Chapter 4

Socioeconomics and neighbor mimicry drive yard and neighborhood vegetation patterns

Emily Minor, J. Amy Belaire, Amélie Davis, Magaly Franco and Meimei Lin

Introduction

Residential yards are perhaps the most under-appreciated and under-studied ecosystem in the world. Although the area they cover is small on a global scale, their impact on humans is disproportionately large. In cities, where the majority of the global population lives, residential yards can comprise 25 to 35 percent of the total landscape (Mathieu *et al.* 2007; Loram *et al.* 2007) and almost half of the total urban green space (Loram *et al.* 2007), or more in developing nations (Gonzalez-Garcia and Sal 2008). The composition and configuration of yards across a city influences ecosystem service provision and quality of life for urban residents.

Yard design and management considerations can significantly influence the ecosystem services they provide (Cameron *et al.* 2012). Vegetation in residential landscapes can reduce the urban heat island effect (Akbari 2002; Loughner *et al.* 2012; Declet-Barreto *et al.* 2013), mitigate stormwater runoff (McPherson *et al.* 2011) and influence water quality and quantity (Xiao *et al.* 2007; Bedan and Clausen 2009), provide opportunities for recreation, mental restoration, and aesthetic value (Gomez-Baggethun and Barton 2013), and provide privacy and a buffer against outside noise (Bolund and Hunhammar 1999). Residential yards can contribute to bird and pollinator conservation (Daniels and Kirkpatrick 2006; Lerman and Warren 2011; Belaire *et al.* 2014; Lowenstein *et al.* 2014), which provides additional ecosystem services to urban residents. Exposure to plant and animal diversity has been linked to human well-being (Fuller *et al.* 2007) and may encourage a greater connection with and concern for nature (Pyle 1978; Miller 2005).

Yard decisions are influenced by a large number of factors, including neighborhood rules or norms (Nielsen and Smith 2005; Nassauer *et al.* 2009), income ('the luxury effect,' Hope *et al.* 2003), social status ('ecology of prestige,' Grove *et al.* 2006), age (Meléndez-Ackerman *et al.* 2014), and personal considerations such as aesthetic preferences, environmental values and practicality of maintenance (Larsen and Harlan 2006; Larson *et al.*

2009; Larson *et al.* 2010). Neighborhood-scale social norms appear to have an especially dramatic influence on yard preferences (Nassauer *et al.* 2009), and several studies have demonstrated that residents mimic nearby neighbors' yard and garden designs (Zmyslony and Gagnon 2000; Hunter and Brown 2012). Mimicry was observed in the landscaping of front yards in Montreal (Québec, Canada; Zmyslony and Gagnon 2000) and in the presence of easement gardens in Ann Arbor (Michigan, USA; Hunter and Brown 2012) but was only found once in a study of gardens on 13 streets in Hobart (Tasmania, Australia; Kirkpatrick *et al.* 2009).

In large cities with diverse human populations, residents are often segregated according to income and racial or ethnic differences (Logan and Stults 2011). These socioeconomic clusters, when combined with social norms and mimicry, can result in distinct clusters of similar yards and create emergent patterns in vegetation and biodiversity across the city. In this paper, we examined socioeconomic drivers and neighbor mimicry in yard vegetation in residential neighborhoods in Chicago, Illinois (USA). Here we use the North American term 'yard' to refer to any outdoor green space around a house, including turf grass, trees and shrubs, and planted garden beds. Similar studies in the United Kingdom and elsewhere use the term 'garden' instead (e.g. Smith *et al.* 2005).

Methods

Study sites

Our study took place in Chicago, IL (USA), a city with approximately 2.7 million residents (U.S. Census Bureau 2014). We selected 25 residential neighborhoods dominated by single family homes. Neighborhoods were stratified across household income and separated from each other by at least 1.5 km. In each neighborhood, we surveyed front yards on a single street segment along one city block. These 'blocks' are considered our 'neighborhoods' and the two terms are hereafter used interchangeably. We surveyed all yards in each neighborhood except those in front of abandoned houses (e.g. houses with boards over the windows) and those in front of apartment buildings.

