Urban Forestry & Urban Greening 10 (2011) 113–118

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.de/ufug

Measuring urban forestry performance and demographic associations in Massachusetts, USA

David Rines, Brian Kane*, David B. Kittredge, H. Dennis P. Ryan, Brett Butler

Department of Environmental Conservation, University of Massachusetts, 160 Holdsworth Way, Amherst, MA 01003, United States

ARTICLE INFO

Keywords:
Community Accomplishment Reporting Systems (CARs)
Tree warden
Urban forest

ABSTRACT

The United States Forest Service measures successful management of the urban forest by the number of communities that have achieved some or all of four parameters described by the Community Accomplishment Reporting System. The four parameters address whether a community has: (1) a management plan, (2) professional staff, (3) urban forestry ordinances/policies, and (4) an advocacy/advisory organization. We surveyed tree wardens in the Massachusetts' communities to determine how many communities met each parameter, as well as other indicators of urban forest management. Nearly all responding communities met 1 performance parameter, but only 15% met all 4 parameters. Communities with greater population were more successful in achieving the parameters than those with smaller population.

Introduction

In 2006, the United States Department of Agriculture (USDA) Forest Service (FS) decided to measure management of the urban forest in communities in the United States (USDA Forest Service, n.d.). To do so, the FS developed four performance measures related to aspects of urban forest management. Success is measured by the number of communities in a state that have achieved some or all of the four parameters described by the FS Community Accomplishment Reporting System (CARS) (FS, 2007). The four parameters follow.

1. *Management plans:* A document or set of documents, currently in use, developed from professionally based inventories/resource assessments, which outline(s) the future management of the community's trees and forests.
2. *Professional staff:* Individuals who have either of the following: a degree in urban forestry or a closely related field or International Society of Arboriculture (ISA) certification (or an equivalent certification); and whom a community retains to assist in the development or management of an urban forestry program
3. *Ordinances/policies:* Statutes or regulations pertinent to the planting, protection and maintenance of urban trees and forests.
4. *Advocacy organization:* An organization that advises on or advocates for the planting, protection and maintenance of trees and forests in the community.

In the state of Massachusetts, the Department of Conservation and Recreation (DCR) administers the urban and community forestry program. DCR measures community performance with respect to urban forest management according to six parameters: the four from the CARS initiative, as well as inter-departmental communication within the municipal bureaucracy, and whether a community has achieved Tree City USA status. The latter parameter is largely redundant with the CARS parameters, but the former parameter is presumably important in situations when municipal agencies undermined an urban forester's good intentions. An urban forester's efforts would be most effective if, in addition to relying on ordinances, he or she regularly communicated with other municipal agencies such as the highway and engineering departments (E. Seaborn, pers. comm.). Such interaction might proactively address issues such as construction damage of trees. Throughout the manuscript, we refer to the CARS parameters, components thereof, and inter-agency communication, collectively as "performance parameters".

To measure urban forestry performance, surveys have been undertaken in other states (Thompson, 2006; Ries et al., 2007), and demographic measures (e.g., population) have been shown to improve the likelihood that communities have formal urban forest management approaches in place (Miller and Bates, 1978; Schroeder et al., 2003; Treiman and Gartner, 2004; Kuhns et al., 2005). Since a better understanding of the current status of urban and community forest management performance was the first step to developing programs that effectively targeted municipal assistance needs (Treiman and Gartner, 2004), we surveyed tree wardens (individuals responsible for maintaining municipal trees) in Massachusetts. Our objectives were to determine how

* Corresponding author.
E-mail address: bkane@nrc.umass.edu (B. Kane).

1618-8667/$ – see front matter © 2011 Elsevier GmbH. All rights reserved.
doi:10.1016/j.ufug.2010.12.005

many communities in Massachusetts had attained the performance parameters and whether attaining them was associated with community demographics and disbursement of grants by DCR.

