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Municipal Tree Care and Management in the United States

Introduction

Trees in communities whether on public or private lands are an asset that grows in value over time. With proper management, this value results in a variety of benefits that ultimately make communities a better place to live. Numerous studies over the past several decades show that communities with vibrant tree populations realize a positive effect on 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.

Project Method

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. 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 scorecard system in the near future.

The quantification of municipal programs used both long and short form questionnaires that contained 109 and 53 questions respectfully. The short form version was used to capture questions deemed critical and as a way to encourage participation by respondents unable to complete the long form that could takes several hours or more to complete. All communities with 50,000 or more people were asked to participate. A random sample from 50% of communities between 25,000 and 49,999 people and 10% of communities between 2,500 and 24,999 was used to select municipalities that were asked to participate. In this study the words place, municipality, and community are used interchangeably to distinguish a Census Designated Place.

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.

A total of 1735 communities with valid postal mailing addresses were contacted up to 4 times to participate using the long form and up to 3 times to the short form if they had not yet responded (Table 1). A total of 667 communities (38.4%, 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.

Results and Discussion

A select set of findings are reported in this paper. These results are focused on budgets and funding, tree operations profile, professional standards and credentials, tree policies and ordinances, and partnerships and volunteers. The results are preliminary and may change slightly from final results currently being compiled in a technical report for this study.

Budgets and Funding

Municipal forestry operations are one of several functions and activities that a community undertakes and prioritizes. Municipalities use a variety of funding sources to support tree care and management (Table 2). The general fund continues to be the primary funding source used by 86% of communities. This was consistent with the mean 85% value from all studies since 1974. However, 71% of overall funding comes from this source which had an absolute decline of 15% from the 1980 value. Greater funding source diversification could help buffer a reduction from any once source. Forestry grants continue to be commonly used in over 30% of communities. This was similar to 1993 when 29% said they used forestry grants. Funding from federal jobs training programs has continued a decline since reaching a peak of 9% in 1980 to only 0.3% today. Federal jobs programs were common in the 1970's and early 1980's. In contrast, the upward trend with community block grants continues with 9% now using this source. Sources such as special frontage tax, road use tax, endowments, vehicle tax, and gas tax are similar to past usage, however, continue to be infrequently used by less than 1 to 3 percent of places.

A municipality spends a mean $801,595 ($107,800 standard error of the mean; $332,872 median value) to fund activities and management. Compared to past surveys adjusted for inflation, funding today is the highest on average (Table 3). This potentially is the result of many urban greening activities such as large scale tree planting efforts, planting trees for storm water management, aesthetics and shade of trees in parks, screening objectionable views, and many more reasons. Another possible explanation is the cost to respond to pest problems such emerald ash borer (*Agrilus planipennis*). Forestry budgets accounted for 0.52% of municipal budgets (Table 4). This is consistent to the 1974 (0.54%) and 1986 (0.49%) allocations and greater than the 0.31% reported in 1993. The highest percent recorded was 0.81% in 1980 which also coincided with continued response to Dutch elm disease (*Ophiostoma ulmi*) in the era. Likewise the current emerald ash borer (EAB) response has affected budgets. A preliminary analysis for Illinois communities currently facing epidemic losses of ash trees suggests approximately 1.5%

of municipal budgets were spent on forestry operations. This is nearly triple the national mean and exploration of annual municipal budgets in Illinois revealed several with a specific EAB line item. Thus, when viewing a statistic such as percent of municipal budget spent on forestry operations, one needs to understand what the monetary resources are being spent on and having a greater percentage is not necessarily a positive outcome. Likewise a low percentage allocation would likely affect growing a vibrant and sustainable urban tree population. Finally, communities were asked to report on their total municipal budget excluding any school budget that may be contained within a municipal budget. Some communities have several enterprise funds (e.g., water, sewer, golf courses, municipal activity centers, municipal liquor stores) that when included reduce the per capita funding level. Other places have few to no enterprise activities. Assuming all things equal except for enterprise activities, the percent of municipal budget should likely be greater in places with little enterprise funds or those places that may have excluded this in their reported municipal budget. Future research should determine what funding source(s) is the best indicator to compare municipal budgets against and which could allow communities to more equitably compare budgets and funding.

