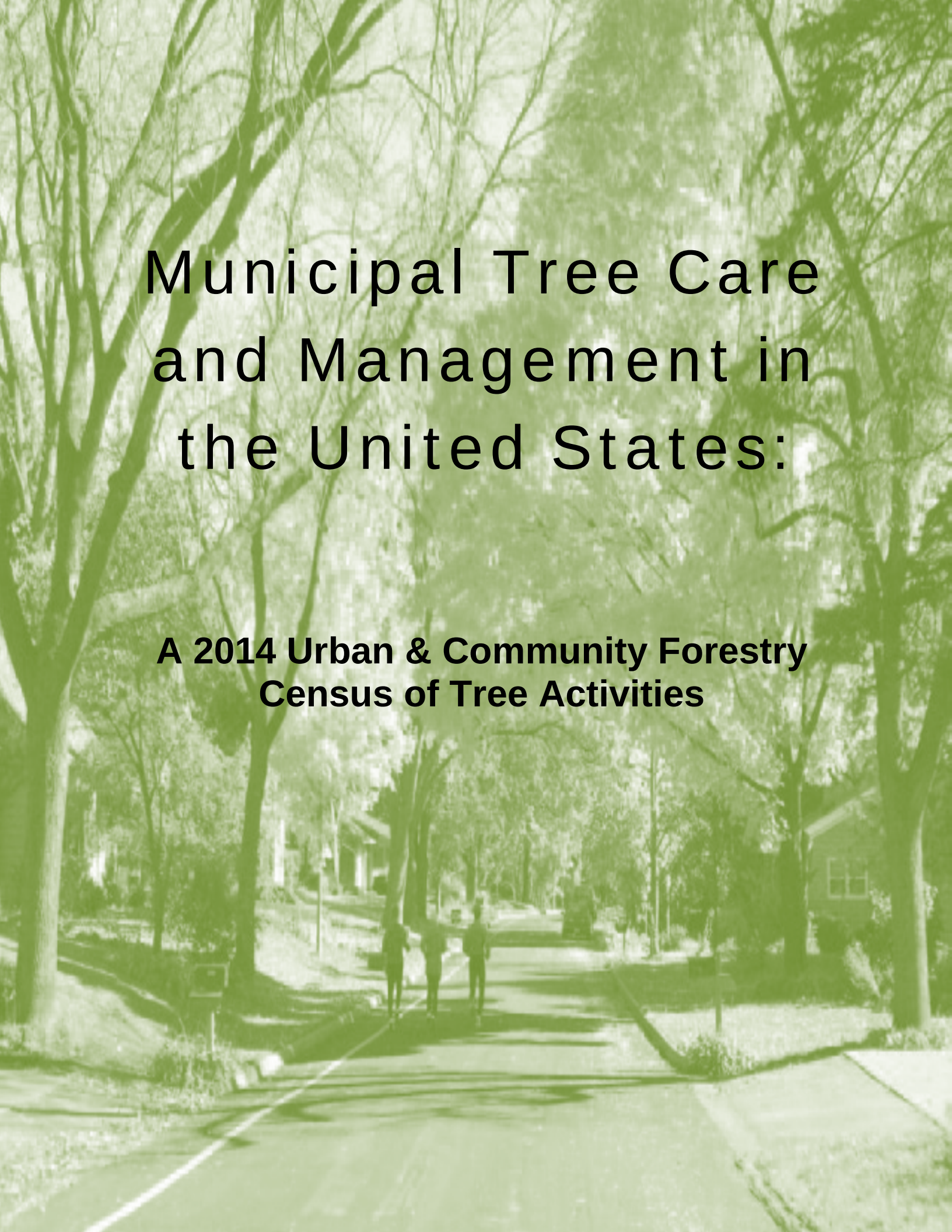

Municipal Tree Care and Management in the United States:

A 2014 Urban & Community Forestry Census of Tree Activities

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Table of Contents

Executive Summary

Trees are a recognized and significant asset to communities. For community trees to remain an asset and to increase in value they need care and regular maintenance. *The Municipal Tree Care and Management in the United States: A 2014 Urban & Community Forestry Census of Tree Activities* is the fifth report over 40 years that addresses the many approaches communities take to manage public trees. It has been over 20 years since the last rendition in 1993. We are grateful to the 667 communities that provided data for this project.

This report shows how communities are managing their trees on average, and how their municipal urban forestry operations are organized and funded. Comparing a community's current configuration with national averages will give an idea of how they are doing, possibly ways to improve the urban forest, or even reduce costs. A companion publication will compare the recent findings with previous versions to see the ways that urban forestry is changing.

The results suggest that Municipal Urban Forestry is maturing and becoming a rooted part of community infrastructure. People that make their careers in urban forestry are more professional, paid better, use recognized standards of work and are more systematic in their management. Communities continue to diversify how programs get funded in addition to general funding monies. A variety of policy tactics and plans that include trees are used to manage the urban forest.

There are challenges also such as emerald ash borer affecting municipal budgets and the reallocation of money from maintenance to tree removal and replanting. Deferred tree maintenance will likely led to future tree structural issues. Some communities report challenges to adequately fund a program to identified needs. In some places the rate of tree removal exceeds tree planting, especially in places that currently have emerald ash borer. A lack of tree diversity is also common in many locations. However, identifying challenges provide a baseline to improve upon.

The report includes communities with populations from 2,500 to more than one million people across the entire United States. It provides results organized by the entire country, community population and geographic regions. The report and data are extensive and can be overwhelming. To help navigate to a section that you might find important, the Table of Contents is organized and is hyperlinked for easier navigation.

Highlights from the study:

- **Community and Staff Profile**
  - Most (55%) communities are using systematic management compared with 39% in 1986 and 63% schedule the tree work continuously over the year.
  - A mean of 382.5 miles of road, 45.7 square miles of land area and 1010.1 acres of park land was reported per community across the US. Of these 82% of the streets had trees and 80% of the land in a community was developed.
  - Communities have had a person responsible for tree management for over 30 years with the current person having 10.7 years in their current position, and 20.0 years of total professional experience. The department responsible for trees varied by population.
  - There are 4.1 decision steps between the staff doing the tree work and the highest level of administration. This varied from 2.6 in the smallest to 6.7 in the largest communities.
  - A mean 2.7 departments were involved with trees, ranging from 2.0 in the smallest to 3.7 in the largest communities.
  - Cooperation between departments decreased as the populations increased.
  - Professionalism was demonstrated with 61% of responding communities having an ISA Certified Arborist on staff. This became the norm in locations with ≥ 50,000 people.

- **Tree Care Funding**
  - Tree activities had a mean annual budget of $801,595. This worked out to an average of $42.59 per street tree, $8.76 per capita, and 0.52% of the total municipal budget.
  - 72% of the funding came from the general fund. Over half (53%) of respondents thought the budget was adequate. Those inadequately funded said it was 45% of an identified need.
  - Two-thirds of funding went to tree planting (14.2%), tree pruning (23.3%) and tree removal (24.5%) or stump removal (3.6%).
  - The mean wage for a municipal field arborist is $47,837. This compares well to the 2014 mean annual $47,230 wage for all occupations in the United States. Mean wages increase as a municipal urban forester climbs the career ladder with a city forester making $71,219.

- **Tree Management Policy and Planning**
  - Two-thirds of responding communities have a government-authorized group helping with developing and/or administering policy. They were active in 80% that have such a group.
  - 90% had tree ordinances of some kind. Defining authority (80%), regulating removal of dead and diseased trees (77%), having an approved tree list for public tree planting (70%), requiring tree planting in new developments (68%), and requiring tree planting around new parking lots (60%) were the five most common ordinances.
  - Half of responding communities had written strategic plans pertaining to urban trees.
  - Over half of the respondents incorporated industry standards (e.g., A300, Z60.1, Z133) in tree procedures.

- **Volunteers and Partnerships**
  - 65% of the communities have volunteers taking part in tree activities with averages of 205 people working 852 hours a year. This translates into a national estimate of 1.5 million hours (714 FTE, 2080 hour base year) of municipal tree volunteering.
  - Volunteers completed 4.8% of total time for tree care activities in a community.
  - Tree planting (85%), watering (40%), and public education (39%) were the most common.

Contracting Tree Care Activities

- 88% hired contractors for some work that involved 40.8 % of all time with tree activities.
- 72% used industry standards or credentials for contractor hiring decisions.
- Communities regularly used tree removal (88%), tree pruning (68%), and tree planting (58%) contracting for a portion or all of these areas.

Community Tree Populations

- Tree inventories were used by 67% of the communities for some part of the tree population with 83% of these computerized. The inventory was last updated 2.7 years ago on average.
- Tree inventories regularly included information about tree species (98%), tree diameter (89%), and tree location (88%).
- Inventories were used for directing work for identifying tree planting locations (72%), tree species selection (62%), tree removal (60%), and scheduling tree pruning (53%).
- Canopy goals were in place or being developed by 25% of respondents. The average goal was to go from 32% to 44% canopy cover over the next 13 years.
- A mean of 55,332 public trees per municipality were found. This works out to 0.55 trees per capita, 4,821 trees per full time equivalent employee, or 76.1 trees per street mile.
- Public trees in a community were worth a total $68,665,110 on average or $1698 per tree.

Tree Operations and Management Profile

- 7.1 trees were planted and 6.0 removed per 1,000 residents with 54% of the communities planting more trees than they removed.
- Trees were pruned on average every 6.6 years, the desired pruning cycle was 4.8 years.
- 55% of communities were rated as having a systematic tree program.

Assistance Programs

- 65% of communities were aware of the state U&CF program. They received technical assistance (41%), financial assistance (48%), and educational/training programs (54%).
- Over half (53%) of responding communities provided technical assistance to community members and 59% gave education programs with Arbor Day (81%), tree planting (59%), tree selection (52%), benefits of trees (51%), and tree pruning (49%) most common.

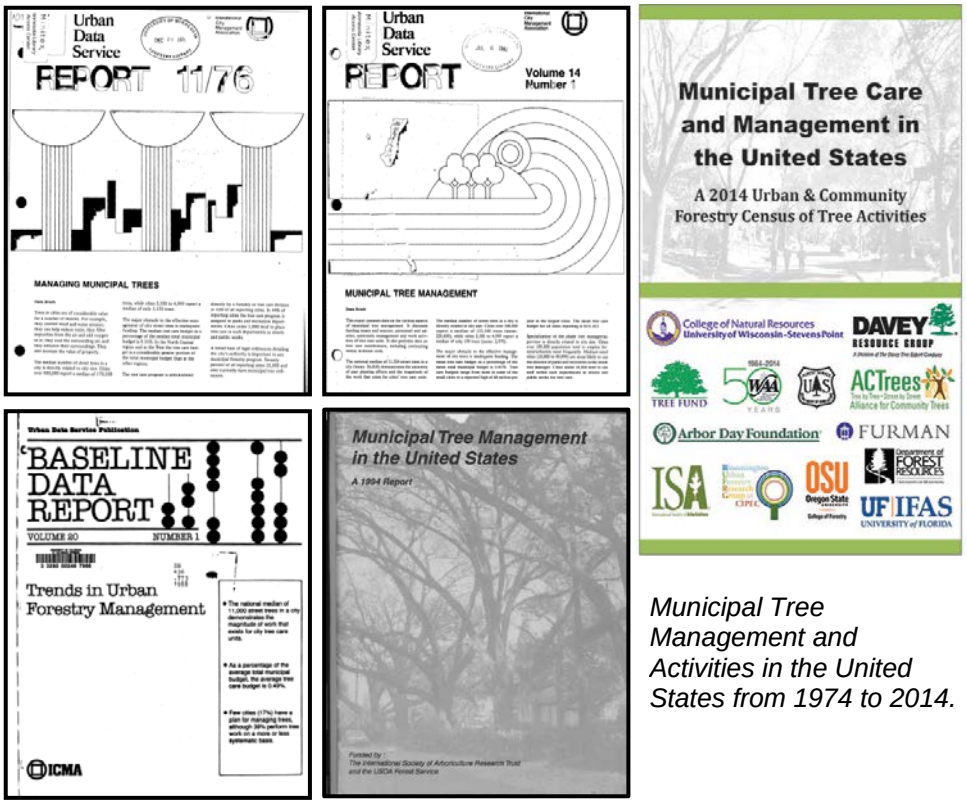
A complementary study presents a more complete trend analysis. An urban forest planning model is proposed for development to help communities compare their operations to the national or regional averages and to help them measure progress over time. The data in this study should be updated on a more frequent basis, such as a 5 year cycle for accuracy and relevance. This could be done efficiently by basing the updates on this study. Results from this recent update and future versions will help to identify the ideal Urban Forest and create Best Management Practices to build it.

Introduction

National assessments of municipal tree management have been conducted periodically in the United States. The first was conducted in 1974 by Ottman and Kielbaso (1976). That seminal project resulted in baseline data and it described various aspects of tree management. Additional assessments by Dr. Kielbaso and students occurred in 1980 (Giedraitis and Kielbaso 1982) and 1986 (Kielbaso et al. 1988). The most recent baseline assessment of municipal tree programs occurred in 1993 by Tschantz and Sacamano (1994). Thus, a 20 year gap in our baseline knowledge of municipal forestry programs exists.

Knowing about tree populations, management costs, and the approaches taken by municipal urban forestry programs provides a baseline for communities to compare their situation to national and regional findings. Findings are further important given the current need to effectively manage emerald ash borer (*Agrilus planipennis*) and other pest issues (Vannatta et al. 2012, Vannatta and Hauer 2012, Hauer 2012, Hauer and Peterson 2016). Thus, baseline understanding of municipal forestry programs through an urban forest assessment tells us how municipalities manage urban trees. This information then can be used to understand how municipal urban forest programs also change over time and what factors lead to effective and efficient programs.

This report describes the current baseline conditions of Municipal Tree Management in the United States. A companion publication will compare the longitudinal trends from 1974, 1980, 1986, and 1993 to the current 2014 baseline data. Trees in communities whether on public or private lands are an asset that can grow in value over time. Community tree management approaches do impact tree value and the benefits. Numerous studies over the past several decades show that trees in communities positively affect human health, provide numerous ecological benefits, and economically increase the value of locations (Miller et al., 2015). Growing and sustaining urban tree populations to maximize these benefits does not happen by chance (Hauer et al., 2015, Vogt et al. 2015). To quantify how communities manage and care for tree populations, we investigated the current status and trends of municipal forestry programs in the United States.



Municipal Tree Management and Activities in the United States from 1974 to 2014.

Methodology

A research team comprised of professionals from academic institutions, state and federal urban and community forestry personnel, non-profit organizations, professional organizations, and municipal foresters developed a research instrument to quantify municipal tree management in the United States. Trends going back to 1974 were also addressed. Several questions from the past work of Dr. James Kielbaso were replicated as a vital part of this continuation of baseline and trends from Ottman and Kielbaso (1974), Giedraitis and Kielbaso (1980), and Kielbaso et al. (1986). Additional questions on municipal tree management from Tschantz and Sacamano (1993) were included to further allow a longitudinal analysis. Questions were further constructed from a variety of urban forestry capacity and sustainability models to develop an urban forestry planning & evaluation system in the near future. Baseline conditions for 2014 are the focus of this report.

Questionnaire Design and Sampling Approach

Municipal tree activities were described for nearly 7500 municipal programs through both long and short form questionnaires that contained 109 and 53 questions respectfully (found in a companion Technical Appendix). The short form version was used to capture questions deemed

Exhibit 1. Sampling approach and response rate in a community and percentage of places that conducted tree activities, that have staff overseeing a program, and rated to have systematic programs in 2014.

Classification	Number of Places (n)	Places Sampled (n)	Returned Surveys (n)	Response Rate (%)	Conduct Tree Activities (%)	Staff Oversees Program (%)	Systematic Program (%)
Total, all cities	7478	1727	667	38.6	86.0	94.1	55.2
Population Group							
2,500 to 4,999	2344	241	73	30.3	60.6	81.7	52.8
5,000 to 9,999	1883	193	49	25.4	61.7	89.6	50.0
10,000 to 24,999	1750	187	52	27.8	85.4	96.1	61.0
25,000 to 49,999	786	400	170	42.5	86.7	94.1	58.7
50,000 to 99,999	442	438	190	43.4	95.1	96.8	59.5
100,000 to 249,999	200	196	97	49.5	92.8	96.9	48.2
250,000 to 499,000	41	41	22	53.7	100.0	100.0	47.4
500,000 to 999,999	23	23	11	47.8	100.0	100.0	27.3
1,000,000 +	9	8	3	37.5	100.0	100.0	33.3
Geographic Division							
East North Central	1414	296	148	50.0	86.0	96.6	58.1
West North Central	755	159	92	57.9	95.6	98.9	60.0
Mid-Atlantic	899	146	34	23.3	81.8	91.2	53.8
New England	808	172	56	32.6	83.3	92.5	29.2
East South Central	505	95	24	25.3	83.3	91.3	31.3
South Atlantic	1010	235	86	36.6	82.3	88.2	53.6
West South Central	846	182	51	28.0	78.0	92.2	53.7
Mountain	437	140	68	48.6	86.8	92.5	63.8
Pacific Coast	804	302	108	35.8	86.9	95.3	61.3
Geographic Region							
Midwest	2169	455	240	52.7	89.7	97.5	58.9
Northeast	1707	318	90	28.3	82.8	92.0	37.8
South	2361	512	161	31.4	81.0	89.9	50.8
West	1241	442	176	39.8	86.9	94.2	62.3

critical and as a way to encourage participation by respondents unable to complete the long form that could take several hours or more to complete. All communities with 50,000 or more people were asked to participate (Exhibit 1). A random sample from 50.9% of communities between 25,000 and 49,999 people and 10.3% of communities between 2,500 and 24,999 was used to select municipalities that were asked to participate. Cities with 50,000 or more people were given greater weight as they have a greater impact on the total number of people compared to communities with 25,000 or less people which also comprise 80% of the total number of locations. This was the same approach used in the past four municipal tree management projects. When reporting at the national level, the interpretation can then be taken as the percent of people that are likely associated with a question. In some cases we report on the percent of all communities (n=7478) associated with a study question. In that case we then adjusted by weighting of smaller communities (e.g. 2500 – 4999) to account for the sampling percent used, Weight = 1 / (% Sampled/100); 9.7261 = 1 / (10.3 / 100); whereas % sampled = (241 / 2344) * 100.

In this report the words place, municipality, and community are used interchangeably to classify a legally incorporated place (self-governing borough, city, town, or village) tracked for urban & community forestry activity in the USDA Forest Service Community Accomplishment Reporting System (CARS) dataset. Contact information for the primary person associated with urban forestry in a community was supplied from over 40 state urban forestry coordinators. For states that were unable to send contact information and communities that coordinators did not have a contact person, municipal websites were searched for a person who is responsible for municipal trees or the person in charge of a department identified as most likely responsible for community trees. Lacking this information, a person from administration (i.e., city clerk, city manager, mayor) was sent the survey. Disaggregation of places followed US Census divisions and regions (Exhibit 2).

A total of 1727 communities with valid postal mailing addresses were contacted up to four times to participate using the long form (sent twice) and the short form (sent twice) if they had not yet responded (Exhibit 1). A total of 667 communities (38.6%, long form n=513, short form n=154) responded which was slightly higher than the most recent two municipal tree care surveys in 1986 (38.1%) and 1993 (34.1%). Nominal monetary values from past surveys were adjusted for inflation using the Consumer Price Index (CPI) to produce a real value in 2014. These CPI adjustment factors are 1974=4.80, 1980=2.87, 1986=2.16, and 1993=1.64.

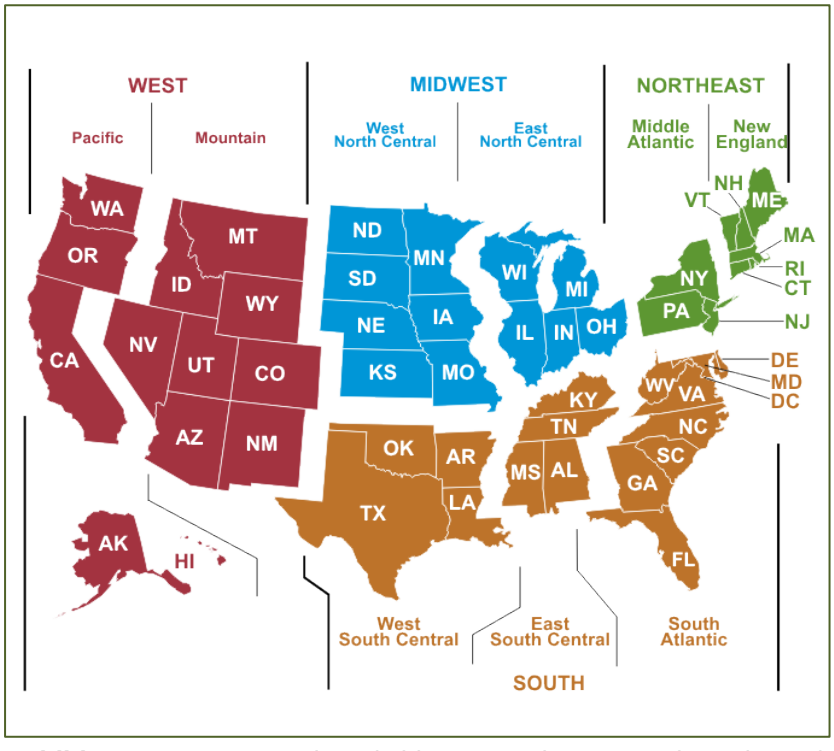


Exhibit 2. US Census regions (Midwest, Northeast, South, and West) and associated nine divisions used to disaggregate national data in this study. (Image from U.S. Energy Information Administration)

Section One: Community and Staff Profile

Community trees occur along streets, in parks, and other municipal locations. Tree are managed by people whose jobs reside in a variety of city departments. This section describes and profiles a community and the attributes associated with community tree management. Where a community tree program is housed and who is in charge is important with defining key responsibilities. The number of departments involved with trees is important to understand, especially if coordination is needed. How many management steps exist between staff conducting tree care and the highest level of decision making is important. Does the municipality assume legal responsibility for trees in the public rights-of-way (ROW) or are adjoining property owners solely or jointly responsible. Knowing the number of staff that are associated with tree management provides the capacity to carryout work in-house. The level of training and credentials of staff is also important to describe capabilities to care for trees. Finally, this section describes how well municipal staff and departments, along with community constituencies, interact and support the management of trees within a community on public and private lands.

Nationwide 86% of places reported they conducted tree activities in 2014 (Exhibit 1). Activity is any tree related outcome, from very limited activities (e.g., annual tree debris collection) in a community to a variety of activities reported throughout this report. Of places with activity, 61% of places between 2500 and 9999 people reported such occurred. In comparison, 95% of places with 50,000 or more people conducted tree activities. It is possible that even in communities that express they did not conduct any activities, trees likely cause some management implications from leaf debris in catch basins, picking up brush, and other activities that the respondent might not have considered. We take it that these communities do not consider taking an active role with tree management. No regional differences were found in reported activity.

Even though a community might not formally conduct tree activities, most places (94%) have a person identified as responsible for the management of trees (Exhibit 1). The difference between small communities (2500 to 9,999 people) was insignificant with 85% specifying an identified person, compared to over 96% of places with 10,000 or more people. No regional differences were found with all reporting 90% or higher.

Systematic tree management is an important criterion associated with managing urban trees. Kielbaso (1990) rated a community as systematic if 40% or more of tree work was reported as being scheduled (syn. systematic). We used the same approach and found 55% of places were at or above this level (Exhibit 1). This increased considerably from 39% of places ranked as systematic in 1986. The Midwest (59%) and West (62%) regions were highest, Northeast (38%) was lowest, and the South (51%) was intermediate. Interestingly places with < 100,000 people were more likely to have a systematic program (58%) than places with 100,000 more people (46%).

The scheduling of tree work provides an additional method to assess the systematic management of municipal trees. Overall 63% of communities reported the schedule for tree work was continuous, 16% said it was seasonal, 11% reported emergency or as needed, 6% was at the request of a property owner, and 5% occurred for other reasons. Approximately two-thirds of communities with ≥ 10,000 people had continuous scheduling. Communities < 10,000 people were equally about one-third continuous and one-third emergency or as needed.

Community Infrastructure and Greenspace

Communities vary in the linear distance of roads, area of parks and other greens paces, and land area (Table 1-1). Public trees grow or potentially grow in these places. Municipalities have greater control over the management of public trees and the canopy they provide than with private land areas. Certainly private land is important for trees in communities and description of these places is covered elsewhere. Key findings from public areas include:

- Not surprising, linear road distance, land area, and park land area all increase as the population of a place increases (Table 1-1).
- A mean 382.5 (174.5 median) miles of road, 45.7 (21.6 median) square miles of land area, and 1010 (301.0 median) acres of park land were reported.
- The density of people increased as population of a place increased. Places with < 25,000 people had mean densities of 1775 (1229 median) people per mi^2. The national mean was 3030 (2276 median) people per mi^2. Places between 50,000 and 499,000 people were 3436 (2580 median) people per mi^2.
- The Northeast and West had greater densities of 3950 (3162 median) and 3918 (3060 median) people per mi^2. The Midwest and South were less dense at 2580 (2043 median) and 2103 (1734 median) people per mi^2.
- Nationally a mean 82% (100% median) of streets had trees. Population had no relationship with stocking level (Table 1-2). Percent of streets with trees was statistically (p=0.01) greater in the Midwest (85%) and Northeast (90%) than the South (80%) and West (71%) regions.
- Nationally a mean 80% (median 86%) of a community was developed with no difference by population group or region.

Table 1-1. How many of each of the following does your community have?

	Linear Road Distance (Miles)				Land Area (Square Miles)				Park Land Area (Acres)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	424	382.5	174.5	39.0	450	45.7	21.6	6.0	439	1,010	301.0	152.7
Population Group												
2,500 - 4,999	52	27.3	20.0	4.6	45	6.6	3.0	1.6	50	45.2	31.0	6.8
5,000 - 9,999	32	58.3	42.0	7.4	28	9.8	5.5	2.1	27	138.4	80.0	44.2
10,000 - 24,999	38	98.2	87.5	8.7	37	15.4	11.0	2.1	37	290.4	160.0	60.4
25,000 - 49,999	107	179.6	158.0	11.5	126	32.1	17.1	9.9	116	387.7	289.0	39.0
50,000 - 99,999	106	298.3	250.0	23.4	120	27.5	25.0	1.5	121	1,168	450.0	434.6
100,000 - 249,999	62	683.8	541.0	73.8	66	73.0	48.4	10.5	63	1,284	1,000	137.5
250,000 - 500,000	17	1,952	1,200	588.2	17	236.3	111.0	108.9	14	4,315	4,061	719.2
500,000 - 1,000,000	7	2,787	2,836	448.3	8	283.3	314.5	66.8	8	6,842	5,750	1,304
Over 1,000,000	3	3,082	2,525	1,549	3	322.0	305.0	109.2	3	14,783	10,200	7,257
Geographic Region												
Midwest	156	366.6	195.0	52.3	166	30.4	21.6	3.4	159	913.4	405.0	115.5
Northeast	73	322.8	105.0	100.8	62	27.3	17.5	5.5	58	1,193	200.0	524.7
South	93	519.9	205.0	124.7	99	79.4	28.0	16.1	101	1,504	301.0	542.7
West	102	324.4	198.0	42.3	123	48.5	20.0	16.4	121	637.4	232.0	122.1

Table 1-2. Relative percentage of streets with trees and percent land area developed in a community.

	Percent of Streets that Have Trees				Percent of Land That is Developed			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	213	82.1	100.0	1.9	170	80.2	85.7	1.5
Population Group								
2,500 - 4,999	25	79.1	88.4	5.7	25	81.1	89.2	4.3
5,000 - 9,999	15	85.6	100.0	8.3	6	74.7	82.1	6.7
10,000 - 24,999	19	74.7	83.3	6.9	15	78.9	78.0	3.6
25,000 - 49,999	51	81.2	94.1	3.9	47	82.0	86.0	2.6
50,000 - 99,999	57	88.9	100.0	2.8	47	83.0	88.9	2.7
100,000 - 249,999	32	74.8	87.8	5.7	23	77.5	81.9	4.1
250,000 - 500,000	12	83.4	100.0	9.2	3	58.9	46.7	21.1
500,000 - 1,000,000	1	100.0	100.0	N/A	3	59.1	53.6	15.3
Over 1,000,000	1	100.0	100.0	N/A	1	87.7	87.7	N/A
Geographic Region								
Midwest	92	85.2	100.0	2.7	72	84.8	89.5	1.8
Northeast	37	89.8	100.0	3.4	21	77.7	80.0	4.5
South	38	79.9	91.0	4.4	30	76.6	82.0	4.2
West	46	71.5	86.8	5.0	47	76.5	80.0	3.0

Departmental Responsibility for Tree Care and Management

The care and management of municipal trees takes many forms. Who in a community is responsible for the care of trees within the public rights-of-way will affect care and management (Figure 1-1). Regardless if a municipality assumes legal responsibility or the reasonability is assumed by the abutting property owner, a duty is owed to the community's people for their safety. Along with identifying responsibilities, defining the level and standards of care is important and should be established. Key findings include:

- Nationally, nearly two-thirds (64%) of municipalities assume legal responsibility for trees in the municipal rights-of-way (ROW).
- Sole municipal responsibility is highest in the Midwest (74%) and Northeast (79%).

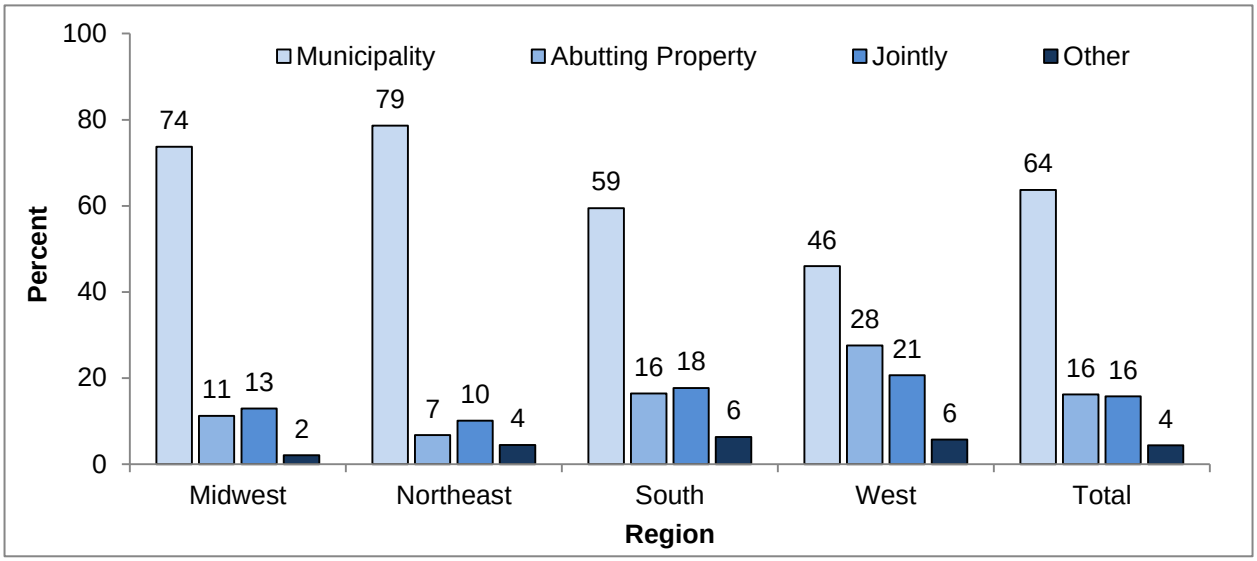


Figure 1-1. Who in your community is primarily (legally) responsible for maintaining trees in municipal rights-of-way, for example street trees between sidewalk and curb or alley trees? (n=661)

- Nearly one-third of adjoining property owners throughout the U.S. were either solely (16%) or jointly (16%) with the municipality responsible for maintaining trees in the ROW.
- Communities in the Western states place greater responsibility upon adjoining property owners with 28% solely and 21% jointly with the municipality responsible.

Coordination of tree care activities is important when multiple parties are involved. These actors include departments that care for trees on various municipal lands; departments that regulate trees on private lands; decision makers at various levels; constituent groups that advise communities on community tree populations; private companies that practice tree care in a community; regional, state, and federal government; and others. These actors will be discussed throughout this report.

Five forms of government are generally regarded to cover most municipal governing in the United States (Figure 1-2). The ultimate decision making rests at the highest level of community government with the five common types: Council-Manager, Mayor-Council, Commission, Town Meeting, and Representative Town Meeting. The Council-Manager and Mayor-Council systems were most common and collectively represented 91% of all places. The town meeting and Representative Town Meeting exist only in the Northeast and comprised three percent nationally, with 18% of this region using this form of government. The Commission form was used in three percent of places. The "other" category was used to capture any system that differed from the primary five. Collectively, words used in the other category fit within any of these five forms.

Communities have a strong history of a person identified as responsible for tree management (Figure 1-3). Nationally communities have had a person responsible for tree management for over three decades. The mean time increased from 25 years in small communities (below 25,000) and steadily increased with size to over 86 years on average in the largest places. The Northeast had the longest history (nearly 50 years on average) which is consistent with the many places having established Tree Wardens that are responsible for public trees. The South region has a more recent history (22 years) of a person being identified as in charge of municipal tree management.

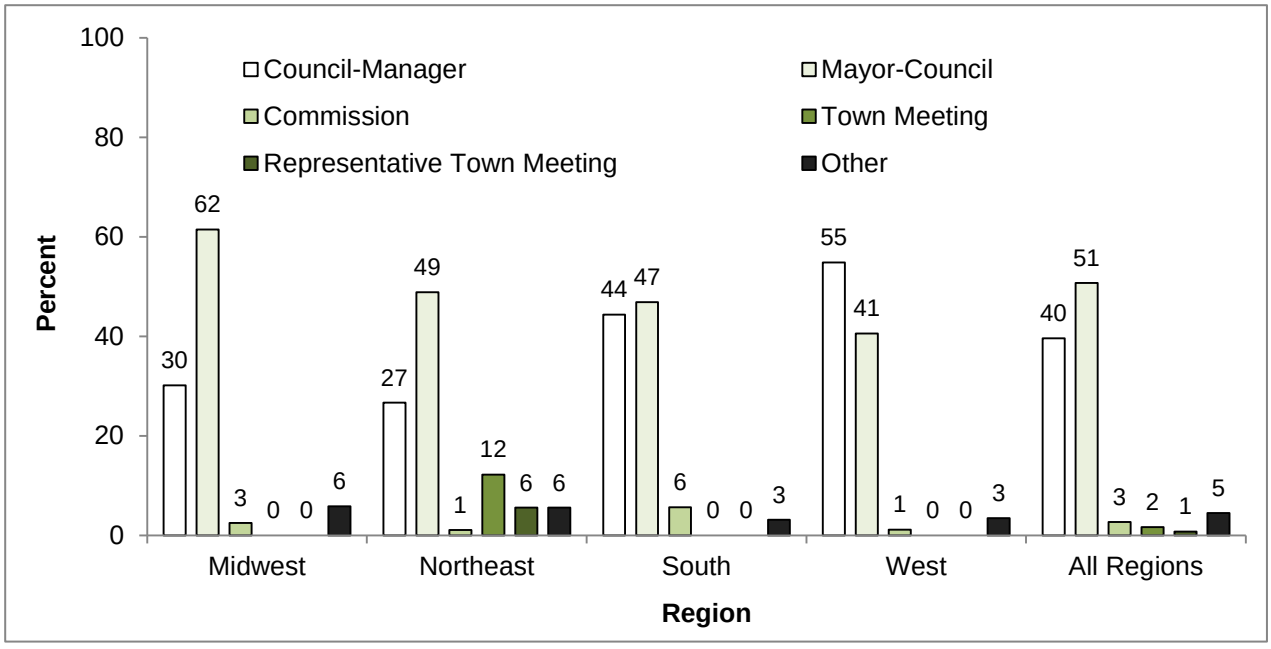


Figure 1-2. Which one form of local government do you have? (n=664)

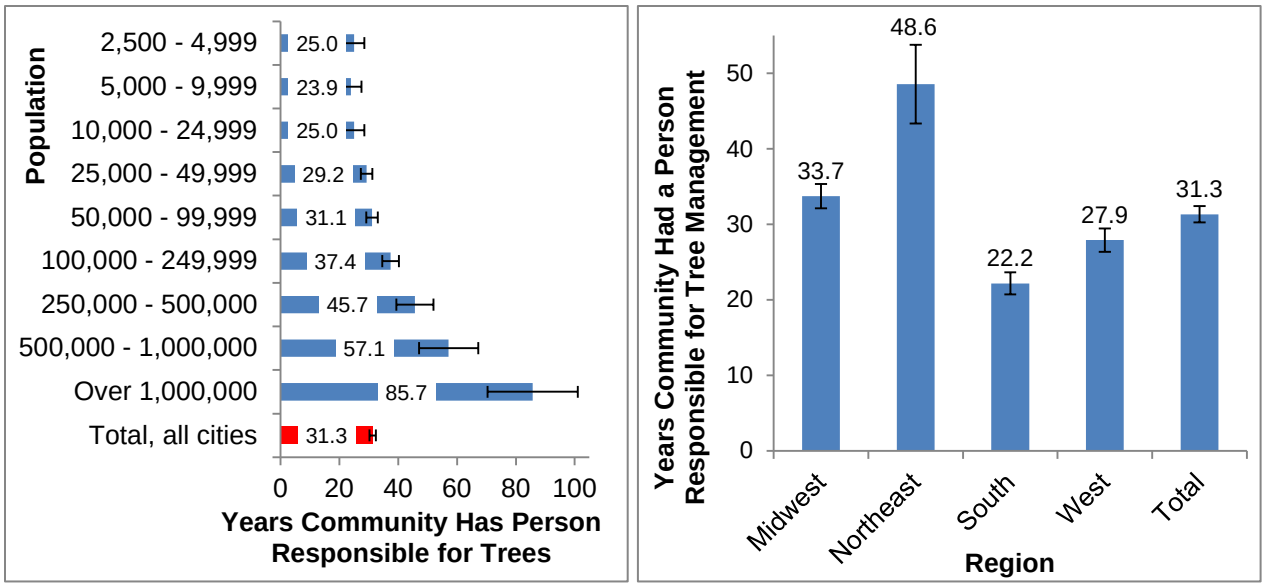


Figure 1-3. How many years has your community had a person responsible for the management of trees? (n=550)

The number of decision-making steps and the departmental responsibilities for municipal tree management that occurs in the United States varied by location. On average over four levels of decision making occur between the staff members who conduct tree work and the highest level of management (Figure 1-4). The highest levels could be the elected government official or a hired staff member such as a city manager. Decision making was least (2.6) in the smallest (2500-4999) population group. This increased to over six steps in places ≥ 500,000 people. Along with decision making steps, the number of departments involved with trees in a community increased from 2.0 to 3.7, with a 2.7 mean for all places. Population was a significant factor and as places increased in size the number of departments and decision-making steps increased. There were no significant regional differences.