The standard Chicago lot is 25 ft (~ 7.5 m) by 125 ft (~ 38 m), although average lot size varies from block to block and houses are sometimes built on multiple lots. Most residential neighborhoods in Chicago have a strip of land between the street and the sidewalk, which is referred to as the 'parkway' (similar to 'easement area' in Hunter and Brown 2012). The city has right-of-way in the parkway and plants street trees there, but home owners are responsible for maintaining any other vegetation. Because the parkway is susceptible to disturbance (e.g. from road work, dogs, pedestrians, utility access, etc.), turf grass is a common ground cover. For all yards, we recorded vegetation on the private property and, separately, on the parkway.

Yard data

We collected data in August 2013. We divided front yards into four different zones (Figure 4.1): the 'parkway' zone, which included the entire parkway; the 'house' zone (within 0.5 m of the house); the 'sidewalk' zone (within 0.5 m of the sidewalk); and the 'middle' zone, which included the remaining

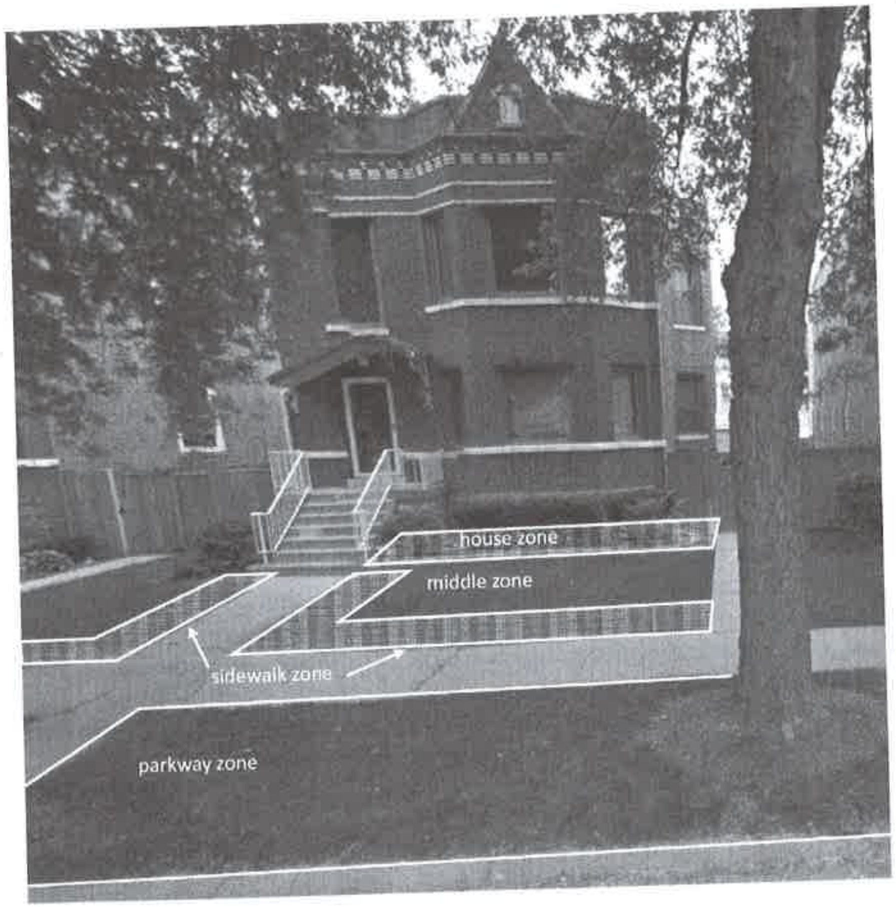

Figure 4.1 Four planting zones were used to examine vegetation heterogeneity in residential yards: the 'house' zone (within 0.5 m of the house), the 'sidewalk' zone (within 0.5 m of the main sidewalks), the 'middle' zone, which included the remaining area of the front yard between the house and sidewalk zone, and the 'parkway' zone (public right-of-way near the street). A street tree is shown in the parkway in the lower right corner of the figure.