The greatest allocation of funding continues with street trees and 62% of funding (Figure 1). Every time this question has been asked in the past a consistent 61% or 62% answer was derived. Park trees continue as second place and 23% of total funding. This is followed by public grounds (8%), cemeteries (2%), nurseries maintenance (1%), and other offered uses (4%). On a per capita basis, program budgets were $8.76. This is double the $4.08 real amount reported in 1993. Thus, the nominal $2.49 from that time period adjusted by 1.64 CPI change yielded the $4.08 value. Other past reported real values are 1974=$7.82, 1980=$6.29, and 1986=$5.62. Thus, the downward trend tracing back to 1974 seems to be stopped in this current study. However, as pointed out earlier, this can be a reflection of more money spent to respond to negative consequences such as emerald ash borer, rather than more positive outcomes such as tree maintenance, tree planting, and public safety through tree risk management.

The big three (planting, pruning, and tree/stump removal) continue to require a majority 2/3rds of funding (Figure 2). Tree and stump removal were greatest (27% of total budget) and consistent with the long term 27% mean value. Pruning used nearly a quarter of the budget (24%) which is below the long term 29% mean. Budgets allocated 14% for planting which is similar to the historical 15% of budget. Why pruning expenditures are lower today is unknown. 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.

Tree Operations Profile

The systematic management of urban trees is suggested to lead to more efficient allocation of public resources. More effective outcomes with growing and maintaining urban trees are another touted benefit of systematic management. A total 55% of communities were rated as having a systematic program. This is similar to the value (56%) reported in 1974. It would seem that this is not a noteworthy outcome having a similar systematic level as from 40 years ago. Greater professional training, credentials, and state and federal urban and community forestry assistance should lead to an increase. However, how questions were asked in the past and the present are

different. In 1974 a respondent was asked if they have a systematic program or not with the 56% saying yes then. The 1986 survey asked a respondent to indicate what percentage of tree care operations were systematic or reactive. A definition was set in 1986 that if 40% or greater of work was systematic the program was ranked as being systematic. Thus, in 1986 only 39% of places were rated as systematic. The current 2014 question used the same 1986 method and found a 43% increase in communities ranked as systematic to the 55% value.

Municipal forestry programs as indicated earlier spend much of their resources on tree planting, pruning, and removals. They also respond to public requests about trees with a national mean of nearly 1,000 requests fielded annually (Table 5). This varied from 16 in places with 2,500 to 4,999 people, to 552 from communities between 50,000 and 99,999 people, and 40,150 on average for places one million or more. Likewise, as population increases the level of activity increases. On average, 629 trees are planted, 2,108 are pruned, 467 removed, and 265 treated for pest issues. This corresponds to a national 55,332 mean public trees (18,644 median) along streets, in parks, public grounds, and other locations. A mean 26,234 (13,000 median) street trees occur in communities. More trees on average are being planted than removed and 52% of places planted more tree than removed in 2014. Some preliminary observations suggest places that tree removal exceed tree planting occurs in areas currently experiencing dramatic loss of untreated ash (*Fraxinus* spp.) trees to EAB.

Knowing the types of trees, their condition, size, tree risk, insect/disease issues, and other criteria is important information to develop tree management plans and budgets. A mean 67% of communities said they have completed an inventory of some sort in the past. This ranges from 30% in communities between 2,500 and 4,999 people to 92% of places with 250,000 or more people having one. However, 41.1% of communities said the inventory was current, 30.5% where in the process of making it current, and 28.4% said it was not current and was missing information. Computerized systems were most common and used at 83% of municipalities. City staff (60% of places) and consultants (44%) were most commonly used to collect data. A community may use more than one approach, thus these numbers adding to greater than 100%. Communities also use interns (23%), volunteers (14%), and state U&CF staff (7%) with inventory collections. These inventories are most commonly used to identify tree species (98% of places), tree diameter (89%), tree condition (88%), tree planting locations (77%), and tree removal decisions (70%). Tree risk assessment was only reported by 51% of places that this is included in the inventory.

