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TREE INVENTORY SYSTEMS AND USE IN THE UNITED STATES

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Introduction

The objective of a public tree inventory is many fold. It ideally provides information that is useful to better manage urban tree populations. In the case of tree growth and longevity, knowing what you have and comparing changes over time provides urban foresters with valuable information on what trees do best in public tree planting locations (Figure 1). By example, a street tree inventory initially conducted in Milwaukee WI in 1979 paved the way to study how construction around trees affected tree growth and longevity (Hauer et al, 1994; Koeser et al. 2013). Without the initial inventory, the study would not have been possible.

Figure 1. Tree inventory systems provide important information on the growth and survival of trees in public spaces.

The use of tree inventories has a historical basis that goes back to at least the late 1800's in the United States (Miller et al. 2015.) Initial data collections likely included information about tree size, species, condition, tree planting locations, and other attributes that were used to guide decision-making. These paper inventory systems have advanced into computer based database systems, Geographical Information Systems (GIS) and spatially locating trees through Global Positioning Systems (GPS). This article details baseline tree inventory systems, the current state and use of tree inventories in the United States, and tree canopy use and goals. Findings reported throughout are adapted from Hauer and Peterson (2016) which also provides the methods behind the study design.

Tree Inventory Systems

Within the United States, approximately two-thirds of people live in a community that has some level of a tree inventory (Figure 2). Tree inventories were uncommon in small communities and become common as community size increased. This does not mean every public tree is inventoried as the study considered an inventory to be any type of record about public trees such as trees in one park location, along streets, or all maintained locations. Approximately 80 percent of the inventories were computerized (Figure 3). Forty-one percent indicated the inventory was current and 30% were in the process of developing or making the inventory current. The rest responded it was not current.

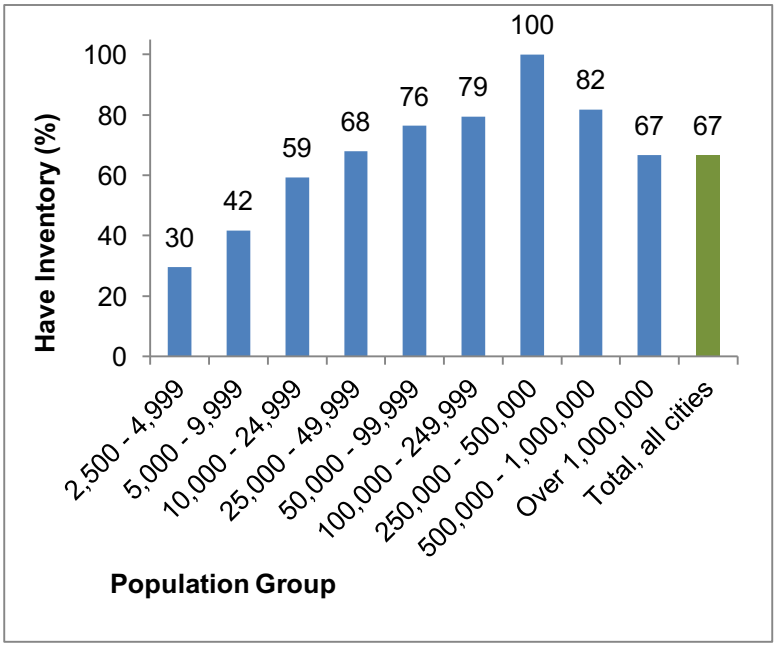

Figure 2. The use of a public tree inventory in communities in the United States. (An inventory is any type of record of public trees in your community, n=656)

How often an inventory is updated will vary from never to daily (as work is completed). The respondents (n=424) reported updating frequency was:

- No or never updated (18%),
- Periodically reinventory (17%),
- Update after work completed daily/weekly (27%),
- Update after work completed less often than weekly (8%),
- Updating for plantings/removals only (15%), or
- Other reasons to update (14%).

