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Does education influence wildlife friendly landscaping preferences?

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Abstract In sprawling metropolitan areas, residential landscaping is a major concern with respect to biodiversity conservation, and it could play a critical role in conserving wildlife habitat. In the United States, residential landscaping typically consists of maintained lawns with specimen plantings of non-native trees and shrubs; such designs provide poor habitat for urban wildlife species. We conducted a case study of Raleigh, North Carolina residents to determine how providing information about the benefits of native plant landscaping to bird species influenced urban residents' landscaping preferences. We used Wilcoxon Signed Rank tests to determine if respondent preferences for 0, 50, 75 and 100 % native plant landscaping coverages changed after residents were informed about the benefits that native plants provide for birds. Initially, the 50 % native landscaping coverage was most preferred by residents; however, preferences for all four native plant landscaping coverage designs were significantly different after the informational treatment. Neutrality changed to opposition for the 0 % native plant coverage, while opposition changed to support and neutrality for the 75 and 100 % native plant coverage designs, respectively. After the informational treatment, the 50 and 75 % native plant landscaping coverage had the highest mean preference levels, although the 100 % design was ranked first more than any other design. Our findings suggest that residential support for native plant landscaping is higher than is reflected by typical residential landscaping practices, and that dissemination of information regarding the benefits of native plant landscaping to birds could alter public preferences for native plant landscaping.

Keywords Birds · Urban wildlife habitat · Landscaping preferences · Native plants · Social norms

Introduction

Western urbanization is largely defined by sprawling suburban areas (Owen 2009). The rate at which these suburban areas are growing makes residential landscaping a critical issue for biodiversity conservation, as urban development is responsible for more species endangerment than any other anthropogenic cause (Czech, Krausman, and Devers 2000). Typical residential landscaping in the United States (US) consists of turf grass lawns with some specimen plantings of trees and shrubs (Helfand et al. 2006; Tallamy 2009). In 2005, more than 16,380,000 hectares of land were dedicated to turf grass in the US, an area three times larger than that dedicated to corn production (Milesi et al. 2005). Between 1982 and 1997, the US experienced a 34 % increase in urban and built up land resulting largely from the conversion of agricultural and forest lands (United States Department of Agriculture Natural Resource Conservation Service [USDA NRCS] 2001).

Turf grass-dominated landscaping contributes to environmental degradation and provides poor wildlife habitat. Although turf grass provides some benefits to urban landscapes by helping to mitigate urban heat islands (Spronken-Smith et al. 2000) and increasing infiltration of stormwater runoff (Brabec et al. 2002), the external inputs required for turf grass maintenance (eg, fuel, chemicals, and frequent

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irrigation) can reduce water and air quality and increase water consumption (Priest et al. 2000; Robbins and Birkenholtz 2003; Milesi et al. 2005). Furthermore, turf grass landscaping does not provide the vertical and horizontal vegetation structure required by most wildlife for food and cover (MacArthur and MacArthur 1961; Adams and Lindsey 2010).

Native plant landscaping provides a more sustainable and wildlife-friendly alternative to turf grass landscaping. Compared to turf grass, native plants require less water, fossil fuels, and chemicals, may help reduce air and water pollution, and moderate urban microclimates (Bijoor et al. 2008; Morris and Bagby 2008). Unlike turf grass, native plant landscaping can provide the vertical and horizontal vegetation structure required by wildlife. Native plants also attract and provide habitat for urban wildlife such as small mammals, birds, and butterflies (Bormann et al. 1993; Helfand et al. 2006; Tallamy 2009).

Because urban residents make management decisions for large portions of urban landscapes, their landscaping choices influence the quantity and quality of wildlife habitat available (Breuste 2004; Grimm et al. 2008). Research suggests residential landscaping also plays an indirect role in urban ecosystems by influencing landscaping decisions for vegetation cover used on adjacent public lands (Zhou et al. 2009). As such, urban residents' decisions regarding urban landscaping help shape biodiversity conservation in urban areas.