The departments that have some level of municipal tree responsibility were ascertained (Figure 1-5, 1-6). Parks and recreation, and public works departments were most common in

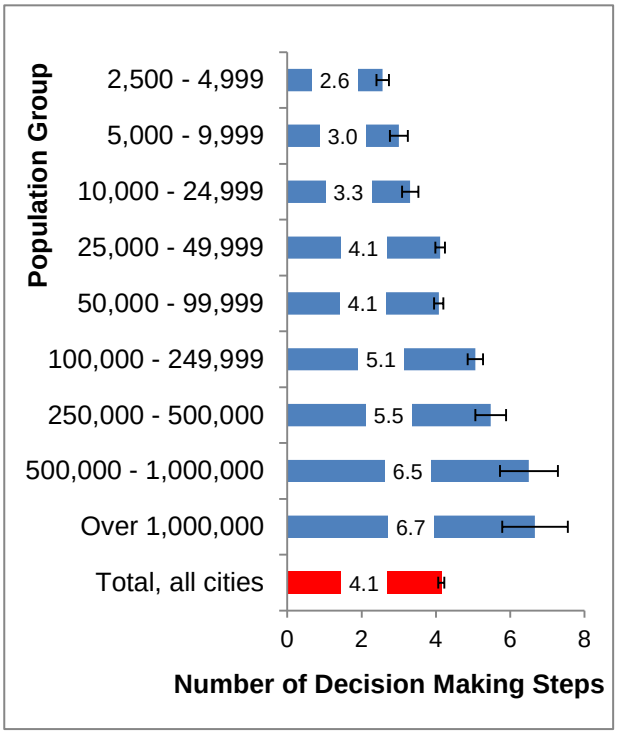


Figure 1-4. How many levels of decision-making happen between the top person in community government and the person actually performing tree care activities? *(e.g., Field Tree Worker → City Forester → Parks Director → Public Works Director → City Manager → Mayor-Council = 6 steps)*? (n=472)

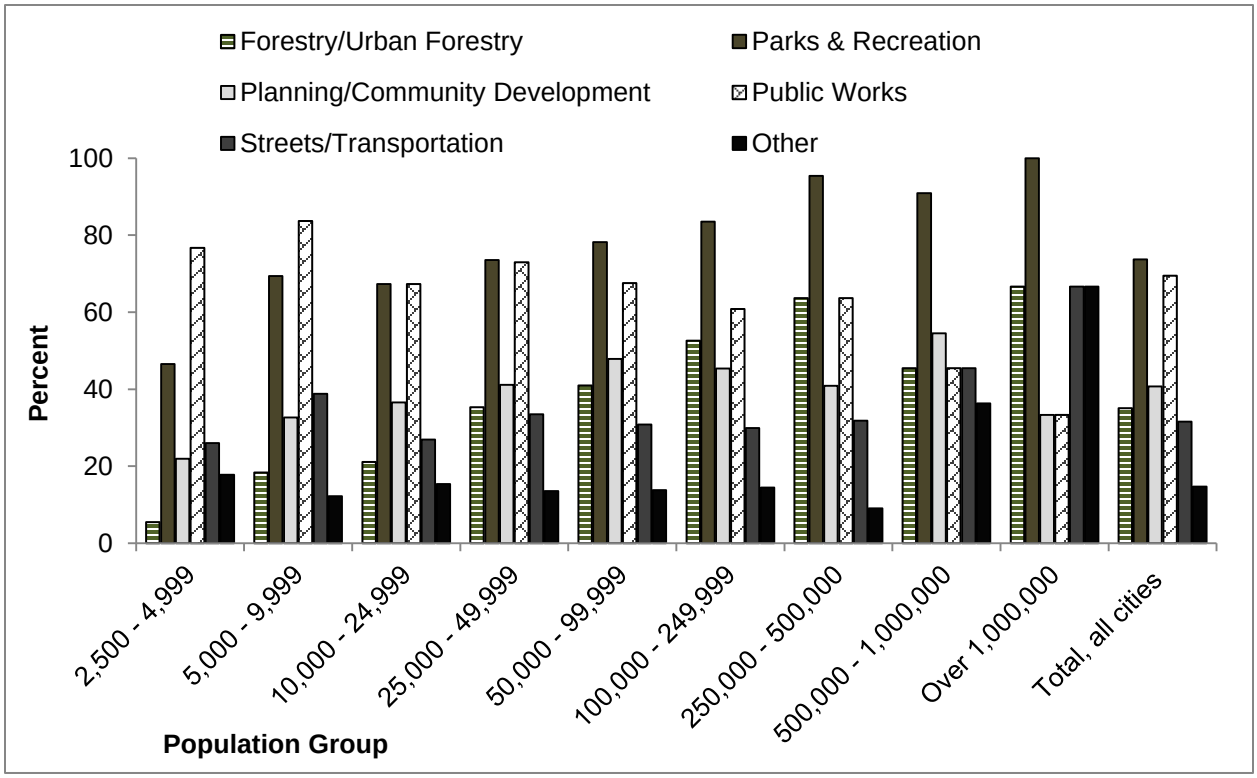


Figure 1-5. Which municipal departments have the responsibility for some level of management of public trees? (n=665)

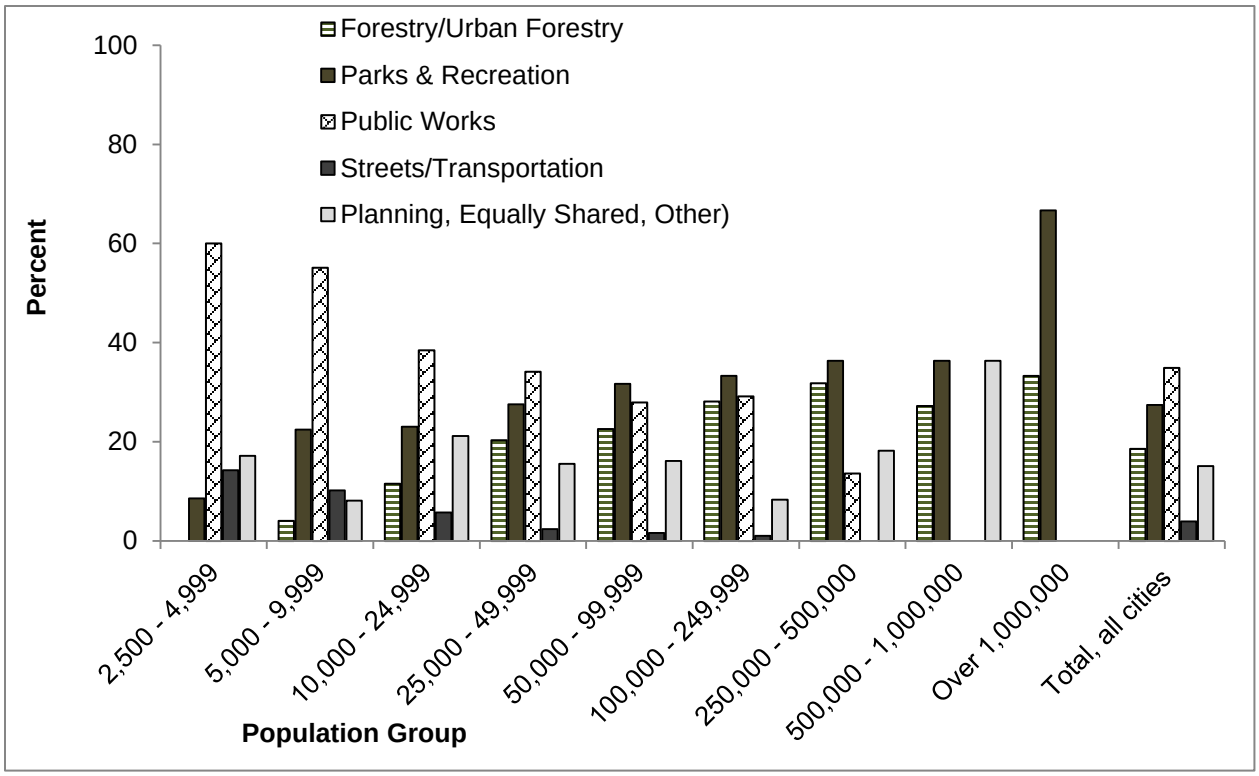


Figure 1-6. What one municipal department has the primary responsibility for public trees? (n=656)

74% and 69% of responding communities respectively. A designated forestry program (35% of respondents), planning department (41%), or streets/transportation department (32%) occurred less frequently in all responding places. Planning and streets showed no difference by population group. A designated forestry department increased as population increased from 5% (2500 – 4999 group) to 46% of places with ≥ 50,000 people.

The department identified to have the primary responsibility for trees changed as population increased (Figure 1-6). Both public works and the streets department were most common in small communities, 74% of the smallest group (2500 - 5000). These departments become less common as the primary department as population increased. Likewise, forestry and parks and recreation departments were < 10% in the smallest group and increased to 60% or more in places ≥ 50,000.

Municipal departments were perceived to cooperate overall (Figure 1-7). This level of coordination and agreement that departments operate from a common goals and objectives did decrease as population increased. Places ≥ 100,000 people were rated lower than the mean scores for all places. This is likely the effect of a greater number of departments and decision making steps. Agreements and coordination help to foster cooperation.

The education levels of staff, credentials held, and training approaches were ascertained (Figure 1-8). Forty percent of places between 2500 – 4999 people indicated no training or workshops were part of operations. A lack of training decreased to 10% or less of larger places (≥ 50,000). Both in-house training (76%) and attending tree care workshops (78%) were common to all respondents. Employees that had formal training through two-year, four-year, and graduate programs became the norm in larger communities. Not having a postsecondary education does not mean a person lacks the knowledge, skills, and abilities. Training in a formal system does however provide a mechanism to learn and later transfer this knowledge through abilities.

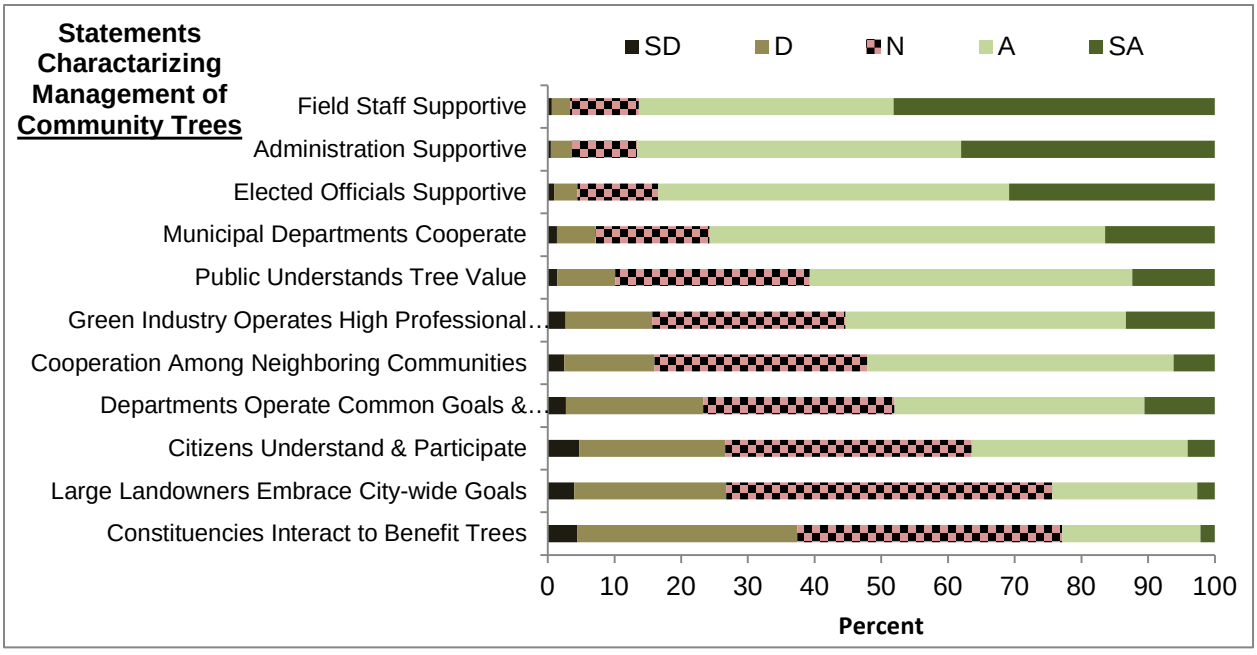


Figure 1-7. How strongly do you agree or disagree with these statements characterizing your community and the management of trees? (n=633 to 641, SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree)

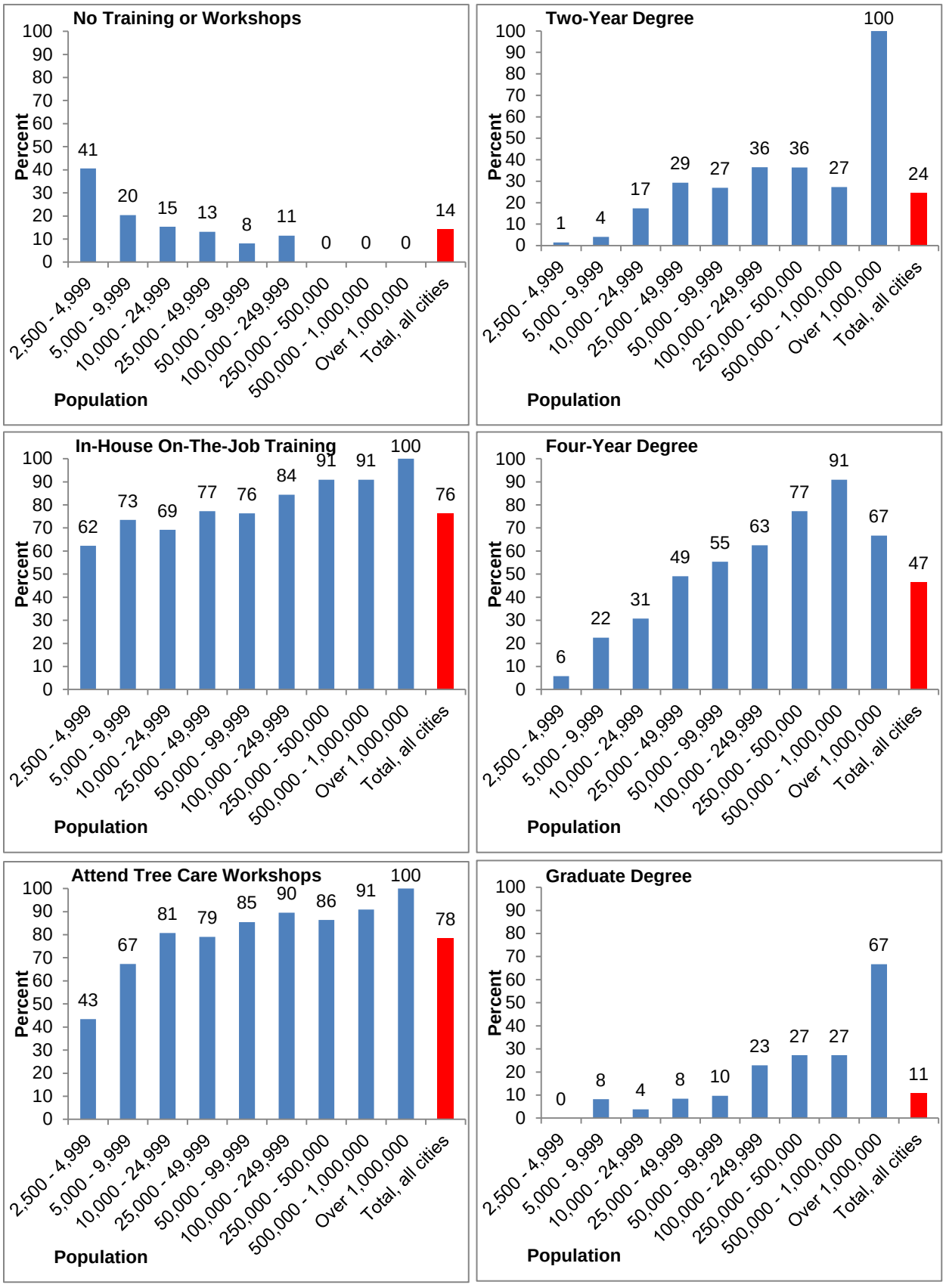


Figure 1-8. What training and/or credentials are collectively held by the staff responsible for tree activities and/or management of trees? (n=655)

Credential systems by the International Society of Arboriculture (ISA) are an accepted way to demonstrate a baseline level of literacy (Figure 1-9). The ISA Certified Arborist (CA) program was common to 61% of responding places. As a reminder, in this study the sampling design placed emphasis on the number of communities within a population group (e.g., 2,500 to 4,999 or 50,000 to 99,999 people) and the relative impact a community has on people. Large communities obviously impact more people than a smaller community. Thus from the sample design of this study, we can say that over 60% of people live in a municipality that has one of more municipal employees with a CA credential. If we just account for each place regardless of the population, then 31% of municipalities in the United States have a CA on staff. In other words, a certified arborist is uncommon to smaller communities with only 12% of locations between 2,500 and 9,999 having a CA. In contrast 83% of larger municipalities with at least 50,000 people have a CA on staff.

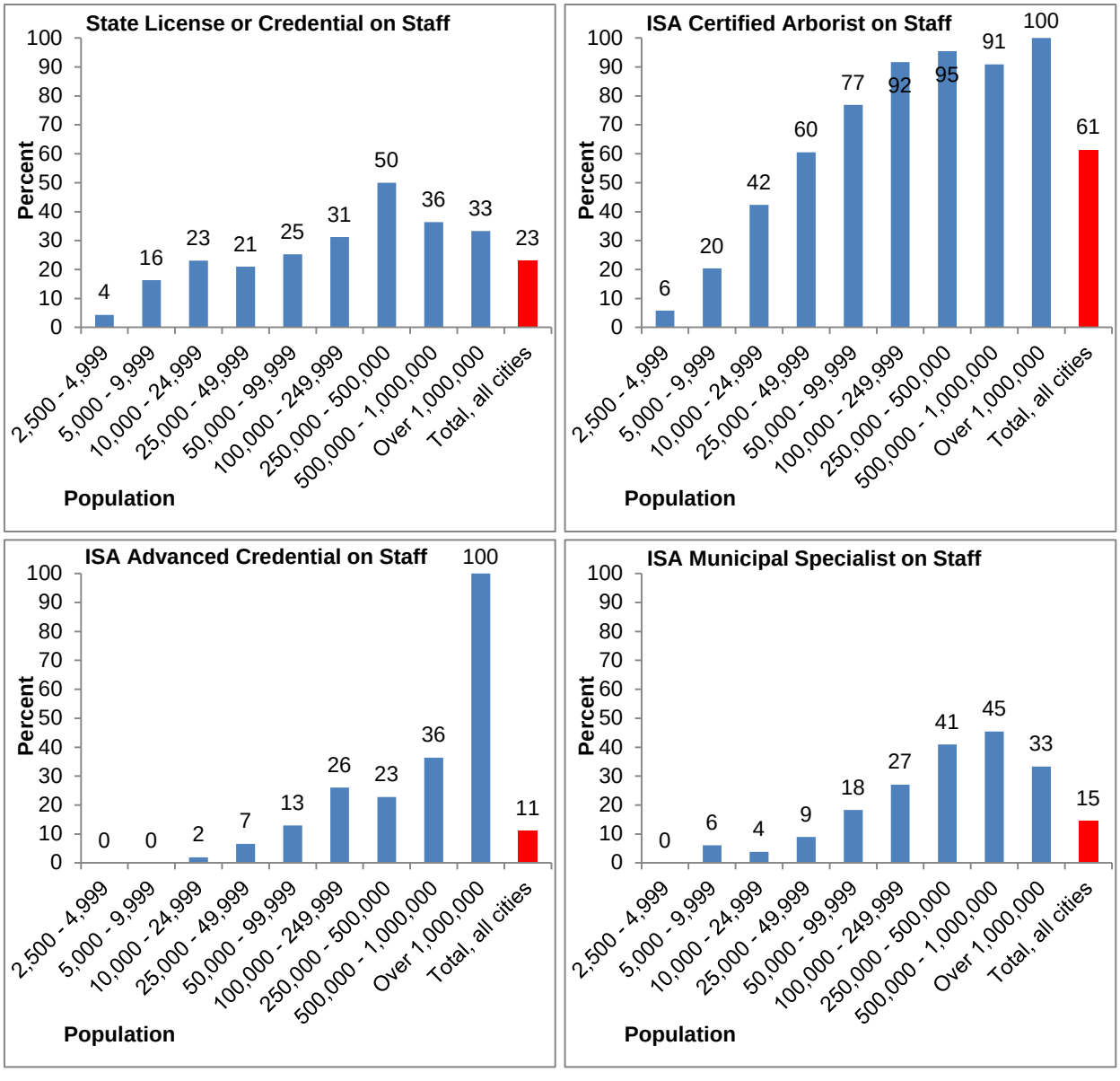


Figure 1-9. What training and/or credentials are collectively held by the staff responsible for tree activities and/or management of trees? (n=655)

The ISA Municipal Specialist is less common in all communities occurring at 15% of responding places. Nearly 25% of all communities with at least 50,000 people have at least one on staff. None of the places below 5,000 people reported having a Municipal Specialist. This credential increased in commonality with nearly 50% of the largest municipalities having one or more staff members with this credential. Likewise, advanced ISA credentials (e.g., Tree Risk Assessment Qualification and Board Master Certified Arborist) were less common in only 11% of reporting places. Again, these were most common to larger communities with 25% or more of municipalities with 100,000 or more people having staff with these advanced credential types.

The title of the person in charge varied by population. In smaller places the responsibility is assigned to a staff member such as a public works director or city administrator/manager. Nearly 50% of places in the smallest population group, this was the case (Figure 1-10). As population increased, a person with the title of arborist or forester became more common and was reported by 46% of all respondents (Figure 1-11). In 60% places with 50,000 or more people, the responsible person held the title of arborist or forester. The responsible person had 10.7 (0.4 SEM) years of time in their current position, 20.0 (0.5 SEM) years' experience in tree care management, and were 67.8% (1.9 SEM) of fulltime for the position. On average they earned $67,664 (1146 SEM, $68,250 median) in this leadership position (Table 1-3). This mean combines all positions from the highest paid in charge staff member (city engineer, $85,450 mean) to least paid (city clerk, $36,500 mean). Mean pay for positions more closely aligned with training in tree care and management include arborist/forester ($63,994), Tree Warden ($55,111), landscape architect ($66,519), and consultant ($56,640).

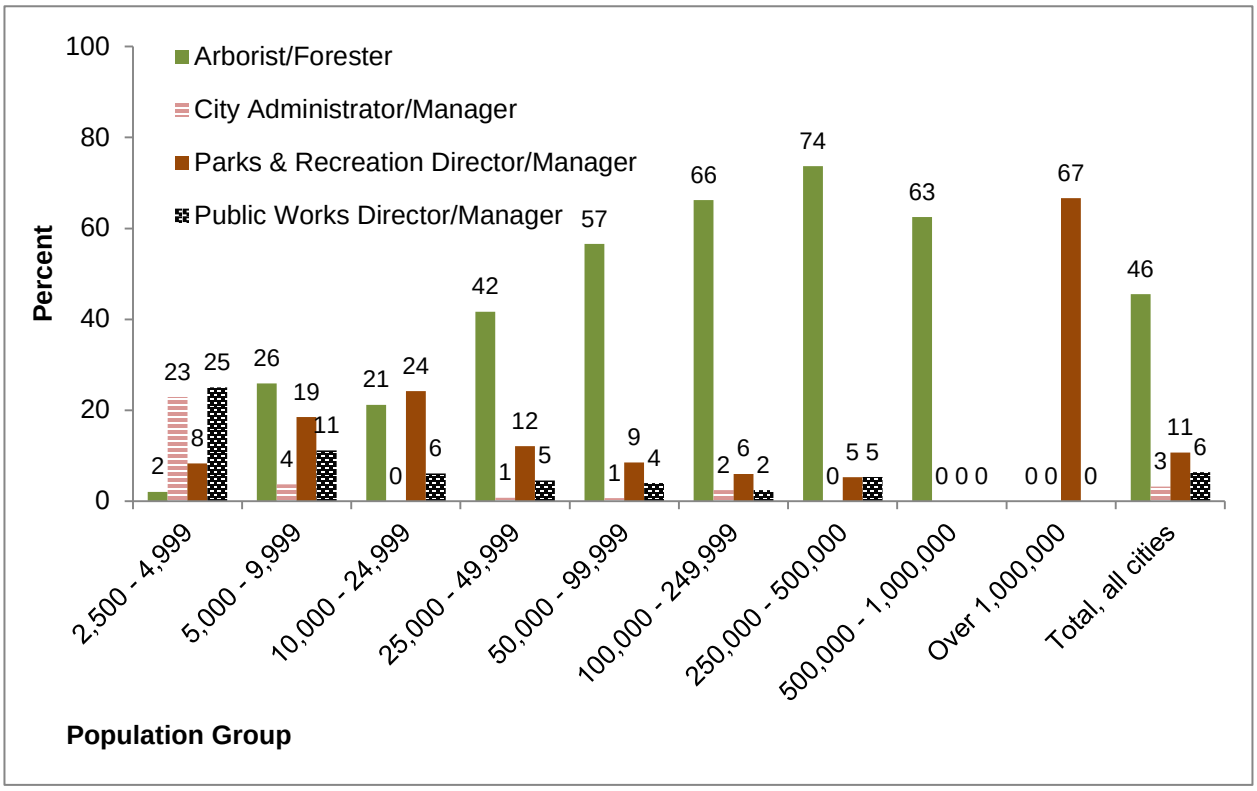


Figure 1-10. As the primary person accountable for the daily management of the tree program or activities, what title best describes you? (n=505)

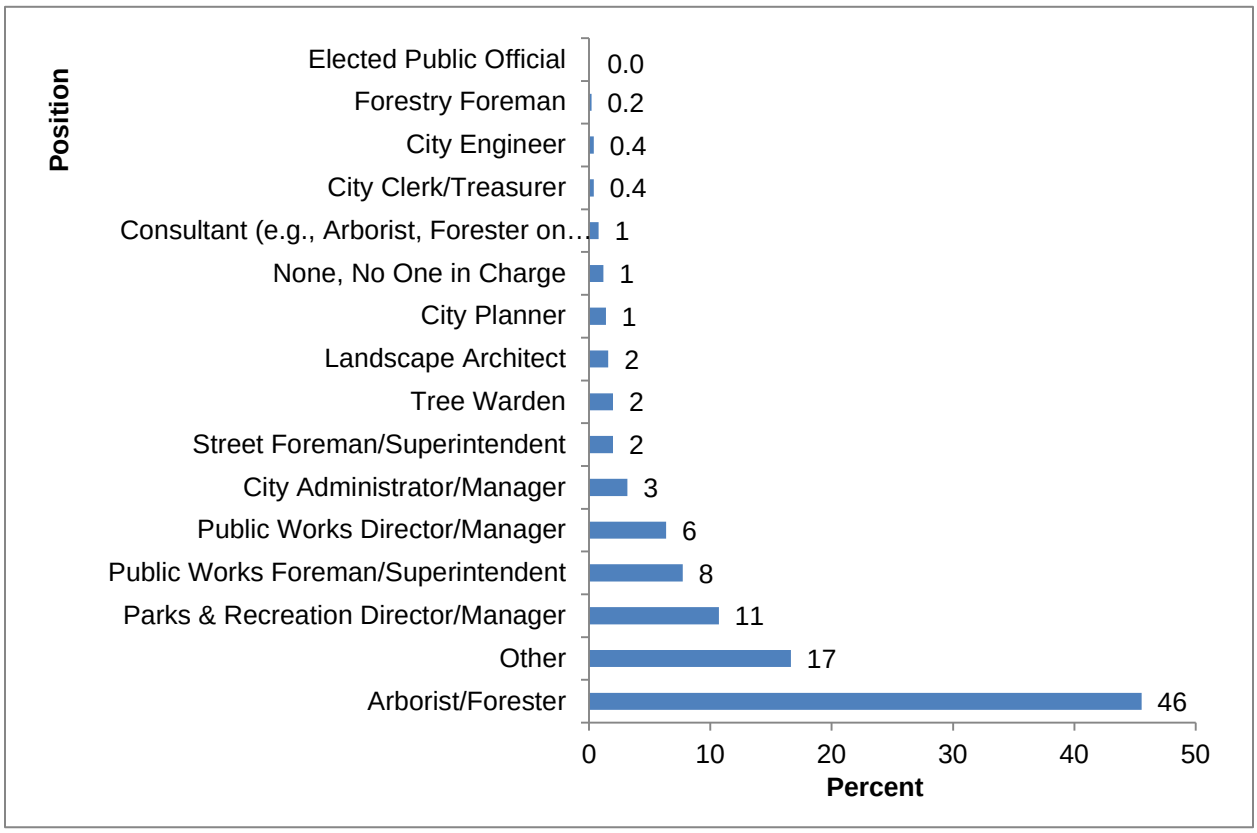


Figure 1-11. As the primary person accountable for the daily management of the tree program or activities, what title best describes you? (n=505)

Table 1-3. For the primary person above who is responsible for tree care management, please indicate the following.

Position	Years in Current Position	Years' Experience in Tree Care/ Management	% of Full-time for the Position	Annual Salary ($)[1]	Sample Size (n)
Arborist/Forester	11.0	22.1	88.0	63,994	226
City Administrator/Manager	10.4	10.3	14.3	79,929	16
City Clerk/Treasurer	11.5	1.0	2.0	36,500	2
City Engineer	6.8	6.8	100.0	85,450	2
City Planner	10.4	9.4	39.5	62,040	7
Consultant (e.g., Arborist, Forester)	17.3	29.0	20.0	56,640	3
Forestry Foreman	2.0	25.0	100.0	N/A	1
Landscape Architect	12.4	19.4	74.0	66,519	8
Other	11.9	19.4	61.2	68,454	77
Parks & Recreation Director/Manager	9.6	17.4	38.5	75,228	53
Public Works Director/Manager	10.1	18.0	35.0	78,665	30
Public Works Foreman/Superintendent	7.8	15.9	43.7	79,142	36
Street Foreman/Superintendent	15.4	19.7	77.5	50,038	10
Tree Warden	10.0	27.9	41.4	55,111	10
Mean All Positions	10.7	20.0	67.8	67,664	481
Median All Positions	8	20	100	68,250	481
SEM All Positions	0.4	0.5	1.9	1,146	481

[1] Based on a full-time equivalent 2080 base hour year.

The number of employees involved in public tree management was established (Table 1-4, 1-5) and translated into full-time equivalents (2080 hour base year). Table1-4 details the employment status from the sample associated with returned surveys. Table 1-5 provides an estimated total number of FTE's and total employees that were adjusted by sampling intensity (Exhibit 1). An estimate 32,588 (±5,864) FTE's are associated with municipal tree care activities in communities with 2500 or more people. This comes from a total employment pool of 49,362 (±9675) people that vary from part to full-time employment. There are also staff associated with municipal tree care in communities with fewer than 2500 people that are not accounted for in this project.

Table 1-4. How many public employees, including managers, are involved with the municipal tree management program? (^{x} nonadjusted, cities mean represents the sample not adjusted for population of places within a population group)

	Full-Time Equivalents				Total Employees			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	508	7.2^{x}	4.5	0.40	614	10.0	6.0^{x}	0.66
Population Group								
2,500 - 4,999	47	3.3	3.0	0.60	65	4.9	4.0	0.59
5,000 - 9,999	35	3.1	2.0	0.61	46	5.1	5.0	0.56
10,000 - 24,999	41	4.7	3.0	0.76	49	7.0	6.0	0.81
25,000 - 49,999	121	5.3	4.0	0.50	156	8.3	6.0	0.49
50,000 - 99,999	146	6.3	4.8	0.53	173	9.1	7.0	0.63
100,000 - 249,999	87	11.8	9.0	1.27	91	14.5	10.0	1.45
250,000 - 500,000	20	18.3	8.8	4.23	21	21.4	15.0	4.19
500,000 - 1,000,000	9	18.2	20.0	2.10	10	19.0	20.0	2.99
Over 1,000,000	2	38.0	38.0	17.00	3	140.3	67.0	97.24
Geographic Region								
Midwest	192	7.4	5.0	0.65	226	9.9	7.0	0.65
Northeast	59	6.4	4.0	1.34	84	11.5	5.0	4.02
South	112	8.2	5.5	0.85	139	11.4	8.0	0.88
West	145	6.3	4.0	0.69	165	8.2	6.0	0.71

Table 1-5. How many total public employees, including managers, are involved with the municipal tree management program? (^{x}adjusted data to account for total number of cities in a population group, SEM = standard error of the mean, CI=confidence interval at 95%)

		Full-Time Equivalents					Total Employees				
Classification	**Population (n)**	**Sampled (n)**	**Mean**	**SEM**	**Total**	**CI 95%**	**Sampled (n)**	**Mean**	**SEM**	**Total**	**CI 95%**
Total, all cities	7,478	508	4.36^{x}	2.10	32,588	5,864	614	6.60^{x}	0.66	49,362	9,675
Population Group											
2,500 - 4,999	2,344	47	3.31	0.60	7,756	2,758	65	4.90	0.59	11,486	2,712
5,000 - 9,999	1,883	35	3.10	0.61	5,836	2,253	46	5.10	0.56	9,603	2,068
10,000 - 24,999	1,750	41	4.70	0.76	8,233	2,609	49	7.00	0.81	12,250	2,780
25,000 - 49,999	786	121	5.25	0.50	4,127	771	156	8.30	0.49	6,524	756
50,000 - 99,999	442	146	6.27	0.53	2,770	460	173	9.10	0.63	4,022	547
100,000 - 249,999	200	87	11.78	1.27	2,356	501	91	14.50	1.45	2,900	572
250,000 - 500,000	41	20	18.28	4.23	749	351	21	21.40	4.19	877	347
500,000 - 1,000,000	23	9	18.22	2.10	419	100	10	19.00	2.99	437	143
Over 1,000,000	9	2	38.00	17.0	342	353	3	140.30	97.24	1,263	2,018

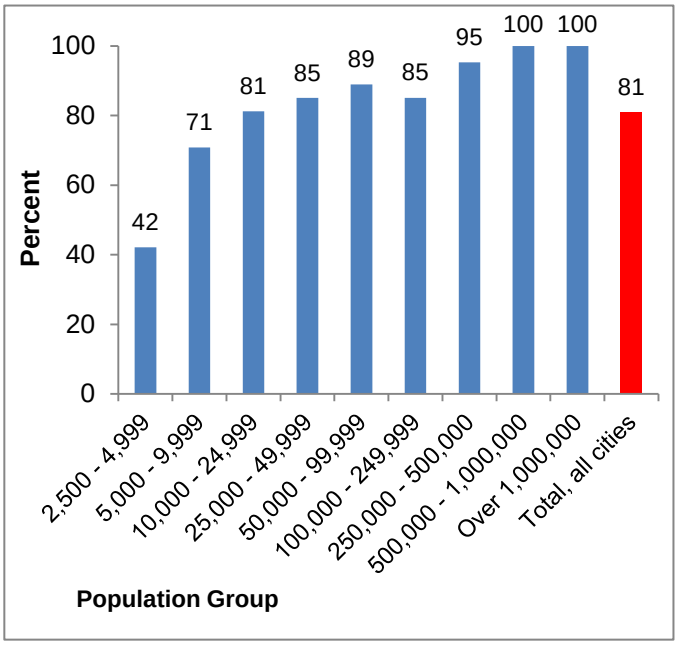
Funding of municipal tree programs comes from many sources. These funds are used to plant, maintain, and remove trees at some time in the future. Funding is also used for a variety of other activities such as public education, tree inventories, and developing plans. This section details the budgets of municipal forestry operations, money allocated for in-house and contracted services, funding sources, the adequacy of budgets, money allocated by tree activity area, and staff salaries.

Municipal Budgets

When respondents were asked if public funding was allocated for tree care activities, overall 81% indicated public funding is allocated for tree care activities (Figure 2-1). Spending could be for a limited array of activities (e.g., picking up brush after storms) to a more fully developed and systematic management program. Smaller communities were less likely to allocate money than larger ones. Midwest communities were more likely (88%) than the South (74%) to use public funds for tree activities.

Funding can come from one or many sources. A municipal budget most likely funds municipal forestry operations. The mean total municipal budget ranged from approximately $5 million in places below 5000 people to nearly $6 billion in the largest places of one million or more people (Table 2-1). The mean municipal budget for all places that responded was $200 million. The amount of the municipal budget spent of tree activities is a fraction of this at 0.52%. Thus, on average a half of a percent of the municipal budget was spent on tree activities.

A mean $801,595 annual budget for tree activities was reported (Table 2-1). A mean $19,406 was budgeted in places below 5000 people. A mean $18.4 million occurred in places over one million people. Geographically the Northeast had the greatest mean tree budget, however, the standard error of the mean (SEM) was also the highest.



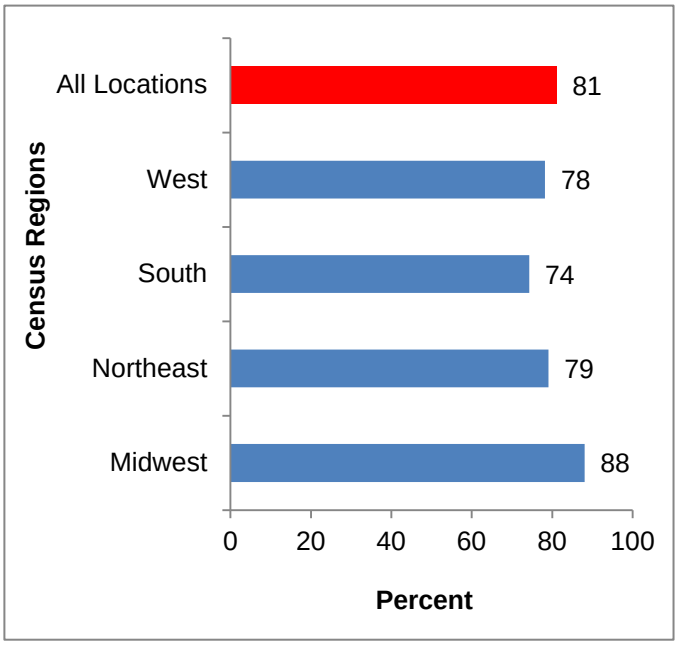


Figure 2-1. Is public funding specifically allocated for tree care activities or management (e.g., planting, maintenance, removal, ordinance enforcement, education, etc.)? (N=623)

Table 2-1. What is the total municipal budget (excluding school budget) for 2014 (Please include entire amount for all governmental functions, activities, etc.) and what is the total annual budget of your municipality funded tree care activities and management from all municipal sources? (Include all tree activity expenses; include personnel, overhead, equipment, supplies, and tree care and contract payments.)

	Total Municipal Budget				Annual Tree Activity Budget			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	550	200,316,126	76,764,902	26,665,629	477	801,595	332,872	107,800
Population Group								
2,500 - 4,999	50	5,382,204	4,163,909	511,831	27	19,406	10,000	3,878
5,000 - 9,999	41	13,749,994	10,383,891	1,688,789	33	68,446	22,630	25,274
10,000 - 24,999	43	30,781,787	25,424,900	3,137,268	36	102,683	65,458	23,869
25,000 - 49,999	137	69,815,340	55,017,030	5,938,603	125	343,596	210,253	32,344
50,000 - 99,999	162	138,851,007	117,664,250	7,330,070	148	646,501	451,704	56,335
100,000 - 249,999	86	331,018,081	260,279,619	24,642,614	78	1,368,607	1,000,000	152,066
250,000 - 500,000	18	780,007,436	708,958,838	113,450,076	18	3,074,165	1,657,742	643,149
500,000 - 1,000,000	10	1,546,248,452	1,187,000,000	215,802,775	9	2,221,708	1,880,000	376,697
Over 1,000,000	3	5,996,218,186	4,490,000,000	3,319,988,839	3	18,389,353	5,338,060	13,725,759
Geographic Region								
Midwest	200	130,849,394	69,879,711	14,664,328	190	760,065	331,197	91,178
Northeast	81	339,080,111	55,000,000	163,220,523	67	1,122,843	143,183	683,347
South	116	215,976,004	100,500,000	38,022,209	92	829,105	402,434	138,152
West	153	205,786,179	111,153,045	22,399,093	128	675,314	371,065	80,724

Several methods are useful to make relative the level of funding (e.g., $/capita, $/tree, $/inch stem diameter) used to maintain public trees. An average $42.59 (4.49 SEM) per street tree was spent annually in 2014 (Figure 2-2). This includes all costs associated with activities (e.g., planting, pruning, pest management, removal). A $37.50 (3.02 SEM) amount was spent on all public trees along streets, in parks, and other public locations. No apparent difference was found by population group. However, the South region had the greatest per tree spending and also the most variable data as indicated by the standard error of the mean (Figure 2-3).