On average an inventory was first completed in 2001, it was last updated in 2011, and it has been 2.7 (0.33 SEM) years since the last update. The earliest reported date for when an inventory was first completed was 1868 followed by 1912, 1932, 1962, and 1969. These five inventories were all updated within the last five years.

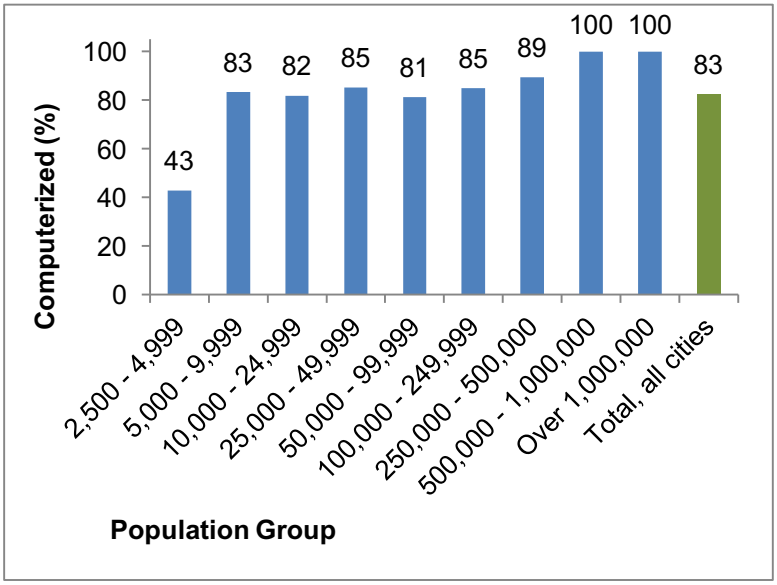

Figure 3. Frequency of computerized tree inventories. (n=355)

The locations included in a tree inventory and the methods used to collect data is dependent on the area of interest and management questions that need to be answered. Common inventory areas include streets, parks, private land, and other municipal properties. Street tree inventories were most common at 93% of

respondents who have an inventory (Figure 4). Of all places, 62% of respondents would then have a street tree inventory since two-thirds of places indicated they have a tree inventory. Park tree inventories were the next most common type with 45% of all respondents having one. Information on municipal green belts and other municipal properties exists for approximately one-quarter of all respondents. A sample inventory of private trees occurred in 4% of responding places.

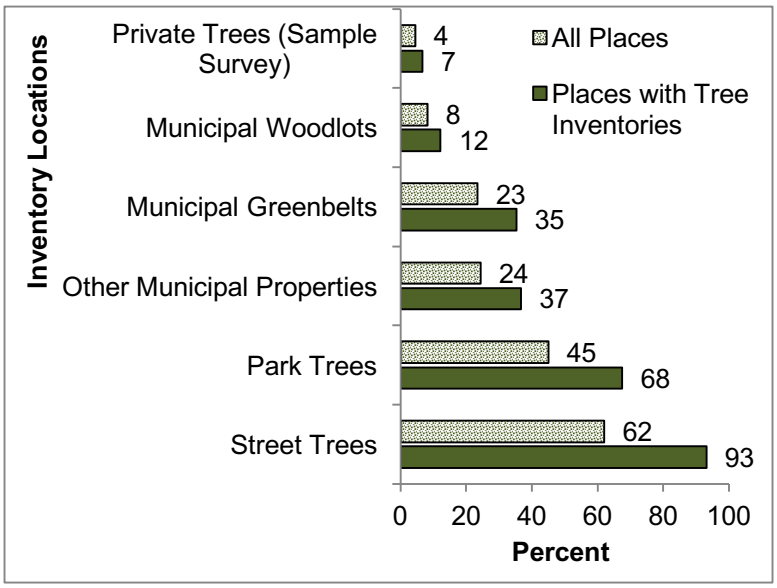

Figure 4. Areas that a tree inventory includes. (n=434)

The type of inventory collection system and analysis tool varied, and some places used several systems. Communities used i-Tree as a tool with 25% of places with inventories using the i-Tree Streets program and 8% conducting an i-Tree Eco analysis (Figure 5). A complete (100%) tree inventory was most commonly conducted with 55% of inventories done this way. A windshield survey was used by 40%. Remote sensing (23%) and canopy cover analysis (21%) were done by nearly one-quarter of communities that conduct tree inventories.

