Predicting native plant landscaping preferences in urban areas

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A R T I C L E   I N F O

A B S T R A C T

The rapidly growing physical footprint of cities makes understanding residential landscaping preferences increasingly important for water quality, biodiversity conservation, and addressing climate change. In this paper we answer four interrelated questions about residential landscaping preferences with a case study in Raleigh, NC: (1) How are residents' landscaping preferences influenced by what residents believe their neighbors prefer? (2) Do residents accurately assess their neighbors' landscaping preferences? (3) How does ethnicity influence landscaping preferences? and (4) Do the socio-demographic and neighborhood norm based correlates of landscaping preferences persist when both are accounted for in multivariate models? Respondents ($n = 179$) in this study preferred a 50% native plant garden design over 100% turf grass or the 75% and 100% native plant garden designs, and inaccurately assumed that their neighbors preferred turf over the native plant garden based landscaping designs. These results suggest that correcting erroneous assumptions about neighborhood preferences may alleviate normative pressure against adopting alternatives to turf grass landscaping. Although landscaping choices were best predicted by what residents perceived their neighbors preferred, ethnicity, income, and home ownership were also related to landscape preferences. African American ethnicity and income were positively related to preference for turf grass coverage. Environmental justice concerns linked to urban vegetation should be considered in light of the finding that African Americans appeared to prefer turf grass dominated landscaping. Results from this study indicate that middle income neighborhoods with high levels of home ownership may prove most receptive to initiatives aimed at increasing the use of more sustainable landscaping.

1. Introduction

The rapidly growing physical footprint of cities makes home landscaping a growing concern with respect to water and soil quality, loss of biodiversity, and climate change. Urbanization can contribute to sustainability when cities are densely populated (Jacob & Lopez, 2009), but urbanization in the United States, and other developed nations, has recently been characterized by sprawling suburban neighborhoods (Owen, 2009). Because private residents own and make management decisions for major portions of the urban land area, their decisions will drive efforts to design more sustainable urban landscapes (Breuste, 2004; Grimm et al., 2008). Further, private landowners may influence vegetation cover on public lands near their homes, making residential preferences for landscape design a central theme in managing sustainable urban ecosystems (Zhou, Troy, Morgan, & Jenkins, 2009). Turf grasses are

often a desired landscape feature (Robbins & Birkenholtz, 2003) constituting more than 16,380,000 ha in the United States, an area three times larger than that dedicated to corn (Milesi et al., 2005). Furthermore, that area is expanding annually, with 23% of new urban land area (675,000 ha per year) dedicated to turf grass lawns (Robbins & Sharp, 2008).

The production of turf grass significantly impacts urban biogeochemical cycling and the global carbon cycle (Kaye, Groffman, Grimm, Baker, & Pouyat, 2006; Milesi et al., 2005). Maintenance of this landscape design contributes to environmental degradation through use of chemicals, including fertilizers, pesticides, and herbicides, which degrade water and soil quality; increased lawn mower usage, which contributes to increased carbon dioxide emissions linked to global climate change; and irrigation, which threatens limited water supplies (Bijoor, Czimczik, Pataki, & Billings, 2008; Zhou et al., 2009). Further, turf grass dominated landscapes tend to be relatively sterile in terms of wildlife habitat as they lack vertical and horizontal structure and the native plant species required for food, cover and reproduction (Adams & Lindsey, 2010).

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Ecologically friendly alternatives to turf grass dominated landscape designs can promote a number of ecosystem functions simultaneously, including moderating urban microclimates, sequestering carbon, reducing air and water pollution, and providing habitats for birds and urban wildlife (Grove, Troy, et al., 2006; Helfand, Sik Park, Nassauer, & Kosek, 2006; Martin, Peterson, & Stabler, 2003; Troy, Grove, O'Neil-Dunne, Pickett, & Cadenasso, 2007). Native plant gardens are one example of an ecologically friendly landscape design that can provide these services. The conversion of turf grass to native plant garden may reduce the use of chemicals, energy, and water (Nassauer, Wang, & Dayrell, 2009).

Although little research has addressed how native plant labeling influences residential landscaping preferences, several studies have investigated relationships between residential landscaping preferences and socio-economic status of residents. One study has addressed the value associated with the "native plant" label, and suggests willingness to pay for landscaping plants increases when the plants are labeled native and decreases when the plants are labeled as invasive (Yue, Hurley, & Anderson, 2010). Martin, Warren, and Kinzig (2004) identified a positive correlation between vegetation richness and socio-economic status. Larsen and Harlan (2006) found lower income homeowners preferred lawn landscapes, middle income homeowners preferred native desert landscapes, and higher income homeowners preferred "oasis" landscapes. Several other studies have found education was positively related with preferences for natural landscapes (Buijs, Elands, & Langers, 2009). Kirkpatrick, Daniels, and Zagorski (2007) found individuals with higher education levels implemented more complex native plant gardens than those with lower education levels.