Methods

In June 2006, we mailed a survey to tree wardens in all 351 towns/cities in Massachusetts. The survey followed the method described by Dillman (2000), including a pre-notice letter, cover letter and questionnaire, and a second cover letter and questionnaire at specified intervals. After one month, we emailed and telephoned non-respondents to encourage them to complete the survey. Despite repeated attempts to contact non-respondents, we were not able to improve our response rate. As an incentive to increase the response rate we entered responding tree wardens in a lottery to win $3000 worth of plant material.

The survey included mostly closed-ended questions regarding attainment of the performance parameters. Answer choices included, "Check One" and "Check All That Apply" (Appendix A). We formatted the survey into an 8.5″ × 11″ booklet with four double-sided pages and pre-tested it with ten tree wardens. Upon receiving completed surveys, we coded responses numerically (e.g. "Yes" = 1, "No" = 2, and "Routinely" = 1, "Periodically" = 2, "Seldom" = 3 and, "Never" = 4). We coded questions that were left blank or contained a response of "Not Applicable" or "Don't Know" as 9. We entered data from the questionnaires into Microsoft Excel™ and randomly checked entries twice for accuracy.

We examined DCR's disbursement records from 2001 to 2008 to compile the number and amount of grants received by any communities that responded to the survey. For all communities in Massachusetts, we compiled demographic data (population, population density, population growth, annual median household income, land area, and percent of population with a college degree) from the 2000 census (U.S. Census Bureau, 2007). We used the Kruskal–Wallis test to compare (1) CARS score and (2) demographic data between communities that did and did not respond to all communities in Massachusetts. The results of these tests determined whether responding tree wardens represented a biased sample. We used the Spearman Rank-Order correlation matrix to investigate the degree and direction of associations between survey responses and demographics. We attempted to use ordered logistic regression to examine associations between CARS score and multiple predictors (demographic measures and performance parameters). The analysis revealed issues of multicollinearity, primarily between individual performance parameters, and explained only 43% of the residual deviance of the model. Consequently, we have not included that analysis. A 90% confidence interval was used to determine significance for all analyses. Data were analyzed using SAS version 9.2 (SAS Institute, Cary, NC) and Minitab version 14 (Mintab, Inc., State College, PA).

Results

Individuals from 143 communities responded to the survey (a 41% response rate). Communities from which we received a response represented half of all Massachusetts residents. Every returned survey was usable and the number of unusable responses per survey was less than 8% for nearly all questions. Communities from which we received a response were distributed throughout the Commonwealth, but there appeared to be a distinct cluster around city of Boston (Fig. 1). At least one response was received from every county, except Nantucket (Fig. 1). Respondents tended to come from communities with greater population, population density, and annual median household income, compared to all Massachusetts communities (Table 1). Importantly, respondents also came from communities that, on average, met an additional CARS parameter (Table 1). Together, these differences do not allow us to predict urban forestry performance for all communities in Massachusetts, only for respondents. Nearly all of the respondents were tree wardens (92%), with the remainder including surrogates, a member of a committee that replaced the tree warden, and a person actively involved in urban forest management.

Massachusetts communities and performance parameters

All but one community met at least one CARS parameter, but only 15% of communities achieved all 4 parameters (Fig. 2). An approximately equal number of communities achieved 1 (27%), 2 (31%), or 3 (26%) parameters (Fig. 2). All communities met the CARS parameter for having an ordinance (although two respondents left the question blank) by virtue of Chapter 87 of Massachusetts General Law (Chapter 87), which promulgates the position of tree warden and his/her responsibility to maintain a community's trees (MGL 87). Enforcement of Chapter 87 varied slightly, but most respondents reported "Routine" or "Periodic" enforcement (Table 2a). Many communities supplemented Chapter 87 with a