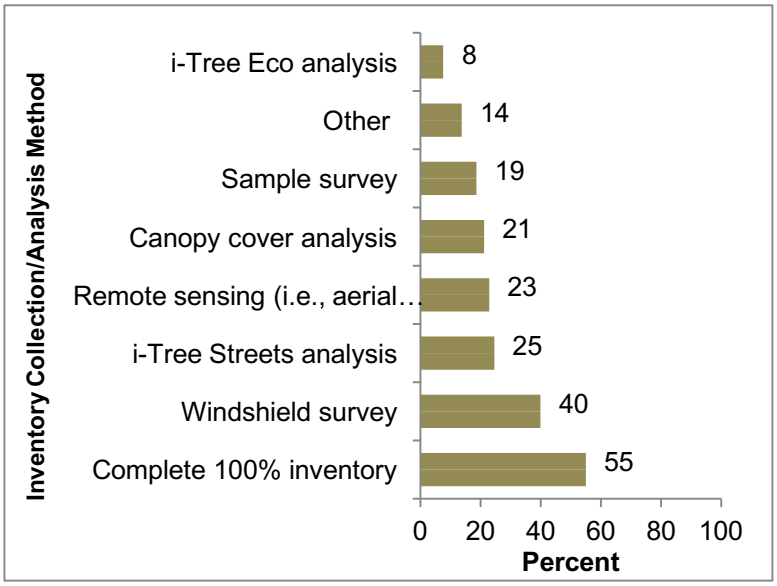

Figure 5. Inventory collection types and analysis methods used to describe your community tree population. (n=408)

Linking tree information to a spatial location is important for locating the tree. The most commonly used systems were GPS/GIS (72%) and street addresses (70%). Linking data to a city parcel (36%) was less commonly used. No difference was found by population size group for data associated by street address. However, linking of GPS/GIS data and city parcel information is technically more challenging and used less frequently in smaller locations. Associating data with other infrastructure data layers occurred in 45% of places. Larger communities were more likely to do such. Some state urban forestry programs have initiated a regional and statewide tree inventory database. Nearly 10% of respondents reported that part of their data is linked to a regional or statewide database. Likewise, private urban forestry consulting firms have developed remote-based tree inventory storage which might be part of a respondent affirming they use a regional or statewide system.

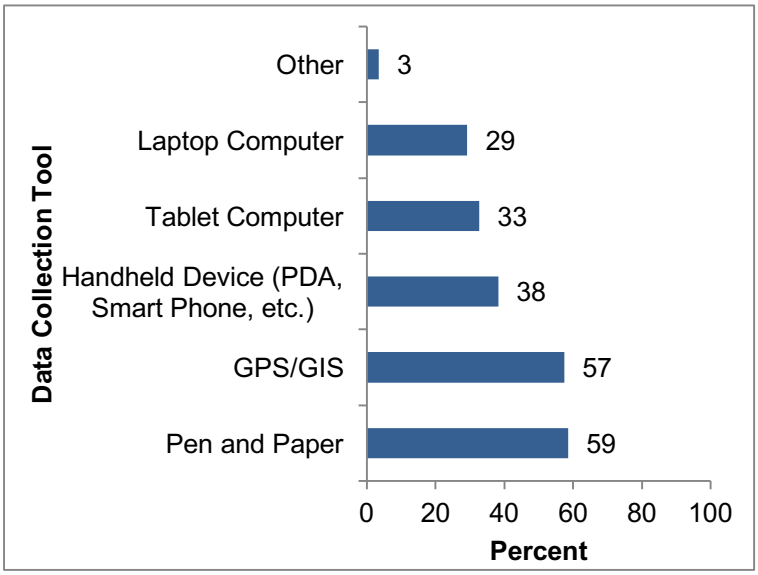

Figure 6. The frequency of collection tools that are used to gather tree inventory data. (n=345)