Because native landscaping can mitigate habitat loss from urban development, it is important that biodiversity conservation efforts address factors that influence residents' landscaping decisions. Past research suggests a variety of factors, such as labeling and socio-demographics, play a role in shaping residents' landscaping preferences. Yue et al. (2011) found consumers were willing to pay more for plants labeled as native versus those labeled invasive. Education level can also influence preferences for native plant landscaping (Kirkpatrick et al. 2007; Buijs et al. 2009). A study of landscaping preferences in Arizona demonstrated a positive correlation between socio-economic status and vegetation richness (Martin et al. 2004). Larson and Harlan (2006) found that preferences for landscaping varied with income category, with low, middle, and high income classes having different preferences and only the middle class preferring native plant landscaping. Other research suggests neighborhood norms influence landscaping preferences independently from socio-demographic differences among residents (Zmyslony and Gagnon 1998). A computer aided simulation study of suburban Michigan residents suggested the existing landscaping in a hypothetical neighborhood predicted personal preferences for landscaping better than broad cultural norms (Nassauer et al. 2009). Peterson et al. (2012) found the best predictors of landscaping preferences were ethnicity and perceptions of neighbors' preferences, although income and ownership were also found to be weak predictors.

Although previous studies have examined factors shaping landscaping decisions (Anderson and Cordell 1988; Breuste 2004; Peterson et al. 2012), and much is known about human attitudes towards wildlife (Kellert 1976; Williams et al. 2002; Manfredo et al. 2003), and urban wildlife in particular (Decker and Gavin 1987; Bjerke et al. 2003), little is known about how wildlife factors into residents' landscaping decisions. We address this question with a case study in Raleigh, North Carolina (NC). Raleigh was the third fastest sprawling metropolitan region in the US, after Greensboro, NC and Riverside, California (Ewing et al. 2002), and typifies an increasingly popular urban growth form that poses a threat to biodiversity. Sprawl centers are critical areas for understanding landscaping preferences as sprawl regions have rapid population growth, bring larger than average geographic areas into household landscaping per capita, and typify new development patterns. In this study, we set out to answer the following questions: 1) how much will residents change their landscaping preferences to improve habitat for birds, and 2) what variables predict residents' landscaping preferences and the change in those preferences for the benefit of birds.

Materials and methods

To address our research objectives, we conducted a survey of residents in Raleigh, NC. To increase socio-economic diversity, we used a stratified random sample based on Potential Ratings on Zip Markets (PRIZM) classifications, a marketing tool which uses census block groupings to cluster neighborhoods using socio-demographics, market surveys, and purchasing records (Peterson et al. 2012). We used a random number generator to select four census blocks (out of a possible 123) within the US highway 440 beltline in Raleigh, NC. Two PRIZM classifications were represented in the four census blocks; we used two census blocks from PRIZM 12 and two from PRIZM 62. PRIZM 12 is characterized by middle-aged whites who participate in online purchasing, whereas PRIZM 62 is characterized by older individuals of mixed race who order items by mail. Home ownership (versus renting) in both PRIZM 12 and 62 census blocks was relatively high. Homes in the PRIZM 12 averaged 58 years old, with construction dates ranging from 1923 to 2008, whereas the homes in PRIZM 62 averaged 30 years old with construction dates ranging from 1930 to 2007. Tree cover in PRIZM 12 was 62.0 % and tree cover in PRIZM 62 was 57.4 %. PRIZM classifications have been criticized for overreliance on race perceptions and potentially contributing to social justice problems (McFarlane 2006), but we use the classifications solely to ensure high ethnic diversity among respondents. Hence, we provide actual demographic data in results rather than rely on PRIZM estimates.

We used Hawth's Analysis Tools for ArcGIS (10.0, Redlands, CA) to generate random addresses within each block group. The census blocks for PRIZM 12 were composed of 491 addresses, of which 100 were selected for inclusion in our study. Of the 100 selected, 11 were post office boxes or non-residential structures; thus, the remaining 89 residences constituted the PRIZM 12 sample. The census blocks for PRIZM 62 included 457 addresses, of which 100 were selected. Of the 100 selected, 10 were post office boxes or non-residential structures, leaving 90 residences as the PRIZM 62 sample.

We conducted an in-person survey during February and March, 2010. Interviewers, undergraduate students with junior and senior standing and graduate students, went door to door in an attempt to contact a household member at each residence in the sample. After the third unsuccessful attempt to contact someone in the household, interviewers marked the address as unavailable and moved on to the nearest address that was not already included in the sample frame. Although the race and ethnicity of interviewers may affect responses in studies on sensitive subjects (eg, illegal behavior and unsocial attitudes; Sudman and Bradburn 1974; Schuman and Hatchett 1974; Webster 1996), there is limited evidence to suggest that these same biases exist for less sensitive topics such as landscaping preferences. As such, we did not record interviewer race or ethnicity.