Tree risk management is an important approach to rate trees for likelihood of failure and to identify the likelihood of injury or damage if a failure occurred. They are undertaken by municipal forestry programs to lessen the risk of personal injury, property damage, and financial losses to a community. Overall 57% of respondents indicated tree risk management is regularly conducted. However, only 14% had a specific written tree risk management policy. Thus, they conduct a program without a written policy saying what they should do, who has authority to inspect and recommend action, and other important tree risk details. Citizen complaints are a very common tactic with 90% saying this is one overall approach. Tree risk inspection as part of routine tree inspections is common to only 35% of responding communities. Again a community may use several methods so percentages will sum to greater than 100. It is however commonly done as part of routine tree maintenance in 59% of communities. Sixty-two percent also use a

windshield survey as part of a tree risk inspection. Over half (52%) of communities have had a claim related to an injury or property damage from public trees. This was most common in large communities. The national mean per claim was $13,290 ($5,000 median).

Tree inventory systems can be used to direct urban forest management activities. Not surprising respondents said they use inventories to most commonly identify tree planting locations (72%), select tree species for planting (61%), removing trees that surpass an acceptable risk rating (60%), and schedule tree pruning (53%). Ideally a tree inventory system is designed to collect information for questions developed prior to collecting data. This *a priori* approach is analogous to a good research process in which a research question is developed and a research design is developed and implemented. The collected data is then used to test the research question.

Professional Standards and Credentials

Professional standards and credentials are used to define and direct with qualified staff how urban forest management occurs. A credential provides a baseline of knowledge held by a person who performed work. Professional standards provide an industry consensus for standard operating procedures. Some standards and credentials have been around for several decades (Tree Wardens since the early 1900's in some eastern states, Z60.1 initially as Horticultural Standards since 1923, and the ANSI Z133 Safety Standard since 1968). Others were just developing since the last survey in 1993 (e.g., ANSI A300 since 1991 and ISA Certified Arborist launched in 1992). Municipalities were asked what types of credentials staff hold which industry standards are incorporated into tree management procedures, and standards and credentials used with contracting tree work.

Certified Arborists (CA) were common and over 61% of communities have at least one CA arborist on staff. A certified arborist is uncommon to smaller communities with only 12% of places between 2,500 and 9,999 having a CA. In contrast 83% of larger municipalities with at least 50,000 people have a CA. The ISA Municipal Specialist however is less common in all communities (15% of places) with nearly 25% of communities with at least 50,000 people having at least one on staff. Likewise, advanced ISA credentials (e.g., Tree Risk Assessment Qualification and Board Master Certified Arborist) were less common in only 11% of all places.

Professional tree care standards were commonly incorporated into tree management procedures. The A300 (Standard for Tree Care Operations) is incorporated in 60% of communities and most common to larger communities with only 10% of places between 2,500 and 9,999 people doing such. The ANSI Z133.1 was also commonly used with 51% of communities. The ANSI Z60.1 (Nursery Standards) was surprising uncommonly used by only 33% of municipalities. By default, however, many states require nurseries to follow the ANSI Z60.1 standards, thus trees are regularly produced to meet industry standards as prescribed in the Z60.1. The Tree City USA standards were most commonly adopted by 72% of communities. Education of the use and purpose of standards would be one way to increase their use. Overall only 7% said they did not know about one or more of these standards. Information targeted to small communities less than 10,000 would be most fruitful since 44% of these locations did not know of any standard. Comparatively, 98% places with a population of 10,000 or more knew of these standards.

The use of standards and credentials in the hiring of contractors was explored. The nursery standards (Z60.1) were again less commonly used by only 44% of communities overall and only 50% of places with 50,000 or more people. The tree care and safety standards were more common with 57% using the Z133.1 and 68% using the A300 as requirements for contractors. Again, these were more common in larger, however nearly half of smaller communities (below 25,000) required A300 be used and a third required following the Z133.1. Contractors were preferentially selected using the ISA certified arborist as a mechanism to choose in 68% of communities. Even smaller communities used this as part of contracting with 47% below 25,000 doing such. The Tree Care Industry Association (TCIA) has an accredited companies program. Few communities (11%) currently use this as a hiring preference approach.

