform the assessment design, third-party forest certification was also referenced. The basic principles for the Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI) certification programs are shown in Table 1. Although forest certification has generally been applied to traditional, rural forestry, basic principles like legal compliance, protection of water resources, management planning, and training and education also have applicability to urban forest management. The review of documents and on-site evaluations that were conducted as part of the project were designed to explore considerations and approaches that would be similar in scope and content to a third-party forest certification audit.

Assessment Findings: On-site Visit and Document Review

The assessment included an initial visit in December 2013 as well as an on-site visit to meet with staff and tour operations in April 2014. Staff and Management were engaged in meetings during the site visit, and operations were also visited and observed throughout the city (e.g., tree removal, material management, etc).

The City of Raleigh, Parks Division, has responsibility for the management of the urban forest. The Parks Division includes 10 field arborists and provides 24/7 emergency coverage. The City of Raleigh has maintained Tree City status for more than 26 years as a result of demonstrated commitment to caring for and maintaining the city's trees and parks. Staff for the Parks Division includes well-trained employees with technical expertise, including ISA certified arborists and North Carolina registered foresters. The City is responsible for 1200+ centerline miles (i.e., street tree corridors); 100+ miles of greenway; and over 200 park sites. The City also has responsibilities for some unique situations, including FEMA/emergency service parcels, cemeteries, vacant city-owned lots, shoreline buffers, and greenway easements.

The Parks Division has a number of systems in place to ensure legal compliance as well as effective citizen engagement, communication, and service. Notification letters, inspections, and posted notices are used to ensure the public is aware of tree management needs and operations. Legal council is also used as necessary to ensure the city is operating appropriately.

The Parks Division has demonstrated innovation and a commitment to best practices in urban forestry through the research and development of tree planting specifications, pursuing wood utilization strategies (as discussed in other sections of this report), and their small nursery operation. The City's NeighborWoods Program is an innovative and effective demonstration of a commitment to long-term maintenance and enhancement of the urban forest of Raleigh. Through the NeighborWoods Program and other public education systems (e.g., email updates, online tree planting video, etc.), the City demonstrates service to the public and residents of Raleigh.

As part of the assessment, site visits were made to the yard waste site, on-site greenhouse and log concentration yard, downtown areas of Raleigh, City Hall, park and greenway areas, street tree removal operations, environmental education center, and NeighborWoods project location. Throughout these visits, there was a consistent pattern of well-trained, professional individuals operating effectively to fulfill their responsibilities and support the objectives of the Parks Division and the long-term vitality of the urban forests of the City of Raleigh. Many of their operations (e.g., yard waste site, NeighborWoods, etc.) demonstrated commitment over a period of years and adaptations within the operations to adjust to changing conditions, new understanding, or additional needs. The ability to recognize and adapt to change is important in the practice of long-term responsible forest management. At several of the sites that were visited, there was interest in exploring opportunities for biomass energy. Individuals recognized that markets for biomass may be an opportunity for the city to address the diversity and volume of material that sometimes needs to be managed. It was also mentioned that the City has a wood working shop and there could be creative opportunities for making use of this capacity (e.g., making benches, signs, bird houses, etc). This may offer opportunities for staff within the city as well as to connect with other woodworkers.

As discussed in other sections of this report, the City benefits from a wide range of supporting resources in the area, including public and private organizations engaged in forestry, land management, and forest products and research institutions. The City has good relationships and effective communication with the regional resources to allow for collaboration and partnerships to occur.

The City manages a number of historic or sensitive sites, including cemeteries, historic and signature parks, and other areas. The ability to effectively understand these situations, protect the important values, and maintain appropriate management is an important component of responsible forestry.

The City of Raleigh has a sophisticated tree removal process, from inspection to notification to removal; the process is comprehensive, thoughtful and professional. The effective use of GIS and database tracking of work orders allows the City to manage, monitor, report, and review operations. The commitment to training and a safe workplace is clearly evident in the operations.

Lastly, the City's engagement with the public through partnerships at environmental learning centers (e.g, Walnut Creek Wetland Center) and through the NeighborWoods program adds another dimension to the Parks Division that helps address the social considerations associated with responsible forest management and unique aspects of urban forest management.

Assessment Findings: Survey Results

Online questionnaires were developed to gather input to the assessment from internal and external stakeholders to the city's urban forestry program.

The external survey (Appendix 3) was directed to citizens that were engaged in the forestry program in some way (e.g., committee members) and would have a reasonable level of knowledge about the programs and activities undertaken by the Parks Division. The external survey included only the first section from the internal survey, namely the SWOT analysis set of questions.

The internal survey (Appendix 2) was directed toward staff, employees, and contractors directly engaged in the urban forestry program and urban forest management activities in the City of Raleigh. The internal survey included questions to address perceived strengths, weaknesses, opportunities and threats (SWOT analysis) to the urban forestry program. The internal survey also includes a series of questions addressing perceptions of the quality and sufficiency of the city’s approach to specific forest management considerations, including tree planting, management planning, forest products and services, community engagement, historic sites, high-conservation value forests, environmental impact, and monitoring systems. The content of this portion of the survey was informed by experience with third-party forest certification standards and auditing practices.

A total of 7 responses were received for the External Survey ; 41 survey responses were received for the Internal Survey. Demographic information provided by the respondents is summarized in Table 2.

Table 2. Demographic Information about Respondents

Characteristics	External Survey (N=7)	Internal Survey (N=41)
Gender		
<i>Male</i>	34 %	76 %
<i>Female</i>	66 %	24 %
Age		
<i>18-24</i>	0 %	3 %
<i>25-34</i>	0 %	12 %
<i>35-44</i>	17 %	25 %
<i>45-54</i>	33 %	38%
<i>55-64</i>	50 %	19%
<i>65-74</i>	0 %	0 %
<i>75 or older</i>	0 %	3 %
Do you work in forestry, forest products, or a related natural resource field?		
<i>Yes</i>	83 %	64 %
<i>No</i>	17 %	36 %
What is your relationship with the city’s urban forestry programs? (select all that apply)		
<i>Current or past city staff of employee</i>	0 %	95 %
<i>Current or past city contractor</i>	17 %	6 %
<i>Member of Citizen advisory group</i>	17 %	0 %
<i>City resident</i>	83 %	12 %
<i>Business owner</i>	17 %	0 %
<i>Elected official</i>	0 %	0 %
<i>Other</i>	50 % (Volunteer, State Gov’t, Educator)	0 %

The following information was provided from the [External Survey responses](#), (emphasis added to highlight key words and phrases).

Q1: What do you think are the greatest STRENGTHS of the city's urban forestry programs? (e.g., what is working well, what are you most appreciative of, what would you like to see continue?)

- Systematic **support for street trees**. Emphasis on ("The City of...") oaks, but support of variety to promote robustness.
- 1. the state urban & community forestry program staff of 3 are amazing; 2 .the state urban forest council is so talented and committed and productive; 3. so appreciative of the **outreach and educational opportunities** provided by these two groups; 4. the city **urban forestry staff is outstanding**; 5. we have so many healthy trees in our city.
- Very **talented, knowledgeable professionals**, who work well with the public and other engaged participants. Programs within the city **encourage citizen participation** and the opportunity to gain more understanding of the complexity of our urban forests.
- **Educational opportunities**
- Good **staff and leadership**
- Has **a lot of trees** on the ground to work with.
- The **knowledgeable and passionate** people.

Q2: What do you think are the greatest WEAKNESSES of the city's urban forestry programs? (e.g., what is NOT working well, what would you most like to see changed?)

- Perceived complication of **permit process / permissions**. And contractors' treatment of line easements ("hey - why did the city cut down all of my trees?" when utility does the cutting under a blanket permission)
- Greater depth and breadth of **educational opportunities** about our urban forests.
- Need Citizen tree keepers, much like the River Keepers, after being trained, or course.
- Opportunities to present to our CAC's, in our schools, in our Arts Programs, You Tube, across the board of social media.
- No matter how many people you have there is **never enough staff** to be able to meet the growing needs, and the need for proactively developing initiatives that support, promote and educate the public and protect the City's resources of trees, both public and development.
- It is too easy to get around the intention of the **tree protection ordinance**.
- The genera of the city is way too heavy in Quercus and Lagerstroemia (Note for clarification: this comment is a reference to a **lack of tree species diversity** in the city, e.g., too many oaks and crape myrtle)

Q3: What do you think are the greatest OPPORTUNITIES for the city's urban forestry programs? (e.g., what should be done to support success?)

- I love the idea of **Neighborhoods and TAR!** Support and inform.
- **invest \$** in it - urban trees are SO important to quality of life, health, energy, etc.
- Greater use of **social media**
- More education tied to specific actions for/by the public. Developing better connections and plans for supporting and **utilizing urban wood** removal (and then increasing size with inclusion of trees on private property) - referring to the wood, not the debris of limbs, decayed wood, etc. Better and specific partnerships with solid waste for this would be necessary - would need to have a specific mandate/direction to develop this... and possible staff person to oversee.
- The new UDO [**Urban Development Ordinance**] is far from tree-friendly. Working to keep transportation corridors, redevelopment areas, and new "urban" developments green will take considerable effort.