Tree inventory data is collected with tools ranging from pen and paper to electronic devices such as field computers and GPS receivers. More than one tool is typically used by a community (Figure 6). Interestingly, pen and paper is a common tool used to collect data with 59% of respondents expressing they use this method. The use of GPS/GIS technologies is a close second (57%). A variety of field-based computers including laptops (29%), tablet computers (33%), and handheld devices (38%) are used.

The approaches for data collection varied by population group (Figure 7). As population increased, the regularity that respondents indicated they used a computerized device increased. Pen and paper declined in use and then increased in use as a method. This may be explained by small and large communities still relying on paper based systems for some data collection and reporting.

Tree inventories are completed by people ranging from municipal staff, hired consultants, interns, state Urban and Community Forestry (U&CF) staff, and volunteers. A community may use none, one, or more than one category of people to complete an inventory. Municipal staff were the most common source with 60% of respondents using this followed by 44% using consultants (Figure 8). Interns were used by 23% and 14% used volunteers. As population increased, the frequency of municipal staff, interns, and consultants increased (Figure 8). Volunteers

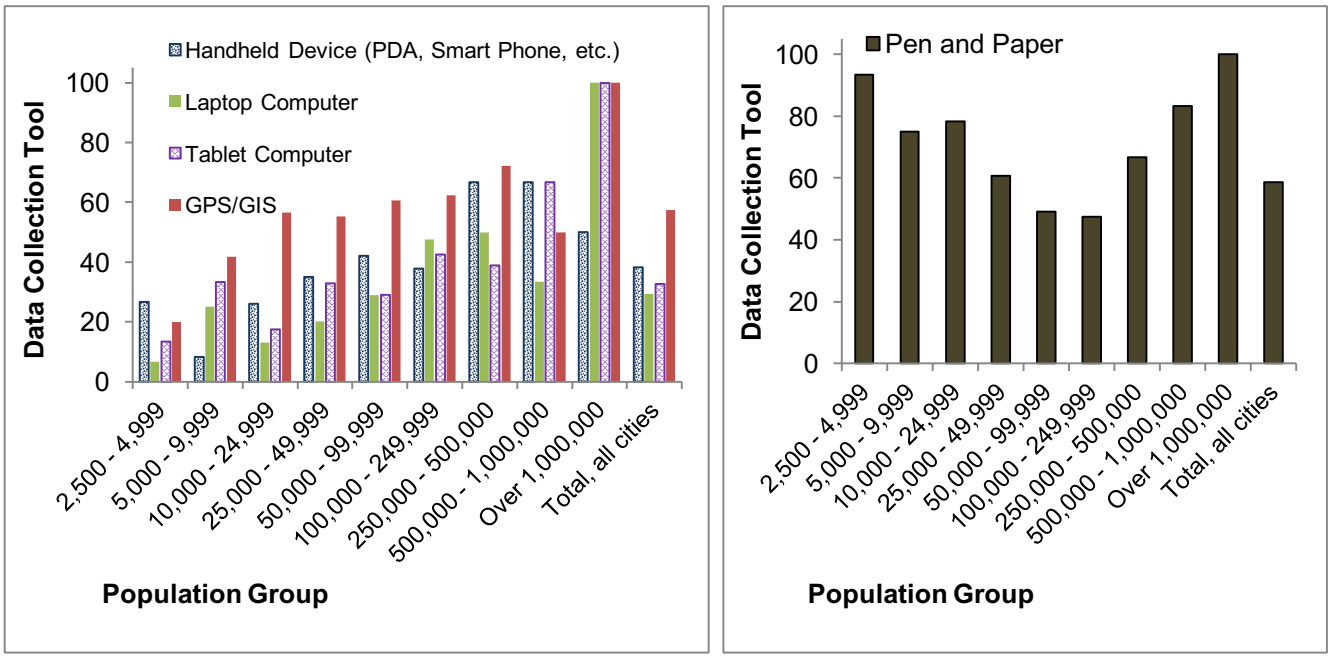

Figure 7. The variation in data collection tools as population changes. (n=345)