Tree Policies and Ordinances

Tree policies and ordinances are used to direct urban forest activities throughout the United States. Ordinances that pertain to trees are common in 89% of municipalities. Another 2% are in the process of developing tree ordinances. They commonly defined the official authority responsible for tree management (80% of places); require removal of dead or diseased trees (77%); regulate tree species planting on public property (70%); require tree planting in new developments (68%); require tree planting in new parking lots (60%); and regulate abatement of hazardous or public nuisance trees (59%). Tree topping is considered by ANSI A300 standards as an unacceptable practice, yet only 37% of communities prohibit this practice by ordinance. Also, even though a CA is common on municipal staff, this does not extend to the community at large through the requirement of certified arborists to perform tree work on public (26%) or private (7%) land.

Active enforcement of ordinances and the use of fines are mechanisms to deter violations. Tree ordinances are actively enforced in 64% of communities. No population trend was noted with most population groups having > 50% with active enforcement. Fines from penalties go into a specific fund in 30% of places.

Tree policies can be incorporated through a variety of approaches from strategic plans, specific plans, and by proclamation. Half of communities have a written strategic plan that addresses urban forestry tree management, open space, green infrastructure, or land use management plans that include trees. As community size increases, the likelihood of having a plan increases. If a respondent said they have some sort of strategic plan pertaining to trees, they were asked to further provide information about the types of plans they have. The city master/comprehensive plan was one plan type with 61% using this as a place to incorporate tree or vegetation management. A specific urban forest management plan exists in 76% of communities with another 10% saying they are developing this plan. Other plans that communities had that included trees were insect and disease readiness plans (76%), storm emergency plans (53%), storm water management (46%), and tree risk management (35%).

Partnerships and Volunteers

Volunteers are one approach to both promote a community tree program and having residents develop a greater stake in there urban forest though their efforts. Nationally 65% of communities

said they worked with partners or volunteers. This was common to all populations groups with over half of small communities using partners and volunteers. This frequency increased with 100% of the largest communities at one million or more people doing such. Most places provide training (79% said they did) for volunteers. Each person on average provided nearly 10 hours (9.8 mean, 4 median) of volunteered time.

Tree planting was the most common activity with 85% of communities saying this occurred. Large and small communities alike had a high frequency of volunteer tree planting (Table 6). Watering was next common (40%) followed by awareness/education programs (39%), and tree pruning (28%). Technically challenging activities such as pest control (3%) and tree removal (9%) were uncommon. Interestingly, 35% of communities between 2,500 and 4,999 people said volunteers helped with tree removal.

Urban Wood Disposal and Products

The disposal and use of urban wood is as important today as in the past. In recent years an active interest in expanding the use of urban forest products has developed. This study asked different ways urban wood is used or disposed and a respondent could select multiple approaches they used (Figure 3). Mulch was the most frequent use with 84% of places saying this followed by firewood (49%). Surprising 31% indicated removed trees are disposed of in landfills. We did not ascertain the volume of material that went to any source, so a community may use a method but for a small portion of overall biomass. Other uses include lumber (14%), biofuel (12%), furniture/flooring/art (9%), roundwood (pulp, sawlogs, veneer) sales (6%), and burned in the open (5%).

Conclusion

Results from this current 2014 assessment of municipal forestry programs provide a mechanism to create current baseline conditions and to monitor trends. A community can use the results to see how they compare. Many positive trends were found such as greater systematic management of tree population, and increased funding as a percent of municipal budget and per capita. As noted however, how money is being spent requires further investigation to see if money allocations are because of tree removal due to pests such as EAB, greater tree maintenance and tree planting, or a combination of these.

Acknowledgements

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Table 1. The number of places sampled by population group and response rate.

