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Lara A. Roman, Lindsay K. Campbell, and Rebecca C. Jordan

### **Civic Science in Urban Forestry: An Introduction .....41**

**Abstract.** Civic science in urban forestry is a means of engaging the public in the study, management, and care of urban trees, and includes varied approaches with different disciplinary foundations. For instance, citizen science has been gaining prominence in urban forestry, with municipalities and nonprofits engaging volunteers in data collection for inventories and monitoring. Residents can also get involved in other stages of urban forest research and management, including framing goals and questions, conducting analyses, interpreting data, and applying results. Diverse forms of public engagement have brought expanded stakeholders into the fold of knowledge production and stewardship of urban greenspaces, including co-management and civic ecology practices. As municipalities, states, nonprofits, and scientists undertake these various forms of civic science, there is a need for basic research about the nature of civic engagement in urban forestry, empirical evidence about best practices for different approaches, and the impacts of volunteering on the participants themselves. This special issue of *Arboriculture & Urban Forestry* aims to advance the scholarship of civic science in urban forestry by addressing these topics, among others, with contributed articles. In this introduction to the special issue, we briefly review terms related to civic science to connect these interrelated bodies of inquiry to urban forestry, and present the research studies and practitioner notes included in this special issue. We then conclude with a discussion of future research needs for civic science in urban forestry, including technological tools to enable data democratization, engaging marginalized and under-represented urban communities, and supporting transdisciplinary exchanges between research and practice.

**Key Words.** Citizen Science; Civic Ecology; Co-Management; Knowledge Co-Production; Participatory Research; Urban Ecology; Urban Forestry.

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### **Every Tree Counts: Reflections on NYC's Third Volunteer Street Tree Inventory .....49**

**Abstract.** TreesCount! 2015 (TC2015) was the third citizen-participatory inventory of street trees in New York City, New York, U.S. Every ten years, the New York City Department of Parks & Recreation has worked with citizen scientists to record the location, size, species, and condition of all public curbside trees. Volunteer street tree inventories promote awareness of the importance of the urban forest and support municipal urban forest management. New York City's prior street tree inventories in 1995 and 2005 led to advances in customer service, funding for routine street tree pruning, and urban greening initiatives. TC2015 attracted 2,241 voluntary participants through multiple recruitment efforts, more than doubling involvement from 2005. Fully digital data collection improved data quality and facilitated near-real-time quality assurance of data, and advanced tree location methods increased spatial data accuracy from past inventories. Data-collection events and reward strategies were also implemented to promote volunteer engagement. Citizen scientists collected tree location data with a high-level of accuracy (96.1%) after minimal training. All 666,134 street trees surveyed in TC2015 populated NYC Parks's operational forestry database, as well as a public facing map (NYC Street Tree Map) for tree stewards. The following paper describes TC2015 project design and execution, outlines some of the key changes made since the first inventory in 1995, and provides results-based recommendations for practitioners planning similar projects.

**Key Words:** Citizen Science; Civic Science; Data Quality; NYC; Street Tree Inventory.

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**Abstract.** Volunteer programs can benefit from a deeper understanding of the motivations and experiences of people engaged in citizen science. Research to date has studied motivations of citizen scientists and tree-planting volunteers. Less work has focused on tree-monitoring volunteers, a role that is rapidly increasing as more cities involve the public in monitoring the urban forest. Researchers conducted an assessment of volunteers (n = 636 respondents) of the TreesCount! 2015 street tree census in New York City, New York, U.S., to understand volunteers' demographics, motivations, experiences, and levels of civic engagement. Semi-structured interviews (n = 40) were also conducted on a subset of the initial assessment respondents, to deepen understanding of these factors. Like tree-planting volunteers in previous studies, volunteers were more likely to be highly educated, female, white, and with high income levels. Top self-identified motivations for participation included personal values, wanting to contribute, and a desire for education or learning. Demographics correlated with different motivations, suggesting opportunities for targeting recruitment efforts to better reach underrepresented populations. Researchers also found motivations shifted slightly in post-census interviews, also identifying a new theme of exploring the city. Street-tree monitoring presents opportunities for contributing to one's community or city, and for learning about trees and urban nature, suggesting these acts of engagement can both strengthen connections to social-ecological systems and provide personal benefits. At the same time, considering volunteer motivations, experiences, and outcomes when designing programs can positively affect participation turnout, effort, and retention.