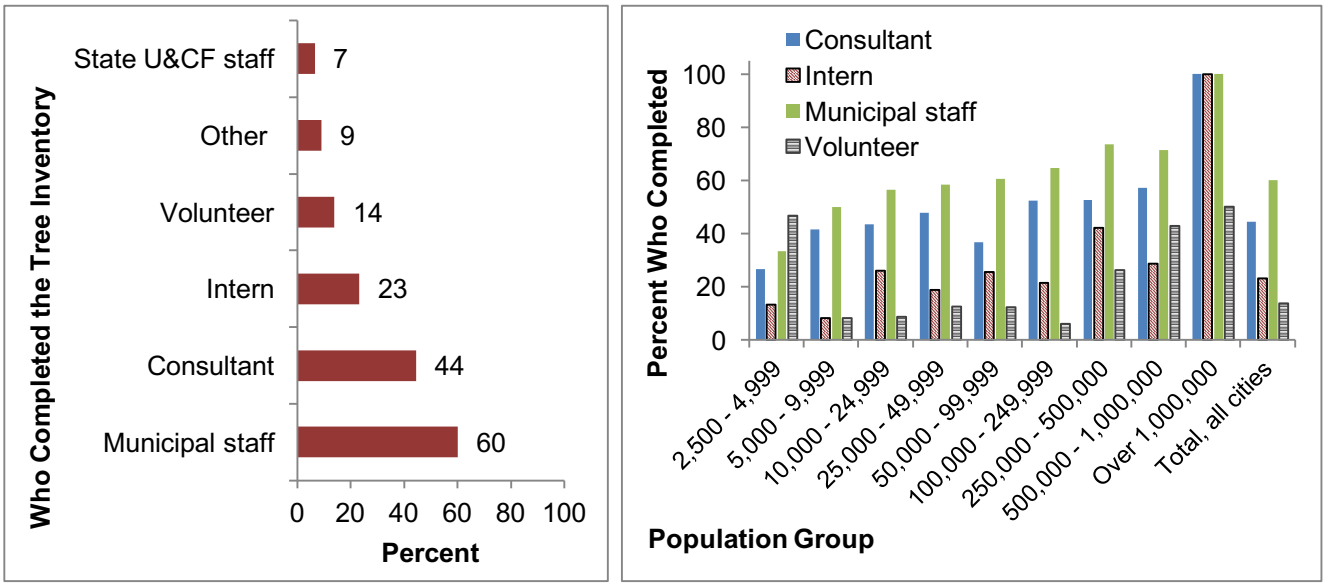

Figure 8. Sources of people who completed the tree inventory. (n=353)

were the most common approach in the smallest population group (< 5000 people) with 47% of places involving volunteers. Approximately 1 in 10 of places between 5000 and 250,000 people used volunteers. The use increased for places with 250,000 or more people with one-third using volunteers.

Tree Inventory Uses

Ideally before a tree inventory is conducted, the organizers should frame a series of questions that indicate the questions they wish to answer based on the inventory. For example, does a diverse mix of tree species exist? Do the majority of trees have a condition rating of good or better? How many dead trees occur along streets? How many tree planting sites exist? The data collected is determined by how to answer these questions. Most responding places collected information about the current tree population by identifying the tree species (98%), tree diameter (89%), and tree condition (88%) (Figure 9). Collecting data to answer management questions was common and included tree planting locations (77%) and tree removal (70%). Approximately half of respondents collected tree risk assessment (51%) information and documented insects and diseases (55%). Determining potential debris was uncommon with only 6% indicating they collect data that could be useful for disaster planning.