Population Group	Places Sampled (a)	Returned Surveys (b)	Percent Returned of Total Returned Surveys (b/c)	Percent Return Within a Population Group (b/a)
2,500 to 4,999	243	73	10.9	30.0
5,000 to 9,999	199	49	7.3	24.6
10,000 to 24,999	190	52	7.8	27.4
25,000 to 49,999	408	170	25.5	41.7
50,000 to 99,999	448	189	28.3	42.2
100,000 to 249,999	200	98	14.7	49.0
250,000 to 499,000	41	22	3.3	53.7
500,000 to 999,999	23	11	1.6	47.8
1,000,000 +	9	3	0.4	33.3
Totals	**1735**	**667(c)**	**100.0**	**38.4**

Table 2. Percent of communities that use a funding source.

Funding Source	1974	1980	1986	1993	2014
General fund	85.1	94.4	94.1	66.6	85.8
Special frontage tax	1.7	0.8	1.3	1.7	1.0
Tree mill levy	9.0	0.9	1.4	0.7	1.3
Road use tax	N/A	2.2	1.5	0.5	3.4
Endowment	1.3	1.7	2.4	5.5	1.8
Vehicle tax	7.6	1.6	1.5	0.5	1.5
Job training/corp	7.0	8.7	2.5	1.4	0.3
Revenue sharing	18.9	8.5	5.2	0.7	1.3
Gas tax	N/A	4.7	5.5	7.4	7.2
Community dev. block grant	N/A	0.9	6.8	8.8	9.3
Forestry grant	N/A	3.3	1.3	28.9	30.4
Assessment district	N/A	N/A	N/A	N/A	10.6
Donations	N/A	N/A	N/A	N/A	17.3
Emergency Mgmt. Hazard Mitigation	N/A	N/A	N/A	N/A	2.6
Fines	N/A	N/A	N/A	N/A	7.2
Permit fees	N/A	N/A	N/A	N/A	11.3
Service fees	N/A	N/A	N/A	N/A	2.6
Stormwater/Utility	N/A	N/A	N/A	N/A	7.0
Tree memorials	N/A	N/A	N/A	N/A	16.2
Wood product sales	N/A	N/A	N/A	N/A	2.3
Sample Size (n)	**700**	**1040**	**869**	**N/A**	**388**

N/A = information not collected

Table 3. Amount of funding in real dollars[1] spent by communities and as a percent of the municipal budget.

Population Group	1974		1980		1986		1993		2014	
	Mean tree care budget ($)	Mean % of total municipal budget	Mean tree care budget ($)	Mean % of total municipal budget	Mean tree care budget ($)	Mean % of total municipal budget	Mean tree care budget ($)	Mean % of total municipal budget	Mean tree care budget ($)	Mean % of total municipal budget
Total, all cities	613,061	0.54	376,036	0.81	352,834	0.49	458,063	0.31	801,595	0.52
Over 1,000,000			8,978,164	0.25	11,880,000	0.09	2,210,174	0.13	18,389,353	0.31
500,000 - 1,000,000	4,608,379	0.34	3,014,860	0.33	1,955,727	0.02	2,767,815	0.28	2,221,708	0.15
250,000 - 500,000	1,863,691	0.45	2,378,444	0.42	2,350,860	0.06	2,221,882	0.41	3,074,165	0.44
100,000 - 249,999	1,463,482	0.64	860,380	1.01	1,088,558	0.06	846,725	0.40	1,368,607	0.48
50,000 - 99,999	544,214	0.61	519,553	0.94	439,219	0.28	323,618	0.38	646,501	0.53
25,000 - 49,999	284,050	0.68	256,908	1.02	267,963	0.62	167,510	0.35	343,596	0.63
10,000 - 24,999	118,939	0.56	92,867	0.69	95,947	0.70	56,316	0.30	102,683	0.42
5,000 - 9,999	58,675	0.25	34,124	0.43	86,489	0.12	25,838	0.22	68,446	0.55
2,500 - 4,999	23,702	0.61	20,980	0.57	10,634	1.91	17,423	0.30	19,406	0.42
CPI Adjustment[1]	4.80		2.87		2.16		1.64		1.00	

[1] Nominal dollar amount by time period adjusted for inflation using the Consumer Price Index (CPI).