area of the front yard between the house and sidewalk zone. In each zone, we noted the presence or absence of vegetation in six different layers: woody vegetation < 1 m tall, woody vegetation 1 – 3 m tall, woody vegetation > 3 m tall, herbaceous vegetation < 0.5 m tall, herbaceous vegetation 0.5 – 1 m tall, and herbaceous vegetation > 1 m tall. By adding up the number of layers in each zone, we could estimate the amount of vegetation in each part of the yard. Because street trees are planted by the city and outside of residents' control, we did not include them in our analysis. We summed all other vegetation layers in all zones (maximum value = 23) to obtain a crude measure of vegetation heterogeneity for the yard. We also examined vegetation planted in the parkway (excluding street trees), referred to as 'parkway gardens' from here forward. We checked for presence or absence of 32 common plants or plant groups (Table 4.1) in each yard and also

Table 4.1 Plants recorded in each yard, listed from most common to least common

Plant	*% yards present*	*% homes on block min–max*
Hosta (*Hosta spp.*)	42%	18%–89%
Ornamental flowers[1]	41%	0%–94%
Yew (*Taxus spp.*)	31%	0%–78%
Rose (*Rosa spp.*)	23%	5%–58%
Cedar (*Juniperus spp. or Thuja spp.*)	22%	0%–50%
Ornamental grass[2]	20%	4%–50%
Ground cover[3]	15%	0%–41%
Geranium (*Pelargonium spp.*)	14%	0%–32%
Vegetables or herbs[4]	13%	0%–50%
Petunia (*Petunia spp.*)	13%	0%–29%
Day lily (*Hemerocallis spp.*)	12%	0%–39%
Impatiens (*Impatiens spp.*)	10%	0%–32%
Boxwood (*Buxus spp.*)	10%	0%–29%
Hydrangea (*Hydrangea spp.*)	9%	0%–35%
Sedum (*Sedum spp.*)	8%	0%–24%
Begonia (*Begonia spp.*)	8%	0%–29%

(continued)

Table 4.1 (continued)

Plant	% yards present	% homes on block min–max
Marigold (*Tagetes* spp.)	7%	0%–15%
Black-eyed susan (*Rudbeckia* spp.)	5%	0%–39%
Coneflower (*Echinacea* spp.)	4%	0%–39%
Spirea (*Spirea* spp.)	3%	0%–17%
Aster (*Aster* spp.)	3%	0%–16%
Scarlet sage (*Salvia coccinea*)	2%	0%–14%
Zinnia (*Zinnia* spp.)	2%	0%–10%
Milkweed (*Asclepias* spp.)	1%	0%–13%
Dianthus (*Dianthus* spp.)	1%	0%–6%
Viola (*Viola* spp.)	1%	0%–7%
Snap dragon (*Antirrhinum* spp.)	1%	0%–7%
Allium (*Allium* spp.)	1%	0%–4%
Hibiscus (*Hibiscus* spp.)	1%	0%–6%
Cat mint (*Nepeta* spp.)	1%	0%–5%
Celosia (*Celosia* spp.)	<1%	0%–5%
Coreopsis (*Coreopsis* spp.)	<1%	0%–5%

[1] Any flowering, ornamental plant not included on the checklist
[2] Includes true grasses (family Poaceae), sedges (family Cyperaceae), and rushes (family Juncaceae); excludes turf grass
[3] Vines or other low-growing plants that tend to form runners or stolons and spread across the ground
[4] Edible plants grown for food or flavoring

noted the presence of any flowering, ornamental plant that was not on the checklist. The plant list included the most common ornamental flowering plants (mostly herbaceous species) observed in residential neighborhoods during a previous study (Lowenstein *et al.* 2014) and was supplemented with several woody plants and a few broad plant groups (e.g. 'vegetables or herbs') that are common in Chicago neighborhoods. We summed the total number of plant types from Table 4.1 in each yard (referred to as 'yard-scale plant diversity' hereafter).