- To **increase biodiversity**. To make sustainable spaces for more trees. People in the community are supportive of your efforts

Q4: What do you think are the greatest THREATS to the city's urban forestry programs? (e.g., what current or emerging issues need to be addressed?)

- Issues involving treatment of **line easement cutting**/protection.
- **climate change** is a threat to the health of our urban trees so we will need more staff and more resources to keep our trees alive and thriving
- A general **lack of understanding of our trees and their life span**, translated into strict regulations, while ignoring the need for ongoing replenishment of the understory canopy and real quantified data. The **lack of a good data base of the existing canopy**, overall health, and evaluation. Including an investigation of current canopy area, 10 year previous area, and projected 10 year canopy (based on anticipated growth). With this factual basis, reasonable fact based projections are able to be made on the impacts to the quality of life in Raleigh of tree/canopy. I believe great public support for maintaining our urban forests, can be garnered from this approach.
- Budgets are an issue and are always tight, so developing new programs/initiatives cannot really be considered with staff fully involved in their existing duties - but continued **population growth and development pressures** will require increased park creation (and public tree management) and more effective public engagement and processes. Spreading staff more thinly will not provide Raleigh with the ability to be proactive.
- **Funding to support program growth** is important.
- The development community will continue to try to push all responsibilities for trees onto public land. **Poor planning**, in the form of a half-baked form-based zoning lite ordinance, will not play well for trees. They will become squeezed into narrow spaces, that will be invaded and re-invaded to build and replace infrastructure (roads, power, waters).
- Insufficient **funding**. Insufficient **buy-in** from the legislature. Insufficient buy-in from high level corporations in the area.

Q5: If you could do ONE BIG THING to improve the city's urban forestry programs, what would it be?

- I think it's already happening - **updating the public-facing urban tree guide**.
- **add staff**. they are kept so busy because we are the City of Oaks!
- I think the current staffing level is short of what is needed. I would **fund more staff** positions. With increased 'boots on the ground' analysis of our urban forest could be accomplished and more public education could be facilitated.
- People know there are trees and the City is proud of that. **More visibility of the programs** and their importance could be helpful for support. Promote the ecosystem benefits and cost savings to residents and the value of paying for that, promote sustainability and how trees contribute as well as sustainability in recycling wood - better and specific partnerships with solid waste would be a part of that.
- **Revamp the development code** with a "City of Oaks" perspective.
- **Increase the biodiversity** and get the city to **buy more trees from North Carolina** nurseries

Based upon the input from the external survey, there are several common themes. There is clear respect and appreciation for the quality and efforts of current staff. There is concern about long-term capacity (staffing and funding levels). There is also concern about some of the policies that impact the urban forests in Raleigh (e.g., ordinances, easements, etc). Given that the authority for these policies goes beyond the Parks Division, being able to affect these concerns will require partnerships and collaboration.

From the **Internal Survey responses**, the following information was provided (emphasis added to highlight key words and phrases; some comments edited for length).

Q1: What do you think are the greatest **STRENGTHS** of the city's urban forestry programs? (e.g., what is working well, what are you most appreciative of, what would you like to see continue?)

- The **educated crews** that maintain and run the programs. The **Neighborwoods** project is fantastic and will continue to benefit Raleigh for many years. I am appreciative of the fact that Raleigh goes to such great lengths to protect and educate people about the trees here.
- awareness, attention to **inspections**, these needs to be continued
- Expertise, knowledge, and enthusiasm of **staff members**
- I am most appreciative of the working relationship between UF and TFS. Zach and Sally are always great to work with and even if we have a difference of opinion, we can work through our differences.
- **Tree management & planting**; Neighborwoods program
- **Outstanding technical advice** re: tree health, structure etc. during planning and construction projects.
- **Everyone working together** making sure trees are pruned and monitored properly
- **Neighborwoods** an excellent community outreach program.
- Dedicated and **knowledgeable staff**. Proactive versus reactive.
- The professional expertise of the staff.
- The overall saving & preserving of our trees. People who care about their work & believe in what they are doing as a unit.
- Quiet/natural "refuge" from urban landscape
- Knowledgeable staff, **response time** is great
- They have many **certified arborists and highly skilled staff**. Neighborwoods is a great program it really involves
- Volunteer tree plantings; Continuing education/training/certification for UF staff; Professionalism/quality of work; **Positive public interaction**
- Raleigh's urban forestry program responds to citizen concerns and emergency situations in a timely manner. We maintain **high quality tree care** through high quality and friendly staff. I am most appreciative of the emphasis on **safety and quality of work** that our urban forestry program prides itself on.
- The City keeps the **crews up to date** on the latest equipment, training & technology for the crews to do their job efficiently and safely
- The fact that we are **planting trees!** Continue planting!!!!!!
- The Urban Forestry strengths for the city of Raleigh are: * we have an amazing Neighborwoods program; * we have updated and efficient equipment for the job; * we have skilled management staff * we have great work ethics and practices
- **Keeping the parks and streets safe** and free from dangers
- Encouraging urban trees is a great thing! Raleigh seems to do this well.
- The city **taking care of trees** and making sure that if a tree has to be removed, it gets replaced and make sure it is the right tree in the right place
- Neighborwoods program. **Getting trees planted** out in urban areas for folks who can't afford them and then watering them for 1 year to get them established.
- 1. People/staff; 2. Knowledge/expertise; 3. Commitment/professionalism
- We have or can get most of the time **the right Equipment** to do the job,
- **Grant applications** to provide additional funding for strong initiatives and programs.

Q2: What do you think are the greatest WEAKNESSES of the city's urban forestry programs? (e.g., what is NOT working well, what would you most like to see changed?)

- **Allow greater variety of trees** to allow for diverse climate changes. (ie- not just oaks)
- I feel that even with the resources that they have, the urban forestry **crews need to expand** to meet the demands of taking care of so many trees.
- **Public awareness** about everything they do.
- Not enough workers to cover all of the city; **need more workers more inspectors**
- Would love to have **more resources** to share all of the great things they are doing.
- I believe that they could have more focus on **education and outreach** about the importance of urban forestry.
- **Service requests**, it sometimes takes too long to get trees trimmed or removed.
- Do enough people know about it? Not sure **how to raise the profile?** Maybe have an Urban Tree in front of the Performing Arts Center with a placard telling people how to get involved. Maybe also one at City Hall and on Fayetteville Street. Sort of like advertising with the tree?
- I would like to see **more staff** for this division so they could concentrate more on routine maintenance of urban forest.
- The **slow process** of getting to do the work.
- The weakness of the Urban Forestry are: * need more timely ordering of foot protection; * we are under staffed for the area we maintain; * need more funds for budget
- One weakness is **climbing**; need to have some time once or twice a month to climb.
- **Lacking tree trimmers/trucks/equipment** to meet demand
- Not enough **education about program for citizens**
- That **other companies are trimming trees inappropriately**, we should supervise these conditions more closely.
- A weakness of our program is being **under-resourced** to meet the current and growing demands of urban trees in our city. This weakness reduces our time available for staff to be involved with continuing education, training and professional development.
- **Need more urban forests!** The single tree with a mulch ring around it isn't green at all...if you planted urban forests with trees on a 10 foot center + or - a few feet and keep the vines out this would be much greener..Put walking trails and tree identification to educate our citizens. Please plant more White Oaks Quercus alba!!!
- **Communication** is a problem, not just for the Urban Forestry program, but throughout the Parks and Recreation Department. Park managers do not have the software to enter **service/work requests** into the City of Raleigh's work request system. We rely on admin assistants and other to enter our requests. The work request system software appears to be very limited in scope. Maps are not attached. Park doesn't open until 10 am and is closed on Monday. This means there is no park staff member available to answer questions or direct the crew to the correct tree. Tree crews/grounds crews do not call or email the park manager the day before to get the information.
- **Always asking for a service request**, when we are in the field and see a problem we do not have the option of sending one. If we call or send a quick email they should create it themselves to handle the issue.
- **Maintenance of street trees** in general... funding and resources do not allow for frequent enough pruning cycles
- I do not see any plans to sustain **Raleigh's native urban tree diversity**. Losing Raleigh's "legacy" tree diversity can be avoided **ONLY** if the same native "legacy" species are actively planted – they cannot reproduce on their own in a developed urban setting.
- **How the wood is processed** when a tree is removed. Would like to see the city involve more local companies to make something out of the wood.
- **Citizens' awareness** of Raleigh's urban forestry program is low, which hinders its ability to be more effective.

- Being able to decline **tree placement or selection for city projects** when the health and longevity of the species is not taken into consideration when planning the design. Too small of an area for tree roots to establish themselves therefore creating a stressed out tree that doesn't live long and has issues right from the start. The forestry department needs to be able to work with the landscape architects before they decide where the designer wants the tree, not after the drawings are made and then try and find something that will grow there.
- 1. **Value** within the city organization - too many people fail to understand the valuable and necessary resource they are for the city; 2. Not enough members of the team to support a city the size of Raleigh

Q3: What do you think are the greatest OPPORTUNITIES for the city's urban forestry programs? (e.g., what should be done to support success?)