Table 4. Municipal tree management per capita in real dollar values adjusted to 2014 base year.

Population Group	1974	1980	1986	1993	2014
Total, all cities	7.82	6.29	5.62	4.08	8.76
Over 1,000,000		4.08	4.62	2.21	3.69
500,000 - 1,000,000	4.32	4.53	2.83	3.69	3.32
250,000 - 500,000	7.20	6.95	5.21	5.92	9.28
100,000 - 249,999	9.84	6.06	6.22	4.84	9.05
50,000 - 99,999	7.82	7.20	6.44	4.31	9.40
25,000 - 49,999	8.26	7.23	6.78	4.46	9.75
10,000 - 24,999	7.25	5.68	4.69	3.21	6.22
5,000 - 9,999	7.54	4.56	7.11	3.44	8.79
2,500 - 4,999	7.34	6.00	2.94	4.64	5.14
CPI Adjustment	4.80	2.87	2.16	1.64	1.00

[1] Nominal dollar amount by time period adjusted for inflation using the Consumer Price Index (CPI).

Table 5. Tree care activities reported by communities.

| Population Group	Public Requests	Trees Planted	Trees Pruned	Trees Removed	Treated for Pests
All Groups	998	629	2108	467	265
1,000,000 +	40150	34937	61805	9334	N/A
500,000 to 999,999	2122	2008	4553	1305	905
250,000 to 499,000	2266	2386	4336	2416	784
100,000 to 249,999	1591	634	3897	593	339
50,000 to 99,999	552	353	1734	434	292
25,000 to 49,999	372	324	1034	282	192
10,000 to 24,999	97	65	270	89	45
5,000 to 9,999	34	34	102	22	48
2,500 to 4,999	16	54	99	16	236
Sample Size (n)	270	349	330	344	269