The percent of the total forestry budget relative to the entire municipal budget is one approach to compare forestry programs. Nationally a mean 0.52% (0.04 SEM) of the total municipal budget was allocated to forestry activities (Figure 2-4). Funding allocation was greatest in the Midwest (0.67%), lowest in the Northeast (0.34%) and intermediate in the South (0.47%) and West (0.44%) regions. The largest cities (500,000 and more people) spent the least.

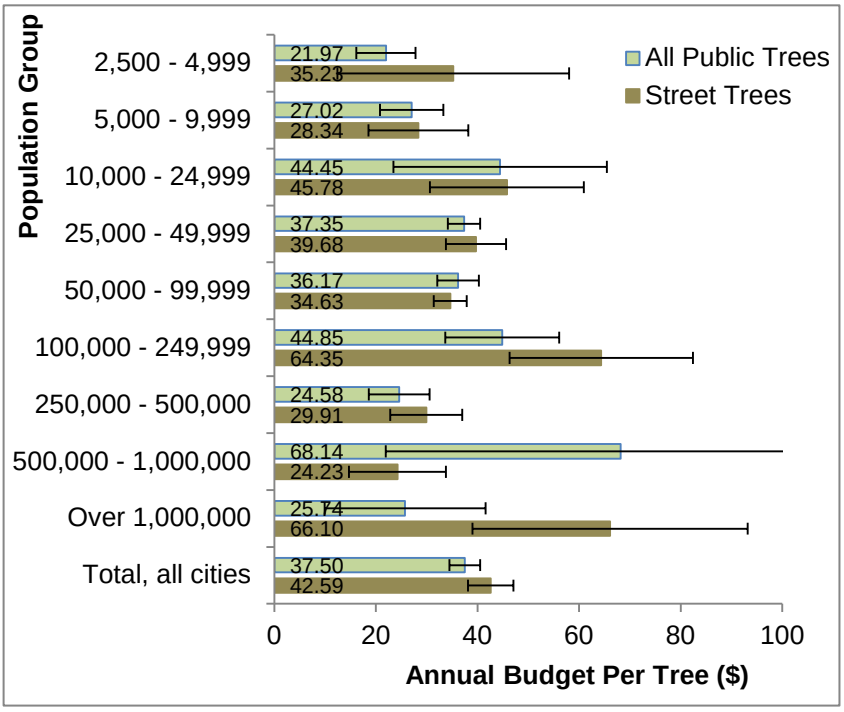


Figure 2-2. Annual budget spent per street tree (n=230) and per public tree (n=286) within the United States.

Determining the cost of the forestry budget per capita is straightforward and involves dividing the total forestry budget by the community population. A mean $8.76 per capita was spent on forestry budgets (Figure 2-5). Municipalities with 25,000 and 500,000 people spent approximately $9.40. The Tree City USA (TCUSA) program established a $2 per capita base requirement for communities as one of four requirements for TCUSA. The $2 per capita was initially set in 1976 and adjusting this value by the consumer price index to 2014 dollars produces an $8.32 value. Thus, communities on average are above this inflation adjusted TCUSA value. Regionally there was a difference in per capita spending. Spending was highest in the Midwest ($10.91), least in the Northeast ($5.81), and intermediate in the South ($7.86) and West ($7.75) regions.

Emerald ash borer is likely a factor with higher spending in the Midwest region (Hauer and Peterson 2016). After the initial 0 to 4 years, the percent forestry budget will approximately triple by the peak year in the 5 to 8 year post EAB confirmation in a state time period (Figure 2-6). Spending on tree and stump removal increased at the expense of tree pruning (Figure 2-7). Tree planting spending did not increase in locations in places with EAB compared to other places.

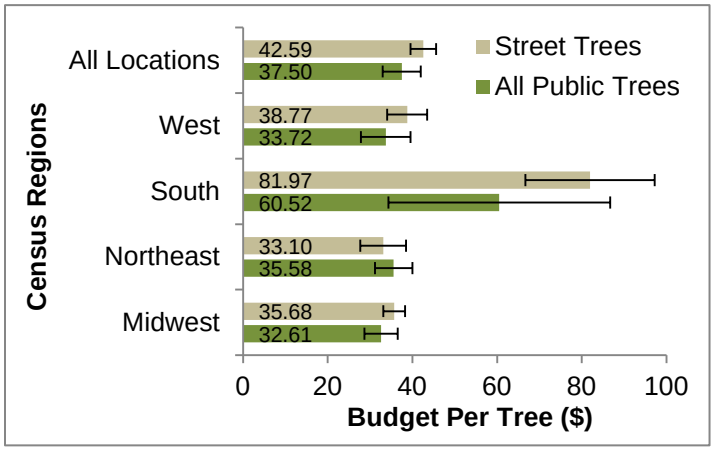


Figure 2-3. Regional comparison in annual budget spent per street tree (n=230) and per public tree (n=286) within the United States.

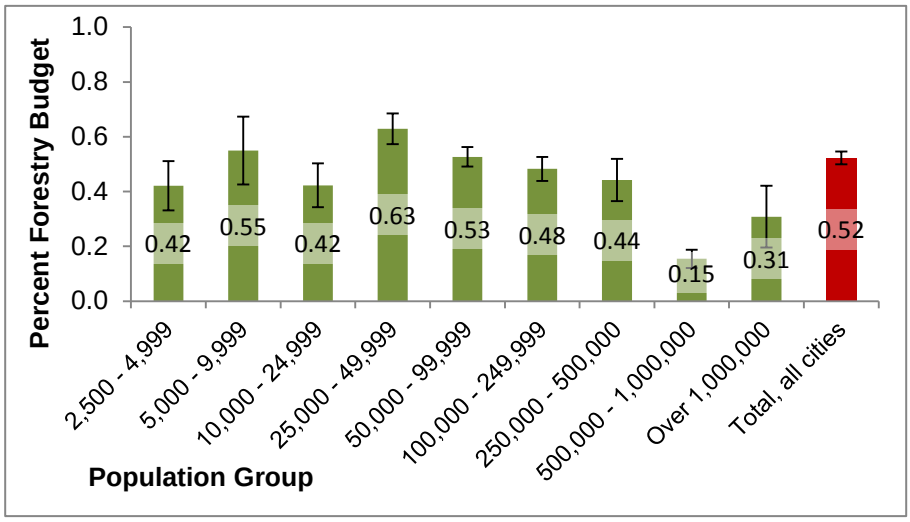


Figure 2-4. Percent forestry budget of the total municipal budget. (n=463)

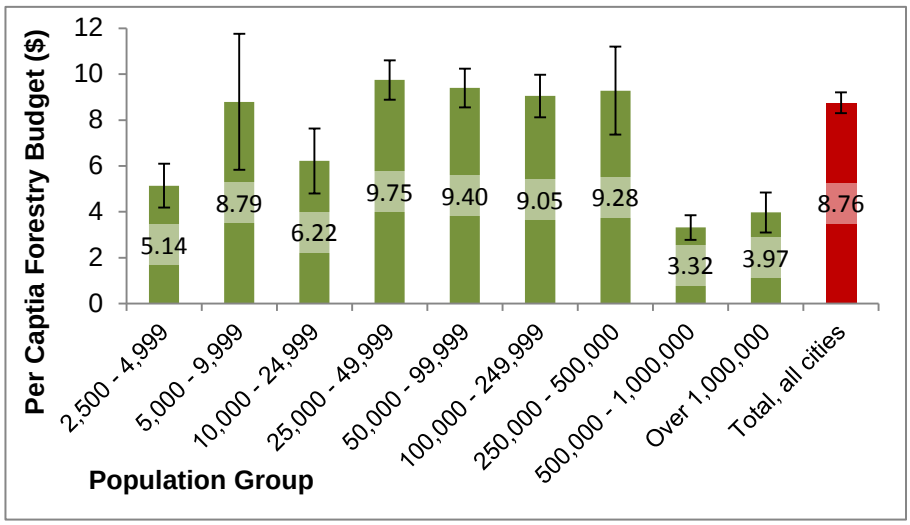


Figure 2-5. Per capita forestry budget. (n=477)

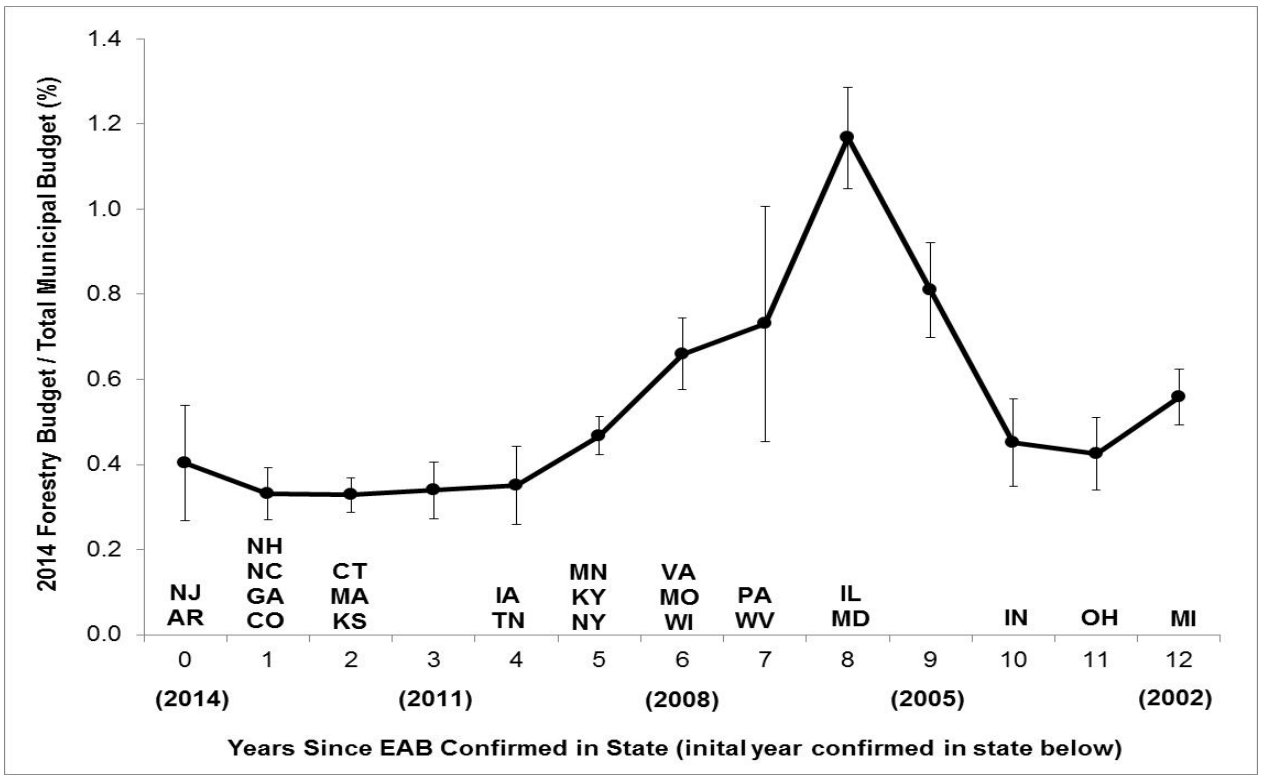


Figure 2-6. Temporal effect of emerald ash borer (*Agrilus planipennis* Fairmaire) on municipal forestry budgets as a percentage of the total municipal budget. (n=366). Adapted from Hauer and Peterson 2016

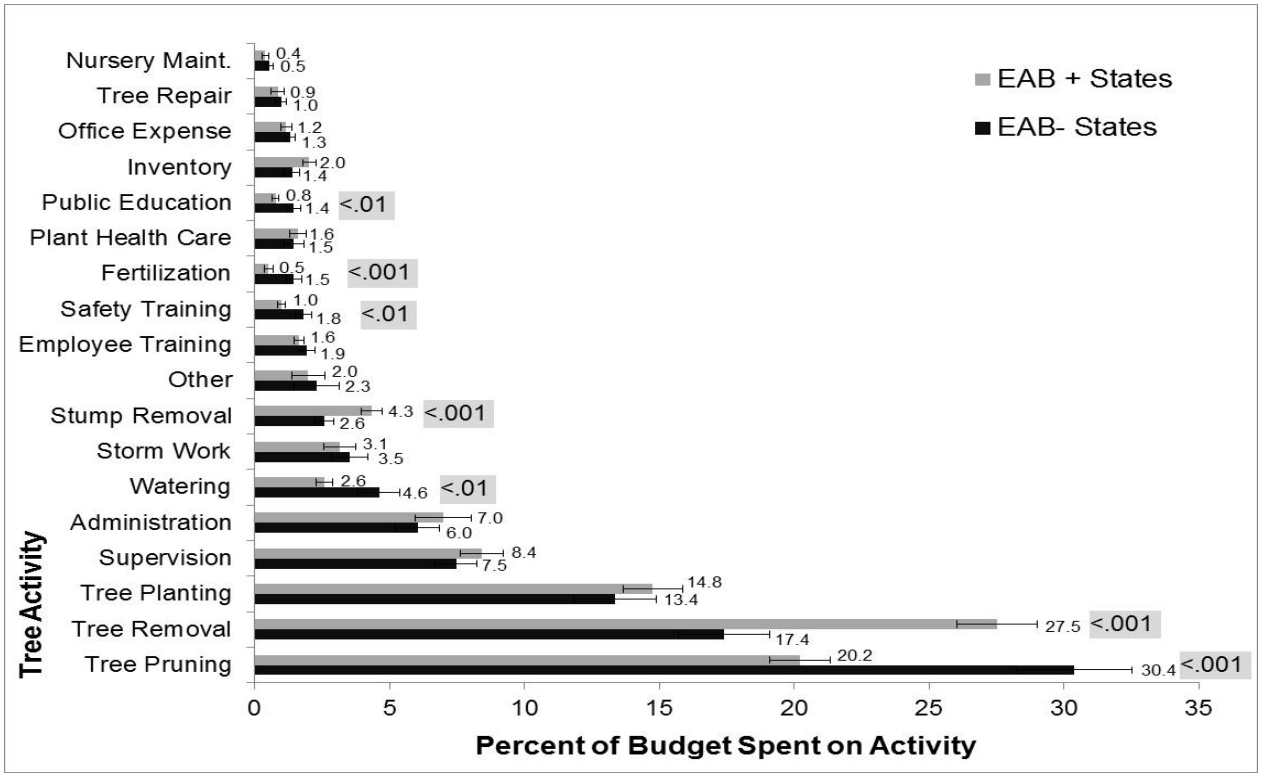


Figure 2-7. Percent of forestry budget spent on tree activities in states with a confirmed emerald ash borer (EAB) case (EAB+) and states without a confirmed EAB (EAB-) case. (n=268)

Public utilities are a municipally or regionally owned organization that a community may own or have a controlling interest. Along with utility ownership comes the necessity to manage vegetation under and near the electrical line. These utilities prune and remove trees to provide the safe and reliable distribution of power. A public electrical utility was reported for 17% of places which is consistent with industry statistics. There was no apparent difference among population groups and the percentage of places in a group with a public utility.

There was a difference in the utility budget amount by population group. Communities below 5000 people spent a mean $12,250 on vegetation management (Table 2-2). This compares to places with 500,000 or more people that spent $6,750,000 on average. The per capita spending for utility tree work is another way to measure and estimate the cost of electrical utility forestry operations. Nationally a mean $7.17 (1.17 SEM) was spent per capita. Costs per capita were higher in the South versus other regions. This could be a function of larger trees, more frequent pruning due to growth rates, or other reasons. Less populated places appeared to spend less than public utilities in larger communities.

Contracting is one approach communities use to complete tree care activities. A total of 410 places provided contract budget information, including 14 places that specified $0 were spent and these places were included in the analysis. A mean $313,750 (111,980 SEM) were spent on contracting, ranging from $0 to $45.5 million (Table 2-3). As population increased the mean total contracting budget increased. Regional differences were not significant. A mean $3.09 (0.23 SEM) per capita was allocated for contracting tree activities. The per capita spending did not differ significantly by region or population group.

Table 2-2. Does your community have a municipal electrical utility and if so what is the budget for the utility tree clearance program? (This includes all tree activity expenses; include personnel, overhead, equipment, supplies, and tree care and contract payments.)

		Annual Utility Tree Budget ($)			Per Capita Tree Budget ($)		
Classification	**N**	**Mean**	**Median**	**SEM**	**Mean**	**Median**	**SEM**
Total, all cities	48	775,303	190,440	268,234	7.17	4.54	1.17
Population Group							
2,500 - 4,999	2	12,250	12,250	7,750	2.98	2.98	1.43
5,000 - 9,999	4	47,250	47,000	16,255	5.29	5.24	1.66
10,000 - 24,999	6	67,737	60,667	25,543	5.02	4.56	1.95
25,000 - 49,999	15	191,267	157,000	32,113	5.85	4.66	1.20
50,000 - 99,999	9	675,205	403,227	246,165	10.27	4.95	3.89
100,000 - 249,999	8	1,509,845	700,000	780,566	10.31	5.98	4.63
250,000 - 500,000	2	1,035,000	1,035,000	255,000	3.66	3.66	1.34
500,000 - 1,000,000	2	6,750,000	6,750,000	4,250,000	8.48	8.48	5.44
Over 1,000,000	0	N/A	N/A	N/A	N/A	N/A	N/A
Geographic Region							
Midwest	18	491,119	112,500	203,025	4.28	3.01	1.05
Northeast	3	81,667	100,000	31,667	3.43	3.51	0.60
South	17	1,341,783	285,000	709,968	11.02	7.98	2.32
West	10	531,907	325,000	201,420	6.96	3.03	3.09

Several tree activities are conducted in-house, contracted, or communities use both approaches. Tree removal and storm cleanup were the most costly activities on a per tree basis (Figure 2-8). Interestingly all in-house costs per activity were lower than reported contracting costs. One explanation is in-house is the least cost option. Another plausible reason is contracted costs involved larger trees. In-house accounting may be different, sometimes capital expenses (equipment) is not included in maintenance budgets. Tree size was not accounted for in this question. Future examination is needed to quantify how in-house and contracted services compare.

Table 2-3. How much is the total annual cost for all contracted tree care activities and management activities for the last fiscal year?

		Annual Contract Budget ($)			Contract $ per Capita		
Classification	**N**	**Mean**	**Median**	**SEM**	**Mean**	**Median**	**SEM**
Total, all cities	410	313,750	60,000	111,980	3.09	1.46	0.23
Population Group							
2,500 - 4,999	25	13,032	6,720	3,510	3.40	1.63	0.82
5,000 - 9,999	27	21,214	9,375	4,664	2.73	1.11	0.54
10,000 - 24,999	33	35,410	16,000	7,237	2.42	0.89	0.53
25,000 - 49,999	111	132,485	60,000	19,345	3.81	1.59	0.54
50,000 - 99,999	130	221,263	80,000	33,533	3.19	1.27	0.48
100,000 - 249,999	59	343,389	250,000	48,607	2.43	1.49	0.38
250,000 - 500,000	18	582,603	391,360	141,730	1.75	0.96	0.41
500,000 - 1,000,000	5	907,551	900,000	282,792	1.37	1.10	0.47
Over 1,000,000	2	23,908,000	23,908,000	21,622,000	3.53	3.53	2.04
Geographic Region							
Midwest	165	195,606	47,500	28,041	3.45	1.47	0.43
Northeast	60	923,216	50,293	757,476	2.61	1.94	0.39
South	78	182,928	72,563	30,279	2.87	1.14	0.45
West	107	249,544	75,000	40,324	2.95	1.32	0.45

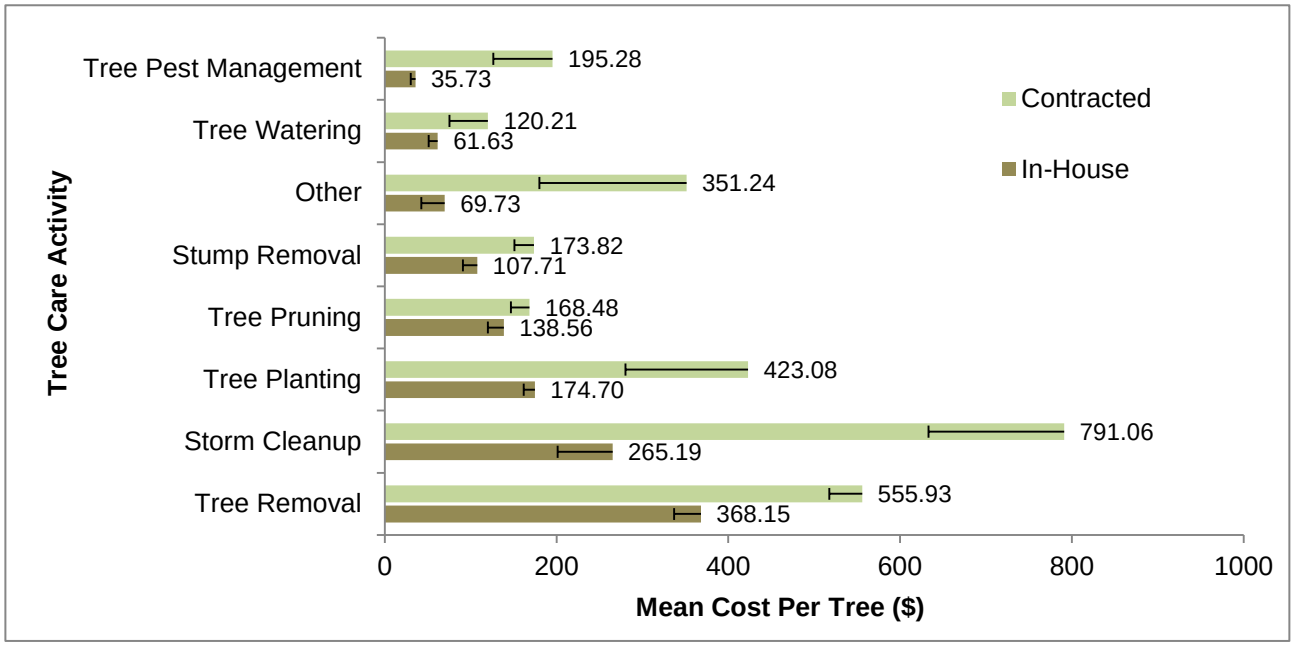


Figure 2-8. Please indicate the in-house and contractor budget (costs) and number of trees associated with each of the tree activities below for your municipality for the last fiscal year. (n=92 to 209)

Tree Management Areas and Budget

Tree budgets are allocated for different management areas (e.g., street trees, cemetery trees, public grounds, park trees, and other locations). Street trees received the greatest budget allotment with 62% allocated within the United States (Figure 2-9). Park trees were allocated 23% of the tree budget. Interestingly the South and West regions had a greater park tree budget by percent than the Midwest and Northeast which coincidentally had a greater street tree budget allocation. The remaining budget areas were public grounds (8%), cemeteries (2%), nursery tree maintenance (1%), and other offered uses (4%).

Communities use a variety of funding sources for urban tree care activities (Figure 2-10). Respondents were asked to indicate the use of funding sources from a list that included municipal funding, donations, sales of products, grants, fines, fees, and others. The general fund is the most common funding source. Nearly 86% of communities use the general fund which on average provided 72% of the money used for public tree budgets in the United States. State and federal forestry grants were used by 30% of communities within the immediate past. However, only a mean 2.6% of the total budget was supported by grants. Stormwater fees are becoming more common as a mechanism to cost account for this environmental benefit. Seven percent of the places used this source and it covered 1.4% of the funding for all communities tree budgets. Capital improvement funding was commonly mentioned in the other category.

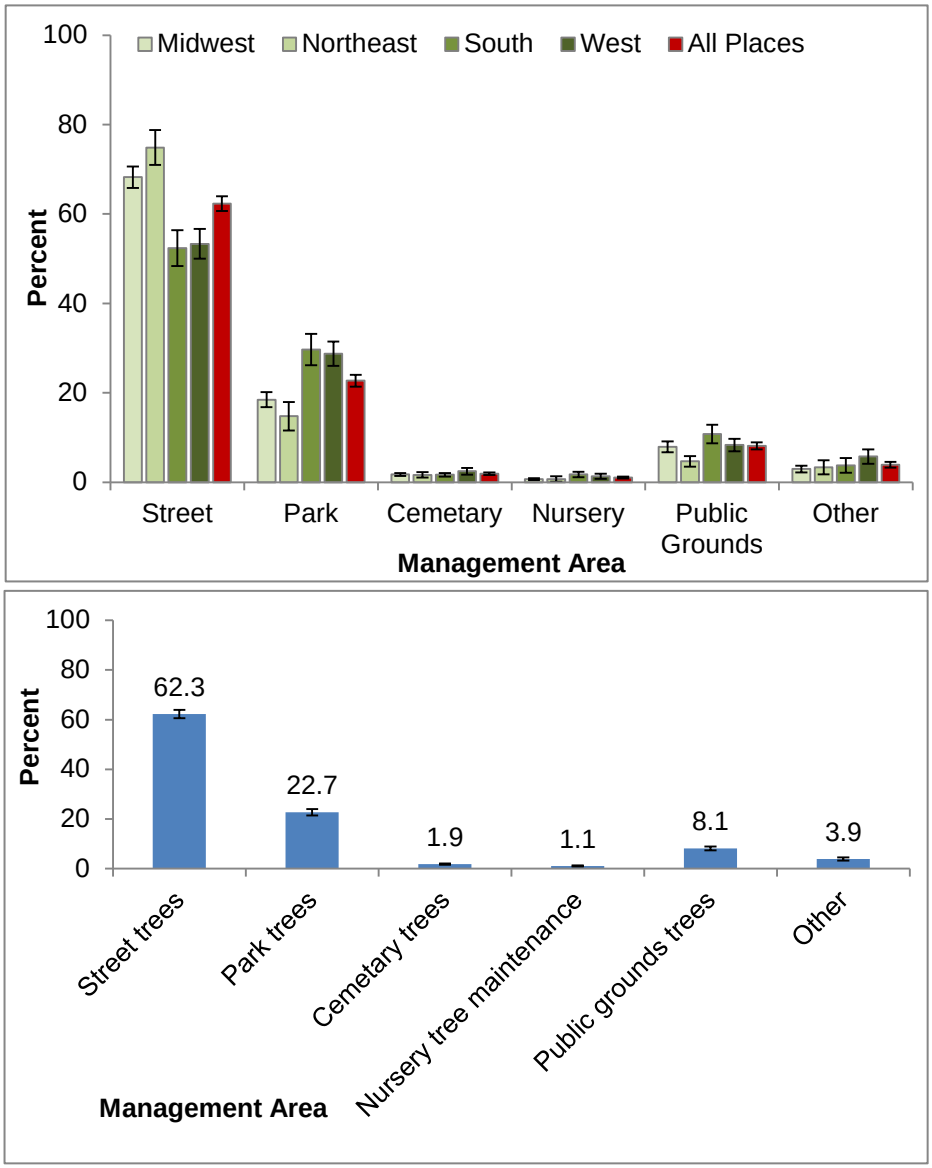
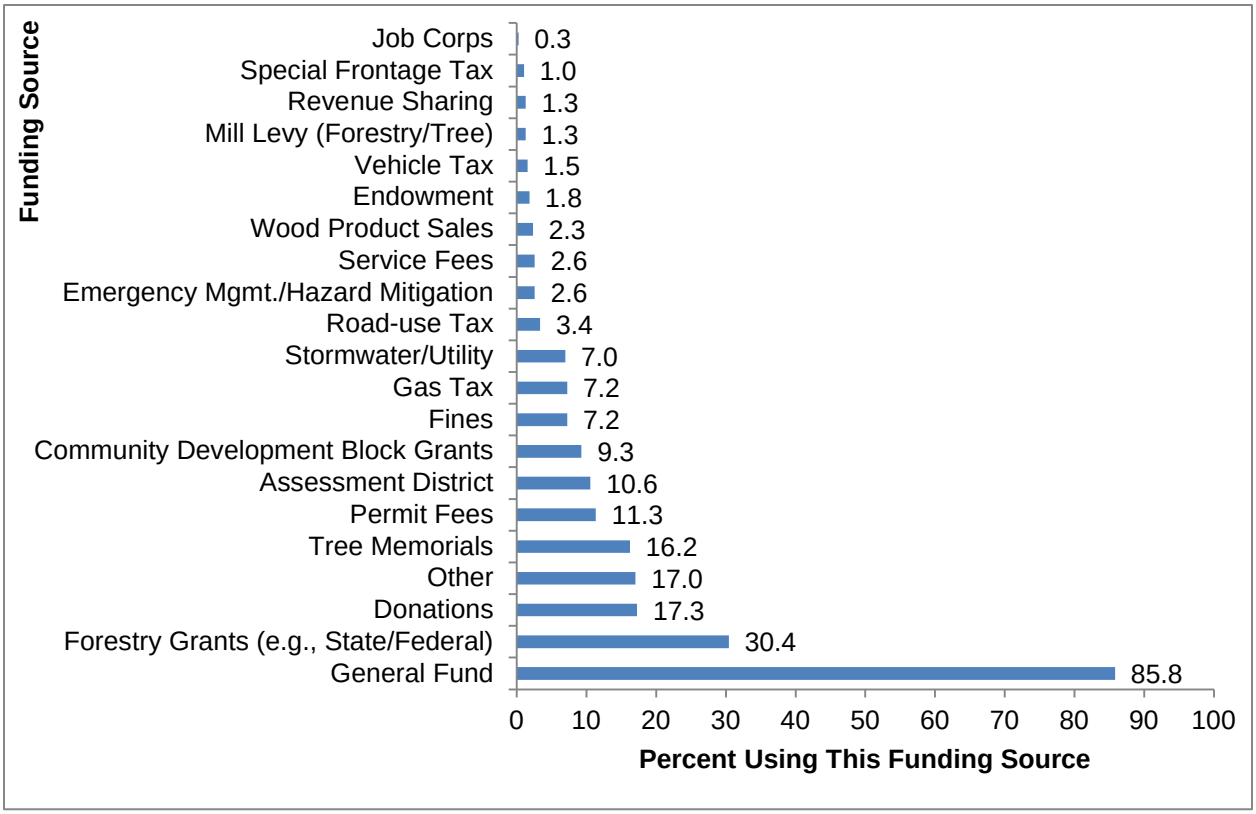


Figure 2-9. What percent of your annual tree care budget is used in each of the following general areas? (n=352)



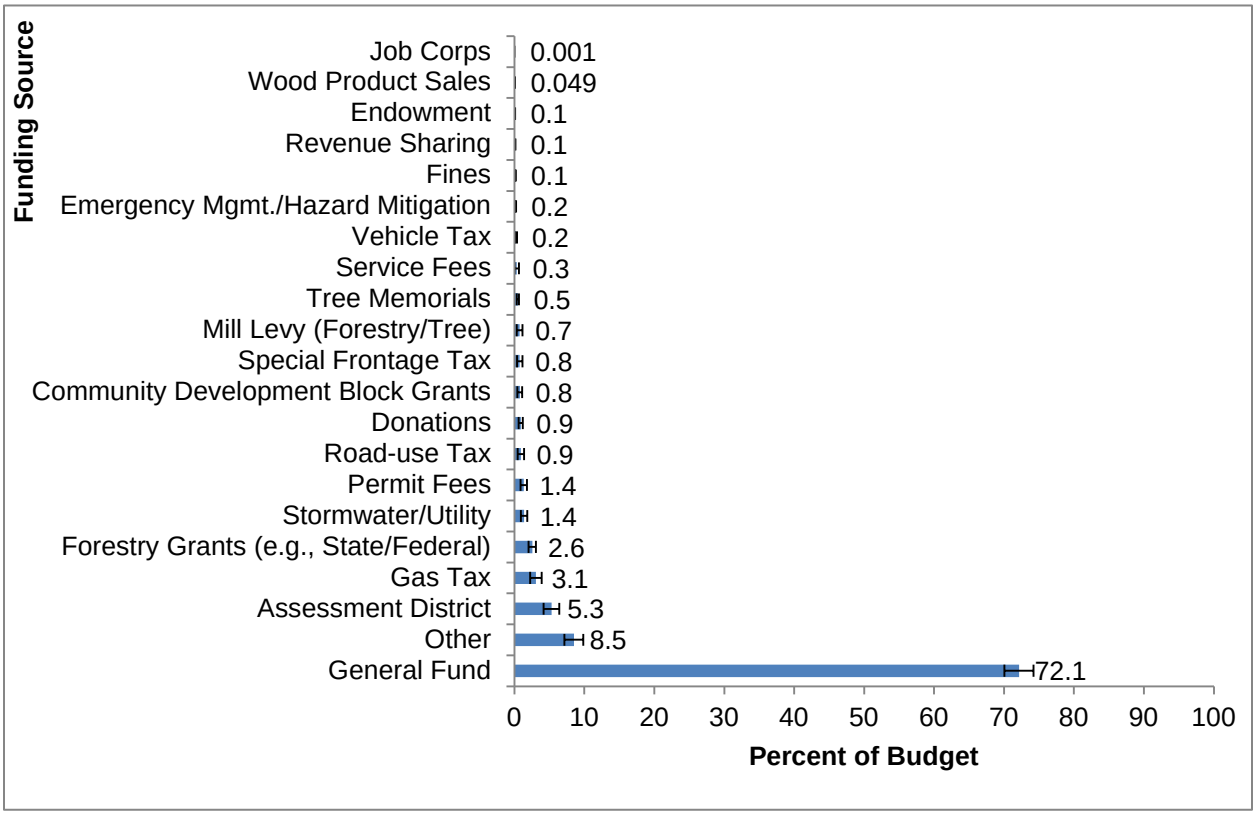


Figure 2-10. What sources fund your municipal tree management budget? (n=325)

Adequacy of Budget

Municipal budgets fluctuate based on community resources, identified needs, and priorities. Respondents were asked their belief on an upcoming budget and if it will stay the same, decrease, or become bigger (Figure 2-11). Overall 87.4% indicated the upcoming budget would stay the same (48.8%) or increase (38.6%). Few (12.6%) thought the budget would decrease. Nearly half (46%) of the respondents from the Midwest indicated that their budgets would increase. Emerald ash borer is currently a major pest issue that is causing communities to treat, remove, replant thus increasing needed funding.

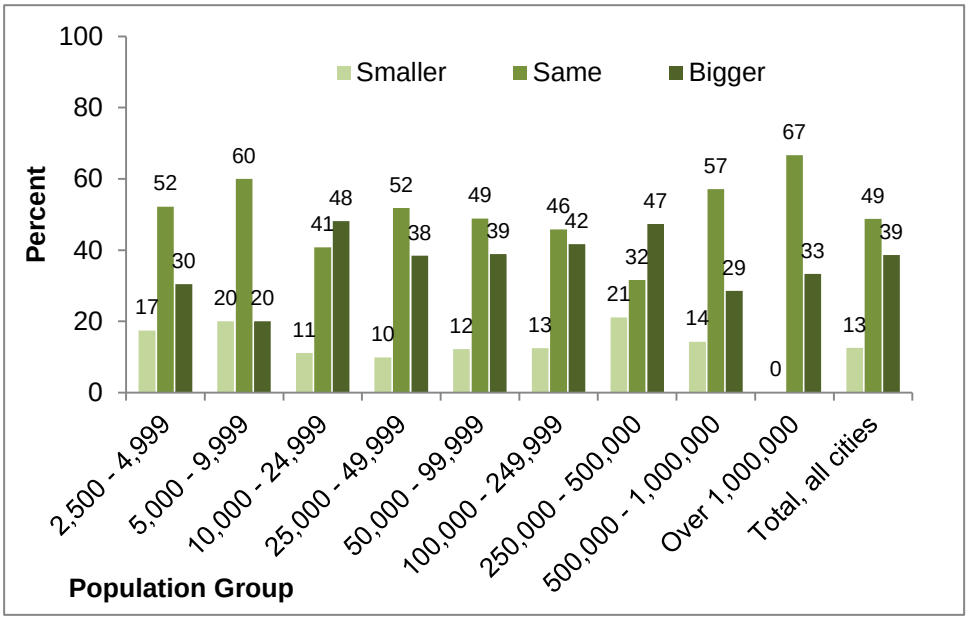


Figure 2-11. Is your community tree budget smaller, the same, or bigger this year compared to last year? (n=414)

Was the current budget adequate to meet identified needs? Over half (53%) of communities indicated the budget was adequate to meet currently identified needs (Figure 2-12). Communities above 100,000 were less optimistic that the budget was adequate.

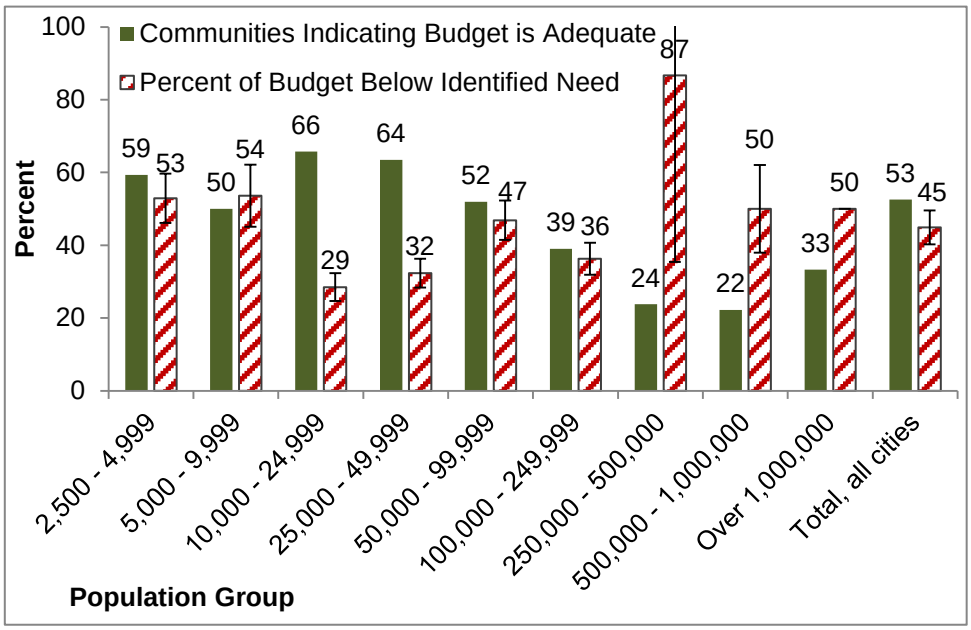


Figure 2-12. Is your budget adequate to meet current needs as defined in your work plan or your identified annual urban forestry budget needs? (This includes planting, maintenance, removal, inventory, education, etc.) (n=512 for community budget; n=186 for % below identified need)

Respondents with an inadequate budget indicated how much their budget is below an identified need. Communities were a mean 45% (4.6 SEM) level below an identified need.