GIS data and predictor variables

We counted the number of homes surveyed on each block. We geocoded all addresses in ArcGIS 10.2 and linked each yard to a parcel in a 2011 cadastral dataset. We measured the size of each parcel and calculated the distance between all parcels on a block with the 'Generate Near Table' tool in ArcGIS. We used block-group data from the 2008–2012 American Community Survey (ACS) 5-Year Estimates (U.S. Census Bureau) to measure several variables for each block: median household income in the past 12 months (in 2012 inflation-adjusted U.S. dollars); percent of residents who self-report as white, black or African American, Asian, and Hispanic; percent of homes that are renter occupied (from the tenure variable); median age of residents; and mean year that neighborhood homes were built. Homes built before 1940 (the earliest records available) were assumed to have been built in 1935, although many Chicago homes were built several decades earlier. Finally, we calculated the percent of residents under age 18 from the 2010 decennial census data (U.S. Census Bureau).

Before conducting statistical analyses, we tested for collinearity among the socioeconomic variables. The percent of residents who self-report as black was significantly correlated with several other variables: the percent of residents who self-report as white ($r = -0.88$, $p < 0.001$), the percent of residents who self-report as Asian ($r = -0.42$, $p = 0.04$), and the percent of residents who self-report as Hispanic ($r = -0.57$, $p = 0.003$). To reduce potential issues with multicollinearity, we removed the percent of residents who self-report as black as a variable in our models. We assumed that the percent of residents who self-report as white was a sufficient proxy for the percent who self-report as black because of the high negative correlation between the two variables. The remaining pairs of variables had correlation coefficients $\leq |0.55|$.

Data analysis

We started by examining the amount of vegetation in each yard zone and how this varied between yards and neighborhoods. We used Multi-Response Permutation Procedures (MRPP) to ask whether yards in the same neighborhood were more similar to each other than would be expected by chance. MRPP is a non-parametric, permutation-based procedure for testing the hypothesis of no difference between groups (in our case, 'groups' were neighborhoods) (McCune and Grace 2002). We used Euclidean distance to examine differences in number of vegetation layers in each of the four zones (excluding street trees). Distances were converted to ranks prior to analysis. The A statistic describes within-neighborhood homogeneity compared to random expectation and would be highest ($A = 1$) if yards in the same neighborhood were identical to each other. MRPP was conducted in PC-ORD 6.0 (McCune and Mefford 2011).

We were also interested in identifying potential mimicry among neighbors, which could appear as spatial autocorrelation or clustering in yard design (Figure 4.2). We tested for spatial patterns in the following factors: yard-scale plant diversity, vegetation heterogeneity, and presence of parkway gardens. Sample sizes were not large enough to analyze each neighborhood separately so we combined data from all neighborhoods for these analyses.

For spatial analyses, we used an approach similar to Zmyslony and Gagnon (2000) to estimate and standardize the distance between homes. We did this because the average width of parcels varied between neighborhoods, and we wanted a standardized distance measure to characterize the number of homes between any two parcels in a neighborhood. We first calculated the distance between all pairs of homes in each neighborhood. We then divided each pair-wise distance by the average nearest-neighbor distance in that neighborhood. The resulting quotient approximates the number of houses that separates each pair of houses. The maximum value calculated for any pair of houses in the same neighborhood was 20.3, indicating that they were separated by 20 houses. This standardized distance measure was used in Moran's I and join count analyses, described in the following paragraph.

We used Moran's I to test for spatial autocorrelation in yard-scale plant diversity and vegetation heterogeneity. Moran's I varies from [–1, +1], with negative values indicating negative spatial autocorrelation and positive values indicating positive spatial autocorrelation. We used correlograms to plot Moran's I against separation distance between houses. We used join count

Figure 4.2 Example of yard mimicry for yard features in the 'house zone' for three houses in a Chicago, Illinois (USA) neighborhood. Each yard contains numerous small, well-pruned evergreen shrubs of diverse shapes and sizes in the house zone. Photo from Google StreetView.

statistics to test for clustering of parkway gardens. A 'join' is a connection between two points (in our case, two yards) and can be defined based on different separation distances, similar to the correlogram. The join count statistic compares the number of joins that share a categorical attribute (e.g. a parkway garden) to what would be expected under random conditions. Moran's I and join count statistics were calculated in PASSaGE v2 (Rosenberg and Anderson 2011), using 999 permutations to test for statistical significance.