N/A = information not collected.
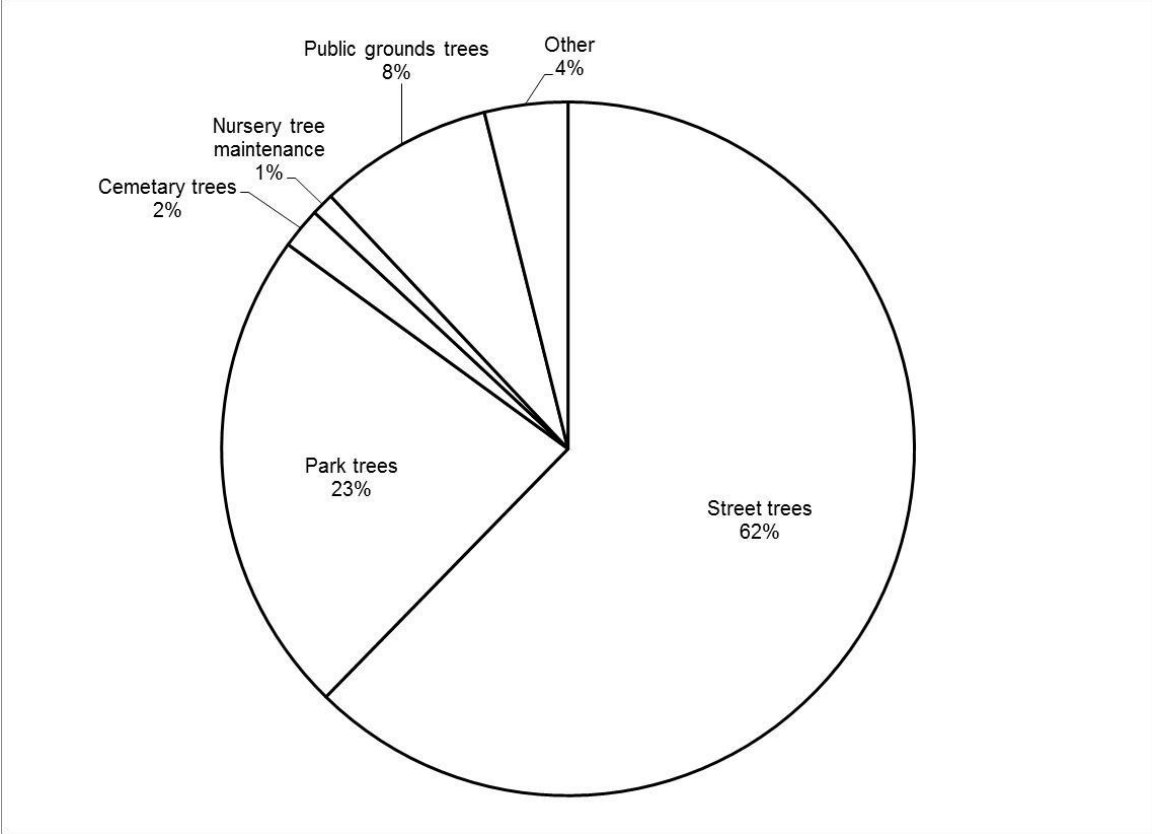
Figure 1. Percent allocation of tree budget by management area.
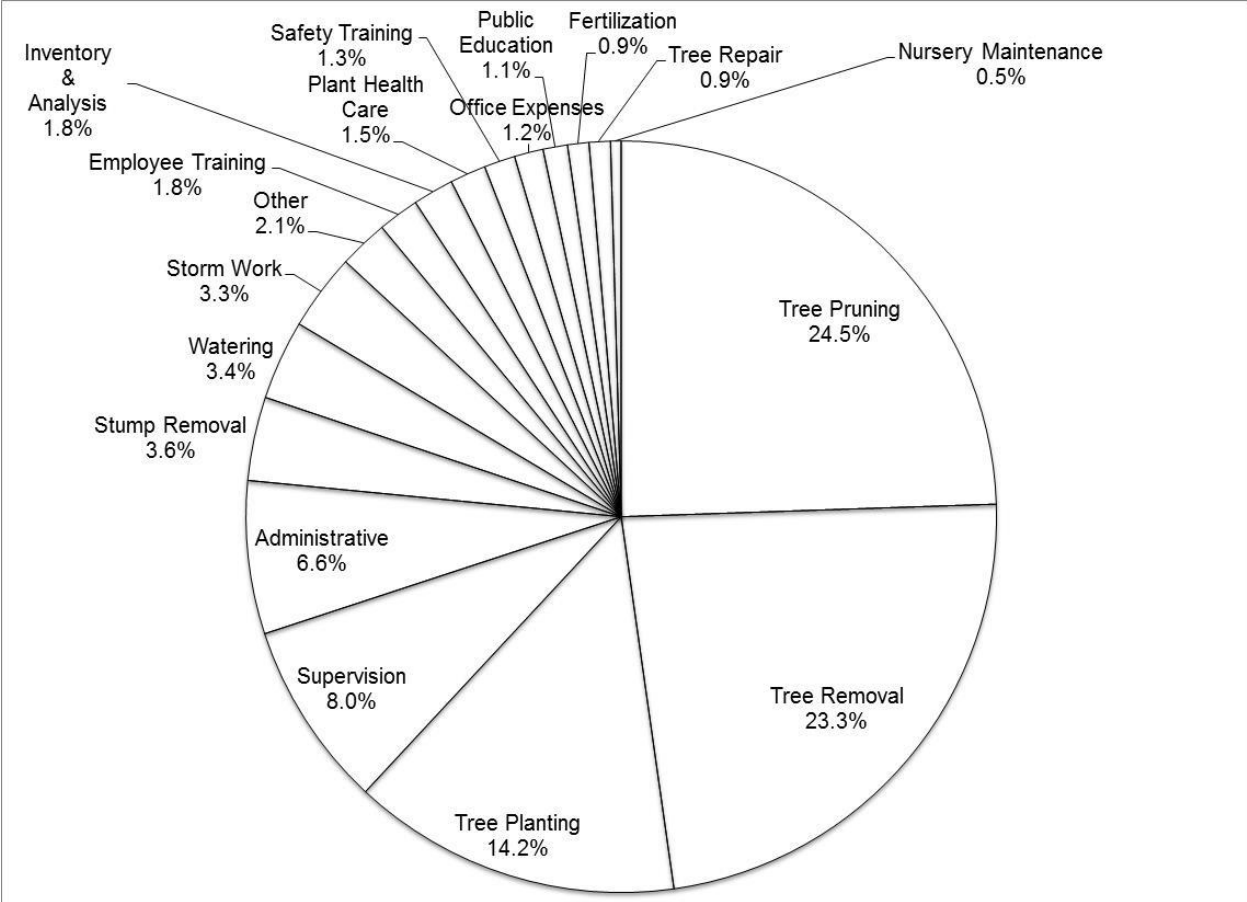