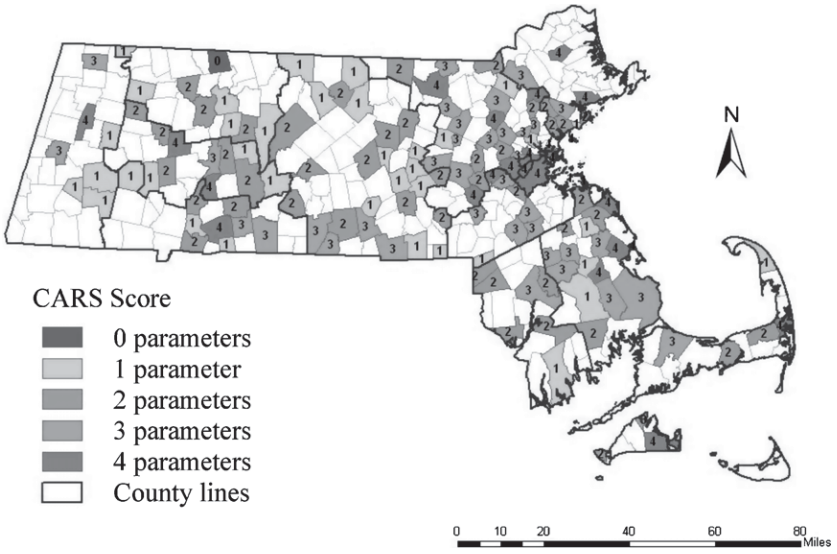

Fig. 1. Towns in Massachusetts that responded to the survey (shaded), and the CARS score each achieved (0–4).

Table 1
Means for demographic measures and CARS score for all communities in Massachusetts ("All" $N = 351$) compared to (a) communities that responded ("Respondents" $N = 143$) and (b) communities that did not respond ("Non-Respondents" $N = 208$). The p- and χ^2 values reflect the comparison between means using the Kruskal–Wallis test.

		(a)			(b)		
Measure	All	Respondents	χ^2	$p > \chi^2$	Non-respondents	χ^2	$p > \chi^2$
Population	18,089	22,234	7.7539	0.0054	15,272	2.0071	0.1566
Population per square mile	1264	1430	4.649	0.031	1150	1.1911	0.2751
Land area (square miles)	22.3	22.9	0.316	0.574	21.9	0.0740	0.7856
% of population with college degree	29%	30%	1.3959	0.2374	0.14	0.1907	0.6624
Annual median household income	$58,315	$59,568	3.8195	0.0507	$57,453	0.9781	0.3227
Population growth (1990–2000)	9.24%	8.46%	0.1057	0.7451	9.77%	0.0304	0.8616
CARS score	1.31	2.29	5.0602	<0.0001	0.64	15.834	<0.0001

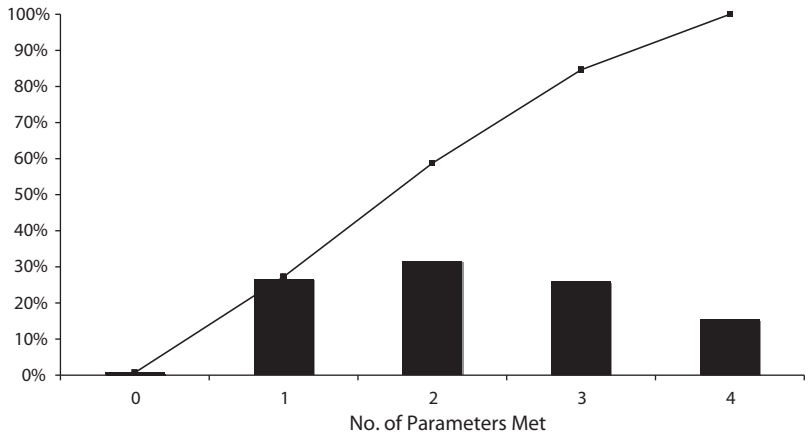

Fig. 2. Percentage of responding communities that achieved 0–4 performance parameters (columns), including the cumulative percentage (line).

local ordinance (Table 2a). Supplemental local ordinances typically required planting replacement trees after (81%) or protecting existing trees during (69%) development, which Chapter 87 does not address. Fewer communities met the parameters for an advocacy/advisory organization or a management plan than met other performance parameters (Table 2a). Although less than half of the communities had a qualified tree warden, some communities had other qualified staff (or contractors), which increased the percentage of communities with qualified staff (Table 2a). The most common qualification for tree wardens was having an appropriate university degree (arboriculture, forestry, horticulture) (29%), followed by the completion of professional development training (21%), and Massachusetts (16%) or ISA (10%) arborist certification. More communities had an inventory than a management plan (Table 2a). Nearly all respondents reported inter-departmental communication (Table 2a), and "Routine" or "Periodic" communication was more common in communities that had tree protection regulations as part of a supplemental local ordinance ($r = 0.2889$, $p = 0.0005$). Communities that achieved a higher CARS score were more likely to have met individual performance parameters, including parameters other than CARS parameters (e.g., receiving a DCR grant) (Table 2b).