Landry and Chakraborty (2009) extended this research by exploring differences in tree cover in relation to ethnicity. They found a significantly lower proportion of tree cover on public rights-of-way in Tampa, FL, USA neighborhoods containing a higher proportion of African Americans and low income residents. This study raises environmental justice concerns, particularly if minorities and lower income communities do not have access to areas with vegetation cover needed to provide important ecosystem services. African Americans may, however, prefer less rural looking landscapes dominated by turf grass. Caucasians often have more favorable attitudes toward wildlife, wilderness, and natural landscapes than African Americans (Floyd, Shinew, McGuire, & Noe, 1994; Kaplan & Talbot, 1988; Sasidharan, 2002; Van Velsor & Nilon, 2006; Virden & Walker, 1999; Zube & Pitt, 1981). Although these studies have focused on parks and natural areas, it seems reasonable that preferences for open landscapes among African Americans may translate into preferences for front yard landscaping with low horizontal and vertical complexity typified by turf grass.

Another body of research suggests neighborhood level norms shape landscaping preferences, at least in part, independently from socio-demographic differences among residents (Zmyslony & Gagnon, 1998). Nassauer et al. (2009) conducted a computer aided simulation study of suburban MI, USA residents which suggested the existing landscaping in a hypothetical neighborhood predicted personal preferences for landscaping better than broad cultural norms. If a hypothetical neighborhood was dominated by landscaping that included large areas of native plant gardens, preferences for conventional turf grass landscaping were replaced by preferences for designs including 75% native plant gardens. Grove, Cadenasso, et al. (2006) and Grove, Troy, et al. (2006) added the possibility that neighborhood level lifestyle differences predicted vegetation cover on private lands and public rights-of-way better than historical trends in population density or socio-economic stratification. These findings suggest advocacy efforts intended to promote increased use of native plants in landscaping must focus to some degree on neighborhoods and not just individuals.

Current research on residential preferences for turf grass landscaping and innovative alternatives with higher vertical and horizontal complexity raises several questions: (1) How are residents' landscaping preferences influenced by what residents believe their neighbors prefer? (2) Do residents accurately assess their neighbors' landscaping preferences? (3) How does ethnicity influence landscaping preferences? and (4) Do the socio-demographic and neighborhood norm based correlates of landscaping preferences persist when both are accounted for in multivariate models? Answering the first and second questions allow us to conduct the first assessment of how personal preferences for landscaping may be swayed by assumptions, false or otherwise, about neighbors' preferences. By addressing the third question, this paper sheds light on potential environmental justice issues associated with the recently documented ethnically related inequities in distribution of urban environmental amenities (e.g., trees, wildlife, green space; Landry & Chakraborty, 2009). Finally, a multivariate approach allows us to determine if each variable predicts unique variance in preferences for landscaping.

We began answering these questions with a case study in Raleigh, NC, USA. Raleigh, serves as a good place for assessing factors influencing residents' front yard landscaping preferences because the region is the third fastest sprawling metropolitan region in the USA, following Greensboro, NC and Riverside, CA (Ewing, Pendall, & Chen, 2011). Sprawl centers are critical areas for understanding landscaping preferences because sprawl regions have rapid population growth, bring larger than average geographic areas into household landscaping per capita, and typify new development patterns. We tested four hypotheses related to residential landscaping preferences: (1) landscaping preferences are predicted by perceptions of neighbor's landscaping preferences, (2) the perceptions about neighbor's preferences are false, (3) African Americans prefer turf grass landscaping more than Caucasians, and (4) socio-economic status is negatively correlated with turf grass landscaping.

2. Methods

We used a stratified sampling approach based on PRIZM classifications to increase the odds of generating socio-economic diversity within our sample. The PRIZM classifications are marketing tools that classify census block groups using a two stage process: (1) clustering neighborhoods based on social rank (e.g., income, education), household data (e.g., life stage, size), mobility, ethnicity, urbanization, and housing (e.g., home value, ownership), and (2) associating clusters with data from market surveys and purchasing records (Grove, Troy, et al., 2006). We chose to sample from PRIZM 12 (primarily Caucasian, middle aged, and high tech online purchasing) and PRIZM 62 (mixed ethnicity, older, order items by mail) classifications because they represented the lifestyle groups in sprawling urbanized areas with both ethnic diversity and relatively high levels of home ownership, and occurred in Raleigh, NC. Accordingly, these groups allowed us to test hypotheses about homeowner's landscaping preferences and the role of socio-economic status and ethnicity, whereas other groups did not.

We used a random number generator to select four census blocks (two classified as PRIZM 12 and two classified as PRIZM 62). There were 120 blocks to sample from in the 7 PRIZM 12 block groups, and 44 blocks to sample from in the PRIZM 62 block group in Raleigh. Homes in the PRIZM 12 blocks averaged 58 years old with construction dates ranging from 1923 to 2008. Homes in the PRIZM 62 blocks averaged 30 years old with construction dates ranging from 1930 to 2007. All four blocks sampled in the study were within Raleigh's inner beltline formed by the highway US 440.