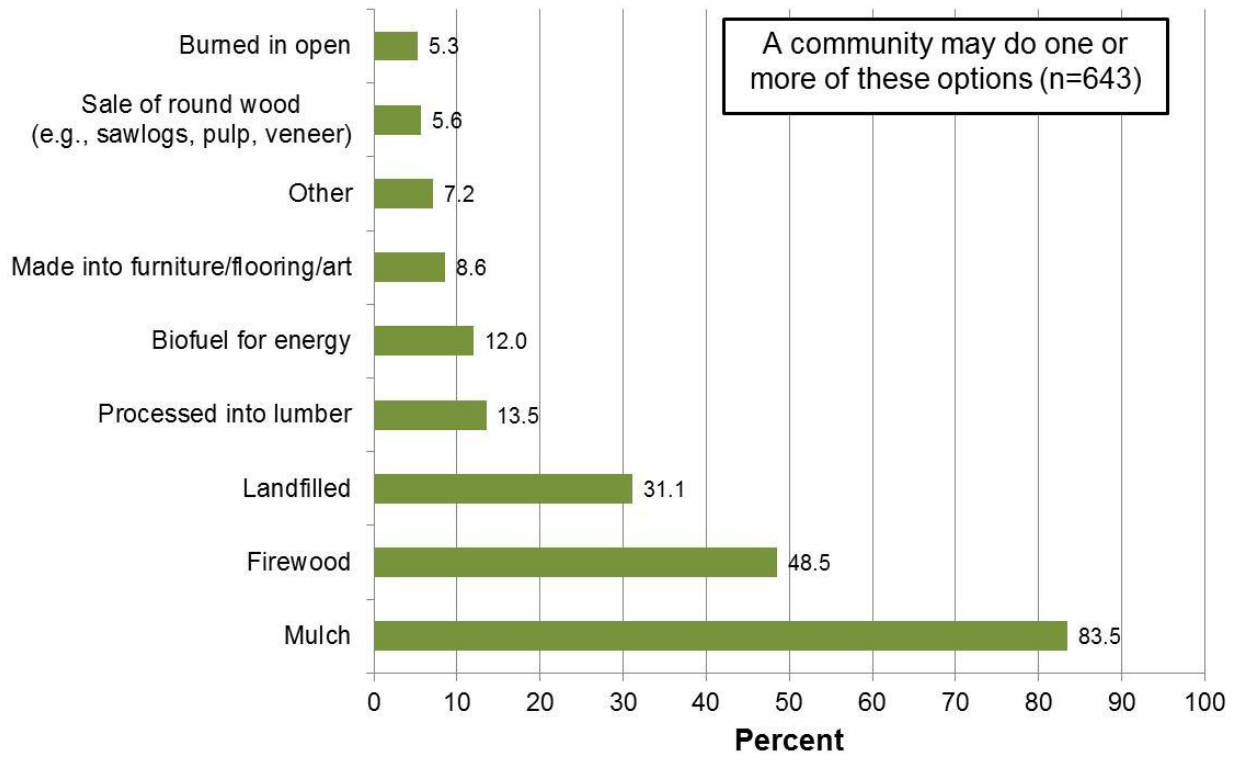**Figure 2.** Percent allocation of tree care budget by activity area.

Figure 3. Percent of communities that use an approach to dispose of removed public trees.