Table 2
Percentage of communities ($N = 143$) that attained each performance parameter (a); as well as Spearman's r- and p-values for associations between each performance parameter and CARS score (b).

	(a) % of communities	(b) CARS score	
Performance parameters		r[a]	p
Advocacy/advisory organization	41%	0.6848	<0.0001
DCR grant	37%	0.2889	0.0005
Inter-departmental Communication	90%	0.1652	0.0487
Supplemental local ordinance	71%	0.3087	0.0083
Management plan	36%	0.7165	<0.0001
Qualified staff	52%	0.7003	<0.0001
Qualified tree warden	48%	0.4800	<0.0001
Routine/periodic enforcement of chapter 87	80%	0.2622	0.0017
Tree inventory	62%	0.4087	<0.0001

[a] Spearman's r reflects the strength and direction of an association. A value of 1 represents a perfect linear relationship between CARS score and the parameter: as CARS score increased, so did the percentage of respondents who affirmed a parameter. A small r-value indicates that attaining a parameter was not associated with CARS score.

The positive associations between CARS score and population (Table 3a), annual median household income (Table 3b), and percentage of residents with a college degree (Table 3c) held regardless of whether we considered (1) responding communities, (2) non-responding communities, and (3) all communities in Massachusetts. For respondents, the percentage of communities that met individual performance parameters was more closely associated with population than the other demographic measures. As the population of a community increased, so did the likelihood of achieving all nine performance parameters listed in Table 3. A similar effect was not observed regarding increases in annual median household income and the percentage of a community's residents with a college degree. Increases in the latter two demographic measures were only significantly associated with five of the nine performance parameters listed in Table 3.

Funding

Less than half of responding communities had received a DCR grant since 2001 (Table 2a), but several communities received multiple grants. Communities that achieved higher

Table 3
Spearman's *r*- and *p*-values for associations between CARS score, performance parameters and community demographics [population (a), annual household median income (b), and percentage of residents with a college degree (c)] for responding communities, non-responding communities, and all communities in Massachusetts.

	(a) Population		(b) Income		(c) College degree	
	r[a]	*p*	*r*	*p*	*r*	*p*
CARS score (respondents)	0.3015	0.0003	0.1935	0.0206	0.2714	0.0010
CARS score (non-respondents)	0.2442	0.0033	0.2183	0.0088	0.2476	0.0029
CARS score (All)	0.4518	<0.0001	0.1253	0.0189	0.1625	0.0023
Performance parameters						
Advocacy/advisory organization	0.2729	0.0010	0.2546	0.0021	0.2382	0.0042
DCR grants	0.4051	<0.0001	0.1131	0.1785	0.0961	0.2538
Inter-departmental communication	0.2521	0.0024	0.1913	0.0221	0.1242	0.1395
Supplemental local ordinance	0.3993	<0.0001	0.2020	0.0156	0.4292	<0.0001
Management plan	0.1756	0.0360	0.0560	0.5065	0.0426	0.6131
Qualified staff	0.1574	0.0605	0.1873	0.0251	0.3756	<0.0001
Qualified tree warden	0.2293	0.0059	0.1300	0.1789	0.3085	0.0002
Routine/Periodic enforcement of chapter 87	0.2696	0.0012	0.2133	0.0111	0.2116	0.0210
Tree inventory	0.2806	0.0007	0.0580	0.4914	0.0192	0.8197

[a] See note for Table 2.

CARS scores typically received more funding from DCR grants (Table 2b). Communities with an advocacy/advisory organization ($r = 0.3259$, $p < 0.0001$) and a qualified tree warden ($r = 0.1923$, $p = 0.0214$) also received more funding from DCR grants. The amount of funding received from DCR grants increased with increased population, but not with annual median household income nor percentage of residents with a college degree (Table 3a).