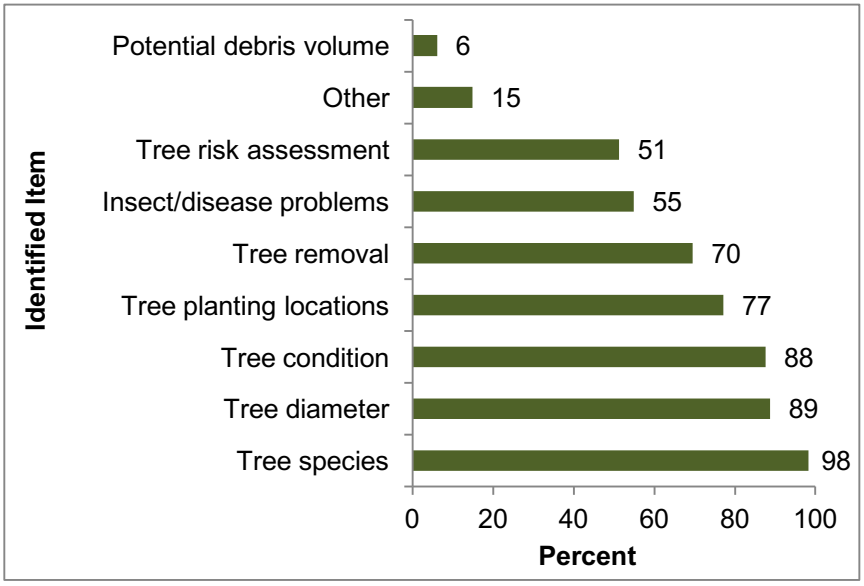

Figure 9. Identified attributes collected in a tree inventory. (n=355)