Allocation of Funding by Activity and Management Area

A variety of tree care activities were examined for allocation of funding. Tree planting, tree pruning, and tree removal (including stumps) are the big three that required a majority (65.6%) of funding (Figure 2-13). Tree (23.3%) and stump (3.6%) removal were the greatest (27% of total budget). Pruning used nearly a quarter of the budget (24%) which is below the long term 29% mean from the past reports dating to 1974. Budgets allocated 14% for planting. Why pruning expenditures are lower today was not established. Possible reasons are greater efficiency of dollars required to prune trees; trees are smaller in size today than in the past; trees are pruned less frequently; or other management areas cost proportionally more today.

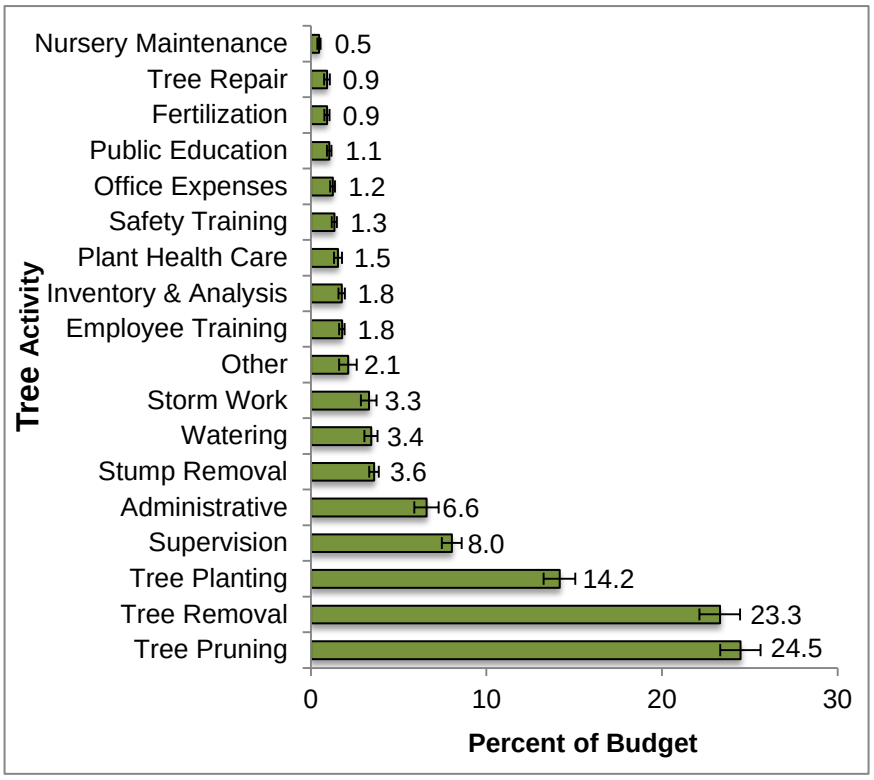


Figure 2-13. What percent of the total tree management budget from all sources is used for the following activities? (n=268)

Tree pruning was greatest in the West with 36% of the budget spent on this activity. There were anecdotal reports that tree pruning budgets were reduced during the great recession and the current greater allocation is reflected in increased tree pruning. Tree removal was greater in the Midwest and Northeast, possibly as a result of emerald ash borer (EAB) (Figure 2-14). In places with EAB, the tree and stump removal budget was 32% compared to 20% in states without EAB (Hauer and Peterson 2016). Tree pruning budgets were 30% in states without EAB and 20% in states with EAB. Budgets for tree watering, public education, safety training, fertilization, also declined in response to budgets allocated for EAB.

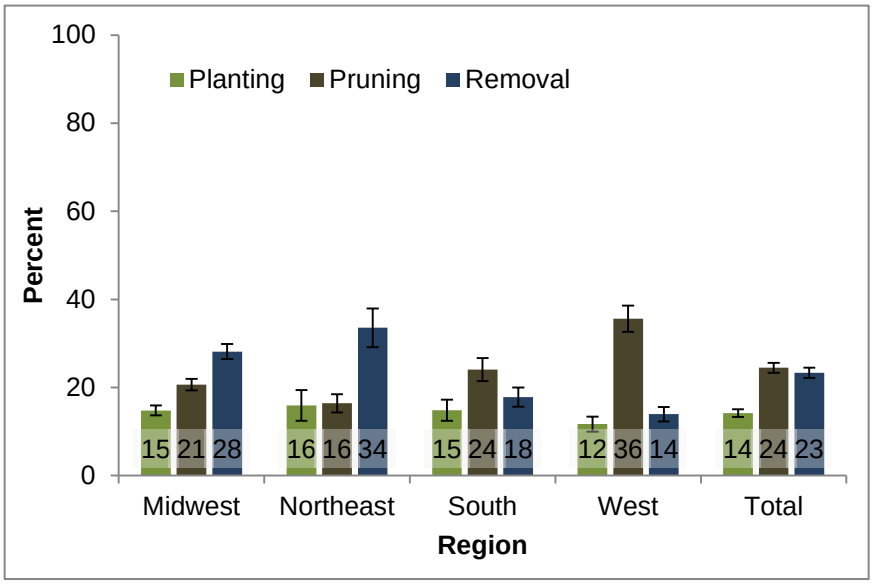


Figure 2-14. What percent of the total tree management budget from all sources is used for pruning, planting, and removal as ranked by region? (n=268)

Staff Salaries

How does starting and average pay of personnel associated with tree care activities compare to other jobs? The United States Bureau of Labor Statistics (BLS) collects data and regularly develops a national mean of all occupations. In 2014 the mean annual wage for all occupations from the BLS was $47,230 (Figure 2-15). The mean salary of a municipal arborist (e.g., pruning/ trimming) was $47,837 (870 SEM) which is slightly above the national BLS mean. As employees climb the career ladder to a working forman ($52,483; 1381 SEM), urban forestry specialist ($56,058; 2634 SEM), or urban forest manager ($71,219; 1635 SEM) their annual wage exceeds the national mean. Salary from entry level, seasonal employees, laborer, clerical, and truck driver jobs were lower than the national BLS mean.

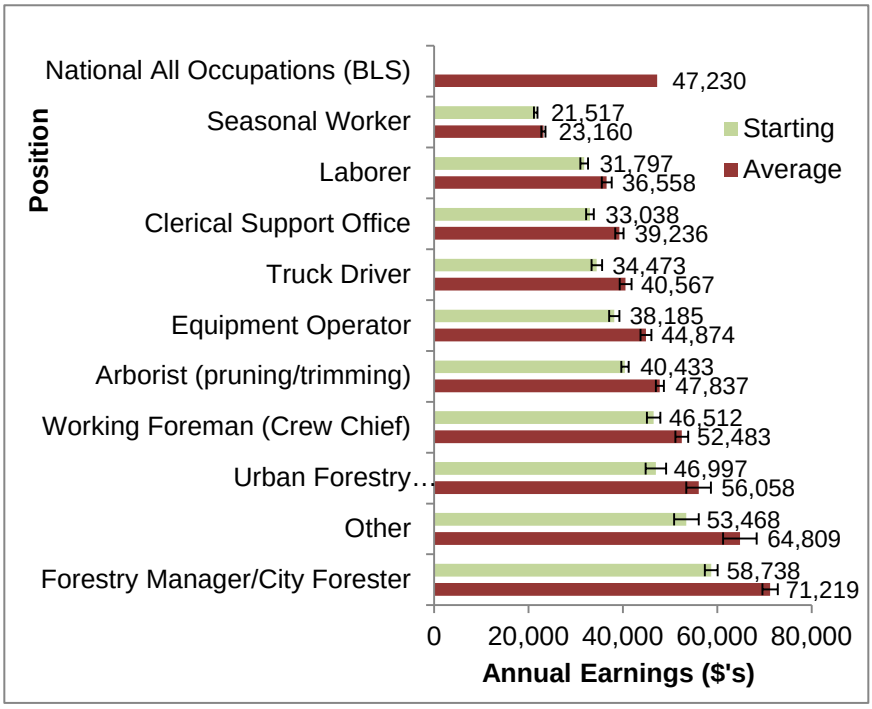


Figure 2-15. Starting and average annual pay for personnel compared to the national mean of all occupations in the United States. (n=47 to 178)

Salary was highest in the Western and Northeastern states and lowest in the Southern states for an urban forestry manager and forestry specialist (Figure 2-16). Arborist pay was the least in the Southern states.

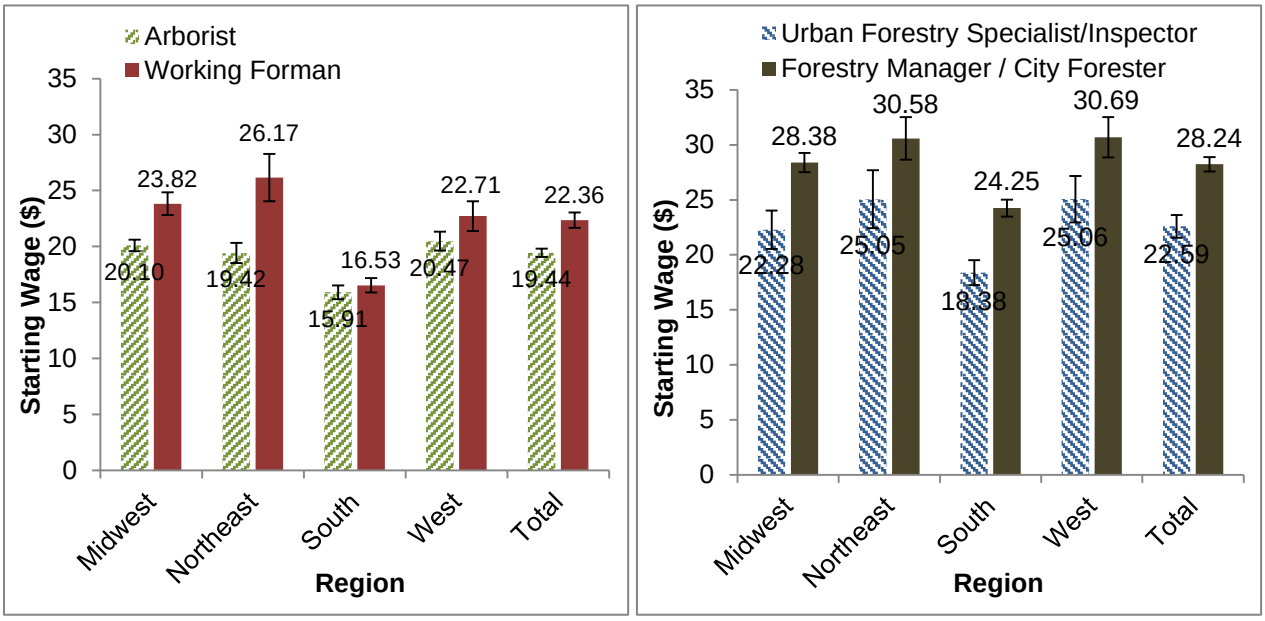


Figure 2-16. Regional differences in starting hourly wage for personnel in the United States. (n=49 to 178)

Section Three: Tree Management Policy and Planning

A variety of approaches are used to plan and develop policy to manage municipal tree populations. Some communities use government authorized tree boards to set policy. Communities use ordinances to regulate trees on public and private land. Different types of plans are used to set policy and develop goals and objectives to manage tree populations. These plans are ideally based on the community's desire for the urban tree resources. The use of industry standards is another approach communities can use to base decisions on the best science and management practices supporting increased tree longevity and greater tree benefits as an end result. This section is divided into four topical areas that cover organizations and institutions involved with policy setting; tree ordinances; plans that incorporate trees and vegetation; and incorporation of standards of practice.

Organizations and Institutions Involved with Policy Setting

Communities use a variety of organizations to establish policy for tree management. Not surprising, 71% of respondents said a city council or community board was commonly used to set policy (Figure 3-1). This was consistent regardless of community size. A parks board (38%) and tree board (32%) were used by less than half of responding places. However both became more common as population increased. The use of a parks board increased from one-third of the smallest group to two-thirds in the largest population group. Using a tree board increased from 20% to over 40% as population group size increased. A mean 2.1 organizations were involved with establishing tree management policy in a community.

Two-thirds of respondents indicated they have a government-authorized group that helps develop and/or administer tree management policy. As community size increased the frequency of having a group increased from 38% (2500 to 4999 people) to over 80% of large places (100,000 or more people). These groups function to provide advisory (83% of respondents), policy setting (45%),

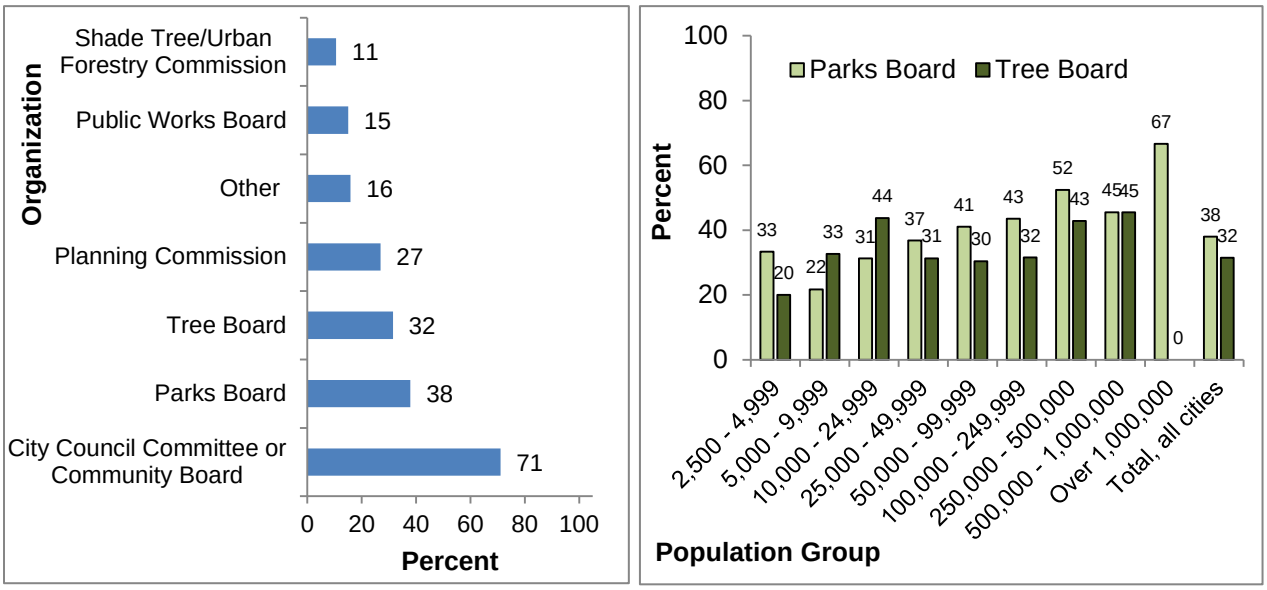


Figure 3-1. Which of the following organizations help establish policy for tree management in your community? (n=622)

advocacy (43%), and operational (25%) roles. Only operational (on the ground work) differed by population group, with the smallest population group having 42% of places doing such and this declined to the 25% level for all other groups. Most of the tree boards/commissions were active with 80% indicating they meet regularly (four or more times per year). The board is required by city ordinance or charter in 63% of reported locations. Approximately one-third (31%) operate from a written manual and 44% report directly to public officials. A tree board (and other board commission) more commonly reported to public elected officials in small communities than larger communities. In the 2500 to 4999 population group 67% reported directly to public officials compared to places with 50,000 or more people and only 40% reporting directly.

Tree Ordinances

A municipal ordinance functions to regulate actions or requirements. A tree ordinance specially functions to regulate trees on public and/or private property. Over 90% of responding municipalities had at least one tree ordinances or were developing an ordinance (Figure 3-2). Having a tree ordinance steadily increased from two-thirds of the 2500-4999 group having one to all places ≥ 100,000 people have tree ordinances. On average tree ordinances were first written in 1985 and last updated in 2007. Interestingly the oldest reported one dates to 1761.

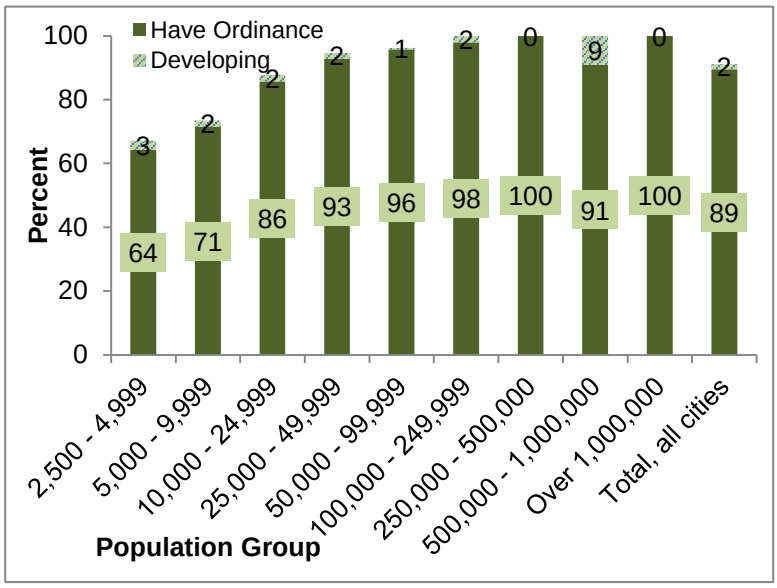


Figure 3-2. Does your municipality have one or more municipal ordinances that pertain to trees? (n=657)

Twenty-five ordinance topics were examined for the commonality of use (Table 3-1). These were further grouped within four ordinance types including credential, management, planting, and preservation. A credential is defined as a qualification or background of a person or company that designates a suitability to perform an activity. Management involves ordinances that affect existing trees and how they are maintained. Preservation also involves existing trees but encompasses regulation of trees in construction areas or retention of trees from removal. Planting ordinances direct the tree species to plant and vegetation requirements in developed areas (e.g., parking lots and new developments).

Credential. The most common ordinance topic was defining the authority for public tree management within 80% of responding places. An ISA certified arborist is specified by 26% of respondents for public trees and this was less common with 7% of communities for paid private tree work. A requirement for licensing private tree care firms was common to 29% of respondents.

Preservation. The preservation of trees during construction is used by communities to regulate tree removal and construction near trees. Tree preservation requirements were more common as community population increased. Over half (54%) of places required tree preservation during development to some extent. Restricting tree cutting on private property (25%) and identifying heritage or significant trees for preservation (31%) were also specified in ordinances.

Table 3-1. What topics do your community tree ordinances include? (Percent with an ordinance type, n=579)

Ordinance Topic	Ordinance Type	Population Group (Percent Yes)									
		2,500 - 4,999	5,000 - 9,999	10,000 - 24,999	25,000 - 49,999	50,000 - 99,999	100,000 - 249,999	250,000 - 500,000	500,000 - 1,000,000	Over 1,000,000	Total, all cities
Requires certified arborist for paid private tree work	Credential	2	6	8	3	9	7	23	0	0	7
Requires certified arborist for public tree work	Credential	14	15	20	21	31	32	55	18	0	26
Requires licensing of private tree care firms	Credential	11	18	23	25	39	32	36	18	0	29
Defines official authority for public tree management	Credential	80	70	78	78	82	85	91	82	100	80
Requires annual community tree work plans	Management	5	15	13	12	11	14	9	0	0	11
Identifies formula for determining monetary tree value	Management	5	15	23	23	30	34	32	36	33	26
Requires regular public tree maintenance	Management	34	24	35	44	40	38	32	27	33	39
Requires particular types of maintenance (e.g. pruning)	Management	41	30	28	38	40	43	55	27	0	39
Establishes permit system for work on public trees	Management	27	30	43	45	59	60	64	64	67	50
Establishes provisions for penalties for non-compliance	Management	36	55	63	52	61	56	64	73	33	56
Restricts burning of solid wood waste	Management	23	18	28	12	19	15	18	27	33	18
Establishes an insect/disease control strategy	Management	18	18	20	23	28	26	14	18	33	24
Defines tree maintenance requirements on public property	Management	34	15	28	36	37	39	55	36	33	36
Prohibits tree topping	Management	34	21	20	38	39	43	59	36	0	37
Regulates abatement of hazardous or public nuisance trees	Management	50	36	63	55	66	61	82	64	0	59
Regulates removal of dead or diseased trees	Management	80	58	83	77	79	76	77	82	33	77
Regulates tree species which may or may not be planted on private property (approved tree list)	Planting	27	27	35	26	25	26	14	27	0	26
Requires tree planting around reconstructed parking lots	Planting	14	18	35	35	51	49	50	45	33	41
Requires replacement of removed publicly owned trees	Planting	34	24	45	41	47	45	45	36	33	42
Requires tree planting around new parking lots	Planting	25	42	63	60	69	66	64	64	67	60
Requires tree planting in new developments	Planting	41	58	75	67	75	69	73	64	100	68
Regulates tree species which may or may not be planted on public property (approved tree list)	Planting	61	70	68	67	77	68	68	73	100	70
Restricts tree cutting on private property	Preservation	9	24	18	19	30	34	23	27	0	25
Identifies preservation of heritage or significant trees	Preservation	14	12	33	28	35	38	36	55	67	31
Requires preservation of trees during development	Preservation	36	36	40	54	60	56	73	82	100	54

Planting. Tree planting ordinances are used to regulate what types of plants can be planted and to define tree species that are prohibited from planting. An approved tree list for public trees was common to 70% of responding places. Only 26% of respondents regulated what tree species could be planted on private land. The requirement for planting trees in new developments and near parking lots is used in ordinances. Two-thirds of ordinances required tree planting in new developments. Sixty percent of ordinances required tree planting around new parking lots and 41% specified tree planting around reconstructed parking lots. The required replacement of publically owned trees was specified in 42% of respondent's ordinances.

Management. Tree ordinances are also used to regulate the management of existing trees. The most common management item reported was regulating the removal of dead or diseased trees within 77% of ordinances followed by abatement of hazardous or public nuisance trees (59%). Establishing a permit system for public tree work (50%) and establishing provisions or penalties for non-compliance (56%) were common to ordinances. Tree topping was prohibited by 37% of responding communities. Approximately one-third of responding places specified the requirement for public tree care (39%), a requirement for specific types of maintenance (39%) such as pruning, and defining public tree maintenance requirements (36%). Few ordinances (11%) specified a requirement for a community tree work plan. A quarter of respondents indicated ordinances were used to establish an insect or disease control strategy (24%), or identify a formula for determining monetary tree value (26%). Nearly one-fifth restricted the burning of solid wood waste.

Even though a community may have a tree ordinance, enforcement and education help make the ordinance work. Overall 64% of respondents indicated tree ordinances are actively enforced. This was consistent among population groups. Enforcement fines are deposited into a specific fund in 30% of responding communities. This increased from 12% of the smallest group to over 50% of places ≥ 100,000 people. Approximately half of the respondents indicated that enforcement will be the same or greater next year.

Ordinances are developed by municipal staff and external groups (e.g., consultants, state and federal U&CF personal, and volunteers). Municipal staff were the most common way of developing ordinances in 89% of responding places (Figure 3.3). These were further formally approved in 85% of places by local government. Volunteers (31%), consultants (16%), and state U&CF staff (12%) were also involved. The population of the community did not appear to affect who developed the ordinance except smaller communities used consultants more so. Nearly 30% of places under 25,000 used a consultant compared to 13% of places with 25,000 and more people that hired external experts to develop an ordinance.

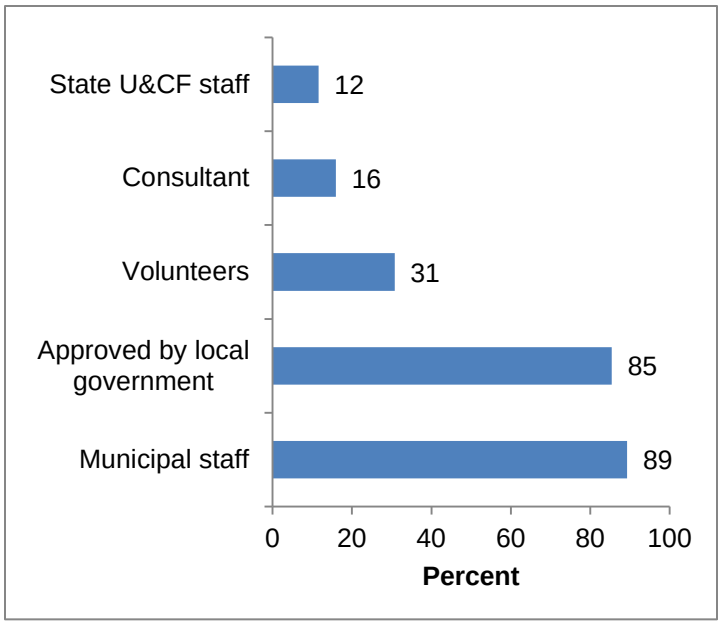


Figure 3-3. Who helped develop the municipal tree ordinance? (n=439)

Plans That Incorporate Trees and Vegetation

Plans to direct the development and maintenance of urban forests and urban green spaces take many forms. They can be stand alone or as a section of a plan that includes urban vegetation to meet community goals. In general, half of responding communities have a written strategic plan for urban forestry, tree management, open space, green infrastructure, or land use that includes trees (Figure 3.4). The commonality of a written plan increased as population size increased.

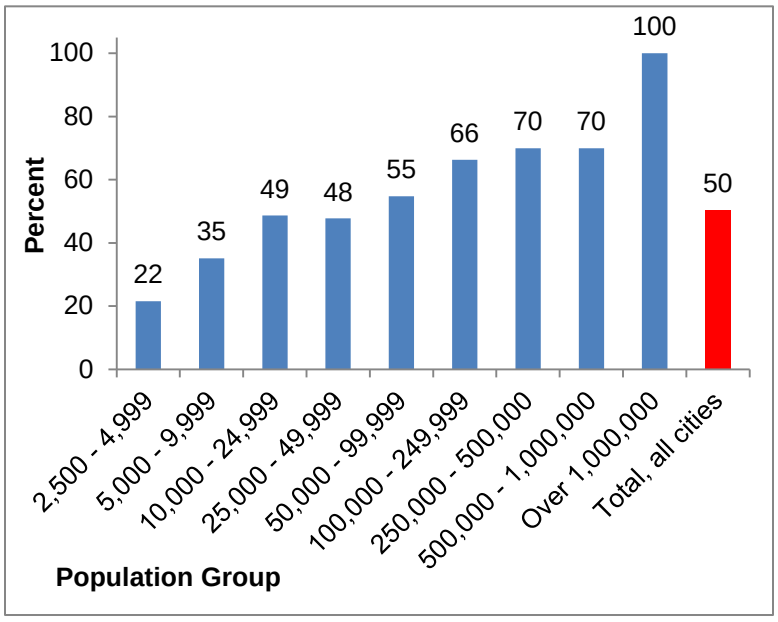


Figure 3-4. Does your community have a written strategic plan for urban forestry, tree management, open space, green infrastructure, or land use management that includes trees? (n=594)

If a community had a written plan, they were asked to report which types of plans they have (Figure 3-5). Tree management can be incorporated into a specific plan (e.g., urban forest strategic, tree risk management) or as part of another plan (e.g., city master plan or storm water management). An insect and disease readiness plan was most common with 76% having such a plan and 10% were developing one. This plan was uncommon (10%) in small communities (< 5000 people) and increased as population increased. Over 75% of respondents indicated they either had (67%) an urban forest or tree management plan and 10% were developing one. Two-thirds of responding places incorporated (or were developing this) tree management into the city master or comprehensive plan.

A municipal storm water (52%) or watershed management plan (34%) could also include tree management as part of their plans or were currently developing such. Trees were incorporated into 59% of storm/emergency response plans.

A tree risk management plan occurred in 35% of places. An urban forest strategic plan was least common with 33% having one (19%) or developing one (14%).

The urban forest is used to accomplish several community goals such as storm water management, public health, and/or air quality. Forty-five percent of respondents indicated such goals are met

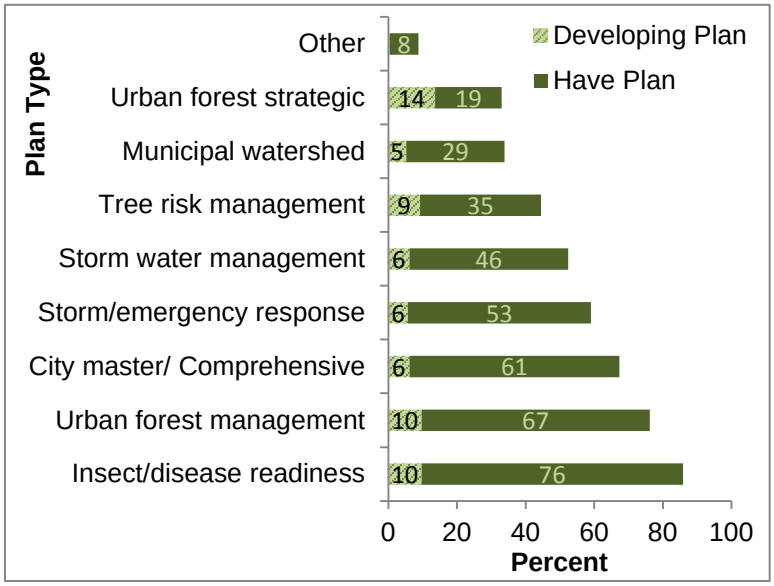


Figure 3-5. Which types of plans (separate or combined together) do you have that incorporate the management of trees and other vegetation? (n=227)

by the urban forest (Figure 3-6). As population increased the use of the urban forest for environmental and social reasons increased. Only 22% of the smallest places did such and this increased to 100% of places with one million or more people.

A plan is used to implement specific goals (Figure 3-7). Several urban forest goals were incorporated into plans. Species diversity was the most common with 70% of respondents including this in their plans. Tree condition (49%) and a tree canopy goal (48%) were incorporated by nearly half of responding communities. A tree canopy goal was more common in larger places. Storm water management is a vital community action and trees were incorporated into 42% of these plans in communities. Other ecological goals such as carbon storage (13%), energy conservation (19%), and air quality (22%) were less commonly incorporated.

Municipal staff were the group of people that were most commonly associated with developing plans in 85% of places (Figure 3-8). One-third of places used a consultant (35%) and volunteers were used in 20% of places. Consultants were more commonly used by small places with 60% of places with fewer than 5000 people hiring this professional. State U&CF staff were involved with 11% of places with assisting in the development of a plan. The primary plan was approved by the local government in half of the responding places.

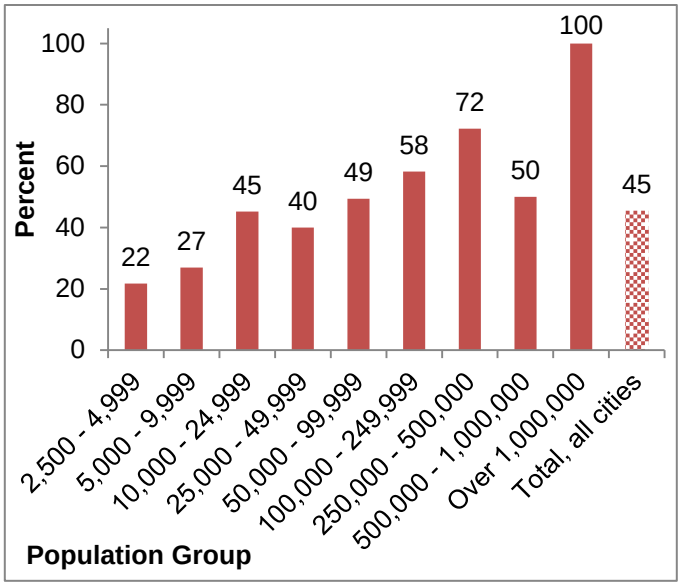


Figure 3-6. Does your community use the urban forest to accomplish storm water, public health, and/or air quality goals? (n=491)

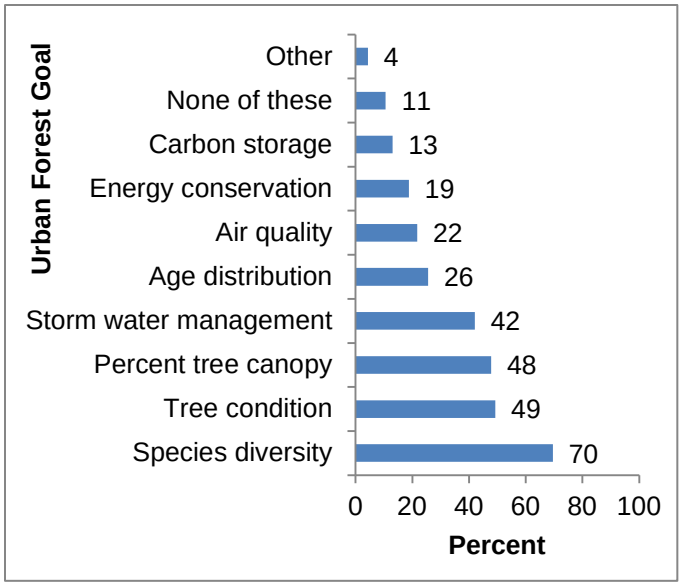


Figure 3-7. Do any of your plans contain the following goals for the urban forest resource? (n=207)

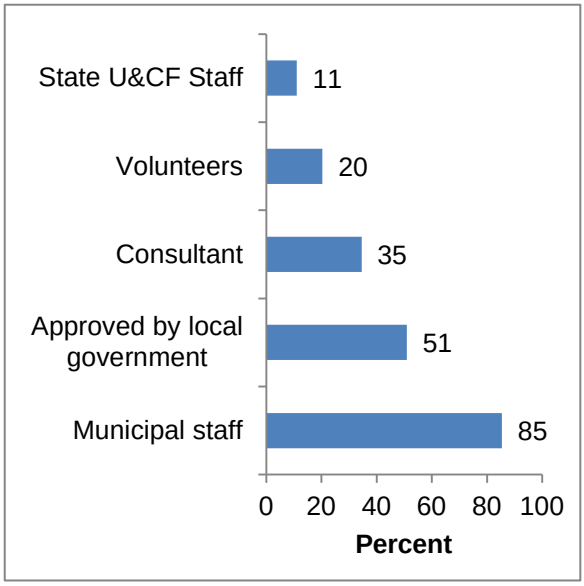


Figure 3-8. Who developed the primary plan to manage the urban forest? (n=226)

Incorporation of Standards of Practice

The management of urban vegetation is guided by the use of standards of practice. These include formal industry standards (e.g., A300, Z133, Z60.1), best management practices (BMP's), and recognition programs such as the Tree City USA program. Only 7% of respondents did not know about any industry standards (Figure 3-9). The unfamiliarity was most common in small communities (Figure 3-10).

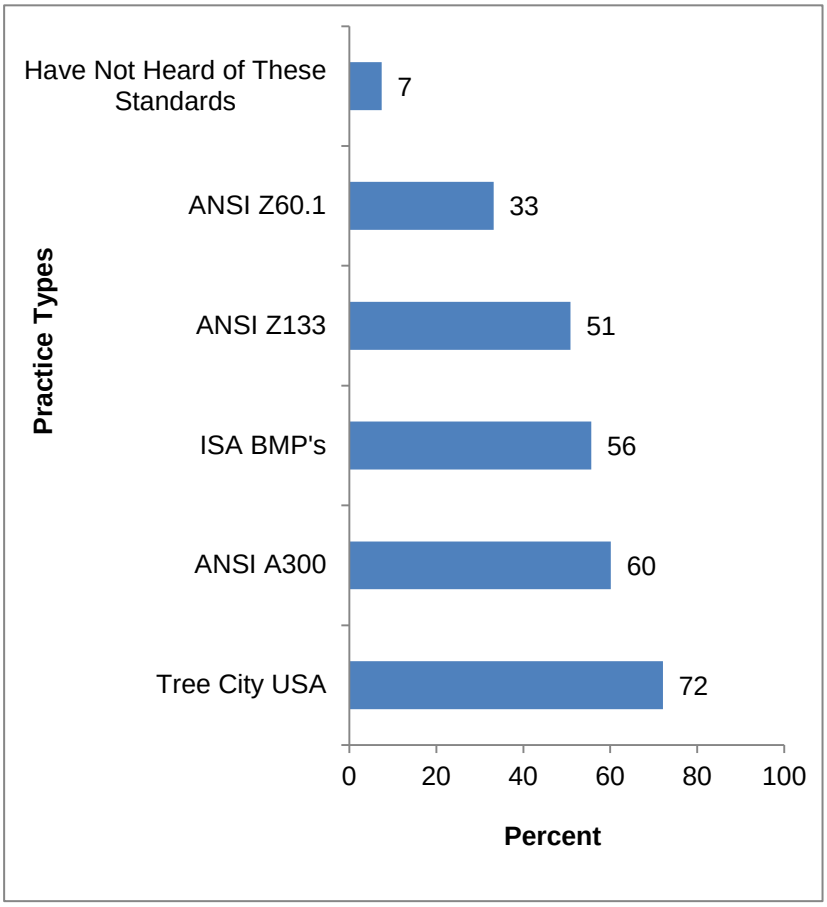


Figure 3-9. Standards of practice incorporated into tree management procedures? (n=419)

The ANSI A300 (Tree, Shrub, and Other Woody Plant Management Operations – Standard Practices) is a voluntary industry standard that is used to guide common arboricultural practices (e.g., pruning, planting and transplanting, tree risk assessment, soil management, and others). Overall 60% of responding communities incorporated the A300 into tree management procedures. Only 10% of communities below 10,000 people did such compared to 67% of places with 10,000 or more people.

The ANSI Z133 (American National Standard for Arboricultural Operations – Safety Requirements) provides criteria for workers engaged in arboricultural operations and address general safety, electrical hazards, use of vehicles and mobile equipment, power hand tools, and others. Over half (51%) of respondents incorporated this standard. Again places with fewer people were less likely to incorporate this standard that become more common as community size increased.

The ANSI Z60.1 (American Standard for Nursery Stock) is an industry standard used to grow, measure, and harvest woody plants. Surprising only 33% of respondents incorporated this standard which is useful for developing specifications for purchasing nursery stock for planting. No places less than 5000 indicated they used this standard while it was more commonly incorporated by larger places. The low adoption rate might be a moot point since tree nurseries regularly grow nursery stock under the guidance of the Z60.1. The National Plant Board Plant Quarantine, Nursery Inspection, and Certification Guidelines suggest the ANSI Z60.1 be given consideration when developing nursery grades. Thus, the Z60.1 is embedded within tree nursery culture.

The Tree City USA program is sponsored by the Arbor Day Foundation. A community becomes a Tree City USA by meeting four standards: a tree board or department, tree ordinance, community forestry budget at least $2 per capita, and an Arbor Day observance and proclamation. The Tree City USA was incorporated by 72% of respondents. Larger places were more common doing such, however nearly 50% of places < 10,000 people indicated they incorporated Tree City USA. It is unclear from this question if the respondents met all four standards or were indicating their familiarity with the program and partial adherence to standards. Likewise, over half (56%) of the respondents indicated they incorporated International Society of Arboriculture (ISA) BMP's.