Discussion

Our results overstated the actual performance of communities in Massachusetts because the mean CARS score for responding communities was greater than that for all communities in Massachusetts. However, despite the fact that respondents came from communities with greater population and median income (both of which were positively associated with CARS score), associations between CARS score and demographics were similar for responding communities, non-responding communities, and all communities in Massachusetts (Table 3). Our discussion contains the important caveat that our results do not reflect the performance of all communities in Massachusetts.

Nationwide (Kielbaso, 1990), as well as in many states (Elmendorf et al., 2003; Schroeder et al., 2003; Treiman and Gartner, 2004; Kuhns et al., 2005; Ricard, 2005a; Ries et al., 2007; Stevenson et al., 2008), no studies have reported more than 78% of communities having a tree ordinance; typically, fewer than half of the surveyed communities have an ordinance. With the exception of other states in New England, no studies (Schroeder et al., 2003; Treiman and Gartner, 2004; Kuhns et al., 2005; Ries et al., 2007; Stevenson et al., 2008) have reported more than 62% of communities with an individual who is responsible, at least part-time, for urban forest management. This pronounced disparity can be attributed to laws in New England states that require communities to have a tree warden (Ricard, 2005b). In Massachusetts, Chapter 87 promulgates the tree warden's duties and domain, but has a limited scope (MGL 87). The large majority of communities with a supplemental local ordinance illustrates the need for additional measures to protect or replace trees during or after development. This is consistent with previous work demonstrating that residents value tree preservation (Treiman and Gartner, 2004; Elmendorf et al., 2003).

Of the CARS parameters, management plans and an advocacy/advisory organization were the least commonly attained, which is consistent with the small percentage of tree wardens who agreed that either parameter was important to successful urban forest management (Rines et al., 2010). Throughout New England, tree wardens lacked confidence in advocacy/advisory organizations (Ricard and Bloniarz, 2006), but in the current study, advocacy/advisory organizations were more helpful than having a qualified tree warden with respect to obtaining a DCR grant. Presumably, management plans and advocacy/advisory organizations would help to address policy issues, provide public education and outreach, and undertake preventative tree maintenance and planting, but only a small percentage of tree wardens in Massachusetts considered these tasks a priority (Rines et al., 2010). Our findings are consistent with previous work in which the percentage of communities that had a management plan ranged from 9% to 30% (Kielbaso, 1990; Elmendorf et al., 2003; Treiman and Gartner, 2004; Kuhns et al., 2005; Ries et al., 2007); for advocacy/advisory organizations, the range was 10–38% (Schroeder et al., 2003; Kuhns et al., 2005; Ries et al., 2007). Although Clark and Matheny (1998) reported 64% of communities with management plans, their survey mostly included larger cities (the median population was nearly 270,000), and involved a small sample ($N = 25$).

A tree inventory appears to be the preferred tool for urban forest management, since more communities in Massachusetts had inventories than management plans. This was also true in other states (Elmendorf et al., 2003; Kuhns et al., 2005; Ries et al., 2007). Inventories facilitate many aspects of management, such as planting, pruning, and removing trees. In smaller communities, where tree wardens were primarily concerned with removals (Rines et al., 2010), an inventory would be less valuable since hazard trees can be identified in windshield surveys (Rooney et al., 2005). Practical and/or financial constraints may limit the utility of a management plan. In personal correspondence, some tree wardens expressed frustration with the time and effort expended to develop management plans that were never used; others noted that their community's budget precluded proactive management. Despite these frustrations, the percentage of communities in Massachusetts with a management plan has more than doubled in less than a decade (Doherty et al., 2000).

Consonant with previous studies (Reeder and Gerhold, 1993; Dickerson et al., 2001; Schroeder et al., 2003; Kuhns et al., 2005; Ries et al., 2007), population had the strongest associations with attainment of performance parameters. One explanation for these findings is that communities with greater populations would have increased tax revenue available to fund urban forest management (Miller and Bates, 1978) because the fixed cost of a tree mainte-

nance program would consume less of the budget (Groninger et al., 2002). However, communities with greater populations typically offer more, and experience a greater demand on, public services, so it is not necessarily true that more funding for urban forest management is available per capita (Kuhns et al., 2005). Other explanations are more persuasive.