- Allow for more **flexibility** in preservation, and greater root zones. The State senate has changed laws- get that word out.
- Expanding **NeighborWoods**. Educating the public on the benefits of trees. Do calculations and hang signage to explain/show the benefits of trees. Reorganizing how trees are dealt with so there is better coordination between arborists/foresters in Plan Review and PRCR. Should Urban Forestry be under PRCR?
- **Increase staff**; hire more experienced **tree workers**
- Reaching out to developers & builders, **educating the building industry** on the importance of urban forestry.
- I think there is a great opportunity to **educate the public** on the importance of trees.
- Maybe **re-organize and add staff** to better serve the citizens of Raleigh, more routine maintenance and maybe some outreach or education of the public so they better understand the importance of the division and what they do.
- **Partner with Office of Sustainability** on demonstrated science-based benefits of urban canopy; with Natural Resources staff on value of snags and overall forest health, especially sub-urban. Then partner with SPCA (marketing), State forest programs, etc. on outreach. Expand the education function of urban forestry. The average Ral. citizens probably don't know how extensive and professional our UF program is.
- Continued **training** of our staff.
- I think the greatest opportunities for Urban Forestry are: * continued support for **arborist certification**; * advanced opportunities for growth and development; * reward staff for their job performance
- To **re-forest areas** that have been damaged by storms ect. Maybe have a group that can watch the progress of new plantings & report anything unusual.
- Integrate planting/care programs with **local schools/youth activities**? Involve volunteers?
- Could you offer a **tree buying service for residents** akin to what we do with mulch. Maybe people could buy mulch and trees at the same time as a improvement package?
- Take a look at how work is completed. Perhaps find a way to **address non emergencies** a little more efficiently and quickly to avoid emergencies
- Perform on the job evaluations
- Adoption of **new Tree Ordinance** by City Council with well defined requirements; Create a position to review/modify plans
- Let citizens know what we do, why we do it and how important it is
- **Hire more staff** to ensure the city's parks and streets are kept safe
- Plant a **greater variety of native tree species**, and to promote the planting of those native trees which historically occurred
- Opportunities include: partnering with citizens to help take care of trees and share responsibility, **maximum utilization of removed wood**, educating citizens on proper tree care and what our program does for the city.

- We have an obligation as public employees to be able to **demonstrate sound horticultural practices** to our citizens. We have an obligation to demonstrate sustainability in our tree selection, planting techniques, and placement. Trees create a sense of beauty in our communities and have tremendous sensory and environmental value. Showing the citizens that we place trees in high regard and make decisions based on these principles is one of our greatest opportunities.

Q4: What do you think are the greatest THREATS to the city's urban forestry programs? (e.g., what current or emerging issues need to be addressed?)

- **Disease** from exotics and imported plant material from Monrovia nursery, local requirement would be good.
- I feel that more emphasis needs to be put on the types of trees that new construction and architects install. Go with more native trees and stop putting in so many **crepe myrtles** etc.
- **Growing population** causing more construction and less land for parks
- **Older street trees** that are falling apart
- **Funding** and not have the ability to meet the maintenance needs of the growing urban forest.
- **Development**; Increased business competition for space/landscape/development
- The **slow reaction times**.
- The **new UDO** requires more and more of our staff I am not certain that the City is supplying the resources for this. Also **growth and urbanization** will have more pressure on the urban/suburban forests and street trees.
- Planting of the **same species too often** in one area.
- Harm to trees by citizens and City/State mowing crews; Poor planting by contractors or citizens; Large maturing trees being replaced with smaller trees more appropriate for ROW; Not planting enough young trees to replace older declining trees
- Greatest threats to Urban Forestry are: * hiring contractors *due to lack of staff, some areas are neglected * streets * sidewalks * parks * greenways
- Being **understaffed** and not being able to respond to citizens complaints as promptly as should be able to
- **Loss of cavity trees** for cavity nesters such as chickadees, titmice, bluebirds, woodpeckers, flying squirrels, etc.
- **Invasive species** in parks and along greenways. Landowners not understanding the importance of trees. Not having enough staff to oversee planting of trees in private and public jobs. Pests that damage trees.
- Citizens' **lack of awareness** of the value of our urban trees.
- **Devaluing trees** as just an after thought. Using trees just as a design element and not addressing the fact that they are a plant and they grow. Not looking forward enough with our landscape designs to protect and nurture our century trees. Trying to have too many events in our parks with older established trees ie: Moore Square.
- Realistic management of dedicated **Tree Conservation Areas**.

Q5: If you could do ONE BIG THING to improve the city's urban forestry programs, what would it be?

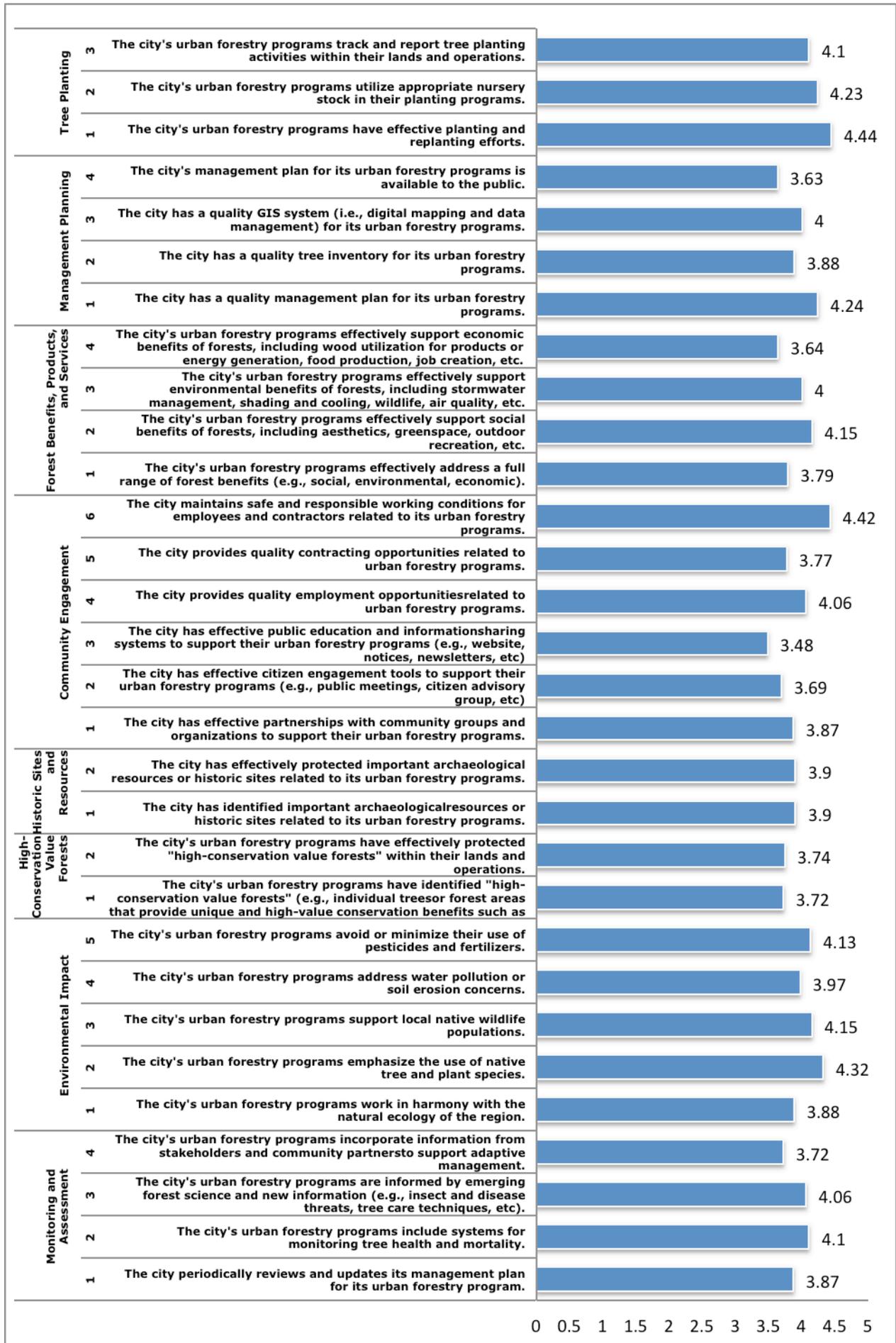
- **Increase trees downtown**, leave large trees - even if old and diseased if at all possible.
- **Larger budget**
- Plant **high profile trees** in high profile areas to make more people aware. Henry Clay Oak anyone?
- Add staff; **Increase the staff**; Hire additional staff
- **Add a crew** of three that included a bucket truck and a terrain king.
- Add **booths to all events** with info and opportunities for the public.
- Improve tracking and reporting of trees over time; **upgrade technology**

- **Educate the people** more let them know how important the trees are to Raleigh. Teach them not to top trees, put chain locks around, put signs up on them and overall give them a better understanding of what the urban forest does for the city.
- Monetary **incentives for professional development** and ISA certification for staff.
- Find some way to **reach out to as many citizens** as possible to educate them about trees.
- Educate and **get your non forestry employees involved!!!**
- **Put all utility underground**
- Improve the **communication** system; After we request something we do not know its done unless we go look.
- **Plant the native trees** that historically grew here
- Being able to **share your urban forestry story** and all the successes in the urban forestry division.
- Have a **comprehensive analysis** done of the ecosystem services that urban trees provide people and create awareness through a top-notch marketing campaign that engages Raleigh's citizens with simplified, straightforward messages.
- More **educational programs about trees for citizens to attend in a park** in the city about planting, tree selection, care, insect and disease control so that people would have a better understanding about why we do the things that we do with trees.
- **Increase the resources to meet the need**
- Identify, dedicate resources, and **advocate for management** of the City's growing TCA program.