We collected socio-demographic information, including gender, race, 2009 total household income (before taxes; answer options were ordinal categories from US $14,999 or less to $200,000 or more), and education level, from respondents. Residents were asked whether they rented or owned the property on which they lived. Residential preferences for native landscaping coverage designs were evaluated by having residents examine photos of different proportions of native plant coverage in four front yard landscaping designs (0, 50, 75, and 100 %; Fig. 1), and answering written survey questions about their native plant landscaping coverage preferences (baseline preferences). Respondents were asked to imagine they had the opportunity to install new front yard landscaping. Then, residents were asked to respond to written questions to indicate their preference for each of the four native plant coverage designs depicted in the photos on a 7 point Likert scale, where 1 was 'strongly do not prefer' and 7 was 'strongly prefer'. Next, researchers explained to respondents that 'birds use

Fig. 1 Photos of four native plant landscaping designs ranging from 0 % native plant coverage to 100 % native plant coverage. Adapted from Nassauer et al. (2009)

native plant gardens to hide from predators and find food'. Then, residents were asked again to indicate their preference for each of the four native plant coverage designs shown in the photos (post-treatment preferences). As a way to reduce potential social desirability bias, respondents were assured that there were no right answers to any of the survey questions, and that we were interested in their true opinions.

The photos used in the study were adapted from Nassauer et al. (2009). Each photo included a caption stating the percent of native plant coverage depicted, and interviewers were instructed to explain to respondents that all of the plants portrayed in the photos were native, except the turf grass and perennial evergreen shrubs. Thus, respondents were responding to both verbal instructions and perceptions of the general appearance of landscaping in the photos (including design), rather than personal knowledge of individual plant species. In addition to the verbal cues from the interviewer, "Native Plant" was listed in writing on the survey instrument and with the photos. The native plants depicted in the photos reflected a general appearance that is typical for herbaceous native plants in the region, both in vertical and horizontal complexity. Furthermore, the design elements we included in the photos (eg, separating native plants from turf in distinct areas) where those that literature suggested as most relevant for introducing native plants (Jorgensen et al. 2007; Kaplan and Austin 2004; Nassauer et al 2009; Todorova et al. 2004). Likewise, given that some grass species are native and presumably could generate similar appearance to exotic grass species, we indicated to the respondents that the turf grass depicted in the photos was non-native. Previous research suggest that color can influence preferences (Nassauer 1983), thus, we used grayscale photos to avoid confounding the effects of color and percentage cover for native plants. The photos were printed on a single 8.5 by 11 inch piece of white paper so that all four landscaping coverage designs were visible to respondents simultaneously.

To understand and quantify the effects of the socio-demographic variables on preference scores for native plant coverage versus turf grass, we converted each respondent's ratings (baseline and post-treatment) into an overall preference score. We created the overall preference score by first ranking each of the four levels of native plant coverage (0, 50, 75, and 100 %) by preference according to Likert scale scores (ie, most preferred to least preferred). We assigned points based on coverage preference; the most preferred coverage design was given 4 points, the next preferred 3 points, and so on to 1 point for the least preferred coverage. When ties occurred, the ranks were averaged. The percent coverage (0, 0.5, 0.75, 1) was then multiplied by the points given to that coverage level, and then totaled. This resulted in each respondent receiving an overall score between 4 and 7.25, with lower scores indicating that the respondent tended to favor the landscaping coverage design with less native plant coverage.

We used respondents' baseline preferences for the four native plant coverage designs and their preferences after being informed of its benefits to birds (post-treatment) to calculate the change in preference scores. The baseline, post-treatment, and change in respondents' preference scores were used as dependent variables. RACE, highest EDUCATION level completed, total household INCOME (category midpoint), home OWNERSHIP (whether the respondent owned the property in which they resided), and whether respondents owned a BIRDFEEDER were used as independent variables to predict baseline, post-treatment, and changes in preference scores for native plant landscaping. Respondents who did not identify themselves as black or white (6 %) were excluded from our regression models. In addition to descriptive statistics and regressions, we compared baseline and post-treatment preference ranking for each native plant coverage design using pairwise Wilcoxon Signed Rank tests. Statistical Package for Social Sciences (19.0.0, Chicago, Illinois) was used for all analyses.