Residents in more populous communities tended to be proactive about urban forest management because they were usually more politically active, better informed, and had higher expectations of municipal services (Treiman and Gartner, 2005). Full-time tree wardens, who were more commonly employed in communities with greater population, emphasized public education and outreach (Rines et al., 2010), which presumably would raise awareness of the value of and benefits provided by trees. Recognition of the benefits that trees provide, which was more common in urban areas (Lohr et al., 2004; Grado et al., 2006; Stevenson et al., 2008), may translate into citizen advocacy for additional funding for urban forest management, which was also more common in urban areas (Elmendorf et al., 2003; Treiman and Gartner, 2005). Advocacy may be integral to raising awareness of residents' attitudes among public officials, since fewer than 10% of officials in Pennsylvania believed that residents would be willing to pay higher taxes for better tree care (Stevenson et al., 2008), even though residents have expressed opinions to the contrary (Lorenzo et al., 2000; Treiman and Gartner, 2005).

Communities with greater population were also more likely to take advantage of external funding (Grado et al., 2006; Ries et al., 2007), which helps support urban forestry programs (Elmendorf et al., 2003; Schroeder et al., 2003; Kuhns et al., 2005; Ries et al., 2007). Schroeder et al. (2003) reported that many less populated communities in Illinois desired help in soliciting external funding for urban forest management. Extramural funding may be critical because adequate funding from a municipality's general fund is rarely sufficient for good urban forest management (Elmendorf et al., 2003). In Massachusetts, DCR grants were more commonly obtained by communities with greater population, perhaps in part because such communities were more likely to have an advocacy/advisory organization that could better negotiate the application process.

It was not surprising that inter-departmental communication was the performance parameter most commonly achieved by tree wardens in Massachusetts (and least associated with CARS score), since the parameter is often emphasized at professional meetings (Rines et al., 2010). This result was also consistent with the findings that (a) most tree wardens routinely or periodically enforced Chapter 87 and (b) more tree wardens from communities with supplemental local ordinances designed to protect trees during development routinely or periodically communicated with other municipal departments. This suggests that tree wardens would need to communicate with other departments when trees were in proximity to construction or repair projects. It is not clear, however, whether such communication preserves or protects trees, as communication might simply involve approval of tree removal. Tree wardens did feel, however, that inter-departmental communication, more than any other performance parameter, was important to successful urban forest management (Rines et al., 2010).

Conclusions

Many communities in Massachusetts met multiple performance parameters, although some parameters (e.g., management plans and advocacy groups) were not as commonly achieved. Attainment of performance parameters was most closely associated with population, consistent with many previous studies. Importantly, advocacy groups were more common in communities with greater population, and communities with an advocacy group were more likely to have received extramural funding to support the urban forestry program. Some CARS parameters appear to have merit with respect to indicating good urban forest management (e.g., advocacy groups), but the relative merit of others (e.g., management plans) is questionable. Part of this may be due to attitudes of tree wardens, who were frustrated with the effort to create a plan, only to have it remain unused. In some communities (particularly those with fewer residents), management priorities are almost exclusively reactive (Rines et al., 2010). Future research should consider similar questions in other states, as well as improving response rates in states where similar surveys have already been undertaken.

Acknowledgments

We thank Eric Seaborn, Paul Jahnige, and Alan Snow of the Massachusetts Department of Conservation and Recreation; and John Parry of the USDA Forest Service. We also acknowledge the many helpful suggestions from four anonymous reviewers on previous versions of this manuscript.

Appendix A.

Q1. Which of the following best describes your role? (Check only one):.

Your role	Check only one
I am the tree warden for my community	☐
I am *acting* tree warden for my community – the position of tree warden is currently open	☐
I am *not* the tree warden but am actively involved with urban & community tree management *and* can answer questions on the tree warden's behalf: Please give your title:_____	☐
I am a member of a town committee that handles tree warden duties for my community	☐
Other (Please specify)_____	☐
I am not the tree warden or acting tree warden, nor can I answer questions on the tree warden's behalf	☐

Q2. In which municipal department or agency does the role of tree warden reside?