**Key Words.** Citizen Science; Civic Engagement; New York City; Stewardship; Tree Monitoring; Urban Forest.

Nick Bancks, Eric A. North, and Gary R. Johnson

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**Abstract.** In partial fulfillment of a grant to assess the potential impact of emerald ash borer on Minnesota, U.S., community forests, six communities were selected in 2009, and eight communities were selected in 2011, to complete tree surveys or inventories. Trained volunteers in each community were used to identify, measure, and assess their community trees. Training methods, technical assistance, and measurement tools utilized were updated between 2009 and 2011 based on input from community volunteers and university training staff, allowing for a *post hoc* study of volunteer efficacy to be conducted. To assess volunteer efficacy and the effect of updated training protocols on data quality, comparisons between volunteer-collected data and university-collected data were analyzed for agreement in genus and species identification, tree measurements, and condition rating for a subsample of trees in each community. Agreement was the greatest for tree identification at the genus level (>90%) and the lowest overall for condition rating (<70%) for all communities. Statistically differences between the 2009 and 2011 communities were detected with 2011 communities having higher levels of agreement on average. The increased probability of agreement with university researchers is likely attributable to increased focus on field-instruction, technical assistance, and more sophisticated tools used by the 2011 communities. However, detailed volunteer demographic data for each community was not available for analysis and could provide further insight into differences detected. Decisions to use volunteer collected data should incorporate appropriate levels of training and tool sophistication for the level of specificity required for a project.

**Key Words.** Citizen Science; Community Involvement; Emerald Ash Borer; Minnesota; Tree Inventory; Urban Forest Inventory; Urban Forest Volunteers; Volunteer Data Accuracy; Volunteer Data Quality.

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**Abstract.** Communities cultivate citizen support of municipal forestry operations through volunteers and partnerships. Through a national census and survey of urban forestry activity in over 660 municipalities in the United States, researchers found two-thirds of all responding communities involve volunteers in tree activities. This increases from half of small communities (2,500 to 4,999 people) to all large communities (one million or more people) involving volunteers. When tabulated for the United States, a mean national estimate of 345,466 (195,754 SEM) people volunteered 1,484,204 (665,460 SEM) hours with municipal tree activities. This equates to 714 (320 SEM) full-time equivalent (2,080 hour-base year) positions. Overall, volunteers completed nearly 5% of municipal tree care activities. Nearly 80% of the municipalities train their volunteers. Tree planting (85% of communities) was the most common activity, followed by tree watering (40%), awareness/education programs (39%), tree pruning (28%), and fundraising (20%). Findings were contrasted with U.S. census population groups to disaggregate if volunteerism varied by community size. Volunteers were more commonly involved in communities with a greater urban-forestry capacity derived from a sustainability index score. Six attributes of municipal forestry program had either positive (+) or negative (-) effect on volunteer participation in urban forestry activities. These included adequate budget (-), per capita spending (-), tree board (+), outreach (+), strategic plan (+), and total employment (+).

**Key Words.** Civic Science; Municipal Forestry; Partnership; Volunteer.

Andrew Almas and Tenley Conway

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**Abstract.** Urban forests are increasingly acknowledged as important areas for producing ecosystem services and maintaining ecosystem processes. In response, municipalities throughout North America have been adopting long-term plans to support strategic management of the urban forest. These plans have the potential to shape the urban forest for decades to come. Most management plans emphasize the planting of native trees, to improve ecological integrity and ecosystem services, and acknowledge the need for resident stewardship to help meet urban forestry goals. Residents' support and action is crucial, since the majority of urban trees are located on residential property, yet it is unclear what residents' attitudes and actions are regarding native trees. Using a case study of four municipalities in southern Ontario, Canada (two that have management plans that call for more native species plantings and two that do not), researchers administered a survey that explored residents' attitudes and actions toward native tree species, focusing on the relationship between municipal emphasis on native species planting, household socio-demographics, and residents' attitudes and actions toward native species. The results indicate that residents' generally have positive attitudes toward native trees, although fewer are interested in planting native species if they create a hazard or increase costs. Moreover, these generally positive attitudes do not translate into emphasizing native species when actually selecting tree species to plant. This paper adds to existing research surrounding the need for further outreach and environmental education and greater availability of native plants in local nurseries.

**Key Words.** Carolinian Canada; Municipal Policy; Native Species; Nurseries; Ontario; Residents; Stewardship; Urban Forest.

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Georgia Silvera Seamans

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**Abstract.** This paper documents the research processes and outcomes of four collegial citizen-science projects about urban spontaneous vegetation. The artist- and designer-initiated collegial projects in this study use a variety of art, design, and natural history strategies to collect and analyze data, as well as to visualize and disseminate their findings. In addition to physical outcomes, the project leaders use legitimating narratives and discourses about urban ecosystem services to counter negative claims about urban spontaneous vegetation, which are often pejoratively labeled 'weeds.' A challenge and opportunity for projects focused on altering the normative bias against so-called "weeds" is mainstreaming a new nature ethic for this type of urban flora.

**Key Words.** Citizen Science; Ecological Knowledge; Ecosystem Services; Public Participation; Small Data; Urban Biodiversity; Urban Spontaneous Vegetation.

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