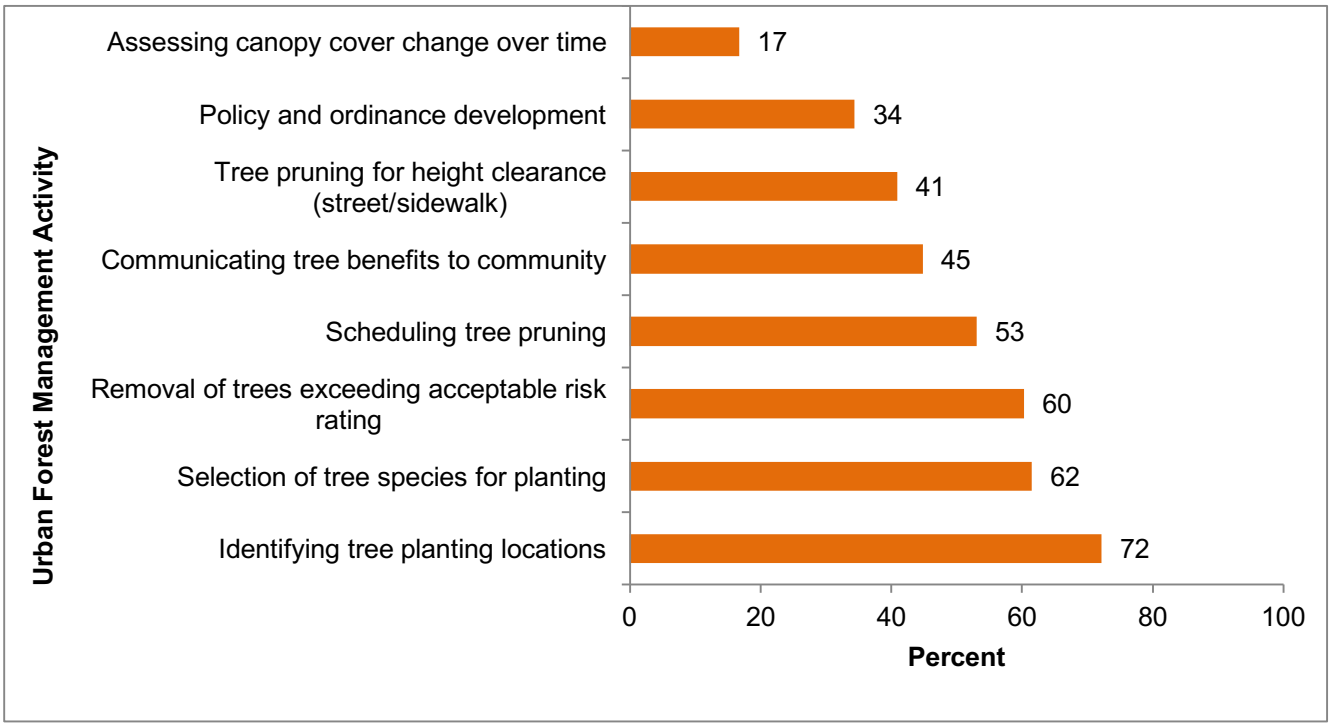

Figure 10. How tree inventories are used to direct urban forest management activities. (n=413)

Tree inventory data should be used to direct urban forest management and report information to the community. Collected tree data can be used to explain the current distribution of trees to a community and perhaps to illustrate current tree benefits. Fewer than half of respondents (45%) used tree inventories to communicate tree benefits. This was more common in places with 100,000 or more people with 60% of respondents using tree data to articulate urban forest benefits.

Using data to develop management approaches and then to evaluate future outcomes is equally important. Respondents were asked what activities are directed by tree inventory information. Identifying tree planting locations was the most common with 72% indicting this (Figure 10). Tree selection (62%), tree removal (60%), and scheduling tree pruning (53%) were also common. Collecting data for tree pruning clearance along streets was less common (41%), possibly explained by the fact that height clearance is often part of scheduled work and/or crews are dispatched to correct clearance issues as encountered. Only one-third use tree inventories to address tree policy and ordinance development. Few respondents (17%) currently track tree canopy change through tree inventories. The frequency increased with the size of the community. Although different than a traditional tree inventory, tree canopy assessments are becoming more common and when coupled with traditional tree inventories, may be used to track tree population and canopy change.

Tree Canopy Goals

Tree canopy cover is the urban forest that occurs on public and private land (Figure 11). Tree canopy assessments are used to quantify how much land area is covered by trees. Tree canopy cover is a metric that can be monitored over time to determine if communities have met tree canopy goals.

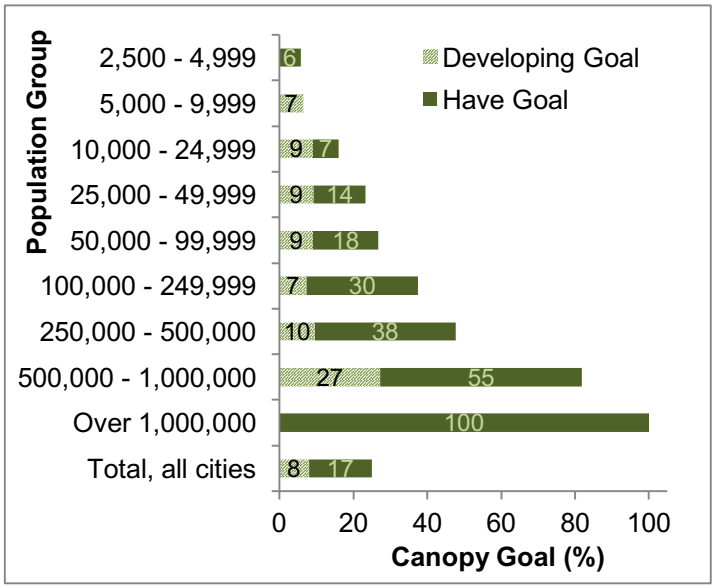

Figure 11. The current status of a municipal tree canopy goal in the United States. (n=629)