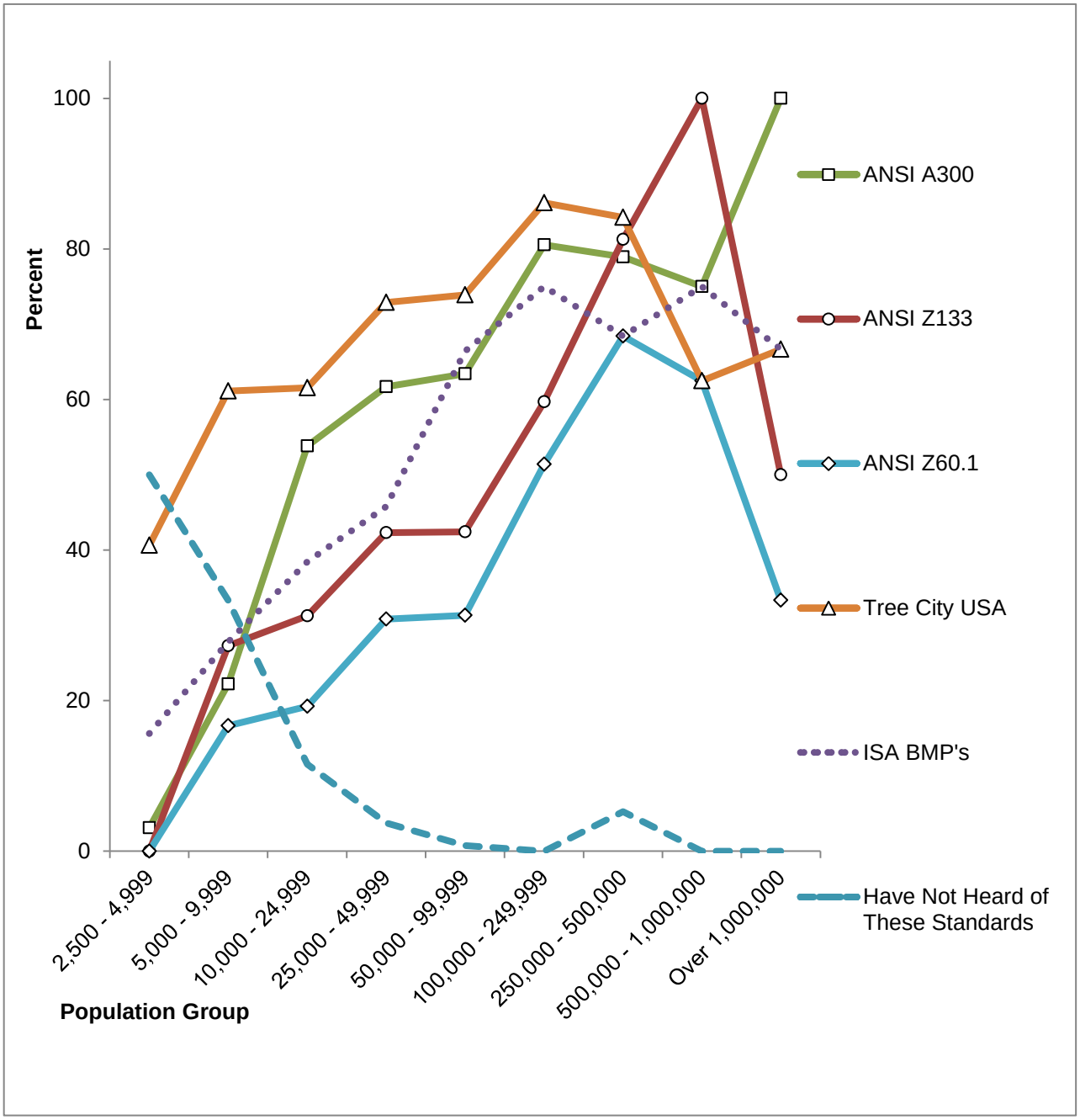


Figure 3-10. Which of the following standards of practice does your community officially incorporate into tree management procedures? (n=419)

One way communities cultivate citizen support for municipal forestry operations is through volunteers and partnerships. Volunteers and partnerships can vary from people serving as advisors on a community tree board to conducting tree activities such as tree planting, tree watering, and tree pruning. They also promote tree programs through fundraising, education programs, and being part of developing management plans and policy. Partnerships include school groups, youth organizations, service organizations, utility companies, and business associations.

Volunteers and partners commonly serve communities through municipal tree activities. Nationally, nearly two-thirds (65%) of respondents indicated that volunteers take part in tree activities (Figure 4-1). The commonality increases from 52% in the smallest population group (2500 – 4999) to 100% of the largest population group (≥ 1,000,000). The number of volunteers is quite substantial with 205 people on average involved with a municipality in a volunteer role. Not surprisingly the smallest group had fewer people volunteering (34 per community) than larger places such as the 500,000 – 999,000 population group with over 500 people on average involved in some capacity (Table 4-1). Volunteer hours also increased from the smallest to largest cities with a national estimated mean of 852 hours of volunteer time occurring in a community. This increased from a few hundred on average per small place to several thousand hours in larger cities.

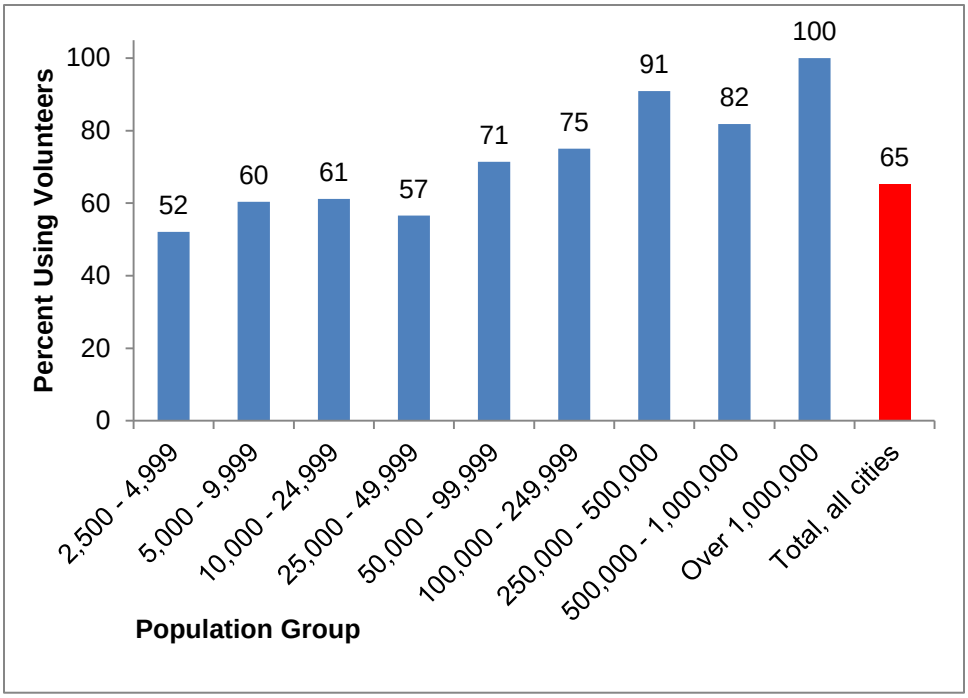


Figure 4-1. Does your community work with partners and/or volunteers (individuals or groups not paid for providing services) for tree planting, tree care, or other tree activities on public property? (n=644)

A national estimate of the total number of volunteers and how much time was involved was established. This value was calculated by developing an estimate for each of the nine population groups and summing these for a national total. The estimate for each population group was derived by multiplying the mean number of people by the number of communities in that group and then multiplying this by the percentage of places that involved volunteers in a population group. A national estimate of 345,466 (195,754 SEM) people volunteered 1,484,204 (665,460 SEM) hours with municipal tree activities. Stated another way, these volunteered hours equates to 714 (320 SEM) full-time equivalents (2080 hour base year). Finally, 4.8% of the total time required to complete tree care activities in a community were done

Table 4-1. If known, list the number of people and volunteer hours annually?

Classification	Sample Size (n)	Mean Number of People (#)	Mean Time All People (Hours)	Mean Time per Person (Hours)	SEM of Number of People (#)	SEM of Time All People (Hours)	SEM of Time per Person (Hours)
Total, all cities	216	205.0	852.3	9.82	56.1	174.3	1.38
Population Group							
2,500 to 4,999	16	34.2	270.4	26.16	18.2	124.5	13.17
5,000 to 9,999	11	31.0	158.7	6.99	14.6	71.9	1.38
10,000 to 24,999	14	37.6	158.3	8.42	15.0	69.1	3.02
25,000 to 49,999	52	211.5	368.4	9.48	151.7	139.3	2.11
50,000 to 99,999	65	119.1	631.5	9.14	52.8	209.0	2.22
100,000 to 249,999	41	251.9	1089.7	7.40	64.6	243.0	1.89
250,000 to 499,000	11	324.1	3087.2	8.03	166.7	1830.2	3.72
500,000 to 999,999	4	525.5	2606.8	3.71	311.3	1227.2	0.51
1,000,000 +	2	4068.5	12,538	4.76	3879.5	11,306	1.76
Geographic Region							
Midwest	77	60.9	378.5	8.42	13.7	108.7	1.40
Northeast	29	325.1	1508.6	20.75	272.8	907.4	8.45
South	46	149.0	1052.6	8.61	51.4	467.5	1.98
West	64	364.2	971.4	7.45	136.7	227.4	1.32

through volunteer efforts. These national estimates do not include other tree activities associated with volunteering through non-profit organizations. The estimate is for those volunteer efforts directly associated with a municipality.

The use of trained people is important in any practice. A trained volunteer force is no different. Training of volunteers was quite common with 79% of respondents indicating they provide some level of training for volunteers. Eighty-nine percent of places with 50,000 or more people provided training.

The activities that volunteers undertook was ascertained for the 65% of the responding places that said they involve these groups. Tree planting by far was the most common activity in 85% of municipalities that indicated they involve volunteers (Figure 4-2). All other activities were less common. Tree watering and awareness/education programs were common to 40% of respondents. This involvement was consistent among population groups. Tree pruning was reported by 28% of respondents. The involvement of volunteers as citizen tree pruners occurred in 44% of places between 2500 and 9999. This became less common (23%) and variable in places between 10,000 and 249,999 people. Over half (54%) of places ≥ 250,000 people involved citizen pruners. Tree removal was rarely done by volunteers. Only 9% of respondents indicated that the technically challenging activity of tree removal was conducted by volunteers. This was consistent among population groups except for the smallest population group where 35% of places responding volunteers were involved with tree removal.

The frequency of people and organizations involved with volunteering and partnerships varied. Individual residents were the most common, occurring in over 60% of communities that involve volunteers (Figure 4-3). No discernible differences among the smallest to largest locations were

found. School groups and youth organizations (e.g., scouts and 4-H) were reported by 55% of the locations. Non-profit groups were common to half of the respondents. While service organizations and neighborhood associations were common to approximately 40% of responding locations.

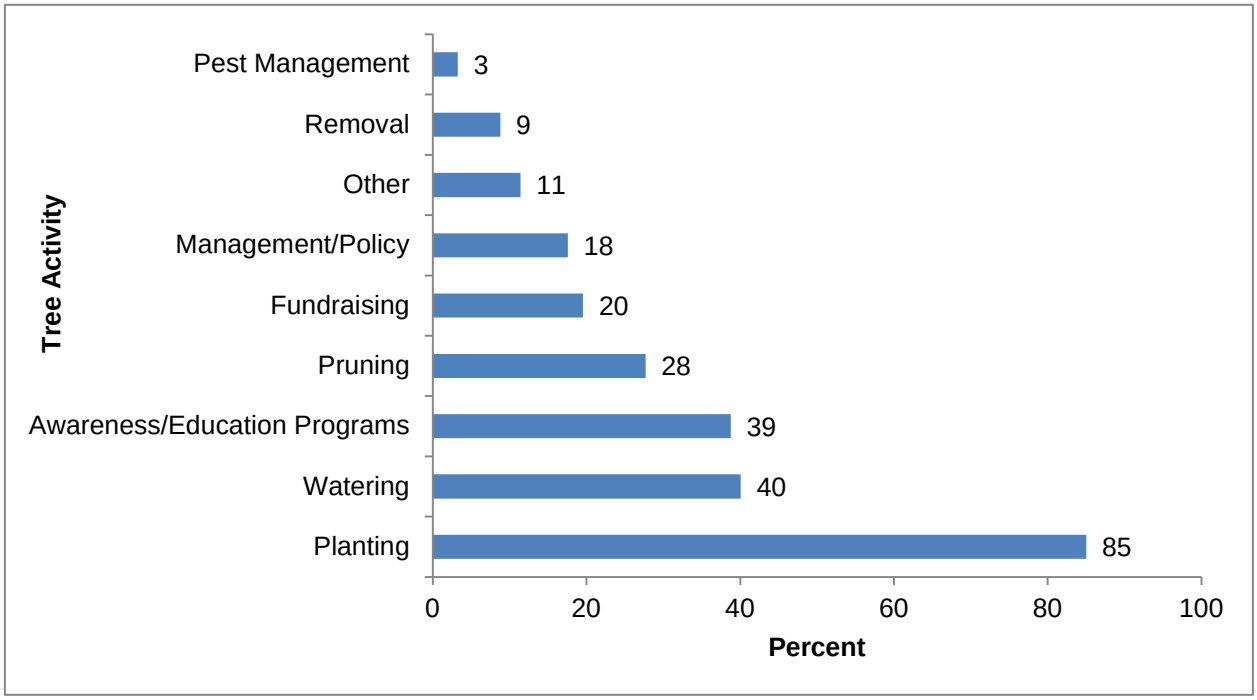


Figure 4-2. Which tree activity work do volunteers perform and if known what percent of the total work time for all public tree activities occurs by volunteers? (n=307)

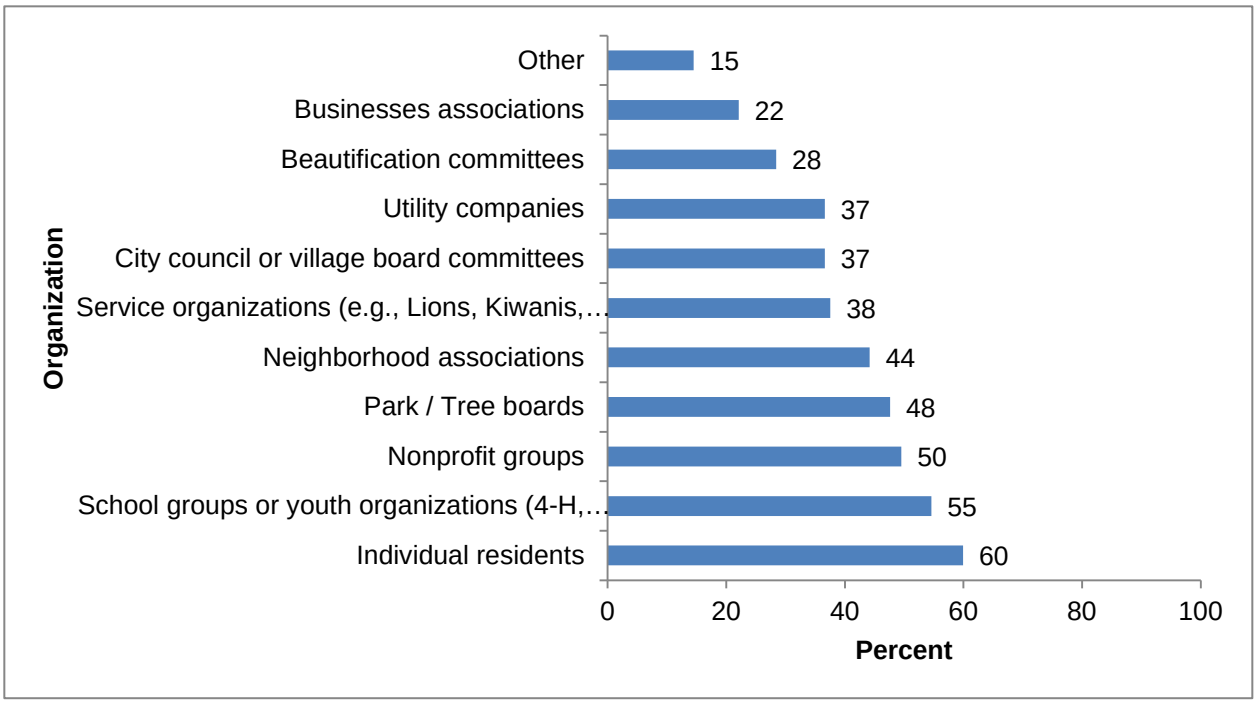


Figure 4-3. Which of the following organizations help your community to carry out tree care or management? (n=317)

Section Five: Contracting Tree Care Activities

Communities use a variety of approaches including contracting to manage municipal tree populations. The use of contracting in any given year varies from none occurring in a community to nearly 100% of a tree care budget allocated through contracting. It is likely that no municipality could spend 100% of a tree care budget on contracting as some level of municipal oversight and administration of contracts is needed.

Contracting is common to municipalities with almost 9 out of 10 (88%) respondents indicated they hire contractors (Figure 5-1). It became more common as population increased. In the smallest two groups (2500 – 9999), approximately 70% contracted some level of tree activities. In cities with ≥ 25,000 people, 90% or more used contractors. The amount of total time contracted to complete a municipal tree activity was 40.8%. This compares to the 4.8% done by volunteers and 54.4% done in-house using public employees. Contractor use was most common in the West (93%) and least common in the South (81%). The Northeast and Midwest were 88% and 89% respectively for the use of contractors. Thus, contracting is a common part of municipal tree care.

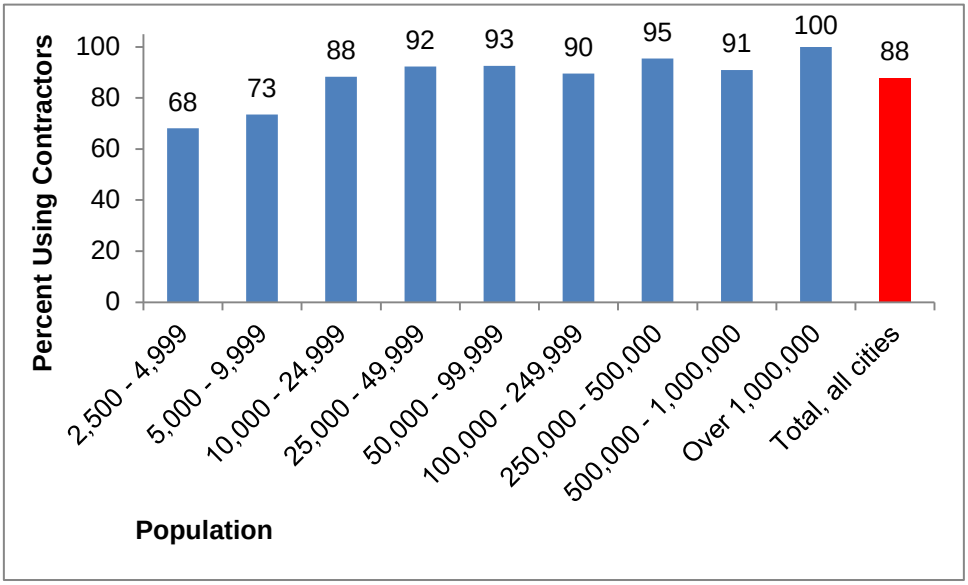


Figure 5-1. Does your community use paid contractors for any of your tree care activities? (n=659)

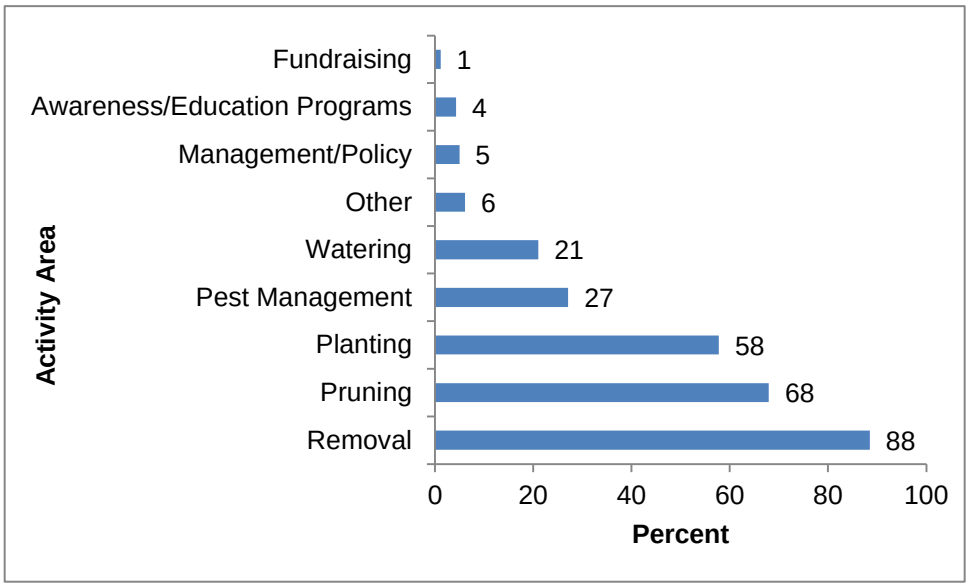


Figure 5-2. Which tree activity work do contractors perform? (n=443)

Tree removal was the most commonly contracted tree activity (Figure 5-2, Figure 5-3).

Nationally 88% of respondents indicated they used contracting with tree removal. Tree removal could vary from none or a few trees contracted to most or all of the tree removals conducted by a contractor. Across population groups there was no apparent difference.

Municipalities also regularly used contractors for some amount of tree pruning. Two-thirds (68%) of places used tree pruning contractual services. Like tree removals, a community could contract no pruned trees to the entire tree pruning program done on contract. All responding municipalities ≥ 500,000 people had contractors involved with the pruning program. Half of the smallest group and around 70% of places between 5000 and 499,000 involved a contractor with tree pruning.

Contractors also commonly conducted tree planting. Overall, 58% of respondents involved contracting with the tree pruning program. The percent of communities steadily increased from

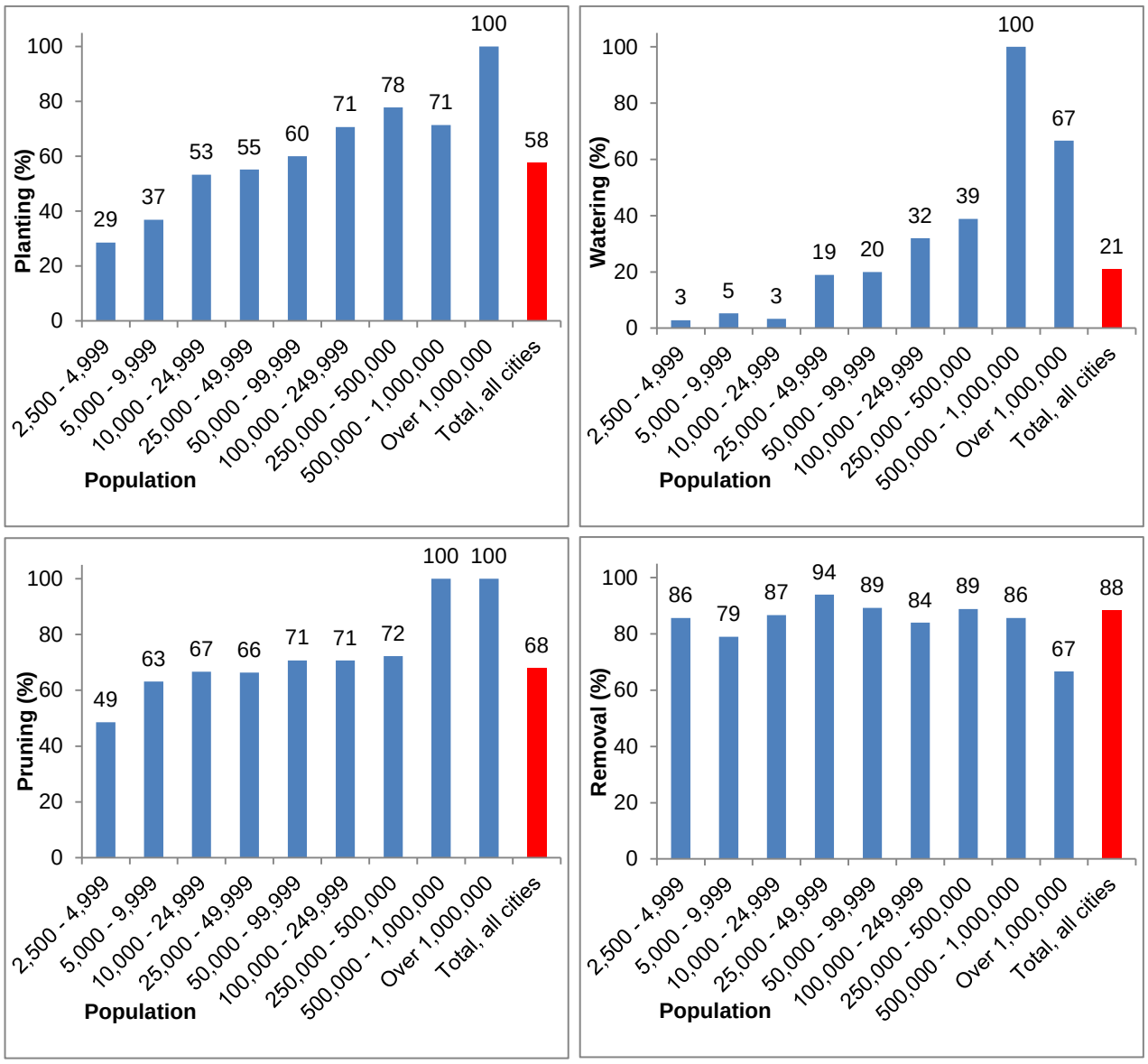


Figure 5-3. Which tree activity work do contractors perform for planting, watering, pruning, and removal? (n=443)

29% in the smallest population group to 100% in the over 1,000,000 group. Tree watering was also contracted and increased from little (3%) in the 2500 – 24,999 groups to 90% in places with the 500,000 and more people.

The percent of respondents that contracted some portion of tree pruning was most common in the West (84%) and South (86%) and less common in the Midwest (51%) and Northeast (60%). Tree removal was more common in the South (95%) compared to the West (54%), Midwest (89%), and Northeast (89%). Tree planting was more commonly contracted in the Midwest (61%) and South (60%) than the West (55%) and Northeast (49%).

Using trained and qualified contractors is as important as developing a budget for tree activities. One way to do this is using established industry standards and credentials as part of the bidding process. This could be requiring or giving preferential selection to companies that have credentialed staff. The International Society of Arboriculture (ISA) and the Tree Care Industry of America (TCIA) are two professional organizations with credential systems and both are part of developing accepted industry standards.

Nationally 72% of respondents said they use industry standards or credentials as part of the evaluation and hiring process. This increased by population group with around 40% of places with 2500 – 9999 people doing such to over 80% of places with ≥ 50,000 people using standards and credentials to evaluate and hire contractors (Figure 5-4).

Industry standards exist for tree planting (ANSI Z60.1), tree care practices (ANSI A300), and safe tree work operations (ANSI Z133). These standards provide important ways to develop scopes of work to define what will be done, describe what safety precautions will be used, and to evaluate

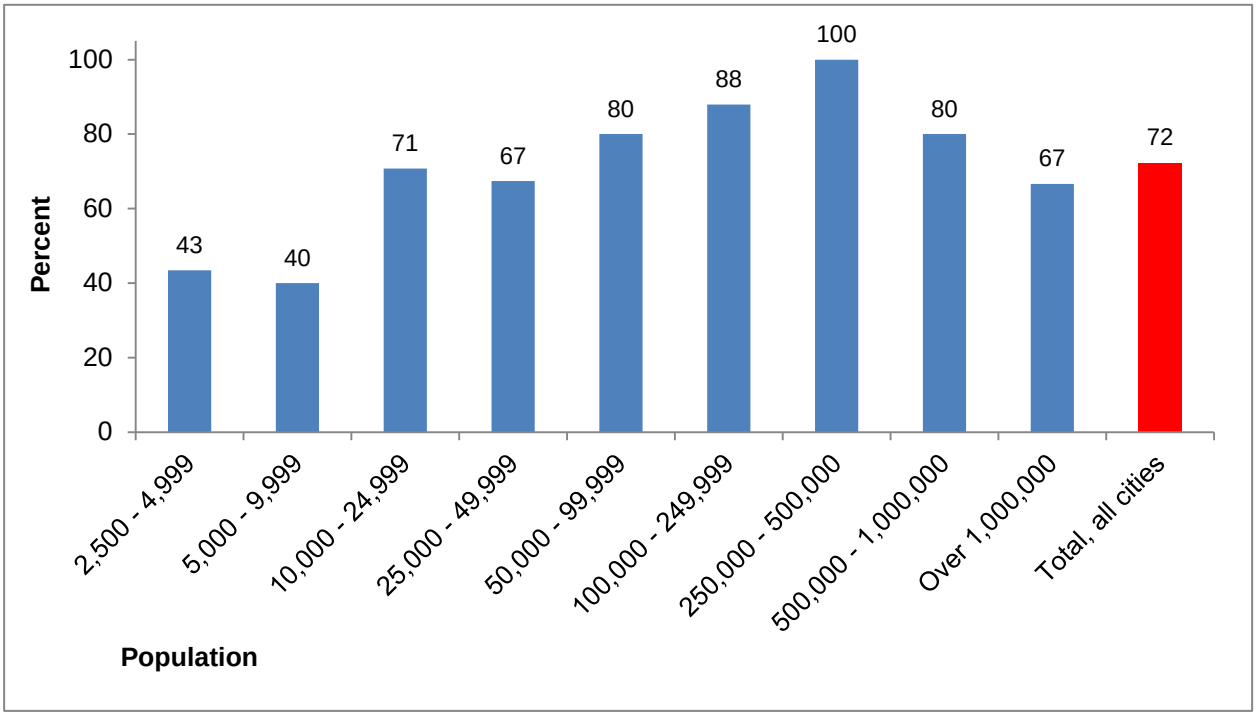


Figure 5-4. Are industry standards or accreditation programs used to evaluate and hire contractors? (n=389)

work upon completion. These standards provide an industry basis to facilitate the expectations of a municipality for contractors when developing a bid. Accreditation and credentials are additional ways to evaluate contractors during a bid evaluation and selection process.

Differences were apparent with the use of standards and hiring preferences among municipalities. The A300 tree care standard was most commonly used with 68% of respondents including this standard to evaluate contractors. The Z133 safety standard was common to 57% of respondents. The Z60.1 American Standard for Nursery Stock was least common and used in 44% of responding places. By default many state agencies that regulate tree nurseries require or suggest the adherence to this standard. Thus even if not required, trees are being produced by this standard. There was a strong increase in the frequency of standards used as the size of a community increased.

A preference for hiring credentialed contractors was found (Figure 5-5). The ISA Certified Arborist (CA) credential was used by 81% of municipalities that use a credential and standards approach for contractor evaluation. Regardless of population size, the CA credential was commonly used to evaluate contractors. The ISA CA system has been in place since 1992 and appears to have become well established as an evaluation criterion in municipalities.

The TCIA Accreditation credential is relatively new, starting in 2004. Few municipalities currently used this as an evaluation mechanism. Only 11% of respondents used the TCIA accreditation credential for evaluation of contractors.

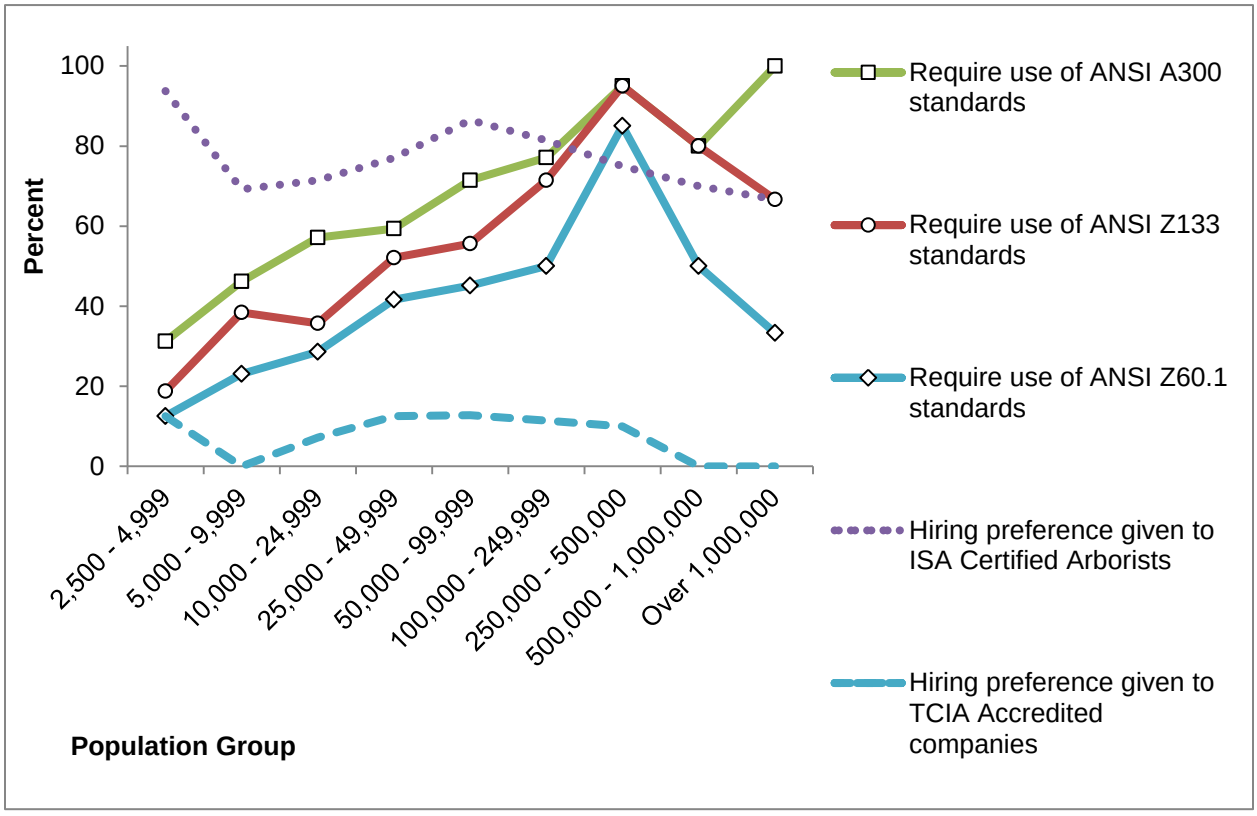


Figure 5-5. Which of the following are true about contractors hired by your city? (n=389)

A tree inventory provides information that is useful to better manage urban tree populations. The use of tree inventories has a historical basis that goes back to at least the late 1800's. Data is collected about tree size, species, condition, pest issues, and more are used to guide decision-making. While paper inventory systems still have merit given the proper situation, computer based database systems, Geographical Information Systems (GIS) and spatial locating trees through Global Positioning Systems (GPS) have become common practice with inventories. This section details tree inventory systems used, the current state and use of tree inventories, tree canopy use and goals, how many publically trees exist, tree diversity, and species abundance.

Tree Inventory Systems

Two-thirds of respondents indicated they have some level of a tree inventory (Figure 6-1). Eighty-three percent of the inventories were computerized (Figure 6-2). An inventory could be any type of record about public trees such as trees in one park location, along streets, or all maintained locations. 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.

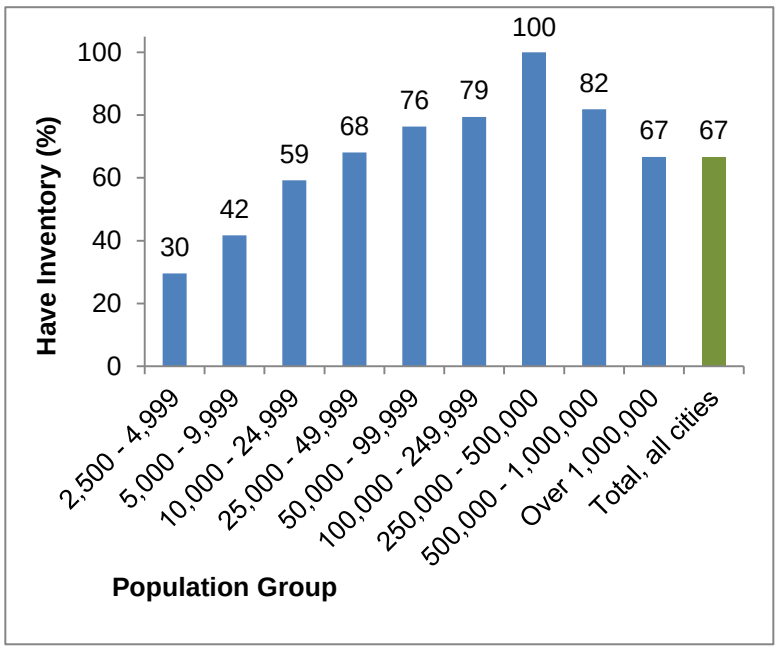


Figure 6-1. Does your community have a tree inventory (An inventory is any type of record of public trees in your community)? (n=656)

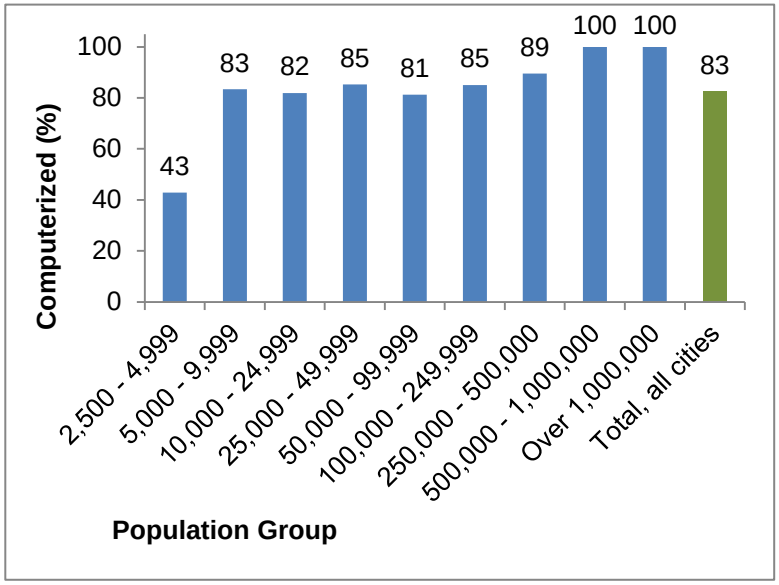


Figure 6-2. Is your inventory computerized? (n=355)

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.

The locations included in a tree inventory and the methods used to collect data is dependent about 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 with 93% of respondents who have an inventory (Figure 6-3). 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.

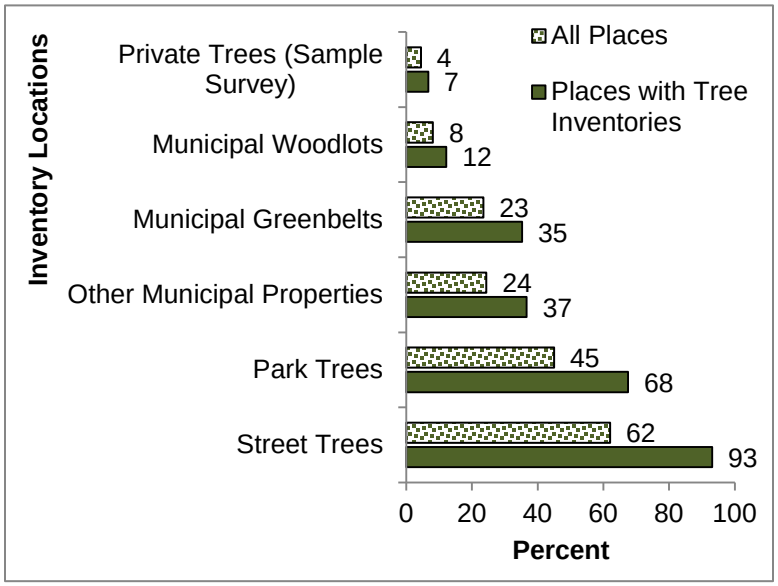


Figure 6-3. What areas does the tree inventory include? (n=434)

The type of inventory collection system and analysis tool varied, 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 6-4). 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.