Similar to the feedback received from the external survey, the internal survey feedback highlights the priorities of having skilled, trained, and professional staff, including concerns about having adequate staffing levels to care for the trees and urban forest needs in the city. There is clear appreciation of the benefits of the Neighborwoods program and the need for public engagement and education activities to support citizen understanding of the urban forestry program and its value. There are also expressed concerns about the future of the city's urban forest and trees due to development pressures, disease, invasive species and other tree health and canopy replacement challenges. In general, it appears that there is alignment and a shared understanding between the internal and external stakeholders regarding the current needs and opportunities of the urban forestry program. There does not appear to be a significant disconnect or conflicting views of the programs current performance and future needs.

The second section of the Internal Survey provided additional information about specific aspects of the urban forestry management program and activities. The survey results for each topic area are briefly summarized below and specific comments that were received are also listed. For each topic area, a number of statements were provided and respondents were asked to *"Please indicate the degree to which you agree or disagree with the following statements."* The survey provided a 5-points scale from 1 for "strongly disagree" through 5 for "strongly agree" with each statement. The appendix includes the entire set of survey statements. The table on the following page (Table 3) provides the listing of eight topics areas and the total of thirty statements that were ranked. In the following narrative summary, emphasis has been added to highlight key words and phrases.

Table 3. Internal Survey, second section questions and rankings



Tree planting

Summary of Ranked Statements:

In relation to the topic of Tree Planting, survey respondents were asked to rank three statements. A total of 38 respondents provided feedback on this topic. The three statements for the respondents to rank addressed the following considerations: 1) effectiveness of planting and replanting efforts; 2) use of appropriate nursery stock; and 3) tracking and reporting tree planting activities. On a scale with a maximum (i.e., best) ranking of 5, all three questions received an overall rating above 4. The effectiveness of planting efforts ranked highest at 4.44; nursery stock ranked 4.23; and tracking activities ranked 4.10. These rankings indicate that in general the survey respondents agreed that these elements of a quality tree planting system are in place in the city. No survey respondents expressed that they “strongly disagree” with any of the statements addressing tree planting, and only one respondent indicated “disagree” with the third statement about tracking and reporting activities. . In contrast, 87% of the respondents Agree or Strongly Agreed with the first statement; 82% with the second; and 55% with the third statement. With regards to the third statement addressing the tracking and reporting of activities, 21% indicated “N/A or No Opinion” and an additional 21% responded with a neutral ranking (neither agree nor disagree).

Comments from respondents in this section:

- The city provides vouchers for residents that plant trees to get free mulch for the trees.
- I like the citizen involvement piece
- Remember to water what you plant
- Do you have a report you put out?
- With more emphasis on education and outreach (internal and with partnerships) could better promote the UF program and benefits
- some of the tree we have gotten are not in the best of shape as far as root system and tree tops
- the only issue i have is sometimes I see trees being planted in the wrong place for the species of tree
- We need to make sure we are planting trees at the right time . Try to schedule projects for the fall or early spring and try to avoid our summer time planting projects.
- we have a very skilled and professional coordinator that works very hard at her job and at pleasing the public within her means
- We have an excellent tree planting program We don't do enough to track the benefits over time of our plantings or taking advantage of technology to justify budgets or needs
- I hear that Taylor's Nursery (perhaps others too) provide tree seedlings to the city if they haven't old them after X time. I really like that relationship but hope these trees are not used instead of purchasing high quality trees for high stress environments like streetscapes.

Management planning

Summary of Ranked Statements:

In relation to the topic of Management Planning, survey respondents were asked to rank four statements. A total of 37 respondents provided feedback on this topic. The four statements for the respondents to rank addressed the following considerations: 1) having a quality management plan; 2) having a quality tree inventory; 3) having a quality GIS system; and 4) making the urban forestry management plan available to the public.

On a scale with a maximum (i.e., best) ranking of 5, the rankings ranged from 3.63 to 4.24. The management plan ranked highest at 4.24; the tree inventory ranked 3.88; the GIS system was 4.00; and the public access was lowest at 3.63. These rankings indicate that in general the survey respondents agreed that these elements of planning are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses) in regards to the details. Overall, about 8% of respondents recorded “Strongly Disagree” or “Disagree” regarding the public availability of the plan. About 3% expressed a disagreement ranking for the tree inventory and GIS system. In contrast, 78% of the respondents Agree or Strongly Agreed with the first statement; 62% with the second; 64% with the third; and 45% with the fourth statement.

Comments from respondents in this section:

- Don't really have this information available that I know of.
- I believe we are doing a good job of planting trees to replace older declining trees before they are all gone
- Again, as an insider I am not familiar with mgmt plan; more outreach!! Invite Smokey, partner with Land Stewardship, partner with NGO's in area...
- Take care of older historic trees

Forest products and services

Summary of Ranked Statements:

In relation to the topic of Forest Products and Services, survey respondents were asked to rank four statements. A total of 35 respondents provided feedback on this topic. The four statements for the respondents to rank addressed the following considerations: 1) forest benefits; 2) social benefits; 3) environmental benefits; 4) economic benefits. On a scale with a maximum (i.e., best) ranking of 5, the rankings ranged from 3.64 to 4.15. The overall benefits were ranked 3.79; social benefits were highest at 4.15; environmental benefits were at 4.00; and economic benefits were lowest at 3.64. These rankings indicate that in general the survey respondents agreed that these elements of urban forestry are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses) in regards to addressing the overall full range of benefits and supporting the economic benefits of the urban forestry. Overall, nearly 12% of respondents recorded “Strongly Disagree” or “Disagree” regarding the effective support of the economic benefits of forests, including wood utilization, job creation, etc. About 9% expressed a disagreement ranking for the effective support of environmental benefits. In contrast, 60% of the respondents Agree or Strongly Agreed with the first statement; 79% with the second; 74% with the third; and 50% with the fourth statement.

Comments from respondents in this section:

- Some of the urban forestry products are taken to the City of Raleigh Yard Waste Center where we make mulch, compost and wood chips.
- we sell our wood to people for firewood, energy generation, and give away chips for people to use in gardens and flower beds which i believe is a great use of our tree waste
- While what we do is great, I believe we could do more esp. with economic calculations of social and env.benefits. Reputation (C.of Oaks, greenway) is huge selling point for City and Triangle. This calc. should justify more resources back into the UF program.
- What about an urban food forest? Chavis Greenway, perhaps?
- Save all wood and logs to sell for future plantings

Community engagement

Summary of Ranked Statements:

In relation to the topic of Community Engagement, survey respondents were asked to rank six statements. A total of 35 respondents provided feedback on this topic. The six statements for the respondents to rank addressed the following considerations: 1) effective partnerships; 2) effective citizen engagement tools; 3) effective public education; 4) quality employment opportunities; 5) quality contracting opportunities; and 6) safe and responsible working conditions. On a scale with a maximum (i.e., best) ranking of 5, the rankings ranged from 3.48 to 4.42. The effective partnerships was ranked 3.87; citizen engagement ranged 3.69; public education was lowest at 3.48; employment ranked 4.06; contracting was 3.77; and safe conditions was highest at 4.42. These rankings indicate that in general the survey respondents agreed that these elements of urban forestry are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses) in regards to providing effective public education. Overall, 23% of respondents recorded “Disagree” regarding the effectiveness of public education. About 12% expressed a disagreement ranking for effectiveness of citizen engagement tools. In contrast, 62% of the respondents Agree or Strongly Agreed with the first statement; 57% with the second; 51% with the third; 70% with the fourth; 51% with the fifth; and 94% with the sixth statement.

Comments from respondents in this section:

- neighborhood is a great program where we give away trees to citizens in neighborhoods that are in need for more trees
- Outreach can be improved; train staff (or create position) trained in public participation and marketing, responsible for education and civic engagement.
- I only have limited experience with UF's community engagement but Leigh Bragassa does a great job with it.
- Great place to work; great supervisors

Historic sites and resources

Summary of Ranked Statements:

In relation to the topic of Historic Sites and Resources, survey respondents were asked to rank two statements. A total of 35 respondents provided feedback on this topic. The two statements for the respondents to rank addressed the following considerations: 1) having identified important sites; and 2) effectively protecting important sites. On a scale with a maximum (i.e., best) ranking of 5, both statements were ranked at 3.90. These rankings indicate that in general the survey respondents agreed that these elements of planning are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses) in regards to the details. Overall, about 6% of respondents recorded “Disagree” regarding the identification of sites. About 3% expressed a disagreement ranking for the protection of sites. In contrast, 63% of the respondents Agree or Strongly Agreed with the first statement; and 62% with the second.