Finally, we calculated the following neighborhood-level variables: (1) mean vegetation heterogeneity per yard, (2) percent of yards with parkway gardens, (3) mean yard-scale plant diversity, and (4) total number of plant types present anywhere on the block, called 'neighborhood-scale plant diversity'. These neighborhood-level variables were response variables in four multiple regression models, with the socioeconomic variables described above as predictors. For the model of neighborhood-scale plant diversity, we also added yard-scale plant diversity as a possible predictor variable. We examined all possible combinations of predictor variables and ranked the models using AICc. All models with strong support ($\Delta AICc < 2$) were considered.

Results

We examined 632 yards in 25 neighborhoods. The number of yards per neighborhood ranged from 13 to 43, depending on the length of the block, whether homes were present on both sides of the street, and the presence of any abandoned homes or apartment buildings. The neighborhoods spanned a wide range of household income and racial composition (Table 4.2).

The average yard contained 2.9 of the 32 plant types on our checklist (range 1.2–4.8 per neighborhood). Seventy-eight percent of yards contained at least one ornamental flowering plant, many of which were not on our list. The most common plants on our checklist were hostas (in 42 percent of yards), yews (31 percent of yards), roses (23 percent of yards), cedars (22 percent of yards) and ornamental grasses (20 percent of yards) (Table 4.1).

The house zone was the most common location for plantings (88 percent of yards had vegetation other than turf grass planted in this zone) while the parkway zone was the least common location for plantings (Figure 4.3). Excluding street trees (which are planted and managed by the city) and turf grass, only 18 percent of yards had vegetation planted in the parkway; on one block, none of the yards had a parkway garden. The MRPP analysis revealed significant differences among blocks in terms of the number of vegetation layers in each zone ($A = 0.15$, $p < 0.001$).

We found significant spatial autocorrelation in vegetation heterogeneity and yard-scale plant diversity (Figure 4.4). Vegetation heterogeneity was consistently and positively spatially autocorrelated ($0.10 < Moran's\ I \leq 0.24$) for all distance classes up to and including nine houses apart. Yard-scale plant diversity had a less consistent pattern and lower spatial

Table 4.2 Neighborhood characteristics (n = 25)

Socioeconomic variables	*Mean (min–max)*
Number of homes in neighborhood	25 (13–43)
Parcel size (m^2)	374 (274–609)
Median household income (USD)	49,196 (25,000–93,464)
% white residents	42 (0–97)
% black or African American residents	38 (0–100)
% Asian residents	7 (0–52)
% Hispanic residents	27 (0–95)
% of homes that are renter occupied	45 (0–74)
Median age of residents	36 (29–54)
Mean year homes were built	1952 (1938–1971)*
% of residents under age 18	24 (15–38)
Yard variables	*Mean (min–max)*
Total vegetation heterogeneity	3.8 (2.4–8.7)
Yard-scale plant diversity	3.3 (1.6–5.8)
Neighborhood-scale plant diversity	19.2 (9–27)
% of homes with parkway gardens	18.2 (0.0–44.4)

*This is an underestimate of the age of many homes. The earliest records available start at 1940, although many Chicago homes were built several decades earlier.

autocorrelation values (0.08 < *Moran's I* < 0.16) across the same distance classes. Join count analysis indicated that there were more pairs of homes with parkway gardens than would be expected by random chance in the first five distance classes, although the difference was only significant for the first distance class (Figure 4.5). After the first distance class, the number of observed 'joins' with parkway gardens did not differ significantly from what would be expected by random chance. This suggests that parkway gardens are spatially clustered, especially within one house of each other.