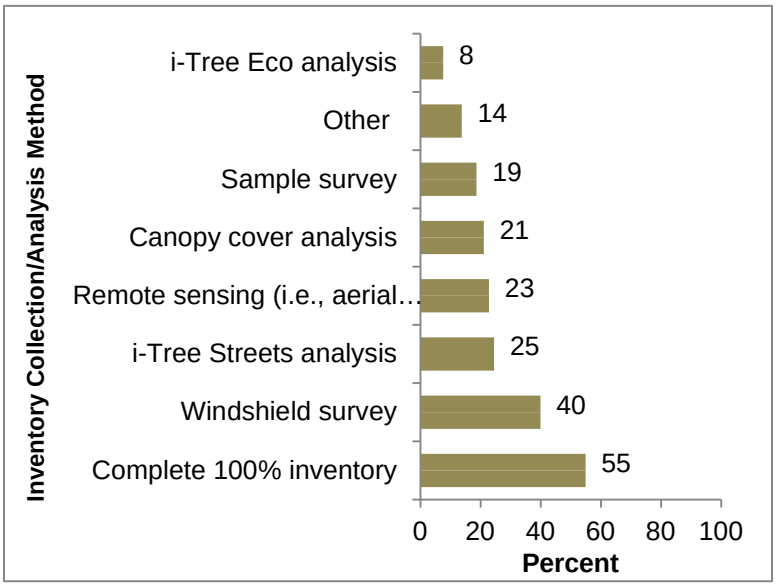


Figure 6-4. Which type of inventory collection and analysis methods have been used to describe your community tree population? (n=408)

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 they did such. 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.

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 6-5). 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.

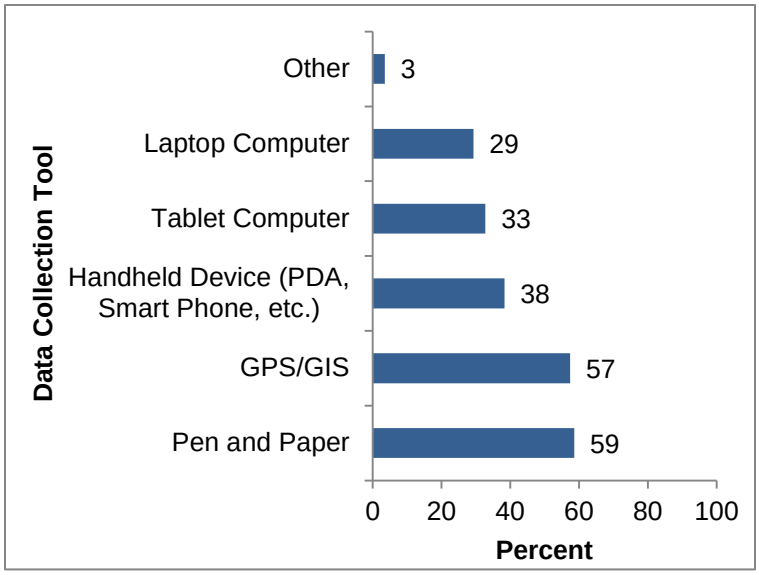


Figure 6-5. What collection tools are used to collect your tree inventory data? (n=345)

The approaches for data collection varied by population group (Figure 6-6). 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. The rational might be explained in small and large communities still relying on paper based systems for some data collection and reporting.

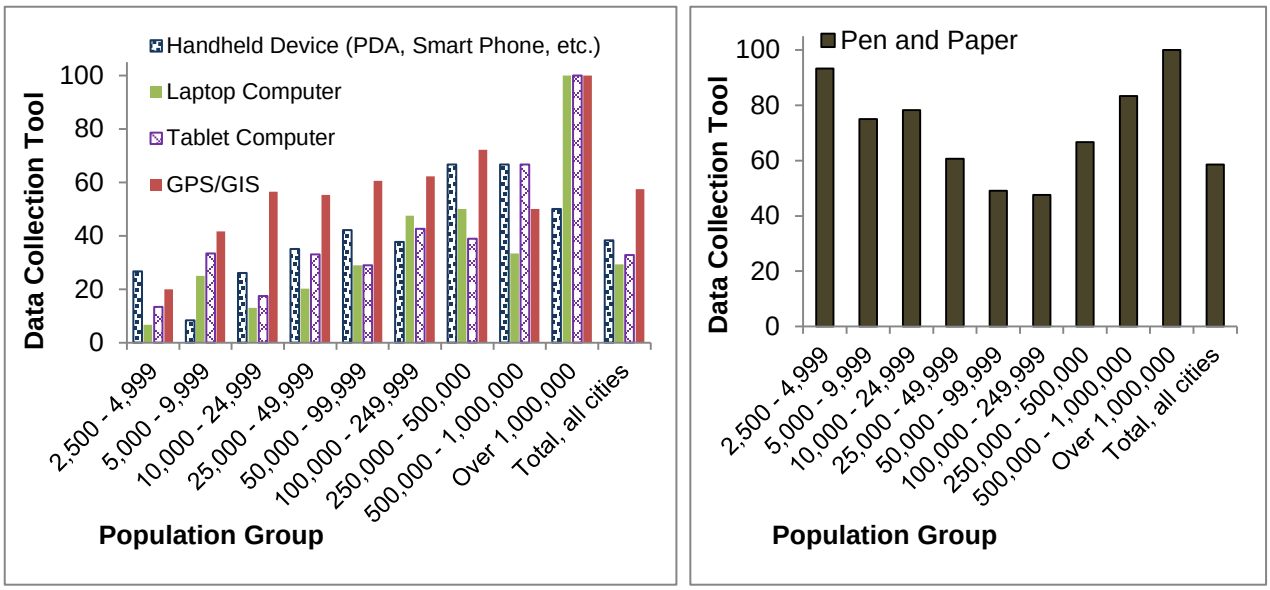


Figure 6-6. Variation in data collection tools as population changes? (n=345)

Tree inventories are completed by people ranging from municipal staff, hired consultants, interns, state 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 6-7). Interns were used by 23% and 14% used volunteers. As population increased, the frequency of municipal staff, interns, and consultants increased (Figure 6-7). Volunteers 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 become more common with one-third doing such.

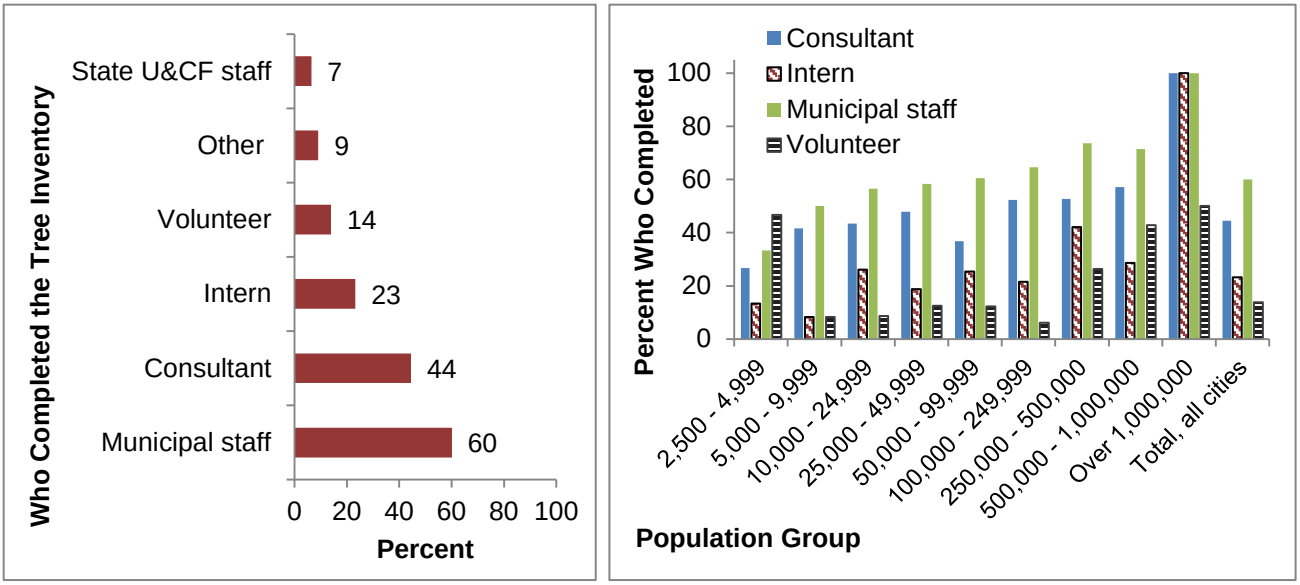


Figure 6-7. Who completed your tree inventory? (n=353)

Tree Inventory Uses

Ideally before a tree inventory is conducted, a series of questions are framed that ask what do you want to determine. For example, you could ask 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? What data is 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 6-8). Collecting data to

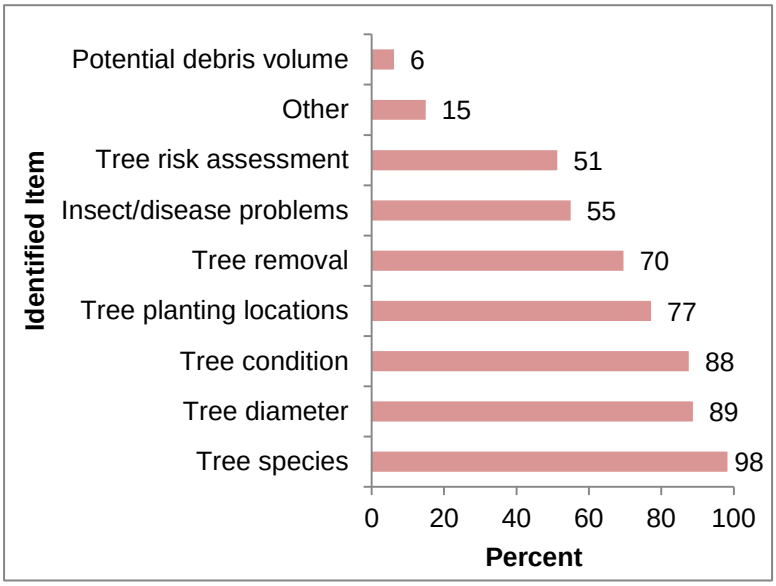


Figure 6-8. The tree inventory is used to identify which of the following? (n=355)

answer management questions were common with tree planting locations (77%) and tree removal (70%) ascertained. 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.

Tree inventory data should be used to direct urban forest management and report information to the community. Tree data that is collected can be used to explain to a community what currently exists 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 6-9). 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 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 larger places doing this more commonly. Also, tree canopy assessments are becoming more common so in the future tree inventories may be used to track canopy change.

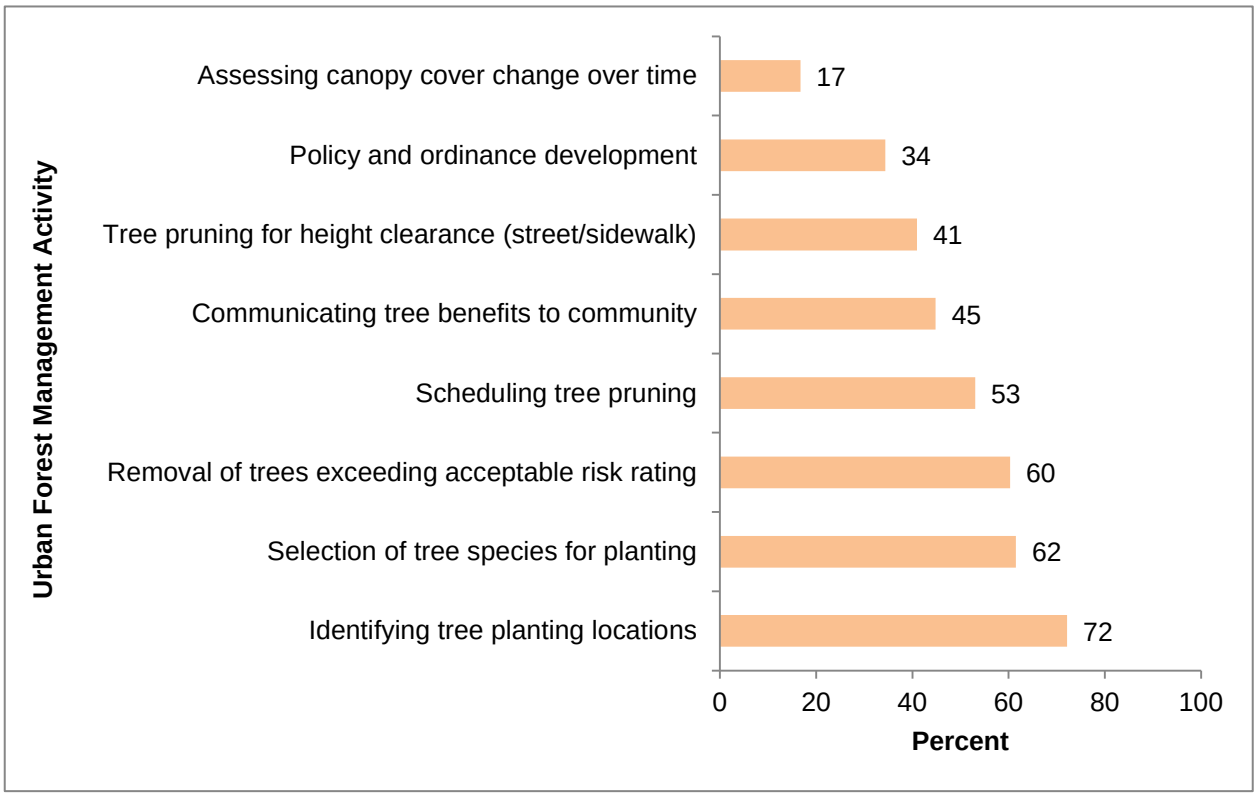


Figure 6-9. Is your tree inventory used to direct any of the following urban forest management activities? (n=413)

Tree Canopy Goals

Tree canopy cover is the urban forest that occurs on public and private land. 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 the tree canopy goals have been met.

Currently 25% of respondents indicated they either have a tree canopy goal (17%) or are developing (8%) one (Figure 6-10). 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 6-11). 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.

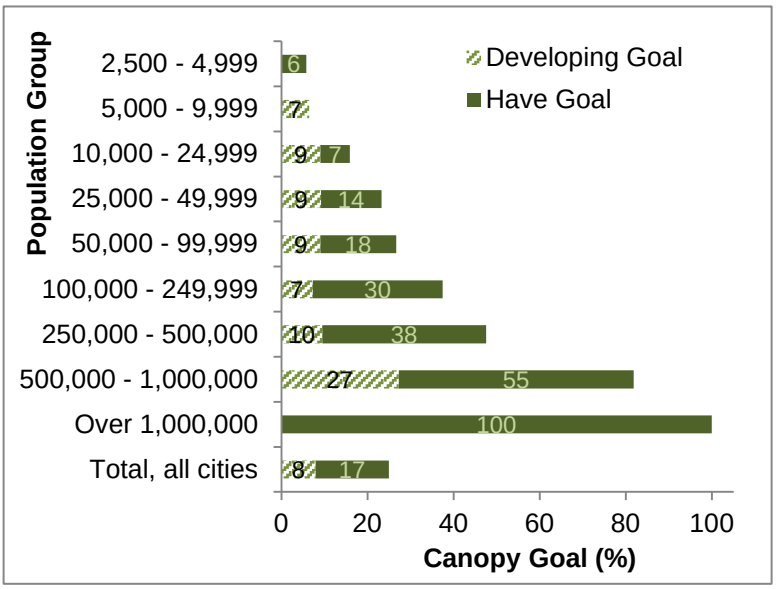


Figure 6-10. Does your municipality have a tree canopy goal? (n=629)

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 being 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%).

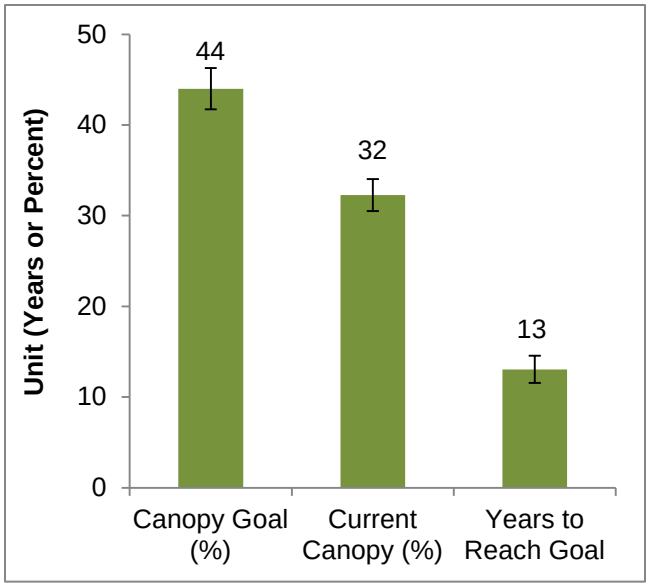


Figure 6-11. Does your municipality have a tree canopy goal? (Canopy Goal n=85, Current Canopy n=87, Years to Reach Goal n=46)

Number of Publically Owned Trees

The urban forest occurs on private and public land. Public trees occur along streets, in parks, and in other municipally owned locations. While there are typically more private trees in a city, public trees tend to be larger. Street trees for example might account for10% of the total tree population, but contribute 25% of the total leaf area in the urban forest (Miller et al. 2015). Thus, public trees are an important resource and more easily managed by a municipality than trees on private lands.

There are several ways to quantify the public tree resource. One simple enumeration is reporting on the total number or abundance of trees. Calculating the density involves expressing the abundance on a unit basis (e.g., trees per street miles, trees per land area, basal area). Other management approaches are conveying how many trees exist per employee or expressing public trees on a per capita basis. Knowing the potential future locations for public trees is an important planning metric. This is often expressed as vacancies and the enumeration of vacancies can use the same metrics as existing trees. The vacancies and total number of trees combined give a snapshot on the total plantable spaces. Percent stocked is total tree locations filled as a percent of the total number of plantable locations.

A mean 55,332 (10,391 SEM) public trees were reported by responding municipalities (Table 6-1). These are trees that a municipality has some level of management action varying from limited to regular maintenance. The value excludes trees that are in wooded areas with little to no maintenance. The mean street tree population was 26,234 (3070 SEM). Parks had a mean 25,720 (10,169 SEM) trees. Regionally the Northeastern states had the highest mean number of trees, lowest median value, and greatest variability as compared to other regions. This is likely the result of this region also having several large cities. As one would suspect, larger cities had more trees than smaller communities.

Expressing trees on a per capita basis or number of trees per full time equivalent employee (FTE, 2080 hour base year) makes comparisons among locations relative. Throughout the United States a mean 0.55 (0.12 SEM) public trees per capita exist (Table 6-1). Street trees were 0.27 (0.01 SEM), park trees were 0.11(0.01 SEM), and other public municipal properties were 0.09 (0.02 SEM) trees per capita (Figure 6-12). There was no statistical per capita difference among population groups for public trees, street trees, and other municipal properties.

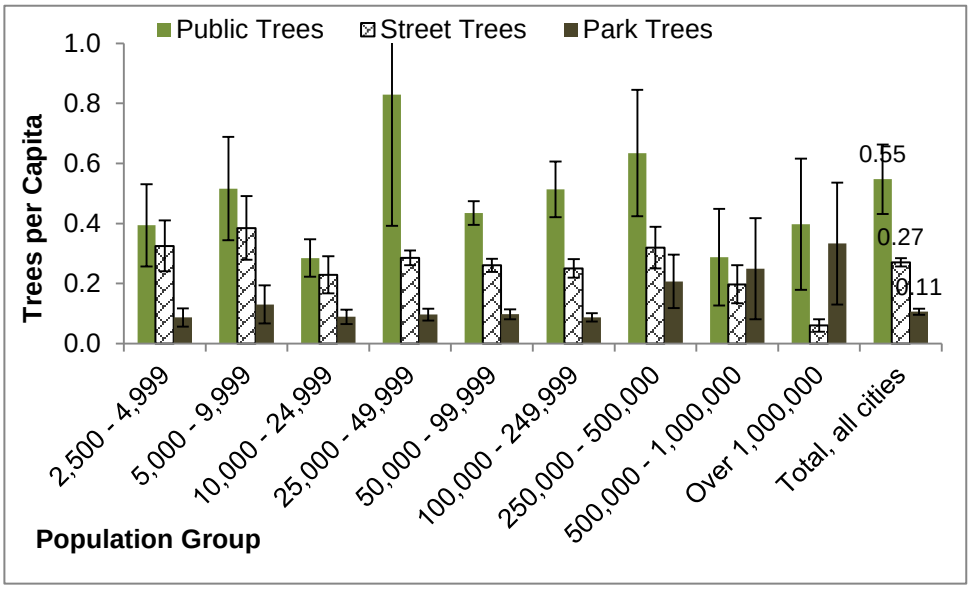


Figure 6-12. Total number of public trees, street trees, and park trees expressed per capita. (Public trees n=330, street trees n=292, park trees n=237)

Park trees did vary per capita by population. Places below 250,000 people had 0.10 trees per capita. Places with 250,000 or more people had 0.24 trees per capita.

Regionally, the Midwest had a higher per capita street tree and park tree population (Table 6-2). The Northeast had the lowest per capita for street and park trees. No regional differences were found for trees planted in other public locations.

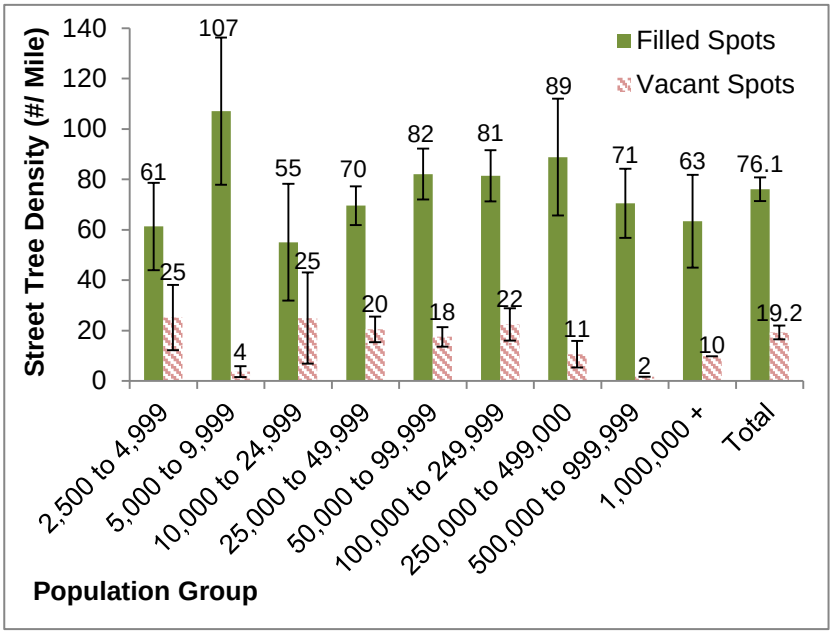


Figure 6-13. Street tree density for spots filled with trees and reported vacant locations? (Filled spots n=207, Vacant spots n=144)

A street tree density of 76.1 (4.7 SEM) trees per linear street mile was found (Figure 6-13). A total 19.2 (2.8 SEM) vacant spots were reported. The street tree stocking level was 81.5% (1.4 SEM). No statistical difference in trees or vacancies per mile by geographic region or population group were found (Table 6-3, 6-4). The reported tree vacancies seem low compared to other reports from the United States. Respondents indicated if their number was an estimate or a record. No statistical difference existed between estimated and recorded vacancies.

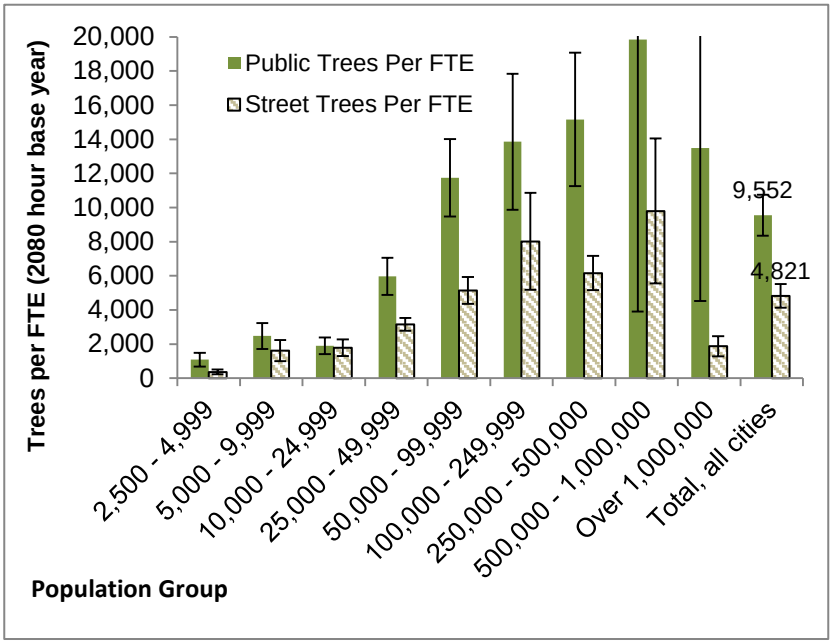


Figure 6-14. What is the total number of publically owned trees per full-time equivalent (FTE, 2080 base year) employee with tree responsibilities? (Public trees n=269, Street trees n=207)

The number of public trees and number of street trees per FTE employee varied by population group. As population increased the number of trees per employee increased (Figure 6-14). A mean 4,821 (696 SEM) street trees per FTE and 9,552 (1,198 SEM) public trees were reported (Table 6-5). Respondents from places with < 25,000 people reported staff responsible for a few thousand public trees per FTE. Places with 50,000 or more residents had over 10,000 trees per FTE. Larger communities also tended to contract services to higher levels than smaller communities. This may account for the higher tree per FTE level in larger places.

Table 6-1. What is the total number of publically owned trees in the following locations?

	All Public Trees (#)				Street Trees (#)				Park Trees (#)				Other Municipal Trees (#)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	330	55,332	18,422	10,391	292	26,234	12,821	3,070	237	25,720	3,151	10,169	182	8,814	1,000	2,660
Population Group																
2,500 - 4,999	18	1,321	817	488	17	1,180	1,000	307	20	301	119	105	14	203	63	139
5,000 - 9,999	14	4,329	1,755	1,504	11	3,171	2,000	930	7	1,062	283	554	7	1,230	108	1,129
10,000 - 24,999	20	4,894	3,607	1,261	21	4,115	2,694	1,264	19	1,431	1,086	408	9	475	125	277
25,000 - 49,999	85	25,819	10,600	11,675	74	10,451	9,129	937	52	3,379	2,150	584	48	1,425	550	428
50,000 - 99,999	110	30,036	21,675	2,738	89	17,904	15,000	1,352	80	6,882	4,350	1,372	66	6,526	1,367	2,267
100,000 - 249,999	60	73,723	46,563	11,795	58	38,122	29,783	5,036	40	12,802	8,257	1,991	31	21,238	2,145	11,475
250,000 - 500,000	13	203,044	98,000	70,835	13	103,361	85,000	24,138	11	62,818	35,000	25,261	5	82,600	8,000	50,480
500,000 - 1,000,000	7	227,278	100,000	133,098	6	140,066	151,698	43,261	5	195,310	77,000	140,304	1	1,000	1,000	0
Over 1,000,000	3	1,308,267	1,235,000	722,675	3	252,340	135,000	174,143	3	1,049,669	1,100,000	563,765	1	16,810	16,810	0
Geographic Region																
Midwest	136	41,748	18,706	8,571	137	24,912	14,517	3,024	101	18,701	3,580	7,993	79	5,238	823	2,323
Northeast	40	134,291	10,000	71,674	31	37,311	12,642	19,192	28	114,203	2,000	80,062	18	18,336	750	14,679
South	52	70,122	13,000	26,367	41	32,529	9,500	10,536	36	13,515	2,250	4,791	28	10,772	1,029	8,876
West	102	34,939	22,000	4,259	83	21,171	11,000	3,793	72	7,258	3,863	1,362	57	9,800	1,000	4,735

Table 6-2. What is the per capita number of publically owned trees in the following locations?

	Public Trees (per capita)				Street Trees (per capita)				Park Trees (per capita)				Other Municipal Trees			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	330	0.55	0.31	0.12	292	0.27	0.22	0.01	237	0.11	0.06	0.01	182	0.09	0.02	0.02
Population Group																
2,500 - 4,999	18	0.39	0.24	0.14	17	0.33	0.24	0.08	20	0.09	0.04	0.03	14	0.06	0.02	0.04
5,000 - 9,999	14	0.52	0.26	0.17	11	0.39	0.32	0.11	7	0.13	0.05	0.06	7	0.15	0.01	0.13
10,000 - 24,999	20	0.28	0.21	0.06	21	0.23	0.16	0.06	19	0.09	0.06	0.02	9	0.04	0.01	0.03
25,000 - 49,999	85	0.83	0.32	0.44	74	0.29	0.28	0.02	52	0.10	0.06	0.02	48	0.04	0.02	0.02
50,000 - 99,999	110	0.43	0.33	0.04	89	0.26	0.23	0.02	80	0.10	0.06	0.02	66	0.09	0.02	0.03
100,000 - 249,999	60	0.51	0.32	0.09	58	0.25	0.22	0.03	40	0.09	0.06	0.01	31	0.16	0.02	0.08
250,000 - 500,000	13	0.63	0.34	0.21	13	0.32	0.25	0.07	11	0.21	0.11	0.09	5	0.24	0.03	0.15
500,000 - 1,000,000	7	0.29	0.13	0.16	6	0.20	0.20	0.06	5	0.25	0.13	0.17	1	0.00	0.00	NA
Over 1,000,000	3	0.40	0.32	0.22	3	0.06	0.07	0.02	3	0.33	0.24	0.20	1	0.01	0.01	NA
Geographic Region																
Midwest	136	0.50	0.39	0.04	137	0.34	0.32	0.02	101	0.14	0.08	0.02	48	0.01	0.00	0.00
Northeast	40	0.42	0.27	0.12	31	0.17	0.17	0.02	28	0.08	0.04	0.03	13	0.01	0.00	0.01
South	52	1.11	0.21	0.72	41	0.22	0.13	0.05	36	0.10	0.04	0.02	19	0.01	0.00	0.00
West	102	0.38	0.29	0.04	83	0.21	0.17	0.02	72	0.07	0.05	0.01	36	0.02	0.00	0.01

Table 6-3. How many empty/vacant spaces do you have for potential tree plantings?

	Street Trees (#)				Park Trees (#)				Other Municipal Trees (#)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	197	5,089	1,000	1,173	132	1027	200	249	16	46	6	31
Population Group									4	23	20	7
2,500 - 4,999	12	296	40	176	18	107	10	60	10	75	79	21
5,000 - 9,999	11	137	80	52	5	29	31	13	29	313	50	122
10,000 - 24,999	14	369	225	134	8	131	100	54	33	1,205	200	903
25,000 - 49,999	52	2,145	1,000	358	29	644	120	196	20	1,665	200	1,234
50,000 - 99,999	55	2,865	1,615	441	39	726	300	188	2	150	150	100
100,000 - 249,999	39	6,801	4,080	1,275	26	1,480	625	517	1	500	500	0
250,000 - 500,000	9	26,307	8,711	11,346	5	8,350	1,500	5,018	1	1,962	1,962	0
500,000 - 1,000,000	4	53,560	11,000	45,997	1	2,000	2,000	0	16	46	6	31
Over 1,000,000	1	7,052	7,052	0	1	3,186	3,186	0	4	23	20	7
Geographic Region												
Midwest	87	5,959	2,000	1,396	49	1,581	100	618	48	243	50	70
Northeast	24	5,136	1,150	2,049	13	410	100	167	13	414	100	201
South	24	8,760	353	7,926	22	983	250	468	19	344	100	121
West	62	2,430	784	443	48	648	300	140	36	1,747	100	1,063

Table 6-4. How many empty/vacant spaces do you have per capita for potential tree plantings?

	Street Trees (#)				Park Trees (#)				Other Municipal Trees (#)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	197	0.05	0.02	0.01	132	0.01	0.00	0.00	116	0.01	0.00	0.00
Population Group												
2,500 - 4,999	12	0.10	0.01	0.06	18	0.03	0.00	0.02	16	0.01	0.00	0.01
5,000 - 9,999	11	0.02	0.01	0.01	5	0.00	0.01	0.00	4	0.00	0.00	0.00
10,000 - 24,999	14	0.02	0.02	0.01	8	0.01	0.01	0.00	10	0.00	0.00	0.00
25,000 - 49,999	52	0.06	0.03	0.01	29	0.02	0.00	0.00	29	0.01	0.00	0.00
50,000 - 99,999	55	0.04	0.02	0.01	39	0.01	0.01	0.00	33	0.01	0.00	0.01
100,000 - 249,999	39	0.05	0.03	0.01	26	0.01	0.01	0.00	20	0.01	0.00	0.01
250,000 - 500,000	9	0.08	0.03	0.03	5	0.02	0.00	0.01	2	0.00	0.00	0.00
500,000 - 1,000,000	4	0.07	0.01	0.06	1	0.00	0.00	0.00	1	0.00	0.00	0.00
Over 1,000,000	1	0.00	0.00	0.00	1	0.00	0.00	0.00	1	0.00	0.00	0.00
Geographic Region												
Midwest	87	0.06	0.04	0.01	49	0.02	0.00	0.00	48	0.01	0.00	0.00
Northeast	24	0.05	0.03	0.02	13	0.01	0.00	0.01	13	0.01	0.00	0.01
South	24	0.03	0.01	0.01	22	0.03	0.00	0.01	19	0.01	0.00	0.00
West	62	0.04	0.01	0.01	48	0.01	0.00	0.00	36	0.02	0.00	0.01

Table 6-5. The mean number of trees per full-time person with tree responsibilities.

	Public Trees (#/employee)				Street Trees (#/employee)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	269	9,552	3,775	1,198	249	4,821	2,556	696
Population Group								
2,500 - 4,999	12	1,084	518	402	9	366	200	136
5,000 - 9,999	11	2,474	1,955	756	10	1,612	833	623
10,000 - 24,999	19	1,899	1,085	480	20	1,784	520	489
25,000 - 49,999	65	5,967	3,615	1,093	59	3,147	2,420	374
50,000 - 99,999	88	11,747	4,448	2,272	78	5,148	3,000	787
100,000 - 249,999	54	13,855	5,323	3,982	55	8,020	4,000	2,835
250,000 - 500,000	13	15,162	10,000	3,907	12	6,162	5,931	1,006
500,000 - 1,000,000	5	19,846	4,545	15,939	4	9,803	9,130	4,247
Over 1,000,000	2	13,484	13,484	8,970	2	1,871	1,871	584
Geographic Region								
Midwest	114	7,941	3,641	1,694	121	5,010	2,778	1,258
Northeast	31	12,371	3,333	5,024	23	4,469	2,667	1,031
South	37	7,229	2,407	2,189	32	3,352	1,978	743
West	86	11,781	5,669	2,198	73	5,262	2,181	1,043

Public assets are assessed and recorded in municipal financial records. Public trees are a public asset that can be quantified and recorded in city financial records. Only 19 out of 384 respondents (5%) indicated they carried the value of publicly owned trees in city financial records. Respondents gave information on the total urban forest value which ranged from a few million dollars in the smallest population group to over 400 million in the largest places (Table 6-6).

The value of a public tree was derived by dividing the reported public tree value by the number of public trees in a community. Each public tree was worth $1698 (170 SEM) in the 85 reporting places (Figure 6-13). Trees located in the Western region have an estimated $2553 (313 SEM) value per tree. The Midwest ($1097, 202 SEM) and South ($1010, 308 SEM) tree values were the least. The Northeast ($1527, 384 SEM) trees were intermediate in value. The size of tree may be an explanation with the lower value in the Midwest. Dutch elm disease resulted in the loss of many public trees that were replanted in the late1970's and 1980's and possibly with trees that have yet to mature.

Table 6-6. What is the total value of publically owned trees in the United States?

		Public Trees Value ($)		
Classification	**N**	**Mean**	**Median**	**SEM**
Total, all cities	94	68,665,110	35,000,000	11,285,949
Population Group				
2,500 - 4,999	3	3,298,474	4,675,422	1,593,956
5,000 - 9,999	4	1,062,381	57,793	1,023,313
10,000 - 24,999	5	34,426,439	5,300,000	28,496,492
25,000 - 49,999	22	18,590,200	14,500,000	3,362,285
50,000 - 99,999	28	50,505,486	37,500,000	8,177,658
100,000 - 249,999	20	98,460,117	80,900,000	22,169,130
250,000 - 500,000	8	100,559,126	69,770,723	30,580,324
500,000 - 1,000,000	2	418,503,101	418,503,101	44,496,899
Over 1,000,000	2	417,211,800	417,211,800	302,788,200
Geographic Region				
Midwest	36	30,594,006	8,600,000	6,368,118
Northeast	10	118,942,106	48,500,000	68,031,958
South	12	122,451,086	38,748,417	46,877,632
West	36	74,841,722	51,478,473	13,865,197

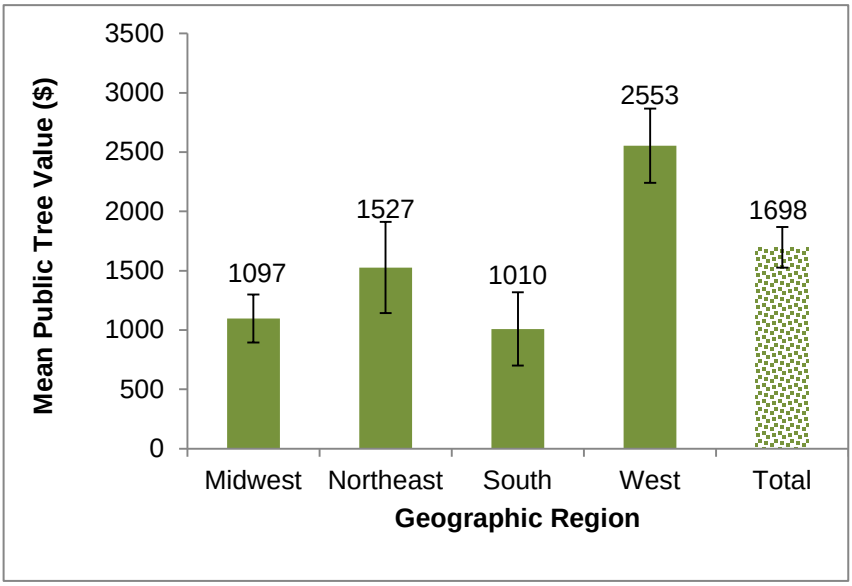


Figure 6-13. Per tree value of publically owned trees in the United States. (n=85)

The majority of trees in a community often exist on private land. Knowing how many private trees exist, their location, taxonomic types, canopy cover, and other identified metrics is valuable in urban forest planning. The vast majority (93.4%) of respondents did not know how many private trees exist. Of the 458 respondents, only 3.1% knew and 3.5% were developing an estimate of private trees. Trees on private lands can be enumerated through a few hundred sample plots or from remote sensing technologies.

Tree Diversity

Tree diversity is evaluated as to the percentage of trees that occur at the species, genera, or family level. A variety of tree diversity rules exist that suggest planting no more than a selected upper percentage limit. Examples include no more than 5 to 10% at the species level, 10 to 20% at the genus level, and 15 to 30% at the family level (Miller et al. 2015). To gauge tree diversity, the six most common street tree species were reported by communities.