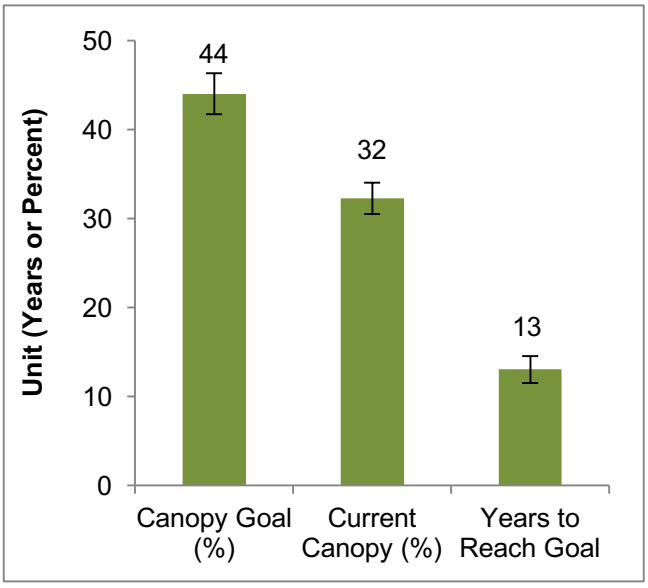

Figure 12. Municipal tree canopy goals. (Canopy Goal n=85, Current Canopy n=87, Years to Reach Goal n=46)

Currently 25% of respondents indicated they either have a tree canopy goal (17%) or are developing (8%) one (Figure 11). The frequency increased strikingly as the population of a location increased. Less than 10% of communities below 25,000 people have a tree canopy goal. In contrast, over 80% of respondents from a city with 500,000 or more people have or are developing a tree canopy goal. The mean tree canopy coverage goal is 44% (2.3 SEM) (Figure 12). Currently the responding places have a 32% (1.8 SEM) tree canopy and have given themselves 13 years (1.5 SEM) on average to complete the goal.

A variety of methods were used to set the goal. No one approach was distinct as a common method. The most frequent response was selecting "other" to the question. The respondent then indicated that several of the choices they could select were used. Thus, for one-third of places with tree canopy goals, multiple approaches were used. Choices that respondents (n=90) selected include:

- Best educated guess (12%),
- Political process (mayor/council) developed goal (12%),
- Public opinion used to set goal (1%),
- Tree board/commission set goal (8%),
- American Forests established guidelines (14%),
- State U&CF program guideline (8%),
- Available budget to manage trees used to develop goal (4%),
- Potential maximum canopy in community (7%), or a combination as selected by
- Other (33%).

Conclusion

Tree inventory systems are an important part of managing urban tree populations. Many communities have historically planted, maintained, and removed trees without an inventory. However, inventory systems provide data to make informed decisions and to ideally assess which practices work best and to promote urban tree growth and longevity. This article provides the current state of municipal tree inventory systems in the United States.

Tree inventory systems are a vital part of managing urban tree populations. The reported baseline information provides urban forestry managers a source on the commonality of tree inventory systems in the United States. Tree inventories are becoming a common part of managing tree populations. They are further being used to drive decision making for urban tree management.

Write to us with any comments or questions!

Rich Hauer: rhauer@uwsp.edu

Literature Cited

Hauer RJ, Miller RW, Ouimet DM. 1994. Street tree decline and construction damage. *Journal of Arboriculture* 20:94-97.

Hauer RJ, Peterson WD. 2016. Municipal Tree Care and Management in the United States: A 2014 Urban & Community Forestry Census of Tree Activities. Special Publication 16-1, College of Natural Resources, University of Wisconsin – Stevens Point. 71 pp. http://www.uwsp.edu/cnr/Pages/Forestry---MTCUS.aspx

Koeser A, Hauer R, Norris K, Krouse R. 2013. Factors influencing long-term street tree survival in Milwaukee, WI, USA. *Urban Forestry & Urban Greening* 12:562-568. http://doi.org/10.1016/j.ufug.2013.05.006

Miller, R. W., R. J. Hauer, and L. P. Werner. 2015. Urban Forestry Planning and Managing Urban Greenspaces (3rd Edition). Waveland Press. Long Grove, IL. 560 pp.

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