Comments from respondents in this section:

- Not a lot of public info that I know of available to public.
- Outreach could include labeling highly visible trees - species, age, timeline (turn of century, great depression, WWII, etc. in the life of tree)

- I am not aware of any efforts like this unless you consider spaces like Moore and Nash Squares with very old trees.
- I would like to see wildlife managed and controlled more throughout the parks

High-conservation value forests

Summary of Ranked Statements:

In relation to the topic of High-conservation value forests, survey respondents were asked to rank two statements. A total of 35 respondents provided feedback on this topic. The two statements for the respondents to rank addressed the following considerations: 1) having identified forest areas with unique conservation benefits; 2) effectively protecting identified forest areas. On a scale with a maximum (i.e., best) ranking of 5, the first statement was ranked 3.72 and the second was 3.74. These rankings indicate that in general the survey respondents agreed that these elements of planning are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses) in regards to the details. Overall, about 14% of respondents recorded “Disagree” regarding the identification of unique forest areas. About 11% expressed a disagreement ranking for the protection of these areas. In contrast, 62% of the respondents Agree or Strongly Agreed with the first statement; and 57% with the second.

Comments from respondents in this section:

- To my knowledge, we are not proactive enough. Stewardship includes ID'ing significant resources and recommending appropriate mgmt. Partner with other Divisions, agencies, SME's etc. to do so on undeveloped lands and recommend mgmt, including the resources (capital, operating funds) to carry it out.
- I would love to see this happen and know there is interest in it and perhaps even some support but am unaware that it has happened to date.

Environmental impact

Summary of Ranked Statements:

In relation to the topic of Environmental Impact, survey respondents were asked to rank five statements. A total of 35 respondents provided feedback on this topic. The five statements for the respondents to rank addressed the following considerations: 1) working in harmony with natural ecology of the region; 2) use of native tree and plant species; 3) support of native wildlife populations; 4) addressing water pollution or soil erosion; and 5) avoiding or minimizing use of pesticides and fertilizers. On a scale with a maximum (i.e., best) ranking of 5, the rankings ranged from 3.88 to 4.32. The statement addressing natural ecology ranked lowest at 3.88; use of native species ranked highest at 4.32; wildlife ranked 4.15; water pollution and soil considerations ranked at 3.97; and use of chemicals ranked at 4.13. These rankings indicate that in general the survey respondents agreed that these elements of urban forestry are in place, but there was some uncertainty (e.g., “Disagree” or “Strongly Disagree” responses). For each of the five statements 3-6% of the respondents recorded “disagree” or “strongly disagree”. In contrast, 76% of the respondents Agree or Strongly Agreed with the first statement; 88% with the second; 85% with the third; 71% with the fourth, and 68% with the fifth statement.

Comments from respondents in this section:

- UF concerns are safety first, then aesthetics and not focused on benefits to natural systems. Many forests are overrun with invasive species that choke out native vegetation.
- Single trees with mulch around them require regular spraying or hand weeding
- I believe you need to have fertilization programs for capital or important trees. We should do more than just prune some of our trees
- continue to strive for balance of keeping snags vs. removing under the guise of safety. Remove limbs and leave the trunk; be more aggressive protecting critical root zones, especially in downtown squares.
- The erosion problems are getting out of hand. Mainly because of development in urban areas that is not addressed during construction or planning process
- It provides a natural and safe place to look at and relax

Monitoring system

Summary of Ranked Statements:

In relation to the topic of Monitoring Systems, survey respondents were asked to rank four statements. A total of 34 respondents provided feedback on this topic. The four statements for the respondents to rank addressed the following considerations: 1) period updating of management plan; 2) monitoring tree health and mortality; 3) use of forest science and new information; and 4) incorporating information from stakeholders and community partners. On a scale with a maximum (i.e., best) ranking of 5, the rankings ranged from 3.72 to 4.10. The statement addressing periodic plan updates was ranked at 3.87; tree health ranked highest at 4.10; use of forest science ranked at 4.06; and incorporating information from partners ranked lowest at 3.72. These rankings indicate that in general the survey respondents agreed that these elements of urban forestry are in place. Only one statement received any “disagree” or “strongly disagree” responses, and that was statement two related to tree health, which received 3% “disagree”. In contrast, 61% of the respondents Agree or Strongly Agreed with the first statement; 78% with the second; 73% with the third; and 50% with the fourth statement. With the fourth statement, related to incorporating information from stakeholders and partners, 35% indicated a neutral response (neither agree nor disagree) and an additional 15% indicated “no opinion”.

Comments from respondents in this section:

- I've seen the monitors on trees in Nash Square, for instance
- I am not aware of the extent UF does mgmt updates, monitoring, or solicits input for adaptive mgmt (such as this survey!). Long overdue.
- We have a great team

Additional Comments provided at the end of the survey:

- I would love to see a video on these programs published on the web and RTV. Need to let people know what you are doing.
- The hazard tree service that Urban Forestry provides has been excellent. Sometimes I think the crews are a little too eager to cut trees further from the trail that I would like to keep as snags or standing dead trees for wildlife purposes.

- Have looked for acre+ sites on undeveloped land in the past for potential mgmt such as harvests, and should pursue this. Could pursue recycle and/or reuse of const. and storm debris as partner with Wake Co and multiple municipalities (econ of scale). Could take the lead in Triangle with UF education, esp. from a stewardship and sustainability perspective. We have a good professional program, can be GREAT with appropriate resources dedicated and effective partnerships. Do more with NCSU and Extension, Arboretum and nursery industry as well as local retailers.

Summary and Conclusions from Survey Rankings

The survey rankings echo some of the responses from the SWOT analysis. Overall, there is a high opinion and level of support for the urban forestry programs. Respondents generally agree that the key components of a strong and responsible management system are in place. There were no areas of the survey where respondents indicated a strong negative view of the urban forestry program (e.g., all statements ranked greater than 3.45, in the range “of “Agree” to “Strongly Agree”). Opportunities for improvement identified within the results include:

- a) the tracking and reporting of tree planting activities;
- b) making management plans available to the public;
- c) addressing and supporting the benefits of the urban forest, including environmental and economic considerations;
- d) public education, information sharing systems, and citizen engagement tools;
- e) identification and protection of historic sites as well as forests with unique conservation values; and
- f) incorporating information from stakeholders and community partners in to adaptive management planning.

Conclusions and Recommendations

From the entirety of the urban forestry management program assessment process – including the review of documents, on-site visits and interviews, and complete survey results – the following summary to programmatic strengths and opportunities is provided.

Strengths:

- Attracting talent, passion, skills in workforce and service providers
- Appropriately staffed, well-trained, experienced and professional individuals – emphasis on good science-based practices
- Leveraging legacy as the City of Oaks
- Innovative, comprehensive programs – from tree planting, inspection, removal, disposal/utilization
- Diverse lands and appropriate management approaches to fit them – ROWs, greenways, nature preserves, parks
- Awareness of importance of communications between departments

Opportunities:

- Updating and receiving approval of Manual, including the addition of technology improvements via CityWorks
- Establishing funding stability and long-term strategies and objectives for NeighborWoods program
- Exploring new market opportunities for urban wood, including potential for biomass, bioenergy

Since this assessment was undertaken, it is important to note that the City has accomplished the updating of the City Tree Manual and the tree ordinance (as of March 2015).

Next Steps

To undertake the next steps, and to continue through the Mobius process (Figure 4), the City could consider these actions:

- 1) Use the results of this project to develop a Strategic Plan
The listing of recommendations and opportunities from this report can be used to identify a set of priorities as the basis for establishing a strategic plan for the urban forestry program. This plan's development and implementation could be directed internally by staff and/or with external stakeholder input.
- 2) Establish a Structure for Measuring Progress
To support the successful implementation of the strategic plan and the accomplishment of goals, a structure for monitoring progress could be established. This could be identifying an individual staff member who will periodically (e.g., quarterly, bi-annually, or annually) review and report process. Alternatively, an internal team of multiple individuals could contribute to this process and/or external stakeholders could participate. Specific sections of the plan could be assigned to different teams or individuals as well. The important thing is to have roles and responsibilities clearly defined as well as schedule of review milestones.
- 3) Develop a Strategic Plan specific to the Neighborwoods Program
Given the strong support and enthusiasm for this program, it is important to ensure its success through a thoughtful process. Similar to the overall assessment that has been done, an assessment process specific to the Neighborwoods Program could be completed to identify opportunities to protect and grow the program. This planning process could also specifically focus on the economic sustainability of the program. A facilitated meeting that includes key staff and stakeholders to the program could be held to support strategic plan development.