Name of Department or Agency:_____

Q3. Does the tree warden currently have any of the following degrees and/or certifications? (Check all that apply): (If tree warden duties are represented by committee, please indicate if committee members have any of the following degrees and/or certifications?).

Tree warden degrees and certifications	Check all that apply
International Society of Arboriculture (ISA) Certified Arborist	☐
Massachusetts Certified Arborist (MCA)	☐
Associates, Bachelor's or Master's degree from an accredited college or university in a natural resources field, such as Park Management, Arboriculture, Urban forestry, Landscape Design, or Horticulture, other_____	☐
Completed professional courses, such as MAA Tree School, UMass Extension Green School, MTWFA Professional Development Series (PDS) courses	☐
No degrees at this time	☐
Other (Please Specify):_____	☐

Q4. How would you best describe the *frequency* of communication between your department and other municipal agencies and departments regarding the planting, protection and or maintenance of your urban & community trees and forests?

Communication with Agencies and municipal departments	Routinely	Periodically	Seldom	Never
Highway Department/DPW	☐	☐	☐	☐
Parks/Cemeteries	☐	☐	☐	☐
Planning Board/Department	☐	☐	☐	☐
Tree Department	☐	☐	☐	☐
City/Town leaders	☐	☐	☐	☐
Utility Company	☐	☐	☐	☐
City/Town Engineering	☐	☐	☐	☐
Buildings Department	☐	☐	☐	☐
Conservation Commission	☐	☐	☐	☐
Other (please specify):----------	☐	☐	☐	☐

Q5. Has your community completed any of the following types of tree assessments/inventories? Check (a) for each type your community has completed, (b) whether or not it is in active use, and (c) the month and year it was last updated.

Tree assessment/inventory type	Completed?	Currently in active use?	Last updated: month/year
Complete tree inventory	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Partial tree inventory (e.g. downtown core, main streets)	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Site specific tree inventory (e.g. park, common)	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Windshield tree survey	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Open space survey	☐ yes ☐ no	☐ yes ☐ no	- -/- -
GIS analysis	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Satellite analysis	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Statistical sample summary	☐ yes ☐ no	☐ yes ☐ no	- -/- -
Other (specify)----------	☐ yes ☐ no	☐ yes ☐ no	- -/- -

Q6. Does your community have its own local ordinances, sub-division regulations and/or written policies that pertain to the planting, maintenance and protection of trees? (Check all that apply):.

Ordinances, sub-division regulations, written polices	
Local tree ordinance	☐ yes ☐ no
Regulations requiring the planting of new trees during development	☐ yes ☐ no
Regulations that protect existing trees during development	☐ yes ☐ no
Written policies pertaining to tree planting, protection and maintenance	☐ yes ☐ no
Other ----------	☐ yes ☐ no

References

Clark, J.R., Matheny, N.P., 1998. A model of urban forest sustainability: application to cities in the United States. Journal of Arboriculture 24, 112–120.

Dickerson, S.D., Groninger, J.W., Mangun, J.C., 2001. Influences of community characteristics on municipal tree ordinances in Illinois, U.S. Journal of Arboriculture 27, 318–325.

Dillman, D.A., 2000. Mail and Internet Surveys: The Tailored Design Method. Wiley & Sons, New York, NY.

Doherty, K.D., Ryan, H.D.P., Bloniarz, D.V., 2000. Tree wardens and utility arborists: a management team working for street trees in Massachusetts. Journal of Arboriculture 26, 38–47.

Elmendorf, W.F., Cotrone, V.J., Mullen, J.T., 2003. Trends in urban forestry practices, programs, and sustainability: contrasting a Pennsylvania, U.S. study. Journal of Arboriculture 29, 237–247.

FS (U.S. Department of Agriculture Forest Service), 2007. Performance-Based Methodology for Allocating Urban & Community Forestry Program Funds. Retrieved August 10th, 2009 from http://www.na.fs.fed.us/urban/index.shtm.