Results

We received 179 responses to our survey. Seventy-two responses came from residences that were part of our original sample (40 % response rate) and another 107 came from proximate addresses. Compliance rate among respondents who answered the door was 100 %. Most respondents were male (52.8 %), had a Bachelor's degree (27.9 %), and owned the residence in which they lived (58.1 %). The racial majority of our sample was white (56.8 %), with another 37.5 % being classified as black, and 5.7 % as other. PRIZM 12 and 62 samples were demographically similar in terms of income levels (median categorical midpoint = $37,000 for both groups), but slightly more respondents from PRIZM 12 were home owners (61%), than PRIZM 62 respondents (55%). PRIZM 12 also had a much higher percentage of whites (85%) and males (57%) than PRIZM 62 (7% white; 47% male).

The 50 % native plant coverage design received the highest mean preference score for the baseline measurement (Table 1). The baseline preference scores for the 0 and 75 % native plant coverages were the 2nd and 3rd highest, but were not significantly different from each other, while the 100 % native plant coverage was the least preferred. The post-treatment preference scores for each native plant coverage design were different than their respective baseline scores. Despite a small decrease in the mean preference score for the 50 % native plant coverage, it shared the highest post-treatment mean preference levels with the 75 % native plant coverage. The mean preference score for the 75 % native plant coverage, however, increased significantly from baseline to post-treatment. The 100 % native

Table 1 Comparison of mean baseline preference scores and mean post-treatment preference scores (after being informed of the benefits of native landscaping to birds) for four native plant landscaping designs from a survey of urban residents in Raleigh, North Carolina. Mean preference scores for each native plant coverage were significantly different between baseline and post-treatments (p values were all < 0.001). Uppercase letters denote significant differences at α < 0.05

Percent native plant coverage	Mean preference scores (7 pt Likert scale)	Percent of respondents ranking each landscaping coverage in each category from 1 = strongly do not prefer to 7 = strongly prefer (baseline)						
		1	2	3	4	5	6	7
0	4.08 (B)	28.1	6.7	6.1	11.7	11.7	6.1	29.2
50	5.11 (A)	4.5	5.1	6.7	15.7	21.9	19.9	27
75	3.66 (B)	18.1	15.8	16.9	13.6	13.6	10.7	11.3
100	2.82 (C)	45	11.9	11.4	5.7	7.4	4.5	13.1
	Mean preference scores (7 pt Likert scale) after being informed about birds	Percent of respondents ranking each landscaping coverage in each category from 1 = strongly do not prefer to 7 = strongly prefer after being informed about birds (post-treatment)						
		1	2	3	4	5	6	7
0	3.51 (C)	29.4	17.6	4.7	13.5	10	5.3	19.4
50	4.71 (A)	6.5	4.1	11.2	21.2	22.9	15.3	18.8
75	4.63 (A)	10	5.9	8.2	16.5	20.6	24.1	14.7
100	4.21 (B)	21.8	11.8	6.5	11.2	10.6	9.4	28.8

Table 2 Percent of respondents ranking each native plant landscaping coverage design by preference in each rank position for baseline and post-treatment from a survey of urban residents in Raleigh, North Carolina

Ranking of native plant landscaping coverages	Baseline Measurement (%)	Post-treatment Measurement (%)
0 % coverage		
1rst	36.7	32.0
2nd	23.2	10.7
3rd	13.6	14.8
4th	26.6	42.6
50 % coverage		
1rst	44.1	39.6
2nd	40.1	23.7
3rd	15.8	36.7
4th	0	0
75 % coverage		
1rst	20.3	34.3
2nd	29.4	40.8
3rd	49.7	24.9
4th	0.6	0
100 % coverage		
1rst	16.9	48.5
2nd	13.0	9.5
3rd	31.1	18.3
4th	38.4	23.4

plant coverage also increased significantly, moving up in preference past the 0 % native plant coverage design. Post-treatment preference scores for the 0 % native plant coverage decreased significantly, making it the least preferred coverage post-treatment. Comparison of respondent ranking of native plant coverage in the baseline and post-informed measurements show that the 50 % native plant coverage remained relatively stable, minor changes were documented for the 75 % coverage and 0 % coverage, and major changes occurred for the 100 % coverage (Table 2). Most notably, the percent of people ranking 100 % native plant coverage first nearly tripled post-treatment.