The City also has the opportunity to explore some of the newest ideas that are emerging in the practice of urban forestry. These ideas include establishment of “food forests” in urban areas, utilizing fruit and nut trees as appropriate and in collaboration with community partners; engaging with woodworkers and other artists to utilize urban wood resources in special events or as part of an extended effort; incorporating additional wildlife considerations into the urban forest (e.g., nest boxes, food plots, etc); providing training opportunities about how to maximize the economic value of removed trees (e.g., log bucking lengths, grading systems, etc.); and utilizing diverse vegetation management techniques to get desired outcomes (e.g., use of prescribed fire, Integrated Vegetation Management in rights-of-way, etc.). The City could also consider participating in the newly emerging urban forestry programs, including the Urban Forest Sustainability & Management Assessment program or the development of the SCS Salvaged Wood & Fiber Standard.

The City of Raleigh currently has an exceptional urban forestry program. It is thoughtful, comprehensive, and effective. Although there are always opportunities for improvement, perhaps the strongest recommendation for the City is to continue doing what it is already doing well and maintain its commitment to its urban forest resource.

Part IV.

Case Studies

Everett Tree Service

Jimmy Everett is a graduate of North Carolina State University in Industrial Engineering. He is the owner of Everett Tree Service based in Raleigh and serving the Research Triangle area (including the communities of Raleigh, Durham, Chapel Hill, Cary, Apex, Wake Forest, Morrisville, and Holly Springs). The company has been in business for over 15 years serving both residential and commercial customers. Everett Tree Service operates a 10-person crew and is involved in tree and stump removal, tree trimming, storm recovery, mulch production and more. A 2014 purchase of an existing arborist firm enables Everett to also offer plant health expertise such as pruning, spraying, fertilizing and consulting.



Figure 5. Everett Tree Service (Photo Courtesy of Everett Tree Service)

One of Everett's specialties is a large crane that he can bring to a site and access hard-to-reach trees whether they are growing in a customer's backyard, near a house or building, or wherever. One of the advantages of using a crane, is that entire trees (especially pine), can be removed and laid intact on the ground. This makes it much easier to buck (cut) the tree/log into lengths for future utilization such as sawing into lumber.

Everett is careful that his crew knows the specifications of the logger or log yard where his trees will be delivered. A wrong cut on a quality tree could turn a high quality saw log into firewood.

Everett's philosophy is that he has to truck tree parts somewhere so "Why not get paid for them?" To this end, he often sells his better quality logs to a log yard in the Raleigh area – both hardwoods and pine. He also owns a small mill and dry kiln near the coast.

Everett said, "Selling trees is gravy to the bottom-line. For me, it's a no brainer to economically utilize trees." He also speculates that maybe it's an advantage to have only a few logs at a time to sell since: (1) a full-time logger has seen increased costs in (say) the last 10 years, but (2) lumber and/or log prices have essentially been constant over 10 years, and, (3) a tree service firm gets paid for tree removal and doesn't depend on log/lumber prices for a livelihood.



Figure 6. Everett Tree Service (Photo Courtesy of Everett Tree Service)

In addition to the crane, Everett Tree Service typically has, on-site, a dump truck, chipper, chip van, and a Bob Cat (helpful for moving logs on-site). A stump grinder is also available on an as-needed basis. The total value of Everett’s job-site equipment is over ½ million dollars.

Everett Tree Service firm also is an official fuel provider for Warmth for Wake, a program coordinated by the Wake County Human Services and the North Carolina Bankers Association that provides fuel (firewood) to families in need. Between October and March, Warmth for Wake provides wood for low income residents to heat their homes during these cold months. Everett not only provides wood for this program but donates equipment, location and volunteers to this effort.

For more information on Everett Tree Service, see <http://www.everetttreeservice.com/>.



NeighborWoods and the City of Oaks

City of Oaks – Legacy challenges and opportunities.

The City of Raleigh was called “City of Oaks” early in its founding as a recognition of the abundant trees, including laurel oak that grow in the region. The city’s founders dedicated themselves to maintaining parks and woodlands in the region. City staff and planners have continued this effort through the present day. The NeighborWoods program is a current initiative that reflects the City of Oaks legacy. Throughout the assessment process there was frequent mention of Raleigh’s NeighborWoods program. Given the high level of interest in this program and its connection to the City’s history, it is worth summarizing the activities and impact it is having.

In short, NeighborWoods is a tree planting program in the City of Raleigh. It is the method by which trees are planted on public rights of way in Raleigh and added to the urban forest of the community. Tree planting activities through NeighborWoods began in 2004, and nearly 15,000

trees have been planted through the program in the past decade. A goal of the program is to maintain and renew the trees in the “City of Oaks”.

The program provides free trees for citizens to plant in the easement in front of their homes. The city inspects the right-of-way to ensure that there is enough room for a tree. Staff place a flag to mark the suitable planting spot. Homeowners can choose between appropriate tree species and make their request by mail. The select tree is delivered to the home during the planting season (between October and March). The homeowner must commit to planting the tree and also watering it for at least the first two years. The city will help maintain the tree through pruning activities.

The program is voluntary. Citizens can go online or call or email the city to request a tree. Individuals and organizations can also make donations to support purchasing trees (all donations are used exclusively to purchase trees and donations are tax deductible). The program is funded by the City and in partnership with contributing citizens and organizations. Funding for NeighborWoods includes revenues from urban wood utilization. A majority of the logs received at the City’s solid waste site are sold to firewood businesses; the profit from firewood sales is used to buy trees for the NeighborWoods program (\$30,000-40,000 per year goes to this program). Large logs (saw logs) are sold to firms like American Woodyards (see earlier description); recently, the sale of saw logs totaled approximately \$10,000 per year. The city is interested in selling more “large trees” in the future; this would directly result in more money available for tree planting through the NeighborWoods program.

The NeighborWoods program has been part of the City’s response to specific events, including replanting after tornados in 2011 that damaged a number of the trees. In response, areas of the city that were impacted by the tornadoes were targeted for tree planting activities through the NeighborWoods program.

An annual report is prepared to summarize the yearly accomplishments of the NeighborWoods program. The report includes information about annual tree deliveries, total tree deliveries since the program started, the number of tree species offered, tree survival rates, donations and special accomplishments. The report also provides an estimate of the benefits derived from the trees planted through the program. Using the National Tree Benefit Calculator available through Casey Trees and Davey Tree Expert Co., the program has provided nearly \$1 million total cost savings associated with reductions in storm water management, improved air quality, reduced energy costs, increased property values, and carbon storage.

By many measures – number of trees planted, citizen feedback, cost savings – the NeighborWoods program is successful. The program is realizing the goals of maintaining and renewing the trees of Raleigh. However, the program faces some challenges going forward. Perhaps most noteworthy is the challenge of tree maintenance. As the program plants more trees, this increases the work load for pruning and maintenance activities. Changes have been made to ensure pruning and maintenance are occurring so that the trees do not become a nuisance or liability to the homeowner or city and the reputation of the program is not harmed. To address this challenge, the program has piloted the alternatives of “offering/planting years” and “maintenance years”

(e.g. in some years new trees will be offered and planted while in other years maintenance work will be conducted without any new trees being planted that season). This approach will be evaluated after a few cycles to determine effectiveness. Given the demand for the program, there may be a need to evaluate if staff, contracting and funding could be increased to meet the growing needs of the program. Related to this challenge, is the issue of program funding (including the sale of city logs) and reliance on donations. More effort may be needed to market the program, solicit donations, and seek sponsorships if this funding model is to continue.

References

- Alig, R., Stewart, S., Wear, D., Stein, S., and Nowak, D. 2010. Conversions of Forest Land: Trends, Determinants, Projections, and Policy Considerations. In Pye et al., eds. Advances in threat assessment and their application to forest and rangeland management. Gen. Tech. Rpt. PNW-GTR-802. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest and Southern Research Stations: 26 pp. http://www.fs.fed.us/pnw/pubs/gtr802/Vol1/pnw_gtr802vol1_alig.pdf.
- Araman, P., Pryor, L., Lowles, D., and Buehlmann, U. 2006. Recycling Discarded Pallet Parts into "Green" Flooring in North Carolina. Presented at the SmallWood 2006 Conference, Richmond, Virginia, May 16-18.
- APWA. Undated. Urban Forestry Best Management Practices for Public Works Managers: Budgeting & Financing. Available at: <http://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-1.pdf>. Accessed January 23, 2014.
- Bardon, R. Undated. A National Perspective on Utilizing Municipal Trees. Presentation by North Carolina Cooperative Extension Service, North Carolina State University.
- Bragassa, L. 2013. Neighborwoods Annual Report 2012-2013. Parks and Recreation Department, Urban Forestry, Raleigh, NC. 11 pp.
- Bratkovich, S., Bowyer, J., Fernholz, K., and Lindburg, A. 2008. Urban Tree Utilization and Why It Matters. Dovetail Partners, Inc. January 23. (<http://dovetailinc.org/files/DovetailUrban0108ig.pdf>).
- Buehlmann, U. Undated. Alternative Markets: Working Examples in North Carolina. Presentation.
- Buehlmann, U., and Kincaid, J. 2001. Markets for Scrap Wood in the Triangle J Region. Report from Triangle J Council of Governments, Research Triangle Park NC, and North Carolina State University, Wood Products Extension, Raleigh, NC. Available at: <http://infohouse.p2ric.org/ref/50/49410.pdf>. Last accessed on January 23, 2014.
- Buehlmann, U. 2002. Alternative Markets: Possibilities From Across the Country. Presentation at North Carolina State Video Teleconference Series, Raleigh, NC. March 13.
- Buehlmann, U., and Murphy, R. 2002. Availability of Wood Residuals for North Carolina. North Carolina State University. Wood Products Department. December 13, 2002. 23 pp.
- Buehlmann, U. 2003a. Greening Your Facility and Your Bottom Line: Strategies for Managing Wood Waste and Pallets. Presentation in Raleigh, NC. March 12.
- Buehlmann, U. 2003b. Availability of Wood Residuals for Boiler Fuel in North Carolina. Presentation at Forest Products Society annual meeting, Bellevue, WA. June 24.