A total of 115 species from 71 genera within 32 families were reported to occur in the six most common street trees. The most common tree within a community accounted for nearly 24% of the tree population (Figure 6-14, 6-15). The second most common tree accounted for over 13% and the third most common nearly 9%. Collectively the six most common trees on average accounted for over 60% of a communities' street tree population. The West region had greater diversity, however over half of the street tree population was still due to the top six trees (Figure 6-15).

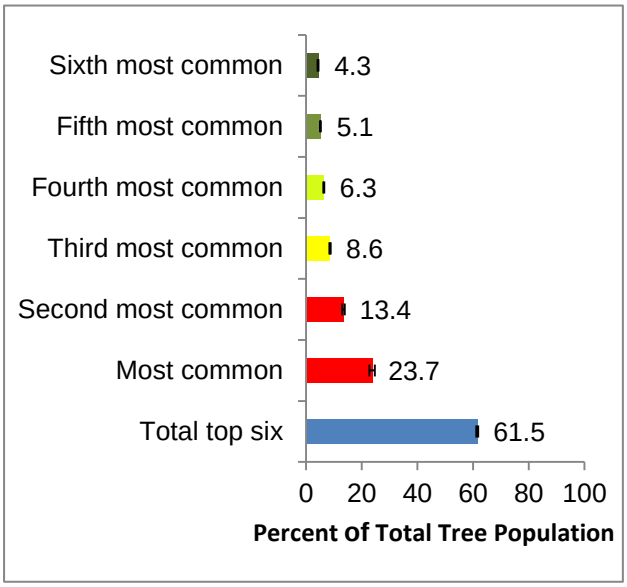


Figure 6-14. If known, list the 6 most commonly occurring street tree species, their number and percentage of the total street trees? (n=188)

Tree diversity can be looked at from a national scale, regional scale, and local scale. At a national scale there was no one dominant species found commonly in all communities. The most common was Norway maple (5.3%) and green ash (3.2%). Regionally a similar diverse tree population exists with the exception of a few species that present a cause for concern. Within the Northeast region

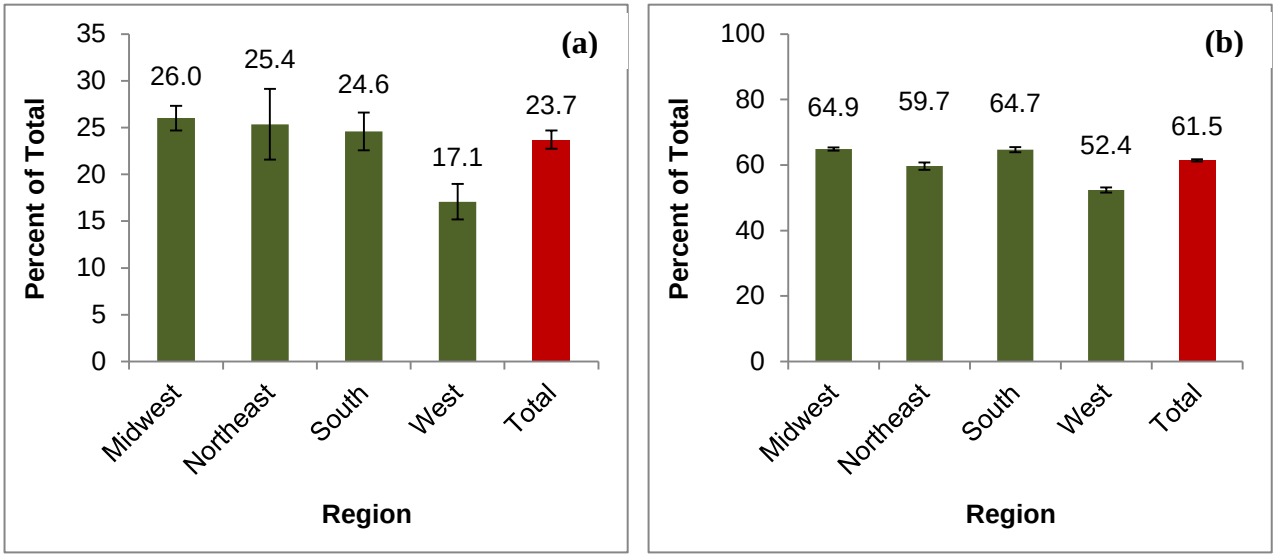


Figure 6-15. The percent of the municipal street tree population accounted for by the most common tree species in a community (a) and the most commonly occurring six street tree species (b) as a percent of the total tree population. (n=188)

Norway maple accounts for 16.5% of all locations. Norway maple is also the most common species in the Midwest (4.9%) and West region (3.8%), but at a lower level. Live oak accounts for 8.1% of the South region tree population. Thus, at a national and regional level in the United States one can conclude that the potential of a species specific pest is not as problematic as reported at the local level within many communities. Results from this project also found a lack of local level diversity when accounting for the most common six tree species.

Maple trees were locally a common top six street tree in the Midwest and Northeast (Figure 6-16). Norway maple accounted for 22.0% of the population in the Northeast and 14.2% in the Midwest in communities that reported this species in the top six. Sugar maple (9.7%), red maple (6.7%), and silver maple (5.8%) were common in the Northeast. In the Midwest, sugar maple (6.6%), red maple (9.8%), silver maple (12.6%), and Fremann maple (6.9%) are common in tree populations.

In the South live oak is common and represented 23.3% of the population in communities that have this tree was in the top six. Sabal palm (21.7%) and crape myrtle (17.6%) were common. Green ash (22.1%), Siberian elm (20.7%), and Norway maple (13.5%) were common in the West. Tree diversity at the genus and family level is also important, especially for insects and diseases

Midwest Region

Species	Places (n)	% Freq	SEM
Acer platanoides	34	14.2	1.6
Fraxinus pennsylvanica	31	13.8	1.6
Acer saccharinum	37	12.6	1.8
Acer rubrum	25	9.8	1.3
Quercus palustris	7	9.3	2.0
Gleditsia triacanthos	48	8.7	0.6
Ulmus americana	7	7.9	2.1
Picea pungens	7	7.9	1.4
Acer x freemanii	7	6.9	1.6
Pyrus calleryana	6	6.7	1.1
Acer saccharum	17	6.6	0.7
Fraxinus americana	9	6.6	0.7
Tilia cordata	11	6.6	1.0
Celtis occidentalis	12	5.6	1.0
Quercus rubra	5	4.2	0.5

Northeast Region

Species	Places (n)	% Freq	SEM
Acer platanoides	15	22.0	4.4
Acer saccharum	6	9.7	2.1
Pyrus calleryana	5	8.4	1.4
Tilia cordata	7	7.4	1.9
Gleditsia triacanthos	12	7.3	0.8
Acer rubrum	12	6.7	0.7
Platanus x acerifolia	7	6.6	1.5
Acer saccharinum	3	5.8	0.9
Quercus rubra	5	5.6	1.5
Fraxinus pennsylvanica	5	5.4	1.1

West Region

Species	Places (n)	% Freq	SEM
Fraxinus pennsylvanica	6	22.1	10.1
Ulmus pumila	4	20.7	8.5
Acer platanoides	12	13.5	2.7
Acer rubrum	7	11.7	2.5
Pistacia chinensis	8	8.2	2.2
Washingtonia robusta	4	8.1	1.3
Lagerstroemia indica	5	7.6	0.8
Platanus x acerifolia	11	7.3	1.0
Magnolia grandiflora	9	7.2	1.2
Syagrus romanzoffiana	4	6.9	2.2
Liquidambar styraciflua	14	6.8	0.9
Gleditsia triacanthos	8	6.8	0.6
Pyrus calleryana	5	6.1	1.1
Cinnamomum camphora	5	5.1	1.0

South Region

Species	Places (n)	% Freq	SEM
Quercus virginiana	9	23.3	3.3
Sabal palmetto	4	21.7	5.8
Lagerstroemia indica	4	17.6	4.1
Ulmus crassifolia	3	14.5	6.7
Acer rubrum	8	13.7	2.1
Celtis occidentalis	4	12.7	3.2
Pyrus calleryana	4	11.0	5.0
Acer saccharum	5	10.2	1.3
Quercus phellos	4	8.4	1.7
Quercus laurifolia	3	7.3	1.5
Acer saccharinum	4	6.5	0.9
Carya illinoinensis	4	6.0	1.1

Figure 6-16. Percent tree species diversity by geographic region in the United States. Percentages represent the mean percent of the six most common street tree species in a community. (n=188)

that have a wide host range. The maple genera is common to all regions comprising from 16% in the Midwest to 12% in the West of the total street tree population (Figure 6-17). Again these percentages only reflect the communities that listed trees from this genera in their top six. Sabal palm was common (22%) in some Southern communities. Likewise ash is common (18%) in some Western communities. Tree diversity at the family level was below 20% in all cases. The soapberry family (Sapindaceae) was most common in the Midwest (16%) and Northeast (15%) regions (Figure 6-18). The former maple family (Aceraceae) is now taxonomically within the soapberry family. The Olive family (Oleaceae) in the West (18%) and members of the loosestrife family (Lythraceae) in the South (16%) were the top in those regions.

Midwest Region

Species	Places (n)	% Freq	SEM
Acer	168	16.2	1.0
Fraxinus	80	14.9	1.1
Gleditsia	49	8.7	0.6
Quercus	41	8.1	0.9
Ulmus	32	7.8	0.9

South Region

Species	Places (n)	% Freq	SEM
Sabal	4	21.7	5.8
Lagerstroemia	11	16.2	2.4
Quercus	26	15.4	2.0
Acer	21	13.1	2.0
Celtis	6	11.8	2.1

Northeast Region

Species	Places (n)	% Freq	SEM
Acer	43	15.3	2.3
Malus	6	8.8	1.6
Pyrus	7	7.9	1.3
Quercus	11	7.3	1.9
Tilia	11	7.2	1.3

West Region

Species	Places (n)	% Freq	SEM
Fraxinus	13	17.9	5.3
Acer	27	12.3	1.6
Ulmus	11	11.5	3.7
Lagerstroemia	10	9.3	1.5
Platanus	14	8.5	1.3

Figure 6-17. Percent tree diversity at the plant genus level by geographic region in the United States. Percentages represent the mean percent of the six most common street trees in a community. (n=188)

Midwest Region

Family	Places (n)	% Freq	SEM
Sapindaceae	168	16.2	1.0
Oleaceae	83	14.6	1.1
Fabaceae	51	8.8	0.6
Roseaceae	51	7.0	0.7
Malvaceae	42	7.7	0.5

South Region

Family	Places (n)	% Freq	SEM
Lythraceae	11	16.2	2.4
Fagaceae	26	15.4	2.0
Arecaceae	7	14.8	4.5
Sapindaceae	21	13.1	2.0
Cannabaceae	6	11.8	2.1

Northeast Region

Family	Places (n)	% Freq	SEM
Sapindaceae	43	15.3	2.3
Roseaceae	13	8.3	1.0
Fagaceae	11	7.3	1.9
Malvaceae	11	7.2	1.3
Fabaceae	13	7.2	0.7

West Region

Family	Places (n)	% Freq	SEM
Oleaceae	13	17.9	5.3
Sapindaceae	29	11.8	1.5
Ulmaceae	12	11.1	3.4
Arecaceae	11	8.6	1.5
Platanaceae	14	8.5	1.3

Figure 6-18. Percent tree diversity at the plant family level by geographic region in the United States. Percentages represent the mean percent of the six most common street trees in a community. (n=188)

Section Seven: Tree Operations and Management Profile

Activities such as tree planting, tree pruning, and tree removal can be planned and systematically scheduled. The approach taken to manage pests differs and is dependent upon municipal objectives and the type of pest. The sources of trees and if a community has a tree nursery varies. Tree risk management is another activity undertook with municipal trees to identify and abate tree risks that exceed an acceptable threshold. Storms happen in communities and describing the approaches communities take to integrate trees within storm planning was ascertained. This section details tree activities initiated and the planned nature of tree management.

Activities Undertaken

Keeping records of the types of tree activities undertook is important to demonstrate what was done and what was most successful. Documenting the resolution of public requests provides verification of the completed action. Illustrating needs and communicating these to public officials and citizens is possible through recorded information. Just saying a lot of work was done carries little weight compared to being able to say with certainly how much activity occurred and having records to back that claim.

Municipalities regularly get public requests with trees. A request might involve a tree branch blocking an intersection, or a request to provide technical advice on tree care. Responding communities handled a mean 998 requests (311 SEM) annually for a variety of tasks (Table 7-1). As population increased the number of requests increased with several thousand requests occurring in places with 100,000 or more people. Per capita approximately 8.2 (0.9 SEM) requests are made per 1000 people. There were no regional or population group differences.

The minority of respondents (35%, n=244) kept records on public requests. It is likely that when a public request is taken by municipal staff, it is recorded on paper or in an electronic record, and then a person is dispatched to take action. At a minimum that record trail could be retained. Ideally an annual report summarizing the disposition of a request and action taken could be summarized. Taking action on requests and documenting the outcome is useful to demonstrate what occurred, when it was acted upon, and other information you wanted to collect.

Table 7-1. Public requests for service on all municipal properties in 2014.

	Public Requests (total number)				Public Requests (per capita)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	270	998	211	311	270	.0082	.0040	.00089
Population Group					23	.0042	.0003	.00165
2,500 - 4,999	23	16	1	6	12	.0040	.0008	.00212
5,000 - 9,999	12	34	6	18	19	.0051	.0055	.00167
10,000 - 24,999	19	97	60	37	64	.0105	.0049	.00198
25,000 - 49,999	64	372	200	66	81	.0082	.0042	.00190
50,000 - 99,999	81	552	300	123	56	.0101	.0052	.00206
100,000 - 249,999	56	1591	656	404	9	.0074	.0099	.00160
250,000 - 500,000	9	2266	2739	534	4	.0031	.0028	.00133
500,000 - 1,000,000	4	2122	2119	828	2	.0050	.0050	.00479
Over 1,000,000	2	40,150	40,150	39,850	23	.0042	.0003	.00165
Geographic Region								
Midwest	121	583	250	78	121	.0095	.0057	.00116
Northeast	29	3748	372	2742	29	.0084	.0065	.00161
South	44	957	160	477	44	.0065	.0023	.00232
West	76	632	148	158	76	.0073	.0028	.00209

Basic information on trees planted, trees pruned, trees removed, and trees treated for pests are important to guide management (Table 7-2). For example, are more trees being removed than planted? How does this year's pest management compare to last year? How many trees were pruned and how does this compare to a desired pruning cycle?

A mean 0.0071 trees per capita (7.1 trees per 1000 residents) were planted (Table 7-3). This compares to 0.0060 trees removed per capita. Thus nationally more trees were being planted than removed. Fifty-four percent of respondents (n=334) either planted more trees (49%) or the same number (5%) as removed. Thus, 46% of places planted fewer public trees than removed.

The Midwest region is a primary explanation for tree removals exceeding tree planting. Emerald ash borer is a likely reason for budgets mobilized for tree removal at the expense of tree planting. A mean 0.01 (0.001 SEM) trees are being removed and a mean 0.0086 (0.001 SEM) planted in the Midwest. All other regions have mean tree planting numbers exceeding tree removals.

Table 7-2. What level of tree care activity occurred on all municipal properties in 2014?

	Trees Planted (#)				Trees Pruned (#)				Trees Removed (#)				Trees Treated for Pests (#)			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	349	629	158	199	330	2,108	524	340	344	467	127	70	269	265	12	46
Population Group																
2,500 - 4,999	31	54	8	32	33	99	40	46	35	16	8	3	24	236	0	208
5,000 - 9,999	17	34	10	13	15	102	65	28	17	22	8	7	12	48	0	26
10,000 - 24,999	22	65	51	12	22	270	200	55	22	89	35	34	19	45	7	18
25,000 - 49,999	89	324	135	74	83	1,034	597	125	87	282	130	41	71	192	10	74
50,000 - 99,999	106	353	200	48	99	1,734	950	223	102	434	171	108	79	292	22	86
100,000 - 249,999	65	634	400	132	61	3,897	2,000	743	63	593	350	110	52	339	28	109
250,000 - 500,000	12	2,386	2,249	566	10	4,336	3,422	1,114	11	2,416	1,486	740	8	784	35	493
500,000 - 1,000,000	5	2,008	1,359	835	5	4,553	2,058	2,848	5	1,305	700	549	4	905	201	722
Over 1,000,000	2	34,937	34,937	32,955	2	61,805	61,805	30,977	2	9,334	9,334	7,252	NA	NA	NA	NA
Geographic Region																
Midwest	153	552	185	85	144	1,688	520	208	150	660	267	104	125	317	15	76
Northeast	42	1,856	111	1,612	39	2,957	220	2,372	42	572	71	392	30	173	0	123
South	67	393	200	74	61	1,564	500	425	65	279	62	97	46	215	10	120
West	87	356	153	97	86	2,813	826	594	87	226	75	41	68	245	23	68

Table 7-3. Per capita level of tree care activity that occurred on all municipal properties in 2014.

	Trees Planted (per capita)				Trees Pruned (per capita)				Trees Removed (per capita)				Trees Treated for Pests			
Classification	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**	**N**	**Mean**	**Median**	**SEM**
Total, all cities	349	.0071	.0031	.00110	330	.0247	.0122	.00202	344	.0060	.0028	.00066	269	.0104	.0002	.00601
Population Group																
2,500 - 4,999	31	.0167	.0021	.01036	33	.0285	.0082	.01292	35	.0046	.0024	.00097	24	.0743	.0000	.06678
5,000 - 9,999	17	.0051	.0018	.00210	15	.0139	.0086	.00336	17	.0029	.0012	.00097	12	.0074	.0000	.00433
10,000 - 24,999	22	.0039	.0041	.00064	22	.0173	.0117	.00395	22	.0064	.0022	.00314	19	.0034	.0003	.00171
25,000 - 49,999	89	.0091	.0044	.00193	83	.0295	.0168	.00362	87	.0079	.0036	.00110	71	.0056	.0002	.00210
50,000 - 99,999	106	.0053	.0028	.00070	99	.0256	.0127	.00330	102	.0067	.0025	.00181	79	.0043	.0004	.00126
100,000 - 249,999	65	.0047	.0024	.00120	61	.0237	.0123	.00385	63	.0039	.0023	.00060	52	.0020	.0002	.00056
250,000 - 500,000	12	.0073	.0067	.00161	10	.0136	.0124	.00329	11	.0073	.0050	.00206	8	.0022	.0001	.00116
500,000 - 1,000,000	5	.0028	.0023	.00095	5	.0060	.0034	.00338	5	.0019	.0011	.00072	4	.0015	.0003	.00121
Over 1,000,000	2	.0048	.0048	.00347	2	.0163	.0163	.00499	2	.0017	.0017	.00029	24	.0743	.0000	.06678
Geographic Region																
Midwest	153	.0086	.0057	.00121	144	.0300	.0174	.00368	150	.0100	.0055	.00141	125	.0061	.0003	.00160
Northeast	42	.0041	.0021	.00114	39	.0088	.0052	.00156	42	.0029	.0020	.00047	30	.0027	.0000	.00167
South	67	.0087	.0026	.00478	61	.0192	.0091	.00369	65	.0031	.0013	.00061	46	.0368	.0001	.03488
West	87	.0048	.0021	.00105	86	.0270	.0156	.00362	87	.0027	.0016	.00040	68	.0041	.0004	.00123

Systematic and Reactive Management

The urban forest is the product of residual trees existing prior to development, trees that are planted, and trees that naturally regenerate. The management of these trees occurs through systematic and reactive action, or perhaps no action. Systematic management is a planned approach taken with scheduled tree care in advance of performing the activity. In contrast, reactive management occurs on-demand as the result of a crisis or unplanned event. In some locations a reactive approach is the sole approach. Other locations that focus on a systematic approach will still have a part of their activities occur in reaction to an event (e.g., storms, pest outbreak, removing a dead tree, citizen request, and unplanned tree failure).

Kielbaso defined a community to have a systematic program if 40% or more of their work was scheduled (Giedraitis and Kielbaso 1982). Following that approach, 55% of respondents having a systematic program (Figure 7-1). Communities between 10,000 and 100,000 people had approximately 60% of places ranked as systematic. This level decreased as the community population increased with 29% of locations above 500,000 ranked as systematic. Overall a mean 45.4% (1.45 SEM) of all tree care was rated as systematic.

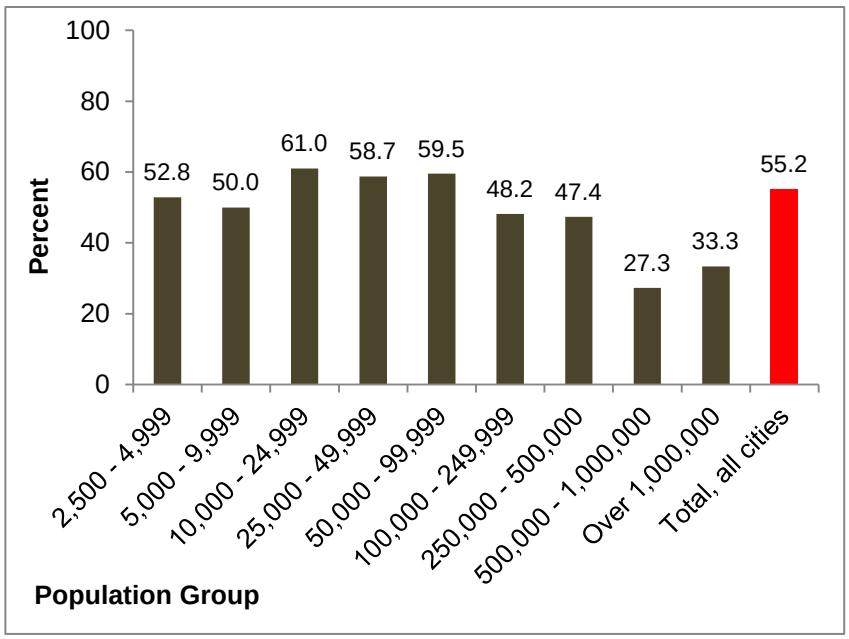


Figure 7-1. What percent of tree care (pruning, pest control, etc.) is done on a systematic (regularly scheduled) cycle and what percent on demand as reactive (complaints, hazardous situations, crisis, post storm etc.)? (n=560)

The overall response to all tree maintenance was rated as a continuous activity in 63% of responding communities (Table 7-4). Smaller communities were more likely to operate under an emergency/as needed basis. Most respondents (99%) responded they prune trees to some extent. Pruning as completed on a needed/emergency or using a regular pruning cycle were equal and each were 46% (Figure 7-2).

Table 7-4. How would you best describe your tree management program's overall schedule for all types of tree maintenance?

Classification	N	Continuous throughout year	Seasonal during a specific time period	Emergency / As needed only	Primarily at request of property owner	Other
Total, all cities	487	63.0	15.6	10.7	5.7	4.9
Population Group						
2,500 - 4,999	47	38.3	21.3	31.9	4.3	38.3
5,000 - 9,999	25	36.0	20.0	32.0	0.0	36.0
10,000 - 24,999	30	76.7	13.3	0.0	6.7	76.7
25,000 - 49,999	130	61.5	18.5	9.2	7.7	61.5
50,000 - 99,999	145	66.9	16.6	5.5	5.5	66.9
100,000 - 249,999	81	75.3	6.2	4.9	6.2	75.3
250,000 - 500,000	18	61.1	22.2	16.7	0.0	61.1
500,000 - 1,000,000	8	75.0	0.0	12.5	12.5	75.0
Over 1,000,000	3	66.7	0.0	33.3	0.0	66.7

Pruning done as needed/emergency was most common in smaller communities and declined as communities increased in size.

Those that use a regular pruning cycle were asked to describe their current and desired pruning cycle. A mean 6.6 year current pruning cycle was reported (Figure 7-3). A desired 4.8 year pruning cycle leaves respondents 1.8 years off their desired pruning cycle. The current cycle increased as community size increased. The reported pruning cycles for communities for all locations is likely higher considering the number of respondents that indicated they prune by emergency only.

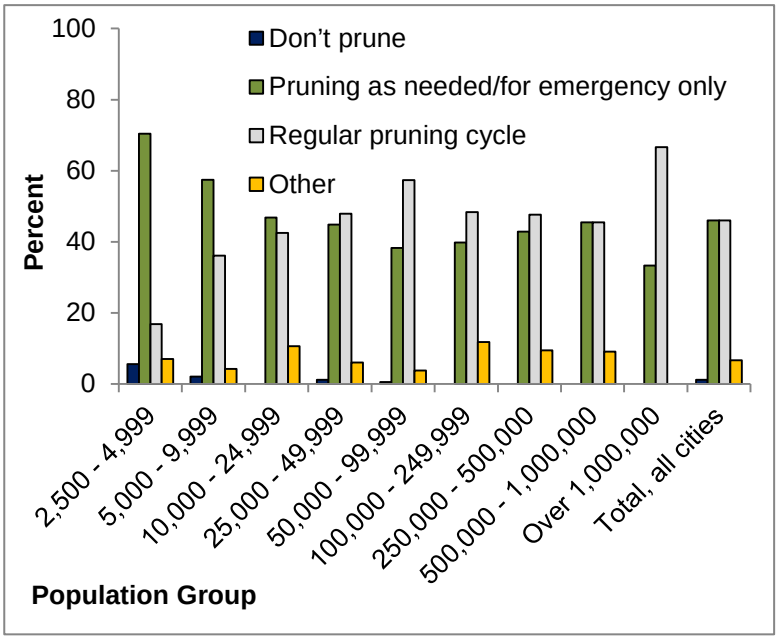


Figure 7-2. How would you best describe your tree management program's approach to pruning? (n=641)

The management of tree pests can use a planned strategy or be reactive. No control occurred with 32% of respondents. This was more common in smaller communities with 56% of places < 10,000 people indicating no control of tree pests occurred. Treating outbreaks as they occur was common to 34% of respondents. An integrated pest management approach was common to 19% of responding locations. Spraying at regular intervals has become uncommon with only 4% doing such now.

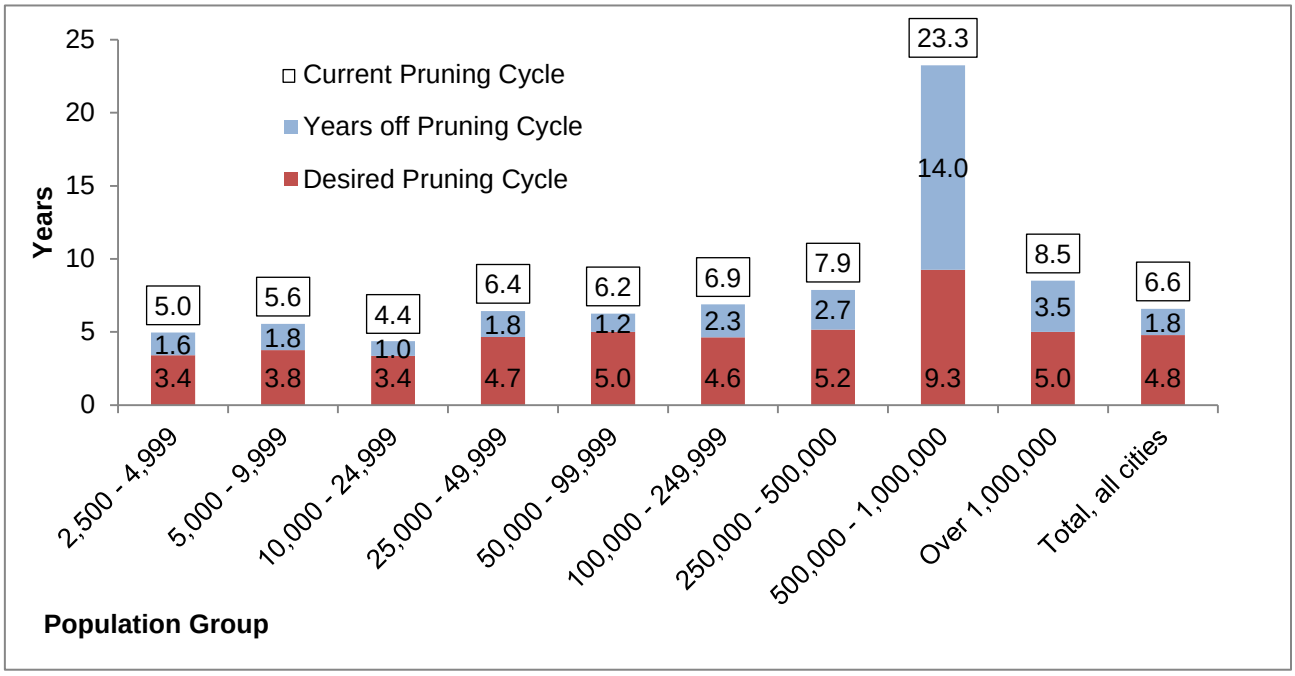


Figure 7-3. What is your current pruning cycle, your desired cycle, and years of the current pruning cycle? (current cycle n=227, desired cycle n=146)

Sources of Trees

The urban forest is comprised of trees that were present prior to development, trees that naturally regenerate, and planted trees. A municipality may get trees that were planted from a variety of sources. Tree advocacy groups may purchase and plant trees in cooperation with a city. Trees might be donated. A city may grow trees or collect them from the wild. Directly purchasing trees from a nursery is a source of planted trees. Trees might also result from a citizen planting a tree on public property.

Keeping records is important to document annual tree planting efforts. Most (80%) of the responding places kept records on the number of trees planted annually. Tree planting records also provide the ability to monitor tree planting survival and growth.

Trees are planted to fill a space. It could be to replace a removed tree. A planned improvement could be the reason. A citizen request could be the mechanism that triggers a tree to be planted. A citizen request was the least common with 10% of respondents replying with this answer as to "why were trees planted" (Figure 7-4). Replacement (36%) of a removed tree and a planned improvement (37%) were similar as a primary reason. Another 17% other reasons were given with most of these as multiple reasons for tree planting.

Growing trees in a nursery to a transplantable size is an art and science. Only 16% of communities operated a nursery to grow trees. Even with this, only 4% of planted trees came from a city nursery (Figure 7-5). The vast majority (84%) of trees were purchased for planting from a nursery. Over 10 percent of trees came from donated (6%) or as nonprofit planted trees (5%). Very few trees (0.1%) are collected from the wild for planting.

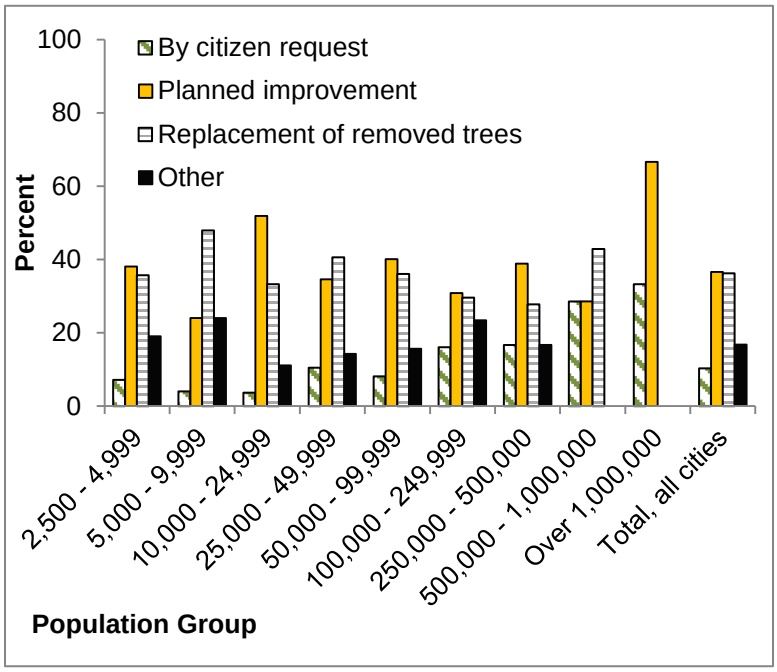


Figure 7-4. What one option best describes your tree management program's primary approach to tree planting? (n=483)

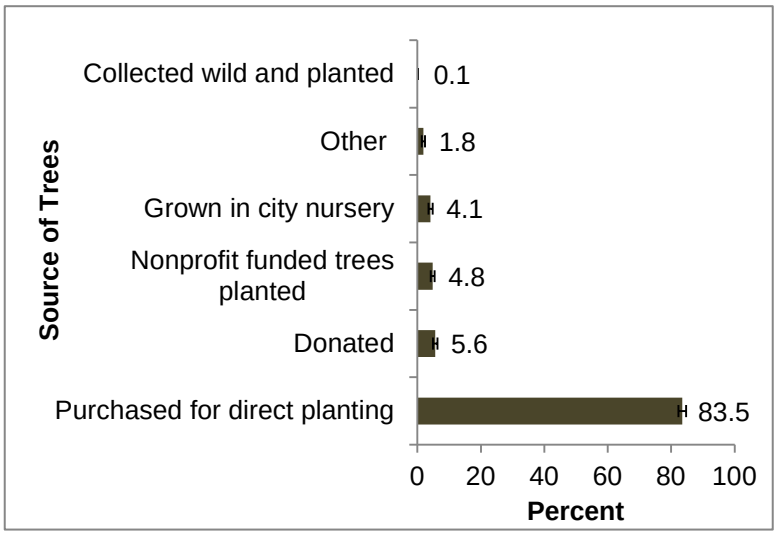


Figure 7-5. What one option best describes your tree management program's primary approach to tree planting? (n=580)

Tree Removal Reasons and Disposal

At some point in time a tree will die or decline to the point that removal is warranted. The reasons for tree removal are as varied as the disposal options. A tree removal could be due to an infrastructure conflict or because the tree exceeds a risk threshold. An insect or disease, storms, or development could be the reason. After removal, there are many disposal options. These vary from burning or landfilling to using tree parts as lumber, mulch, firewood, or other uses.

Almost 60% of the reasons given for the removal of trees were due to a tree declining or dead (46%) or due to a tree risk (12%) exceeding an acceptable level (Figure 7-6). Storm damage (9%) and disease/insect problems (12%) accounted for 20% of removals. Another 10% of tree removals were from damage to sidewalks (5%) or a homeowner request (5%). Development accounted for 9% of tree removals.

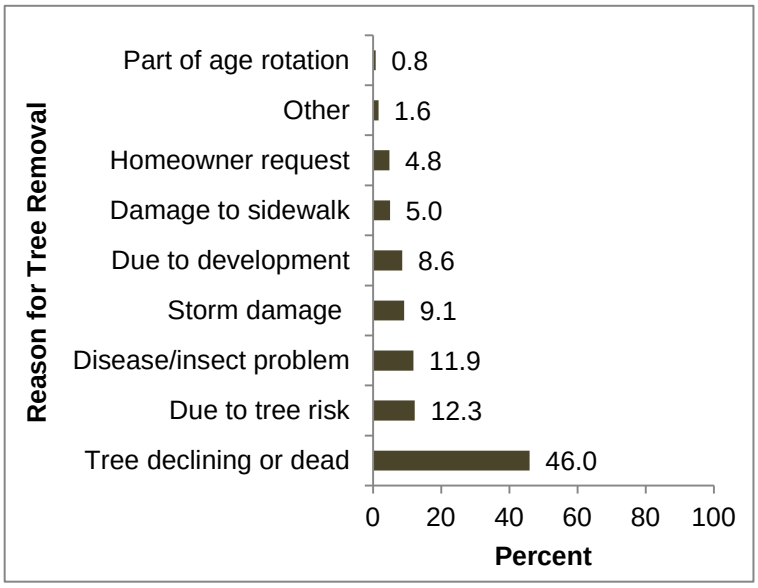


Figure 7-6. Which of the following reasons explain the current removal of trees in your community? (n=452)

Routine inspections occur to identify dead trees or trees with insect or disease issues. The inspections are done as part of a city ordinance or policy for public good. Inspections of public trees were very common with 86% of respondents doing such (Figure 7-7). Private tree inspections were much less common in only 22% of responding places.

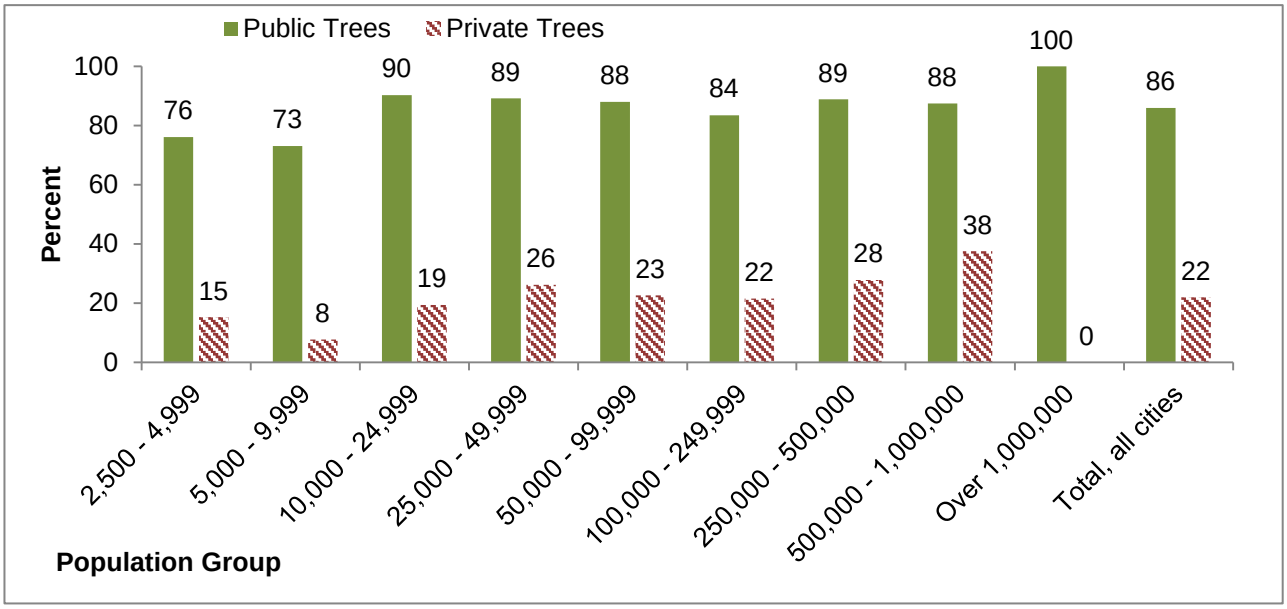


Figure 7-7. Does your community conduct routine inspection and require removal of insect infested or diseased trees on public and/or private property? (n=491)

Woody plant material can retained on a site or moved. A mean 41% of places operated a recycling site for wood and brush for residents (Figure 7-8).

A community has several disposal options for public trees that are removed. A community may use more than one approach. Eighty-four percent of respondents create mulch from public trees (Figure 7-9, 7-10). Firewood was another common method used by 49% of responding locations. A surprising 31% of respondents indicated that landfilling is used to some level for disposing public trees. Other methods including lumber (14%), biofuel (12%), wood for furniture (9%), and sale of round wood (6%) occurred less commonly. Burning trees in the open was uncommon in only 5% of responding places. This practice occurred in smaller places more so and did not occur in places with 100,000 or more people. Biofuel from woody material increased as population increased. The development of firewood decreased as population increased.

