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Research Paper

Growing a diverse urban forest: Species selection decisions by practitioners planting and supplying trees

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HIGHLIGHTS

- Surveyed landscape architects, NPOs, retail garden centers and municipal staff.
- Different actors used varied criteria to make tree species selections.
- Tree supply was a central factor in tree planting and sales.
- Information needed about how to select species to build resilient urban forest.

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ABSTRACT

With the adoption of ambitious goals to grow and diversify the urban forest, municipal and non-municipal planting efforts have increased in many North American cities. A better understanding of the decisions made by those engaged in planting and supplying trees is needed to understand if and how municipal goals are being addressed, provide insight into ways the urban forest may be changing, and more broadly shed light on urban socio-ecological dynamics. This study explores tree species selection criteria used by practitioners involved in urban tree planting and supply to better understand current planting activities. Surveys and interviews with landscape architects, non-profit organizations, retail nurseries and garden centers, and municipal forestry staff in Toronto (Ontario, Canada) were conducted to identify the factors each group considers when selecting tree species, with emphasis on the influence of pests and tree availability. Differences in species selection criteria exist between the four groups, with variations primarily related to consideration of neighboring species and native status, key factors when managing for a resilient urban forest. However, divergent decision criteria between landscape architects and municipal staff actually translated into very similar common planting lists, while two non-profit organizations shared a similar emphasis on native species but planted very different species. Pest knowledge and influence on species selection varied among the actors, but all groups indicated that availability affected what was planted or sold. Results highlight the need for conversations about ways different actors can select species to contribute to a diverse and healthy urban forest.

1. Introduction

Given the numerous benefits of urban forests, many municipalities across North America have adopted aggressive tree planting or canopy cover goals (Young, 2011). Along with simply growing the urban forest, goals related to diversifying species composition and increasing native species presence are also often adopted as a way of reducing vulnerability to pests, maximizing ecosystem services, and maintaining ecological integrity (Ordóñez & Duinker, 2013). These growth and species composition goals have spurred increases in tree planting, which means that current planting activities have the potential to impact urban forests for decades to come. While planting plans are often led and promoted by municipal urban forestry staff, a variety of private land owners, professionals and organizations are also planting trees. A better understanding of the decision-making process by the different actors engaged in planting and supplying trees is needed to understand if and how municipal goals are being addressed, highlight where practices could be improved in order to build a more resilient urban forest, provide insight into ways urban forests may change in the future, and more broadly shed light on current urban socio-ecological dynamics.

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A small but growing literature has explored residential tree planting choices (Avolio et al., in press; Kirkpatrick, Davison, & Daniels, 2012; Pataki, McCarthy, Gillespie, Jenerette, & Pincetl, 2013); changes in species available through retail nurseries (Pincetl, Prabhu, Gillespie, Jenerette, & Pataki, 2013); historic trends in trees planted in public parks (Loeb, 1989; Profous & Loeb, 1984; Stalter, 1981); and the type of information needed to help tree planters choose appropriate species (Sjöman & Nielsen, 2010). However, it remains unclear how key professionals and organizations involved in current tree planting and supply make species selection decisions.

The objective of this study is to explore the species selection process of several actors who are planting or selling trees in an urban context. This objective was addressed through surveys and interviews with landscape architects, tree planting non-profit organizations, retail garden centers and nurseries, and municipal urban forestry staff in the City of Toronto (Ontario, Canada). Surveys and interviews focused on the importance of different decision criteria used to select species to plant or stock for retail sales. Attention was specifically given to whether tree availability and pest knowledge had notable impacts on species selection decisions, as well as what species are actually being planted. The following sections explore the literature examining tree diversity and planting; describe our methods and results; and discuss the results in the context of tree species selection and urban forestry goals.

2. Urban species diversity and tree planting

The many ecological, social, economic, and health benefits associated with the urban forest have been well-documented (Tyrväinen, Pauleit, Seeland, & De Vries, 2005), providing strong justification for increasing and maintaining canopy cover. The benefits of managing for a diverse urban forest are also increasingly recognized. In general, higher levels of biodiversity support more complex ecosystem functioning, greater overall productivity, and more niche opportunities (Jim & Liu, 2001; Hooper et al., 2005). Each of these, in turn, is part of a positive feedback loop supporting even higher levels of biodiversity (Groombridge & Jenkins, 2002). Higher species diversity in an urban forest is thought to provide greater security against environmental changes and stochastic events (Alvey, 2006). As a result, a diverse assemblage of species is often deemed the best approach to minimizing both current pest threats, as well as future, unanticipated outbreaks (Raupp, Buckelew Cumming, & Raupp, 2006), although empirical explorations of pest resilience in relation to tree diversity in urban and non-urban forests has been mixed (Berland & Elliott, 2014; Jactel & Brockerhoff, 2007).