The multiple regression models indicated that median household income was positively related to all measures of vegetation and biodiversity (Table 4.3). The percent of Hispanic residents was positively related to

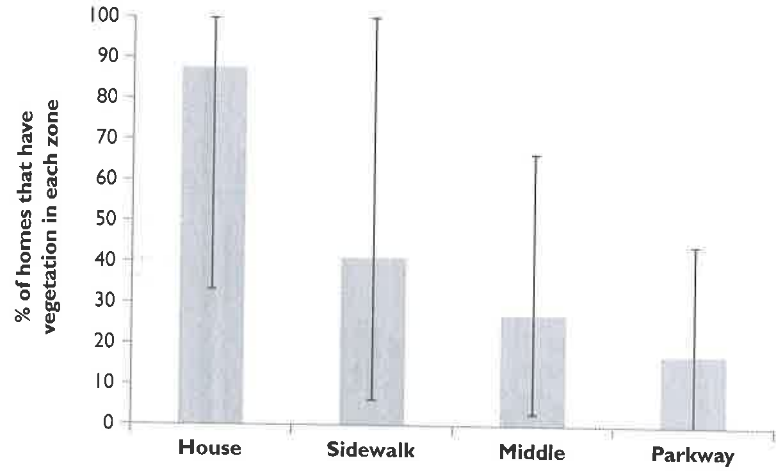

Figure 4.3 The percentage of all houses with vegetation in each zone (excluding turf grass and street trees) is shown with thick gray bars. Black vertical error bars show minimum and maximum values among neighborhoods.

several response variables, including yard-scale plant diversity and neighborhood-scale plant diversity. However, the percent of Hispanic residents was negatively associated with parkway gardens. The percent of residents under age 18 tended to be negatively associated with vegetation and biodiversity, while percent of renter-occupied homes was positively associated with most response variables. Neighborhoods with larger lots had greater vegetation heterogeneity and yard-scale plant diversity.

Discussion

We found that yard design and composition varied among yards and neighborhoods. Within neighborhoods, variation in vegetation heterogeneity was smaller than expected by chance and nearby yards tended to be similar in terms of heterogeneity, plant diversity, and presence of parkway gardens. The difference in yards from one neighborhood to another was mostly explained by a relatively small number of socioeconomic variables. In particular, household income, the percentage of Hispanic residents, and the percentage of homes that were renter occupied were important predictors for most yard characteristics. Lot size was also positively associated with vegetation heterogeneity and yard-scale plant diversity.

Our study adds to the growing literature linking income or socioeconomic status with yard characteristics (Hope *et al.* 2003; Kirkpatrick *et al.* 2007; van Heezik *et al.* 2013). In Chicago, we find evidence that lower income areas have simpler yards (in terms of yard-scale plant diversity