Grado, S.C., Grebner, D.L., Measells, M.K., Husak, A.L., 2006. Status, needs, and knowledge levels of Mississippi's communities relative to urban forestry. Journal of Arboriculture 32, 24–32.

Groninger, J.W., Close, D.D., Basman, C.M., 2002. Can small, rural communities practice urban forestry? Journal of Forestry 100, 23–28.

Kielbaso, J.J., 1990. Trends and issues in city forests. Journal of Arboriculture 16, 69.

Kuhns, M.R., Reiter, D.K., Lee, B., 2005. Characteristics of urban forestry programs in Utah, U.S. Journal of Arboriculture 31, 285–295.

Lohr, V.I., Pearson-Mims, C.H., Tarnai, J., Dillman, D.A., 2004. How urban residents rate and rank the benefits and problems associated with trees in cities. Journal of Arboriculture 30, 28–35.

Lorenzo, A.B., Blanche, C.A., Yadong, Q., Guidry, M.M., 2000. Assessing resident's willingness to pay to preserve the community urban forest: a small city case study. Journal of Arboriculture 26, 319–325.

MGL, 1987. Chapter 87. General Laws of Massachusetts. Retrieved August 10th, 2009 from http://www.ma.gov/legis/laws/mgl.

Miller, R.W., Bates, T.R., 1978. National implications of an urban forestry survey in Wisconsin. Journal of Arboriculture 4, 125–127.

Reeder, E.C., Gerhold, H.D., 1993. Municipal tree programs in Pennsylvania. Journal of Arboriculture 19, 12–19.

Ricard, R.M., 2005a. Connecticut's Tree Wardens: a survey of current practices, continuing education, and voluntary certification. Northern Journal of Applied Forestry 22, 248–253.

Ricard, R.M., 2005b. Shade trees and tree wardens: revising the history of urban forestry. Journal of Forestry 103, 230–233.

Ricard, R.M., Bloniarz, D.V., 2006. Learning preferences, job satisfaction, community interactions, and urban forestry practices of New England (USA) tree wardens. Urban Forestry & Urban Greening 5, 1–15.

Ries, P.D., Reed, A.S., Kresse, S.J., 2007. The impact of statewide urban forestry programs: a survey of cities in Oregon, U.S. Journal of Arboriculture 33, 168–175.

Rines, D.R., Kane, B., Ryan, H.D.P., Kittredge, D.B., 2010. Urban forestry priorities of Massachusetts (U.S.A.) Tree Wardens. Urban Forestry & Urban Greening 9 (4), 295–301.

Rooney, C.J., Ryan, H.D.P., Bloniarz, D.V., Kane, B.C.P., 2005. The reliability of a windshield survey to locate hazards in roadside trees. Journal of Aboriculture 31, 89–94.

Schroeder, H.W., Green, T.L., Howe, T.J., 2003. Community tree programs in Illinois, U.S.: a statewide survey and assessment. Journal of Arboriculture 29, 218–225.

Stevenson, T.R., Gerhold, H.D., Elmendorf, W.F., 2008. Attitudes of municipal officials toward street tree programs in Pennsylvania. U.S. Arboriculture & Urban Forestry 34, 144–151.

Thompson, R.P., 2006. The State of Urban and Community Forestry in California. Urban Forest Ecosystems Institute Technical Report No. 13. San Luis Obispo, CA.

Treiman, T., Gartner, J., 2004. Community forestry in Missouri, U.S.: attitudes and knowledge of local officials. Journal of Arboriculture 30, 205–213.

Treiman, T., Gartner, J., 2005. What do people want from their community forests? Results of a public attitude survey in Missouri, U.S. Journal of Arboriculture 31, 243–250.

U.S. Census Bureau, 2007. Statistical Abstract of the United States. Government Printing Office. Washington DC. Retrieved 10 August 2009 from http://www.census.gov/compendia/statab.

USDA Forest Service, n.d. Urban and community forestry: family of performance measures for the urban and community forestry program. Retrieved 30 October 2008 from http://www.fs.fed.us/ucf/performance.html.