INCOME and RACE were negatively related to the baseline preference scores where respondents with lower income levels and whites ($\overline{x}$ = 5.70, SE = 0.12), more than blacks ($\overline{x}$ = 4.61, SE = 0.12), preferred native plant landscaping (Table 3). OWNERSHIP was positively related to the baseline preference scores where homeowners preferred native landscaping ($\overline{x}$ = 5.42, SE = 0.12) more than renters ($\overline{x}$ = 5.03, SE = 0.12). RACE was negatively related to the post-treatment scores where white respondents ($\overline{x}$ = 6.23, SE = 0.11), more than black respondents ($\overline{x}$ = 5.40, SE = 0.13), preferred native plant landscaping (Table 3).

Analysis of the change in preference scores from baseline to post-treatment indicate OWNERSHIP was negatively related to the change in preference scores, whereas RACE was positively related (Table 3). Owners were more likely than renters to prefer native plants in the baseline measurement, but renters' preference scores increased more post-treatment ($\overline{x}$ = 0.86, SE = 0.15) than owners' ($\overline{x}$ = 0.54, SE = 0.11). Preference scores increased more for black respondents ($\overline{x}$ = 0.85, SE = 0.19) than for white respondents ($\overline{x}$ = 0.58, SE = 0.10). Although respondents with lower incomes preferred native plant landscaping in the baseline measurement, their preferences did not change post-treatment. Lastly, white respondents' preferences for native plant landscaping in the baseline and post-treatment were higher than black respondents', but black respondents' preferences increased more than white respondents' preferences post-treatment.

Discussion

Our results suggest that providing information regarding the benefits of native plant landscaping to birds could have a positive impact on residential preferences for native plant landscaping. Residents indicated preference for landscaping that benefits urban birds. This information is important given that it demonstrates that preferences for landscaping may be more malleable than originally thought and potential benefits to birds may influence those preferences. While the preference for 50 % native plant coverage remained relatively stable, the

Table 3 Estimated coefficients and standardized coefficients of a linear regression models predicting respondent preferences for native plant landscaping coverage designs in the baseline preference scores, post-treatment preference scores, and in overall change in preferences scores from a survey of urban residents in Raleigh, North Carolina

	B (*standardized B*)		
Variable	Baseline[¥]	Post-treatment[¥]	Change in Preferences
INCOME[†]	−0.400 (−0.208)**	−0.002 (−0.101)	0.002 (0.100)
OWNERSHIP [‡]	0.505 (0.213)**	−0.028 (−0.011)	−0.550 (−0.241)*
EDUCATION [§]	−0.033 (−0.065)	0.015 (0.027)	0.052 (0.105)
RACE[ǀ]	−1.361 (−0.549)***	−0.830 (0.315)***	0.494 (0.205)*
BIRDFEEDER [¶]	0.009 (0.004)	0.133 (0.052)	0.073 (0.031)
Intercept	5.872***	6.315***	0.494
R^2 (adjusted R^2)	0.300 (0.271)	0.113 (0.075)	0.070 (0.030)

[†] Income (in thousands) after taking midpoint of income category

[‡] Ownership (0 = renter, 1 = owner)

[§] Education (1 = high school/GED, 2 = vocational/technical/trade school certificate, 3 = some college course work, 4 = undergraduate degree, 5 = graduate degree)

[ǀ] Race (0 = white, 1 = black)

[¶] Birdfeeder (0 = no bird feeders, 1 = bird feeders)

[¥] Preference (7 pt Likert scale where 1 = strongly do not prefer and 7 = strongly prefer)

* $p = 0.10$; ** $p = 0.05$; *** $p = 0.01$

effects of information sharing were seen in the overall shift of preferences from the lower percentage native plant coverages in the baseline measurement towards the higher percentage native plant coverages in the post-treatment measurements. One potential explanation for these results is a recent shift in people's value orientations towards wildlife from the more traditional use-oriented perspectives to protection-oriented perspectives (Fulton et al. 1996; Manfredo et al. 2003). Thus, respondents' post-treatment preferences for native plant landscaping may have been influenced by their desire to protect birds. Another plausible explanation for these findings may be found in E. O. Wilson's Biophilia hypothesis, which suggests humans have an instinctive bond with biodiversity and an urge to be connected to it (Wilson 1984; Peterson and Rodriguez 2012). Social desirability bias among respondents who potentially believed interviewers wanted to protect birds may also have contributed to the effects identified in the study. However, the lack of sensitive questions typically linked to social desirability bias in our survey and our effort to minimize such effects (Krumpel 2013) should limit, if not eliminate, this form of bias. Future research exploring these potential explanations, particularly using experimental protocols, would strengthen assertions about how wildlife education may change public preferences for native plant landscaping.