Buehlmann, U. 2003c. Wood Biomass from Industrial Operations. Presentation at North Carolina Biomass Resource Conference, Raleigh, NC. October 20.

Buehlmann, U., and Fluharty, T. 2004. NC Pallet Recycling Survey Report 2004. North Carolina State University, Wood Products Program, Raleigh, NC. May 17. 23 pp.

Bush, R. and Araman, P. 2010. Report Shows Fewer Pallets Entering Landfills. *Pallet Enterprise* 30(1):71.

City of Raleigh. 1991. Policies and Standards Governing Activities Which Impact City Trees. Parks and Recreation Department, Urban Forestry. February 19. 80 pp.

City of Raleigh. 1999. Raleigh City Code Chapter 8 – Trees and Vegetation. Sections 9-8001 to 9-8014.

City of Raleigh. 2012. (Draft) City Tree Manual. (Companion to Municipal Code). Parks and Recreation Department, Urban Forestry. 65 pp.

City of Raleigh. 2013. Yard Waste Recycling Center. Available at: <http://www.raleighnc.gov/environment/content/SolidWaste/Articles/YardWasteRecyclingCen.html>. Accessed January 24, 2014.

Dennings, K. 2014. Personal communications. February 10.

Duke Energy. 2014. Biopower. <http://www.duke-energy.com/environment/biopower.asp>. Accessed on January 24, 2014.

Duncan, D. 2013. Personal communication. October 15.

Fratanduono, M., Steelman, T., Peterson, M., McHale, M., and Fratanduono, D. 2013. Barriers to Utilization of Municipal Biomass Residues for Bioenergy. *Journal of Extension (April)*, 51(2). Available at: www.joe.org/joe/2013april/a10.php. Accessed December 2, 2014.

Heinen, K., Lawler, M., McHale, M., and Peterson, M. 2012. Urban Wood Waste: A Guide to Managing Your Community's Resource. North Carolina Cooperative Extension Service. 8 pp. Available (under community forestry tab) at: <http://www.ces.ncsu.edu/forestry/pdf/ag/ag767w.pdf>. Accessed February 4, 2015.

Howe, Jeff. 2008. Creating Collaboration out of Chaos: Using Conflict Resolution Processes to Bring Diverse Groups Together. Dovetail Partners. 26 February 2008. www.dovetailinc.org

- Kay, A. 2013. Financing Urban Forestry. University of North Carolina, Environmental Finance. Available at: <http://efc.web.unc.edu/2013/08/09/financing-urban-forestry/>. Accessed January 23, 2014.
- Kish, J. 2013. Personal communication (Bartlett Tree Experts, 5808 Triangle Drive, Raleigh, NC, 27617). October 15, <http://www.bartlett.com/locations/Raleigh-NC.cfm> (accessed October 19, 2013).
- Lawler, M. 2011. Assessing Potential for Municipal Biomass Residue for Renewable Energy. M.S. Thesis, North Carolina State University. Available at: <http://repository.lib.ncsu.edu/ir/bitstream/1840.16/7125/1/etd.pdf>. Accessed January 23, 2014.
- Lawler, M., Peterson, N., and McHale, M. 2011. Using Wood Wastes to Maximize Urban and Community Forest Resources. Funding provided by North Carolina DENR Division of Forestry, Urban and Community Forestry Program.
- Lynch, R. 2013. Personal communication (LynchCo, LLC, 2606 Ablemarle Ave., Raleigh, NC, 27610); October 15; <http://www.lynchconc.com/home.html> (accessed October 19, 2013).
- MacFarlane, D. W. 2009. Potential availability of urban wood biomass in Michigan: Implications for energy production, carbon sequestration and sustainable forest management in the U.S.A. *Biomass Bioenergy*, 33, 628-634. doi: 10.1016/j.biombioe.2008.10.004.
- MacFarlane, D. W. 2007. Quantifying urban saw timber abundance and quality in southeastern Lower Michigan, U. S. *Arboriculture and Urban Forestry*, 33(4):253-263. Accessed April 23, 2015 at: <http://auf.isa-arbor.com/articles.asp?JournalID=1&VolumeID=33&IssueID=4>.
- Mcauliffe, B. 2013. New Levy to Pay for \$9 Million Ash Tree Removal in Minneapolis. *Star Tribune*, December 10. Available at: <http://www.startribune.com/local/minneapolis/235329791.html?page=1&c=y>. Accessed January 24, 2014.
- McMains, D. 2013. Personal communication (J&D Tree Pros, Apex, NC): October 15; <http://jdtreepros.com/> (accessed October 19, 2013).
- Mouw, S. 2015. Personal communication. February 6.
- Mouw, S. 2014. Personal communication. February 3.
- Mouw, S. Undated-a. Disposal of Municipal Trees. Presentation. NC Division of Pollution Prevention and Environmental Assistance.

Mouw, S. Undated-b. History and Effects of North Carolina Material Disposal Bans. NC Division of Environmental Assistance and Outreach. Available at: <http://recyclingorganizations.org/webinars/Scott%20Mouw-RONA-Effects-of-NC-Disposal-Bans.pdf>. Accessed January 21, 2014.

Mouw, S. 2012. Recycling in North Carolina – 2012 State of the State. Presentation at SWANA meeting. Available at: <http://www.ncswana.org/files/2012%20Spring%20Presentations/Mouw%20-%20SWANA%202012%20State%20of%20the%20State%20%5BCompatibility%20Mode%5D.pdf>. Accessed January 21, 2014.

Mouw, S., and Buehlmann, U. 2003. Estimate of Available Wood Wastes in North Carolina in 2002. Report from North Carolina Division of Pollution Prevention and Environmental Assistance and North Carolina State University, Department of Wood and Paper Science, Raleigh, NC. February 28. 7 pp.

North Carolina State University Extension Forestry. 2012. Wood to Energy II: Promoting BioEnergy in Your Neck of the Woods. College of Natural Resources, North Carolina State University. Raleigh. Seminar/Workshop. March 6.

Nowak, D., and Walton, J. 2005. Projected Urban Growth (2000 – 2050) and Its Estimated Impact on the U.S. Forest Resource. *Journal of Forestry*, 103(8):383-389. http://www.fs.fed.us/ne/newtown_square/publications/other_publishers/OCR/ne_2005_nowak01.pdf.

Nowak, D., Noble, M., Sisinni, S., and Dwyer, J. 2001. Assessing the U.S. Urban Forest Resource. *Journal of Forestry*, 99(3):37-42.

Rich, B. 2008. The North Carolina Biomass Roundmap: Recommendations for Fossil Fuel Displacement through Biomass Utilization. College of Agriculture and Life Sciences, NC Cooperative Extension, Extension Forestry. WB0002. 5 pp.

Sherrill, S. 2003. *Harvesting Urban Timber*. Linden Publishing, Fresno, CA. 224 pp.

State of North Carolina. Undated. North Carolina Solid Waste and Materials Management Annual Report FY 2010-2011. 99 pp. Available at: <http://digital.ncdcr.gov/cdm/ref/collection/p249901coll22/id/285573>. Accessed January 23, 2014.

Stockton, William S. *The Mobius Model: A Guide for Developing Effective Relationships in Groups, Teams and Organizations*. Demarest, Ph.D. Herdes, Stockton, Ph.D. and Stockton, Ph.D. <http://www.mobiusmodel.com/>

Terando, A., Costanza, J., Belyea, C., Dunn, R., McKerrow, A., and Collazo, J. 2014. The Southern Megalopolis: Using the Past to Predict the Future of Urban Sprawl in the Southeast U.S. PLoS ONE 9(7): e102261. doi:10.1371/journal.pone.0102261. Available at: <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0102261>.

Winn, M., Lee, S., and Araman, P. 2007. Urban Tree Crown Health Assessment System: A Tool for Communities and Citizen Foresters. Proceedings, Emerging Issues Along Urban-Rural Interfaces II: Linking Land-Use Science and Society. 180-183. Available at: <http://www.treesearch.fs.fed.us/pubs/29359>.