Urban biodiversity is also associated with social and health benefits (Talor & Hochuli, in press). Living, working and visiting areas high in biodiversity provides a range of positive psychological and physiological effects (Cilliers, 2010, chap. 4; Millard, 2010, chap. 3), with urban biodiversity potentially playing this role for city dwellers. Additionally, exposure to a diversity of species is an important element in stimulating people's desire to support conservation efforts (Goddard, Dougill, & Benton, 2010).

Given the benefits, species diversity is recognized as a key component of strategic urban forest management (Kenney, Van Wassenaer, & Satel, 2011). To support management efforts, information about current and future patterns and related drivers of tree species composition is needed. Recent research has documented the diversity of public and privately owned trees, with most urban forests having relatively high species richness when compared to the surrounding landscape (Alvey, 2006). However, composition is typically very uneven, with many individuals of just a few common species and only one or two individuals of most species present (Bourne & Conway, 2014). This pattern is partly a result of the stressful nature of urban environments, limiting the number of tree species that can survive in cities (Sieghardt et al., 2005). Additionally, concerns related to minimizing risks and litter associated with trees, space constraints, professional and institutional norms, and esthetic preferences likely further influence the types of species typically planted in an urban context.

A few studies have specifically examined the ways land use, built form, and neighborhood socioeconomics are related to current tree species diversity (Conway & Bourne, 2013; Ortega-Álvarez, Rodríguez-Correa, & MacGregor-Fors, 2011), shedding light on the broader factors shaping existing urban forest diversity patterns. Understanding current tree planting decisions by non-municipal actors has received less attention. In Sacramento, Summit and McPherson (1998) explored residential tree planting activity, finding 68 percent of those who had planted a tree on their property obtained the tree(s) from a retail nursery. Trees were most likely to be planted in the first five years of residency, with shade and esthetics given as the most common motivations for planting (Sommer, Learey, Summit, & Tirrell, 1994; Summit & Sommer, 1998). More recently, Kirkpatrick et al. (2012) surveyed residents in six Australian cities about their tree planting actions. Their results suggested residents plant trees to improve esthetics, attract wildlife, and increase privacy. Finally, in a Seattle-based study residents were more interested in planting smaller trees and fruit trees than traditional, large shade trees (Dilley & Wolf, 2013). Based on these studies, esthetics are clearly a central consideration when residents make species selection decisions.

Very little research has examined the role of non-municipal professionals and organizations involved in tree planting as compared to private land owners. For example, the knowledge-level and decision-making criteria used by landscape architects for tree species selection has largely been overlooked within the urban forestry or urban ecology literatures, although landscape architects design and implement landscaping plans that frequently include trees. A few studies have examined landscape architects' promotion and use of native plant species (Butler, Butler, & Orians, 2012; Calkins, 2005), while a number of urban forestry studies note that their results have important implications for landscape architects (Asgarzadeh et al., in press; Ellis, Lee, & Kweon, 2006; Kim & Zhou, 2012). A growing number of non-profit organizations are involved in urban forest monitoring (Roman, McPherson, Scharenbroch, & Bartens, 2013) or in the promotion of urban tree benefits (Silvera Seamans, 2013). Some non-profit organizations also have tree planting programs (Greene, Millward, & Ceh, 2011; Moskell & Allred, 2013), but the species selection criteria used to guide plantings have not been examined, beyond noting an emphasis on native trees.

In terms of garden centers and nurseries, Pincetl et al. (2013) explored the changing selection of tree species provided by Los Angeles nurseries throughout the 20th century, but did not examine how stocking decisions were made. A series of surveys in Ohio have looked at municipal urban foresters' planting needs in relation to nursery supply (Sydnor, Subburayalu, & Bumgardner, 2010), with the most recent survey finding a mismatch between species urban foresters want and those available from suppliers. While nurseries said they respond to demand, the need to substitute species due to lack of availability was not necessarily recorded, masking the unmet demand in many cases (Sydnor et al., 2010). Polakowski, Lohr, and Cerny-Koenig (2011) study of wholesale nurseries in Washington State found that there was general support for increasing the diversity of tree species available, but many surveyed did not know why higher species diversity was important.

Finally, Sjöman and Nielsen (2010) reviewed the literature and spoke with practitioners regarding necessary information tree