Residential landowners may not be making initial landscaping decisions because the high preferences for native plant landscaping observed in our results are not reflected in the turf grass landscaping that is prevalent in Raleigh, NC. New residential property landscaping choices are likely made by developers prior to property sales; developers may choose turf grass landscaping because they believe it has greater curb appeal, and therefore may increase the likelihood of sale, is easier and less expensive to install than native plant landscaping, or because it conforms to local codes (Helfand et al. 2006). Similarly, residents who re-landscape are likely to choose landscaping that reflects neighborhood landscaping trends. Previous literature suggests neighborhood social norms, behavioral expectations within a neighborhood, play a significant role in residents' landscaping choices (Nassauer et al. 2009; Peterson et al. 2012). Thus, "lawn conformists" create turf grass inertia in most US residential neighborhoods (Kaufman and Lohr 2002, p. 294).

Despite the relatively large and consistent treatment effect of information sharing on landscaping preferences, homeownership and race were also related to changes in native plant landscaping preferences. These changes may have several possible explanations. Owners may be less inclined than renters to indicate preference for landscaping that benefits birds because owners face higher risks if landscaping influences property values. Native plant landscaping is sometimes perceived as messy and unappealing (Nassauer 1995), and such perceptions could raise concerns about property values. Also, owners of messy properties may be perceived as bad stewards (Nassauer 1997), and as in the farming community, respect as a homeowner may be linked to how well the owner's yard is maintained (Egoz et al. 2006). Though little is known about the effect of landscaping coverage on property values, research on the effect of community gardens and trees on neighborhood property values does exist, and shows that, despite their perceived messiness, trees and gardens can have a positive effect on neighboring property values (Anderson and Cordell 1988; Orland et al. 1992; Voicu and Been 2008). Thus, correcting assumptions about the effect of "messy" landscapes on residential property values may ease homeowner concerns about adopting native plant landscaping to benefit wildlife. Neighborhood norms also may be more important to homeowners, who typically have longer tenure than renters (DiPasquale and Glaeser 1999). Thus, stronger neighborhood norms supporting turf grass may temper homeowner preference and implementation for landscaping that benefits wildlife. Paradoxically, research by Peterson et al. (2012) suggests that for our sample of respondents, neighbors preferred native plant landscaping despite other neighbors' assumptions otherwise. If these erroneous assumptions about neighborhood norms are corrected, homeowners may actually be the most likely to implement landscaping changes to benefit wildlife because pressure to make the changes associated with neighborhood norms would promote wildlife-friendly landscaping.

Black respondents may have been swayed, more than white respondents, by the purported benefits of native plant landscaping for birds because they had lower preferences for native plant landscaping initially and, therefore, had more room for change in preference. Several studies have suggested that African heritage, ancestral history of slavery, and racial discrimination are responsible for lower concerns for the environment among blacks (Cleaver 1969; Taylor 1989). Related research suggested black and Latino attitudes towards wildlife may range from fear or dislike to indifference to active appreciation (Kellert 1976; Van Velsor and Nilon 2006) depending on individual's demographic background, the messages they are given about the value of wildlife, place of residence (ie, urban vs rural), and the type of interactions they have had with wildlife (ie, positive or negative; Van Velsor and Nilon 2006). This flexibility in blacks' preferences highlights the potential value of wildlife-related educational programs such as the US Forest Service's More Kids in the Woods initiative, which focuses on providing opportunities for black and other minority children to gain hands-on experience in natural areas. Such programs may be most effective if they facilitate access to wild places, providing mentoring from adults, and promote positive encounters with wildlife (Van Velsor and Nilon 2006).

Efforts to inform the public about the benefit of native plant landscaping to birds offers a viable strategy for making urban areas more wildlife-friendly. Given the decision-making power urban residents have over major portions of urban areas (Breuste 2004; Grimm et al. 2008), promoting the benefits of native plant landscaping to birds through education could help reduce environmental degradation, increase ecosystem services associated with native landscaping, and provide critical habitat for urban wildlife. Although shifting urban landscaping to more wildlife-friendly designs would likely be difficult, the same norm-driven inertia that preserves turf grass landscaping, despite residents' preferences, would likely protect native plant landscaping once adopted. Further research should attempt to determine if changes in preferences or broad willingness to adopt native plant landscaping to benefit birds extends to other species. Although understanding residents' preferences for native plant landscaping is important, future research should determine how structural barriers (eg, homeowner's association rules) moderate the relationships between wildlife-friendly landscaping preferences and actual landscaping decisions. Research and education must also extend to developers to gain a better understanding of the motivations behind their landscaping decisions and to determine if education about urban residents' preferences for landscaping and the benefits of native plant landscaping to birds would influence their landscaping decisions.