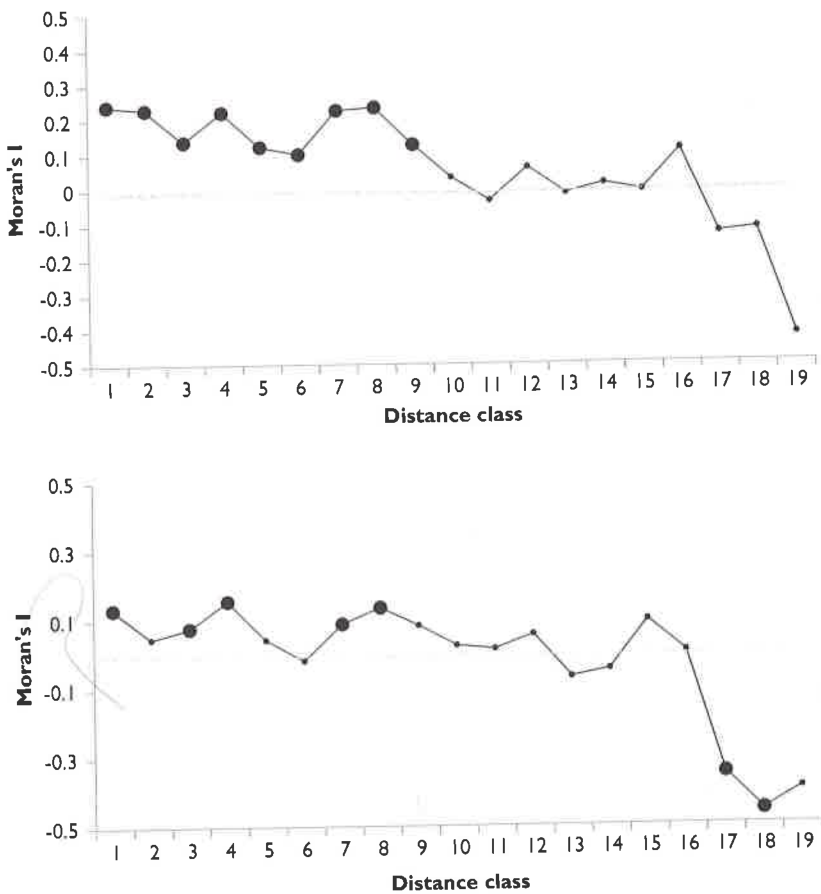

Figure 4.4 Correlograms for vegetation heterogeneity (top) and yard-scale plant diversity (bottom). Distance classes are measured in numbers of houses. Large circles indicate distance classes with significant spatial autocorrelation.

and vegetation heterogeneity), lower plant diversity at the neighborhoods scale, and fewer parkway gardens. In contrast, a study in the tropics found no links between income and yard greenness (Meléndez-Ackerman *et al.* 2014), but this could be due to many factors, from biogeographical to ecological to cultural. Furthermore, recent work in New York City (USA) and Dunedin (New Zealand) suggests that other factors such as social status (Grove *et al.* 2014) or even legacy effects from previous homeowners (van Heezik *et al.* 2014) are more important than income to vegetation patterns in residential neighborhoods. To date, the geographic extent of this literature is limited and biased toward temperate regions (especially North America, Great Britain, and, to a lesser extent, Australia and New Zealand).

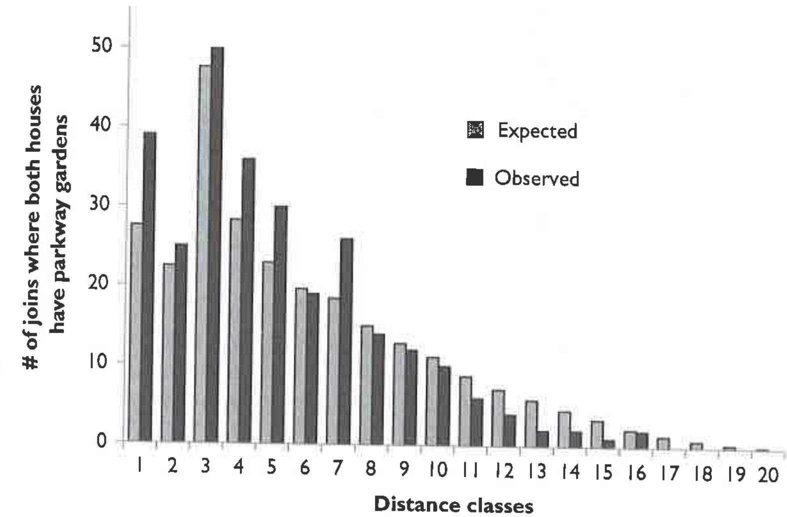

Figure 4.5 Expected and observed number (#) of 'joins', where both houses have parkway gardens. Distance classes are measured in number of houses. The difference between expected and observed is only statistically significant for the first distance class.

Studies comparing yards in different regions could help identify broader geographical trends.

Similar to other studies, we also found that lot size was positively related to vegetation heterogeneity and yard-scale plant diversity. In a study of gardens in five cities in the United Kingdom, Loram *et al.* (2008) found that larger gardens were more likely to contain cultivated borders and vegetation cover > 2 m in height. In New Zealand, garden size was an important factor explaining woody plant species richness (both native and exotic) and vegetation complexity (van Heezik *et al.* 2013). Smith *et al.* (2006) also found that larger gardens had increased species richness, and Gaston *et al.* (2007) found that larger gardens contained more wildlife friendly features. While yard size is sometimes linked with income, lot size was only marginally correlated with income in our study sites ($r = 0.38$, $p = 0.06$), suggesting that lot size can independently constrain the diversity and number of plant species residents place in their yard.