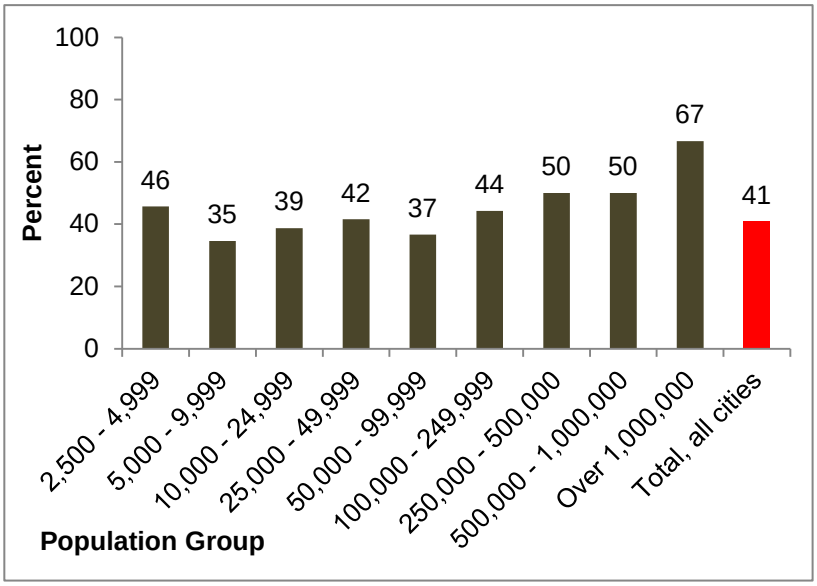


Figure 7-8. Does your community operate a recycling site for disposal of wood and brush for residents? (n=491)

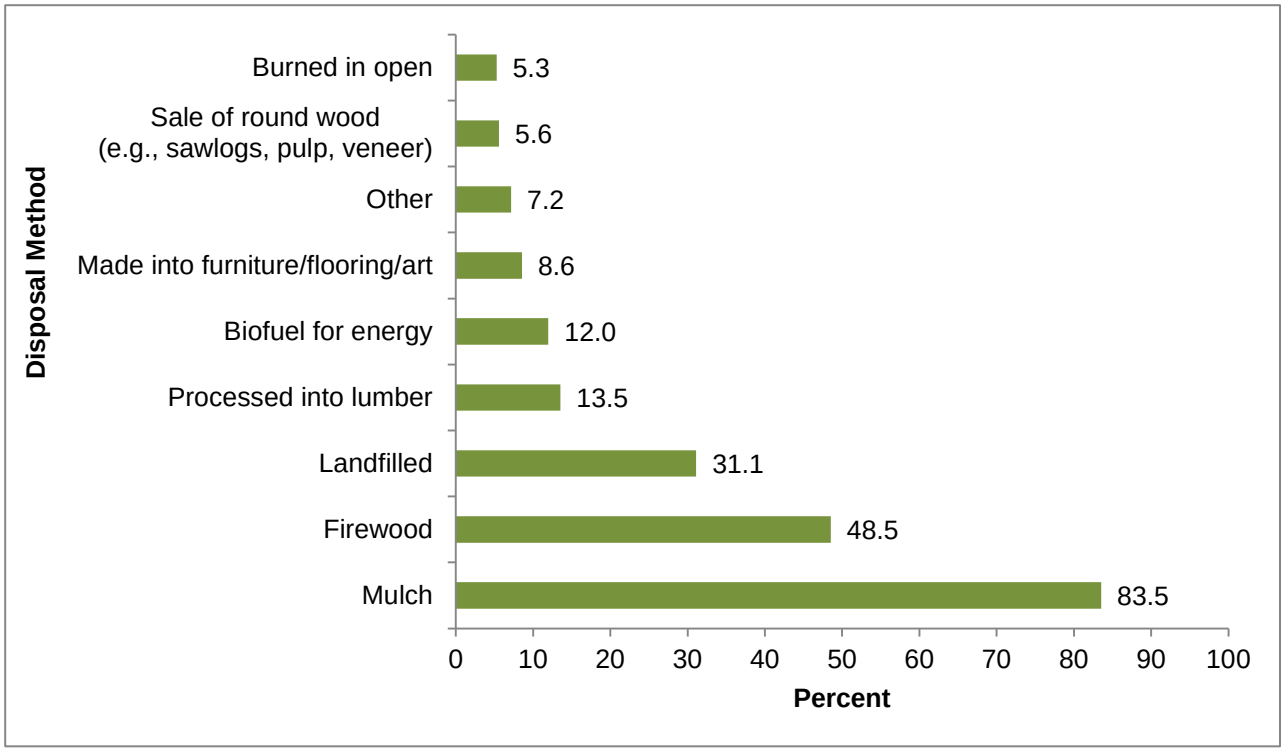


Figure 7-9. When a public tree is removed, which of the following are typical ways that solid wood/residue is disposed of? (n=643)

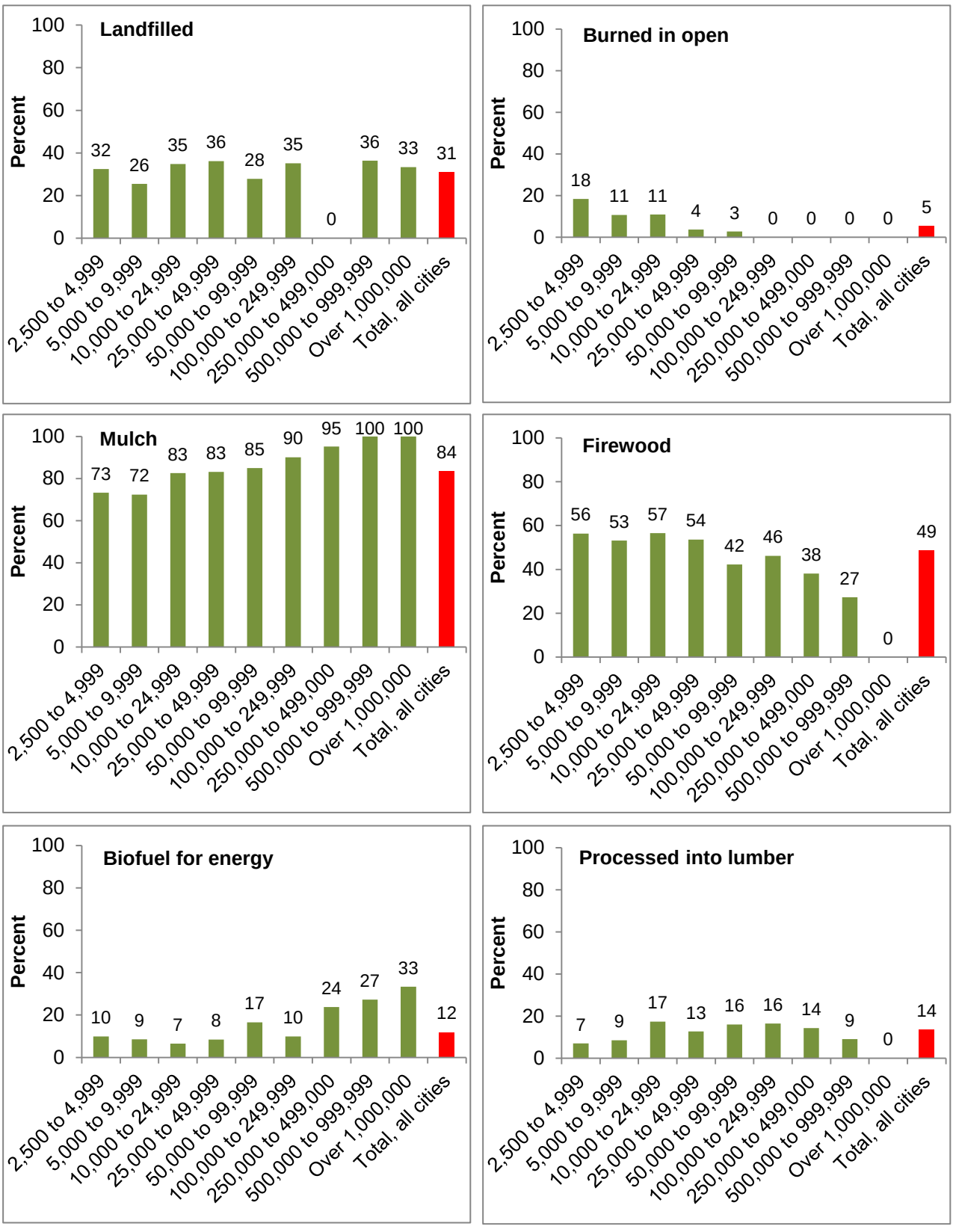


Figure 7-10. When a public tree is removed, which of the following are typical ways that solid wood/residue is disposed of and relationship to population group? (n=643)

The vast majority of urban trees are resilient and pose little unacceptable risk to society. A community risk tolerance and the concept of reasonableness guide what level of risk exceeds an acceptable standard. A community tree risk management program is designed to develop an acceptable level of risk and to further develop the mechanism to evaluate trees for risk.

Regularly conducting tree risk management (hazard tree identification) occurred in 57% of responding communities (Figure 7-11). The frequency of assessment was not ascertained, thus a community could inspect trees frequently or conduct them infrequently and consider tree risk management occurred. A written tree risk management policy is a place to specify inspection frequency. A written policy occurred in only 14% of responding communities.

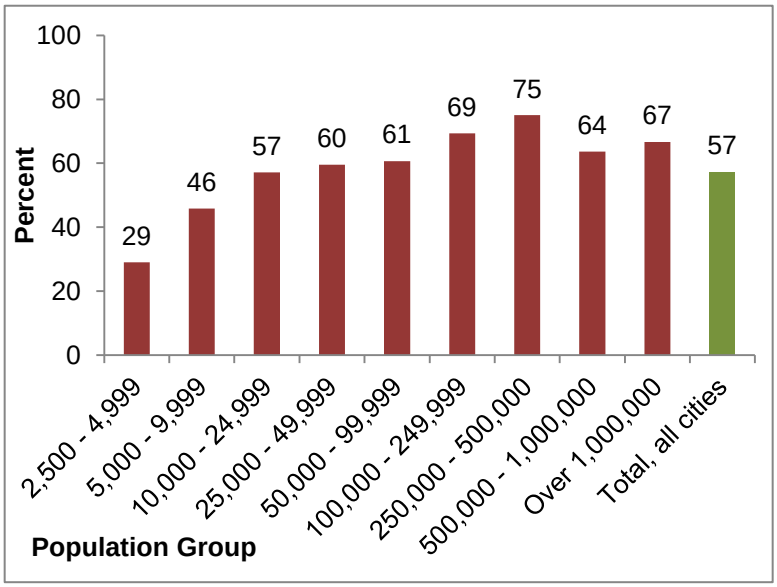


Figure 7-11. Does your community regularly conduct tree risk management (hazard tree identification)? (n=634)

When property damage occurs or injury results from a tree, a claim may be made to compensate for the financial loss. Approximately half (52%) of communities experienced a claim for injury or property damage. A mean $13,290 (2463 SEM) claim resulted.

Several tree risk rating systems exist. No one system was used by the majority of respondents. The greatest number (37%) of respondents signified no system was used (Figure 7-12). The relatively new ISA Tree Risk BMP was the most common system with 22% mentioning its use. An in-house system was used by 16% of respondents. Of the 8% of respondents who selected other, many wrote that several approaches were used. The U.S. Forest Service System, Colorado Tree Coalition System, and U.S. Park Service Hazardous Tree Program were used by a few locations.

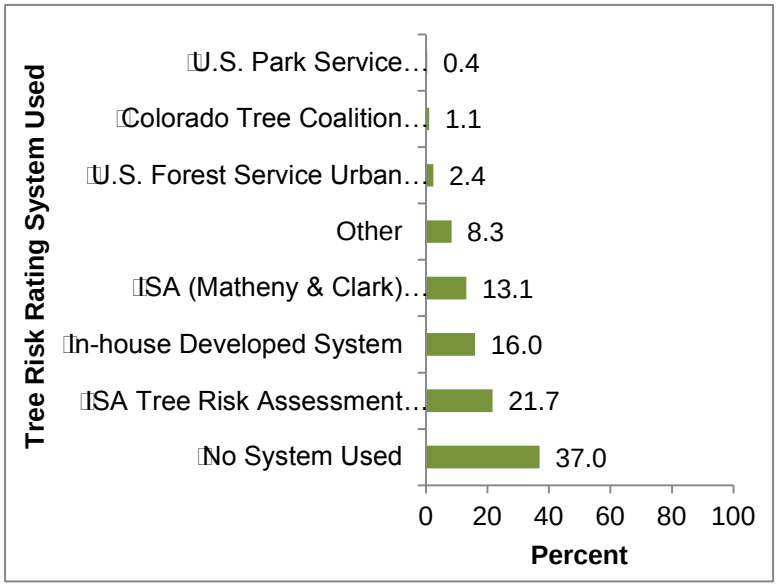


Figure 7-12. Which one of the following tree risk rating systems do you most commonly use? (n=457)

Tree risk inspection involves several tactical approaches. One

approach is responding to a citizen complaint (Figure 7-13). Nearly all (97%) of the respondents use this tactic. Identifying trees at high risk through the use of a windshield survey (78%) or as part of routine maintenance (77%) were common. Approximately half (53%) of respondents used a routine inspection program to conduct tree risk inspections.

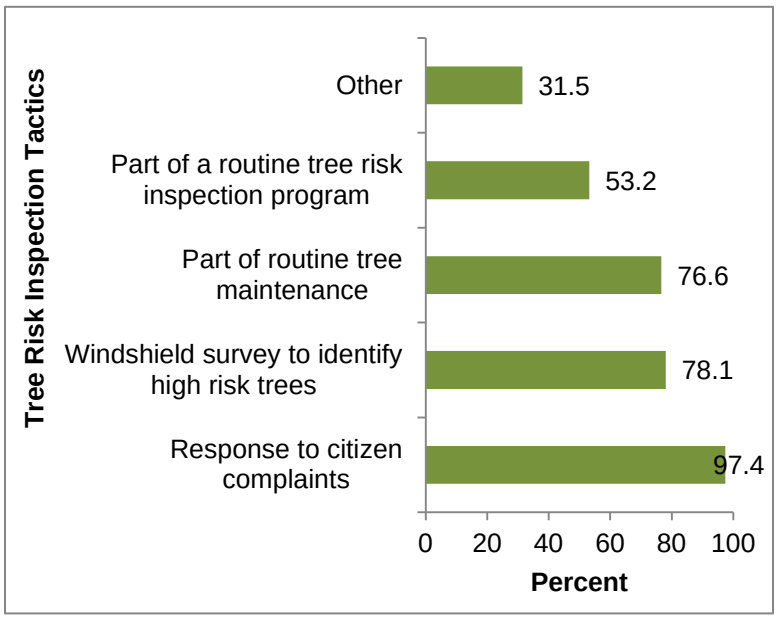


Figure 7-13. Which of the following statements reflects your overall tactic to tree risk inspection? (n=636)

The inspection of trees through tree risk assessments regularly occurs. A mean 86% of responding communities inspect public trees (Figure 7-14). This slightly increased as population increased. Inspection of private trees was less common. Only 22% of respondents specified that private trees were inspected for tree risk. The frequency of private tree inspections increased as the population group increased. The rationale for inspecting private trees is if they pose an unacceptable risk, then the inspection and requirement to abate the problem is providing a public good.

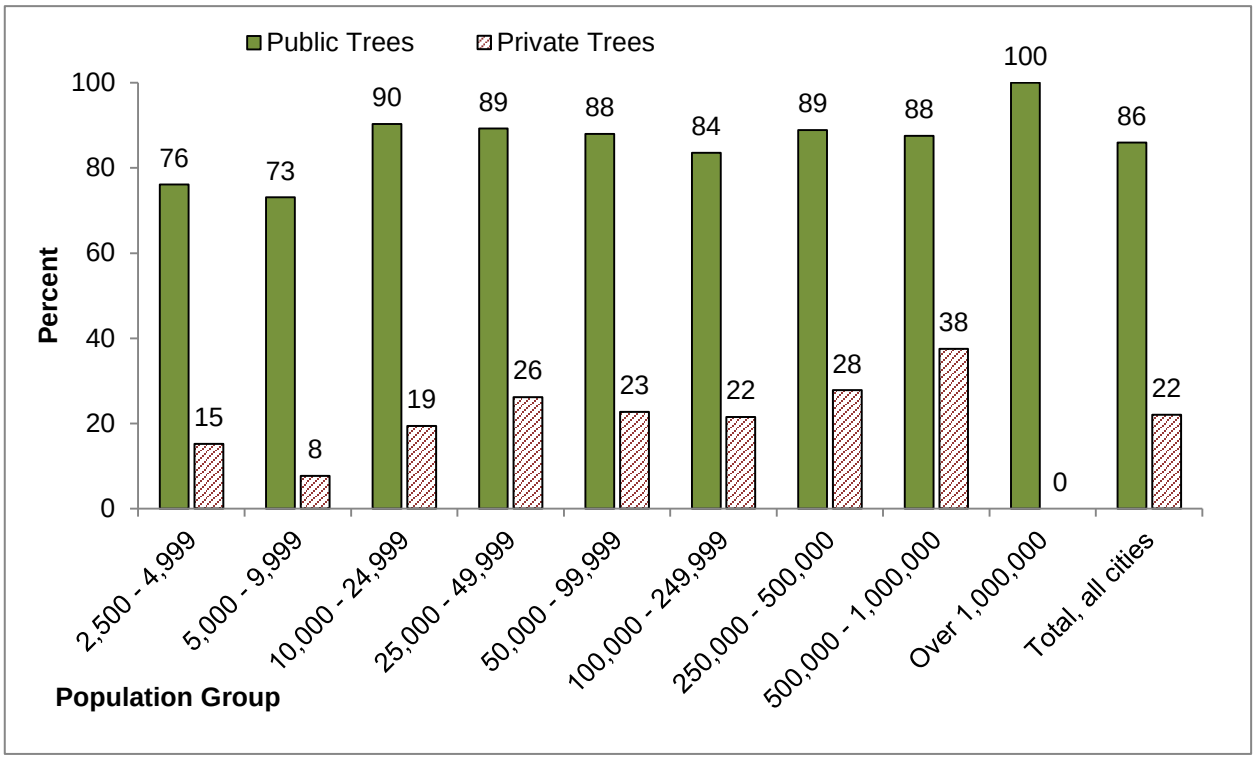


Figure 7-14. Does your community conduct routine inspection and require removal of high risk (aka hazard) trees on public and/or private property? (n=491)

Trees and Emergency Response Systems

Trees and storms regularly occur together. The outcome is predicated on the severity of the storms and the resiliency of the urban tree population. Developing an emergency response system that incorporates trees, taking proactive urban tree management, and responding to storm damaged trees in a timely manner is good advice.

Over half (55%) of the respondents specified that they have an emergency response system in place which includes trees (Figure 7-15). Smaller communities are less likely to have a system in place. Thirty percent of places with less than 25,000 people had an emergency system in place. The places with 25,000 or more people are more likely to include trees in emergency planning.

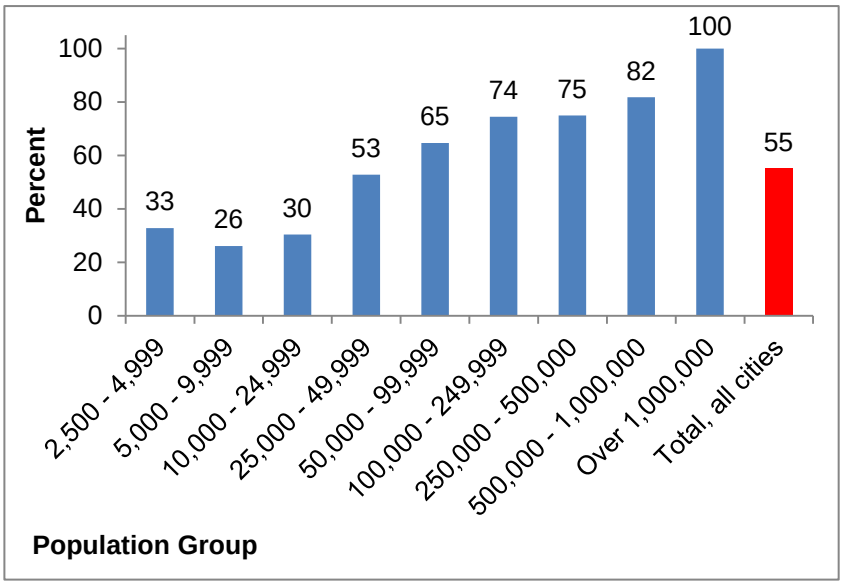


Figure 7-15. Does your community have an emergency response system which includes trees? (n=625)

Training programs exist to develop skills in Incident Command Systems (ICS) and the National Incident Management System (NIMS). The ICS approach is commonly used in wildfire, storm, and emergency management, and recovery. The NIMS provides another standard approach to organize and respond to trees and storms.

Nearly half (49%) of respondents indicated that a person associated with the tree program had training in ICS (Figure 7-16). A lower 41% indicated they had training in NIMS. Interestingly, as population increased the frequency of a trained ICS person increased and started declining with the largest cities. The frequency of trained staff in NIMS followed a similar pattern. A speculative reason is in the largest locations have staff trained in ICS and NIMS, they are just part of a program that is separated from the tree program. It is also possible these larger places have an in-house developed program that works and thus are not using externally developed systems.

Developing coordination mechanisms between tree managers and emergency managers is an important part of managing trees and storms. The can occur prior to storm (proactive) or during storms (reactive). Both are acceptable approaches, however, a proactive stance that establishes processes beforehand should lead to more effective and efficient responses.

Prior to storms, including trees within emergency management storm meetings is one way to coordinate. Only 26% of respondents indicated they do such and the likelihood of this increased as population increased (Figure 7-16). During a storm nearly half of places (48%) responded that emergency managers discuss trees. Again this was more common in larger than smaller locations.

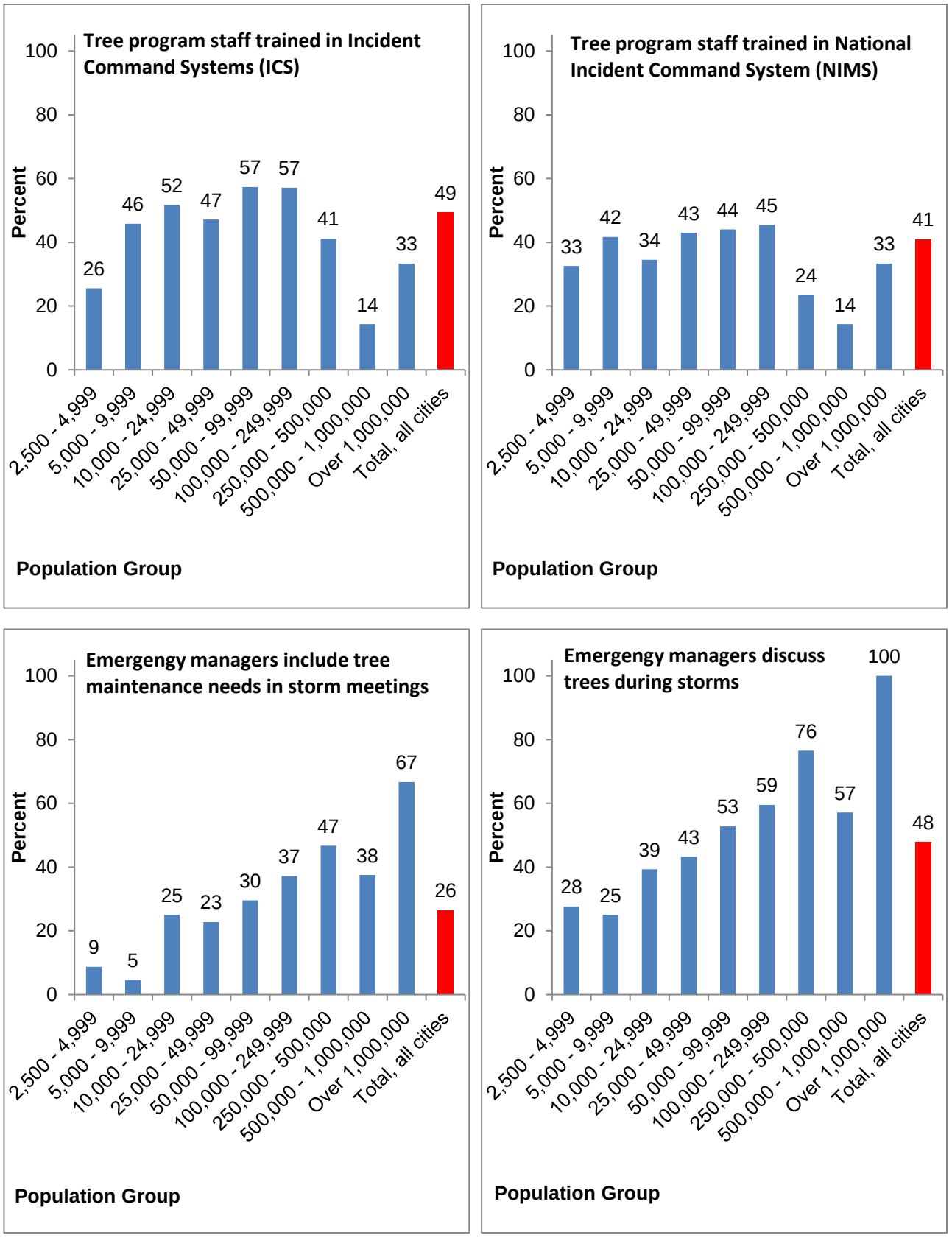


Figure 7-16. Does your community conduct any of the following activities related to trees and storms? (n=464 - 474)

Section Eight: Assistance Programs

Assistance programs are used to build a capacity to accomplish a desired result within a community. As early as the 1970's, State and Federal Urban & Community Forestry (U&CF) programs provided technical assistance, financial assistance, training, demonstration projects, and other mechanisms to increase local urban forestry capacity. Since 1990, every state has a program that provides assistance to communities. This section details the familiarity of local places with U&CF assistance program, their level of receiving assistance, how common local places provide educational programs to residents, and the familiarity with national nonprofit groups and their programs.

State and Federal Assistance Programs

A major impetus of every state U&CF program is providing assistance to communities. All states provide technical assistance and several provide financial assistance. Two-thirds of respondents are aware of the state U&CF program (Figure 8-1). Familiarity increased as community size increased.

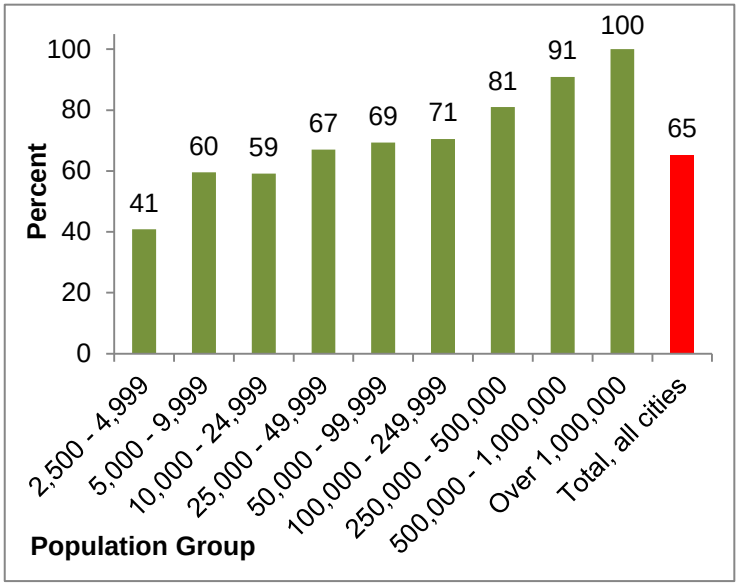


Figure 8-1. Are you aware of the Urban & Community Forestry Assistance Program in your State? (n=650)

The regularity of receiving assistance was ascertained (Figure 8-2). Overall, less than half of respondents were recipients of technical assistance (41%) or financial assistance (48%). Slightly more than half of recipients participated in educational/training assistance (54%). Smaller communities were less likely to participate in assistance.

Responding communities received a mean 3.1 (0.3 SEM) technical assists in the past 5 years. Financial assistance was less frequent with 1.7 (0.1 SEM) over the same five-year time period. Education and training was most common with 4.2 (0.4 SEM) assists over the past five years. There were no difference in response by region or population group.

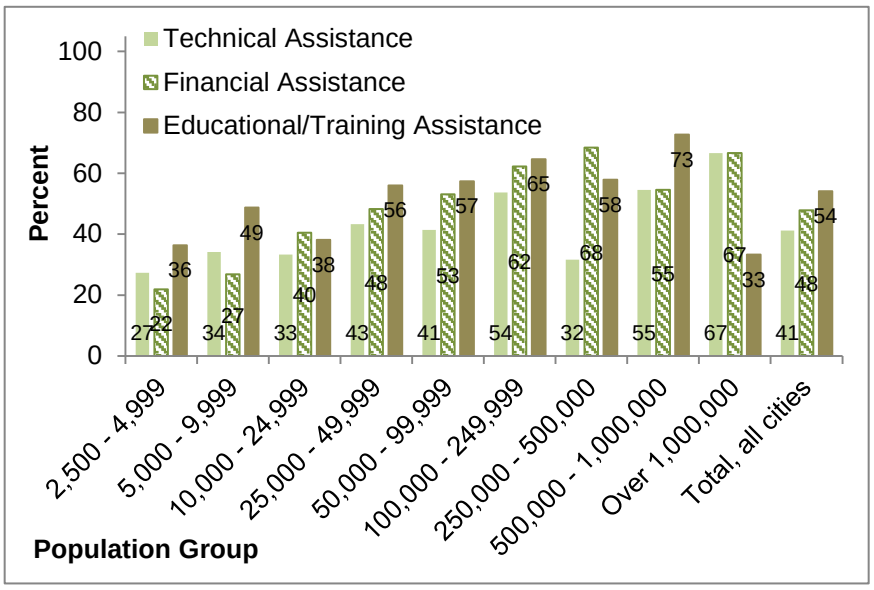


Figure 8-2. What types of assistance from the Urban & Community Forestry Assistance Program in your State have been received?

Local residents turn to several sources for assistance and education about trees. A local garden center, county extension office, professional tree service, and knowledgeable neighbors are sources of information. A community tree program is another source of information for tree advice. Many communities (53%) provide technical assistance (Figure 8-3). A few (4%) responding places even provide financial assistance for tree issues (e.g., epidemics with DED and EAB treatment cost-sharing). Not surprising with another question about educational programing, 59% indicated their community provides educational programing (Figure 8-4).

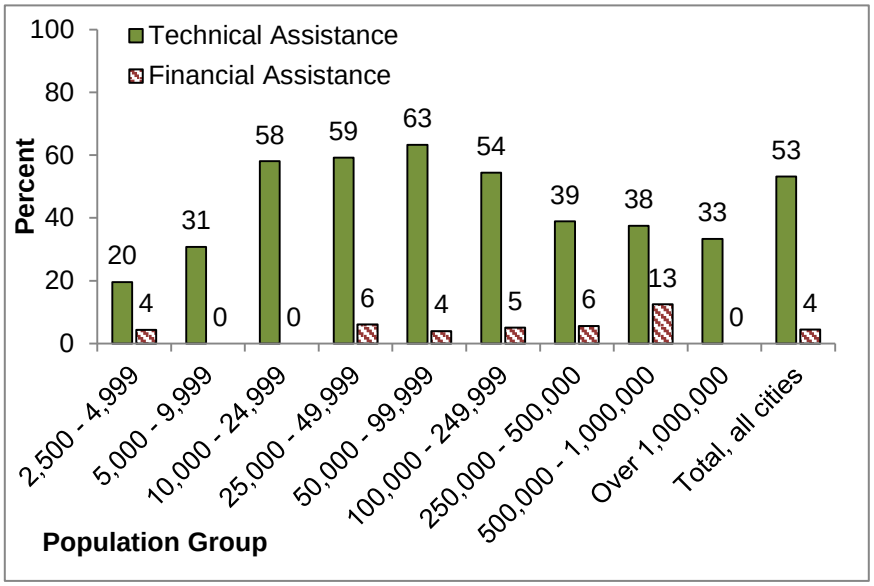


Figure 8-3. Does your community provide technical assistance (information) for tree maintenance on private property and /or financial assistance for specific insect or diseased tree removal on private property? (n=491)

Arbor Day is a popular program in 81% of responding places (Figure 8-5). Tree planting (59%), tree selection (52%) and tree pruning (49%) are common educational programs in approximately half of responding places. As population increased the frequency of providing educational programming increased. A community website is a way to provide information about the tree program in 45% of (Figure 8-6).

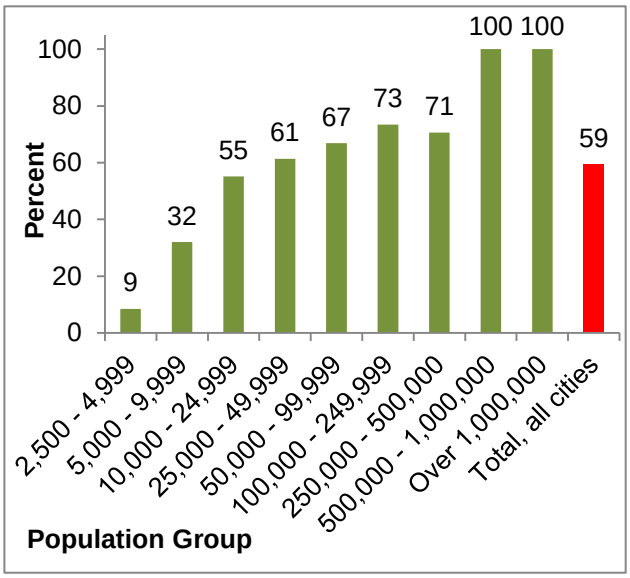


Figure 8-4. Do municipal staff provide educational presentations to city residents in regard to tree care? (n=495)

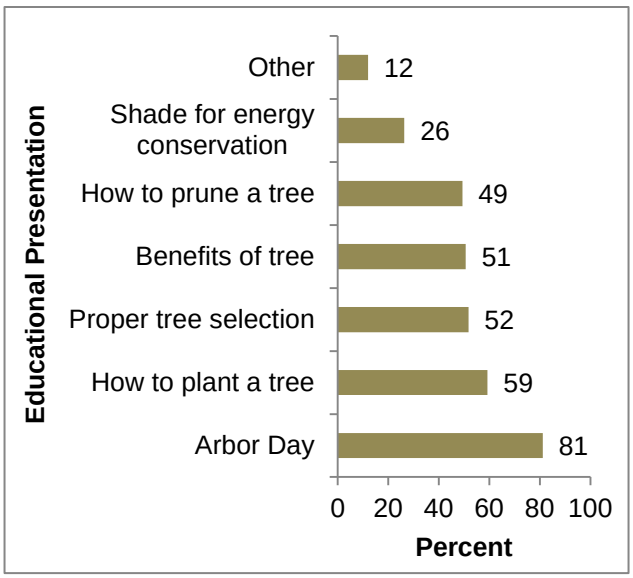


Figure 8-5. Which educational presentations are provided to residents? (n=452)

National Non-profit Organizations

Throughout the United States many local non-profit organizations provide assistance to improve urban forests. The Arbor Day Foundation is a noteworthy international organization. Since 1976 it has hosted the Tree City USA (TCUSA) program.

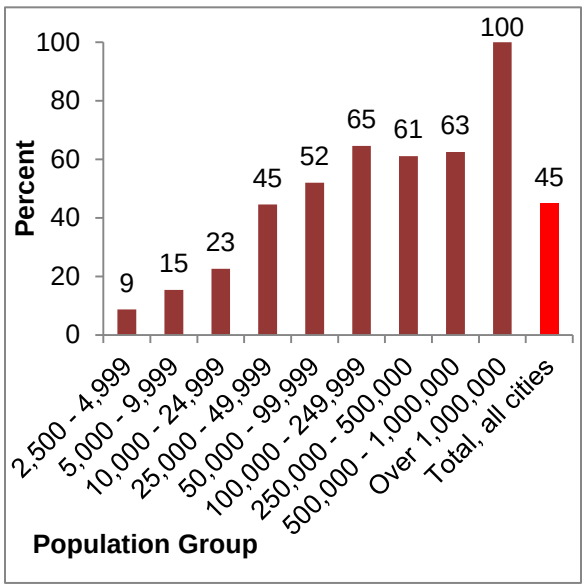


Figure 8-6. Does your community maintain a website page specific to the community/urban forestry tree program? (n=491)

Respondents were asked if their community was a TCUSA. Seventy-three percent of the respondents said yes. A reminder with interpretation that this means 73% of people in the United States live in a location that is a TCUSA (Figure 8-7). An estimated 3876 places were a TCUSA and close to the approximate 3400 places listed by TCUSA. In the smallest population group, 26% said they were a TCUSA. This rose to nearly 100% in places with 100,000 or more people. If a community was not a TCUSA, they were asked if they had heard about the program. A mean 75% said they had (Figure 8-8). Thus, the TCUSA brand is well known.

The Alliance for Community Trees (ACTrees) is a national nonprofit with a mission to build capacity in its members to plant, sustain and advocate for trees in America's communities. Respondents were asked if they had heard of ACTrees National Neighborwoods Month Program which promotes tree planting. Thirty percent of the respondents knew of this program. Seventy percent of responding places with 250,000 or more people were familiar with ACTrees. In contrast, only 4% from places with fewer than 10,000 people had heard of the program. Since 8/1/2015, ACTrees is a program of the Arbor Day Foundation.

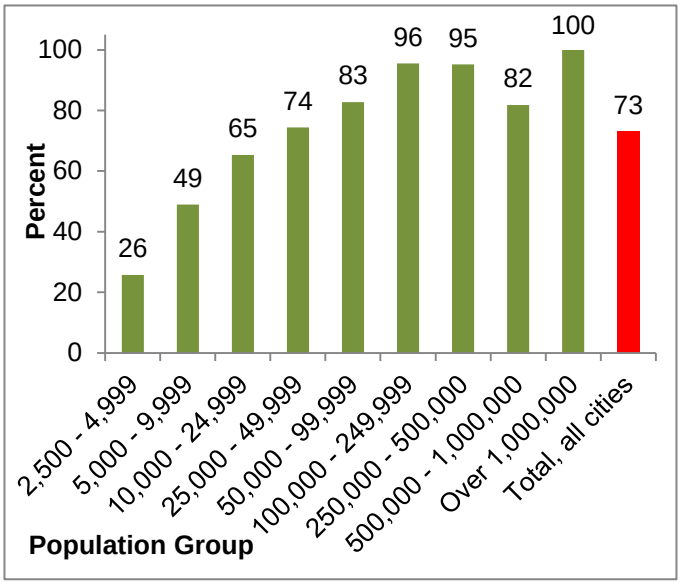


Figure 8-7. Is your community currently a Tree City USA? (n=626)

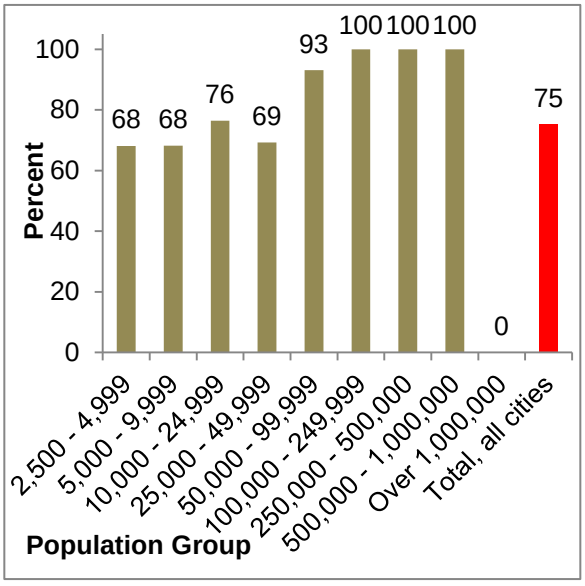


Figure 8-8. Have you heard of the Arbor Day Foundation's Tree City USA recognition program? (n=161)

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