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References

Adams CE, Lindsey KJ (2010) Urban wildlife management, 2nd edn. CRC Press, New York

Anderson LM, Cordell HK (1988) Residential property values improved by landscaping with trees. Landsc Urban Plan 15(1–2):153–164

Bijoor NS, Czimczik CI, Patakiand DE, Billings SA (2008) Effects of temperature and fertilization on nitrogen cycling and community composition of an urban lawn. Glob Chang Biol 14:2119–2131

Bjerke T, Ostdahl T, Kleiven J (2003) Attitudes and activities related to urban wildlife: Pet owners and non-owners. Anthrozoös 16(3):252–262

Bormann FH, Balmori D, Geballe GT (1993) Redesigning the American lawn: a search for environmental harmony. Yale University Press, New Haven

Brabec E, Schulte S, Richards P (2002) Impervious surfaces and water quality: a review of current literature and its implications for watershed planning. J Plan Lit 16:499–514

Breuste JH (2004) Decision making, planning and coverage for the conservation of indigenous vegetation within urban development. Landsc Urban Plan 68:439–452

Buijs AE, Elands BHM, Langers F (2009) No wilderness for immigrants: cultural differences in images of nature and landscape preferences. Landscape Urban Plan 91(3):113–123

Cleaver E (1969) The land question and black liberation. In: Scheer R (ed) Post prison writings and speeches. Random House, New York

Czech B, Krausman PR, Devers PK (2000) Economic associations among causes of species endangerment in the United States. J Bioscience 50(7):593–601

Decker DJ, Gavin TA (1987) Public attitudes toward a suburban deer herd. Wildlife Soc B 15:173–180

DiPasquale D, Glaeser EL (1999) Incentives and social capital: are homeowners better citizens? J Urban Econ 45:354–384

Egoz S, Bowring J, Perkins HC (2006) Making a "mess" in the countryside: organic farming and the threats to sense of place. Landsc J 25(1):54–66

Ewing R, Pendall R, Chen D (2002) Measuring sprawl and its impact. Smart Growth America. http://www.smartgrowthamerica.org/research/measuring-sprawl-and-its-impact/. Accessed on 5 May 2013

Fulton DC, Manfredo MJ, Lipscomb J (1996) Wildlife value orientations: a conceptual and measurement approach. Hm Dimens Wildl 1(2):24–46

Grimm NB, Faeth SH, Golubiewski NE, Redman CL, Wu J, Bai X, Briggs JM (2008) Global change and the ecology of cities. Science 319:756–760

Helfand GE, Park JS, Nassauer JI, Kosek S (2006) The economics of native plants in residential landscape coverages. Landsc Urban Plan 78:229–240

Jorgensen A, Hitchmough J, Dunnett N (2007) Woodland as a setting for housing-appreciation and fear and the contribution to residential satisfaction and place identity in Warrington New Town, UK. Landsc Urban Plan 79:273–287

Kaplan R, Austin ME (2004) Out in the country: sprawl and the quest for nature nearby. Landsc Urban Plan 69:235–243

Kaufman AJ, Lohr VI (2002) Where the lawn mower stops: the social construction of alternative front yard ideologies. In: Shoemaker CA (ed) Interaction by design: bringing people and plants together for health and well-being. Iowa State Press, Iowa City, pp 291–300

Kellert SR (1976) Perceptions of animals in American society. In Transactions of the 41st North American Wildlife and Natural Resources Conference 533-546

Kirkpatrick J, Daniels G, Zagorski T (2007) Explaining variation in front gardens between suburbs of Hobart, Tasmania, Australia. Landsc Urban Plan 79:314–322

Krumpel I (2013) Determinants of social desirability bias in sensitive survey: a literature review. Qual Quant 47:2025–2047

Larsen L, Harlan S (2006) Desert dreamscapes: residential landscape preference and behavior. Landsc Urban Plan 78:85–100

MacAurthur RH, MacArthur JW (1961) On bird species diversity. Ecology 42(3):594–598

Manfredo MJ, Teel TL, Bright AD (2003) Why are public values toward wildlife changing? Hum Dimens Wildl 5:287–306