Appendix 1. Issues and Interventions for Raleigh, NC, pertaining to Urban Tree Utilization

<u>ISSUE (Barrier)</u> ³⁰	<u>INTERVENTION (Strategy)</u>
<p>1.</p> <ul style="list-style-type: none"> -Lack of space to store/drop trees -Lack of time/logistics problems -Small quantities of logs -Where to take tree-take downs? -City strategy is to quickly remove waste 	<p>Develop more log yards in Triangle Area</p> <p>(The “above” plus Intervention #3)</p>
<p>2.</p> <ul style="list-style-type: none"> -Lack of markets/demand -Incorrect mindset -economics (profitability of urban tree use) 	<p>Public awareness/education/ & niche markets/successful business examples</p>
<p>3.</p> <ul style="list-style-type: none"> -Stakeholders not talking with each other -Stakeholders have different objectives -Landfill loopholes -Communities don’t work together 	<p>Regular meeting of stakeholders</p>
<p>4.</p> <ul style="list-style-type: none"> -Whom to contact for milling, drying, etc. -Where are users of urban trees? -Can mills come to site to saw take-downs? 	<p>Develop directory of small mills, loggers, etc</p>
<p>5.</p> <ul style="list-style-type: none"> -Building codes (hard to use local lumber legally) 	<p>Adopt and/or adapt Wisconsin model</p>
<p>6.</p> <ul style="list-style-type: none"> -Getting trees on the ground 	<p>Game of Logging training</p>
<p>7.</p> <ul style="list-style-type: none"> -Lack of public awareness -Lack of education 	<p>Tie into recycling campaign/promote urban tree utilization via universities, cities, etc.</p>

³⁰ The issues were identified via interviews and conversations with various urban tree utilization stakeholders. The intervention strategies are recommendations by Dovetail Partners.

Appendix 2. Internal Survey

Thank you for taking time to provide feedback to this Urban Forestry Assessment. This assessment includes two parts: 1) 5 questions that address the Strengths, Weaknesses, Opportunities, and Threats related to the city's urban forestry programs; and 2) 10 questions that relate to specific management topics such as legal compliance, management planning, and community benefits.

The questionnaire may take up to 30 minutes to complete. If you would prefer to receive the questions in another format or if you would like to provide input via a phone interview, please contact Dovetail Partners at 612-333-0430 or info@dovetailinc.org

Q1: What do you think are the greatest STRENGTHS of the city's urban forestry programs? (e.g., what is working well, what are you most appreciative of, what would you like to see continue?)

Q2: What do you think are the greatest WEAKNESSES of the city's urban forestry programs? (e.g., what is NOT working well, what would you most like to see changed?)

Q3: What do you think are the greatest OPPORTUNITIES for the city's urban forestry programs? (e.g., what should be done to support success?)

Q4: What do you think are the greatest THREATS to the city's urban forestry programs? (e.g., what current or emerging issues need to be addressed?)

Q5: If you could do ONE BIG THING to improve the city's urban forestry programs, what would it be?

Tree Planting

Q6: Please indicate the degree to which you agree or disagree with the following statements.

The city's urban forestry programs have effective planting and replanting efforts.

The city's urban forestry programs utilize appropriate nursery stock in their planting programs.

The city's urban forestry programs track and report tree planting activities within their lands and operations.

Q7: Please provide any comments you have about the city's tree planting activities within its urban forestry programs.

Management Plan

Q8: Please indicate the degree to which you agree or disagree with the following statements.

The city has a quality management plan for its urban forestry programs.

The city has a quality tree inventory for its urban forestry programs.

The city has a quality GIS system (i.e., digital mapping and data management) for its urban forestry programs.

The city's management plan for its urban forestry programs is available to the public.

Q9: Please provide any comments you have about the city's management plan for its urban forestry programs.

Forest Benefits, Products and Services

Q10: Please indicate the degree to which you agree or disagree with the following statements.

The city's urban forestry programs effectively address a full range of forest benefits (e.g., social, environmental, economic).

The city's urban forestry programs effectively support social benefits of forests, including aesthetics, green space, outdoor recreation, etc.

The city's urban forestry programs effectively support environmental benefits of forests, including stormwater management, shading and cooling, wildlife, air quality, etc.

The city's urban forestry programs effectively support economic benefits of forests, including wood utilization for products or energy generation, food production, job creation, etc.

Agree

Q11: Please provide any comments you have about the city's effective management and development of the full range of forest products, benefits, and services related to its urban forestry programs.

Community Engagement

Q12: Please indicate the degree to which you agree or disagree with the following statements.

The city has effective partnerships with community groups and organizations to support their urban forestry programs.

The city has effective citizen engagement tools to support their urban forestry programs (e.g., public meetings, citizen advisory group, etc)

The city has effective public education and information sharing systems to support their urban forestry programs (e.g., website, notices, newsletters, etc)

The city provides quality employment opportunities related to urban forestry programs.

The city provides quality contracting opportunities related to urban forestry programs.

The city maintains safe and responsible working conditions for employees and contractors related to its urban forestry programs.

Q13: Please provide any comments you have about the city's community engagement related to its urban forestry programs.

Historic Sites and Resources

Q14: Please indicate the degree to which you agree or disagree with the following statements.

The city has identified important archaeological resources or historic sites related to its urban forestry programs.

The city has effectively protected important archaeological resources or historic sites related to its urban forestry programs.

Q15: Please provide any comments you have about the city's identification and protection of historic sites and resources related to its urban forestry programs.

High-Conservation Value Forests

Q16: Please indicate the degree to which you agree or disagree with the following statements.

The city's urban forestry programs have identified "high-conservation value forests" (e.g., individual trees or forest areas that provide unique and high-value conservation benefits such as protecting vulnerable sites, habitats, resources, etc).

The city's urban forestry programs have effectively protected "high-conservation value forests" within their lands and operations.

Q17: Please provide any comments you have about the city's identification and protection of high- conservation value forests within its urban forestry programs.

Environmental Impact

Q18: Please indicate the degree to which you agree or disagree with the following statements.

The city's urban forestry programs work in harmony with the natural ecology of the region.

The city's urban forestry programs emphasize the use of native tree and plant species.

The city's urban forestry programs support local native wildlife populations.

The city's urban forestry programs address water pollution or soil erosion concerns.

The city's urban forestry programs avoid or minimize their use of pesticides and fertilizers.

Q19: Please provide any comments you have about the environmental impacts of the city's urban forestry programs.

Monitoring and Assessment

Q20: Please indicate the degree to which you agree or disagree with the following statements.

The city periodically reviews and updates its management plan for its urban forestry program.

The city's urban forestry programs include systems for monitoring tree health and mortality.

The city's urban forestry programs are informed by emerging forest science and new information (e.g., insect and disease threats, tree care techniques, etc).

The city's urban forestry programs incorporate information from stakeholders and community partners to support adaptive management.

Q21: Please provide any comments you have about the city's effective use of forest monitoring and assessment related to its urban forestry programs.

Demographic Information

Q22: What is your gender?

Q23: What is your age?

Q24: Do you work in forestry, forest products, or a related natural resource field?

Q25: What is your relationship with the city's urban forestry programs? (Select all that apply)

Current or past city staff or employee

Current or past city contractor

Member of Citizen advisory group

City resident

Business owner

Elected official

Other (please specify)

Q26: Do you have any other comments that you would like to share?

Appendix 3. External Survey

Thank you for taking time to provide feedback to this Urban Forestry Assessment. This assessment includes 5 questions that address the Strengths, Weaknesses, Opportunities, and Threats related to the city's urban forestry programs.

The questionnaire may take up to 15 minutes to complete. If you would prefer to receive the questions in another format or if you would like to provide input via a phone interview, please contact Dovetail Partners at 612-333-0430 or info@dovetailinc.org

Q1: What do you think are the greatest STRENGTHS of the city's urban forestry programs? (e.g., what is working well, what are you most appreciative of, what would you like to see continue?)

Q2: What do you think are the greatest WEAKNESSES of the city's urban forestry programs? (e.g., what is NOT working well, what would you most like to see changed?)

Q3: What do you think are the greatest OPPORTUNITIES for the city's urban forestry programs? (e.g., what should be done to support success?)

Q4: What do you think are the greatest THREATS to the city's urban forestry programs? (e.g., what current or emerging issues need to be addressed?)

Q5: If you could do ONE BIG THING to improve the city's urban forestry programs, what would it be?

Demographic Information

Q22: What is your gender?

Q23: What is your age?

Q24: Do you work in forestry, forest products, or a related natural resource field?

Q25: What is your relationship with the city's urban forestry programs? (Select all that apply)

Current or past city staff or employee

Current or past city contractor

Member of Citizen advisory group

City resident

Business owner

Elected official

Other (please specify)

Raleigh, North Carolina: An Assessment of Municipal Tree Utilization and the Urban Forestry Program

Report prepared by:

S. Bratkovich, K. Fernholz

Dovetail Partners, 528 Hennepin Ave, Suite 703

Minneapolis, MN 55403

www.dovetailinc.org

Project completed with support from North Carolina Urban and Community Forestry Grant Program

July 2015