Martin CA, Warren PS, Kinzig A (2004) Neighborhood socioeconomic status is a useful predictor of perennial landscape vegetation in residential neighborhoods and embedded small parks of Phoenix, AZ. Landsc Urban Plan 69:355–368

McFarlane A (2006) Who fits the profile? Thoughts on race, class, clusters and redevelopment. Geo State Law Rev 23(1):1–16

Milesi C, Elvidge CD, Dietz JB, Tuttle BT, Nemani RB (2005) Mapping and modeling the biogeochemical cycling of turf grasses in the United States. Environ Manag 36:426–438

Morris J, Bagby J (2008) Reducing environmental impacts: lawn and garden care-case study. Int J Life Cycle Ass 13:226–234

Nassauer JI (1983) Framing the landscape in photographic simulation. J Environ Manag 17:1–16

Nassauer JI (1995) Messy ecosystems, orderly frames. Landsc J 14(2): 161–170

Nassauer JI (1997) Cultural sustainability: Aligning aesthetics and ecology. In: Nassauer JI (ed) Placing nature: Cuture and landscape ecology. Island Press, Washington DC, pp 67–83

Nassauer JI, Wang Z, Dayrell E (2009) What will the neighbors think? Cultural norms and ecological coverages. Landsc Urban Plan 92: 282–292

Orland B, Vining J, Ebreo A (1992) The effect of street trees on perceived values of residential property. Environ Behav 24:298–325

Owen D (2009) Green metropolis: Why living smaller, living closer, and driving less are the keys to sustainability. Penguin, New York

Peterson MN, Rodriguez SL (2012) Human dimensions of wildlife management. In: Silvy NJ (ed) The Wildlife Techniques Manual: Management Volume 2, 7th edn. Johns Hopkins University Press, Baltimore, pp 1–20

Peterson MN, Thurmond B, McHale M, Rodriguez SL, Cook M, Grove JM (2012) Predicting native plant landscaping preferences in urban areas. Sustain Cities Soc 5:70–76

Priest MW, Williams DJ, Parton WJ (2000) Emissions from in-use lawnmowers in Australia. Atmos Environ 34:657–664

Robbins P, Birkenholtz T (2003) Turfgrass revolution: measuring the expansion of the American lawn. Land Use Policy 20:181–194

Schuman H, Hatchett S (1974) Black racial attitudes. Institute for Social Research, Ann Arbor

Spronken-Smith RA, Oke TR, Lowry WP (2000) Advection and the surface energy balance across an irrigated urban park. Int J Climatol 20:1033–1047

Sudman S, Bradburn NM (1974) Response effects in surveys. Aldine, Chicago

Tallamy DW (2009) Bringing nature home: How you can sustain wildlife with native plants. Timber Press, Portland

Taylor D (1989) Blacks and the environment: towards an explanation of the concern and action gap between blacks and whites. Environ Behav 21:175–205

Todorova A, Asakawa S, Aikoh T (2004) Preferences for and attitudes towards street floweres and trees in Sapporo, Japan. Landsc Urban Plan 69(4):403–416

United States Department of Agriculture Natural Resource Conservation Service (USDA NRCS) (2001) Summary report: 1997 national resources inventory (revised December 2001). Accessed on April 30, 2013 at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/nra/nri/?&cid=nrcs143_013657

Van Velsor SW, Nilon CH (2006) A qualitative investigation of the urban African-American and Latino adolescent experience with wildlife. Hum Dimens Wildl 11(5):359–370

Voicu I, Been V (2008) The effects of community gardens on neighboring property values. Real Estate Econ 36(2):241–283

Webster C (1996) Hispanic and Anglo interviewer and respondent ethnicity and gender: the impact on survey response quality. J Mark Res 33(1):62–72

Williams CK, Ericsson G, Heberlein TA (2002) A quantitative summary of attitudes towards wolves and their reintroduction (1972–2000). Wildl Soc Bull 30(2):575–584

Wilson EO (1984) Biophilia. University Press, Cambridge: Harvard

Yue C, Hurley TM, Anderson N (2011) Do native and invasive labels affect consumer willingness to pay for plants? Evidence from experimental auctions. Agric Econ 42(2):195–205

Zhou W, Troy A, Grove JM, Jenkins JC (2009) Can money buy green? Demographic and socioeconomic predictors of lawn-care expenditures and lawn greenness in urban residential areas. Soc Nat Resour 22:744–760

Zmyslony J, Gagnon D (1998) Residential management of urban front yard landscape: a random process? Landsc Urban Plan 40:295–307