More unexpected were our findings about the relationship of renters and Hispanic residents to yard design and composition. In our study, neighborhoods with a higher percentage of renters had higher vegetation heterogeneity and yard-scale plant diversity, and neighborhoods with a higher percentage of Hispanic residents had higher yard- and neighborhood-scale plant diversity. Previous studies indicate that home owners may spend more money on their yards than renters (Behe 2006; Troy *et al.* 2007). On the other hand, home owners in the UK were more likely to use pesticides

Table 4.3 Multiple regression models of neighborhood-level yard characteristics (n = 25). Only variables included in the 'top' models (ΔAICc <2) are shown. For each variable, we show the direction of the coefficient (+ or –) and the variable importance, as calculated by summing the Akaike weights for the models in which the variable was included. A weight of 1 indicates the variable was included in all 'top' models. In cases where only a single model was identified (i.e. for vegetation heterogeneity and yard-scale plant diversity), all predictor variables are significant. For the response variables with more than one 'top' model, variable significance depends on the model and the predictor variables may be significant in some models but not in others

	Response variables			
	Vegetation heterogeneity	*Yard-scale plant diversity*	*Neighborhood-scale plant diversity*	*% parkway gardens*
# homes in neighborhood			(+) 1.0	
Lot size	(+) 1.0	(+) 1.0		
Year homes were built				(+) 0.64
% renters	(+) 1.0	(+) 1.0		(+) 0.64
% residents under 18			(–) 0.47	(–) 0.24
Median age of residents				(–) 0.36
Median house-hold income	(+) 1.0	(+) 1.0	(+) 1.0	(+) 0.17
% Hispanic residents		(+) 1.0	(+) 1.0	(–) 0.40
# of top mod-els (ΔAICc <2)	1	1	2	6
Mean r^2 of top models	0.61	0.67	0.67	0.32

(Steer *et al.* 2006) and were not associated with wildlife friendly gardens (Goddard *et al.* 2013). A survey of 1507 Americans found that a higher percentage of homeowners than renters participated in gardening and made gardening-related purchases, but this difference declined as income rose (Behe 2006). We hypothesize that in places where real estate prices are relatively high and rentals are common for higher-income residents

(e.g. Chicago), residents may personalize their residence by creating a yard that reflects their ideals.

Neighborhood ethnicity, particularly related to Hispanic residents, also played an important role in yard and neighborhood characteristics. A national survey of American homeowners found that Hispanic respondents purchased substantially more trees and shrubs than Caucasians or African Americans (Dennis and Behe 2007). Furthermore, others have observed that "admirable yard maintenance, characterized by neatly cut lawns, carefully edged grass along sidewalks, well-tended flowerbeds, and pruned shrubbery" was much more frequent among Hispanic homes compared to non-Hispanic homes in Ohio (USA) (Kent 1999, p. 51). In that same study, front yard gardens with many ornamental flowers in raised beds occurred more frequently in yards of Hispanic homes (Kent 1999). Our observations of yard features agree with these findings. However, in a separate study of the distribution of tree cover across Chicago, Davis *et al.* (2012) found that census tracts dominated by Hispanic residents had lower tree cover compared to other tracts. The authors postulated that different cultural mechanisms might be at play. That study used remotely sensed data and could not differentiate between turf grass, shrubs, and flower cover, nor did it differentiate between street trees and trees in private yards. Nonetheless, the combined findings of this study and the Davis *et al.* (2012) study indicate that cultural mechanisms may indeed be at play, with Hispanic residents preferring to invest in yard care close to the house (as opposed to the parkway), and in flowers (rather than trees). An alternate, and not mutually exclusive, explanation is that Hispanic neighborhoods in Chicago may have fewer street trees, which were not examined in our study. More research is needed to fully understand the drivers of these patterns.

Across all our study neighborhoods, yards within nine houses from each other tended to be similar in vegetation heterogeneity and plant diversity. Significant spatial autocorrelation suggests that neighbors may be mimicking each other's yard design. Mimicry was more evident in vegetation heterogeneity than in yard-scale plant diversity, perhaps because vegetation heterogeneity is a more easily observed characteristic, more easily mimicked, or may be more constrained by neighborhood norms. Research has shown that neighborhood appearance strongly affects homeowners' preferences and the actions they take in their own yards (Nassauer *et al.* 2009). However, if people feel pressured to 'keep up with the Joneses' (Dzidic and Green 2012) but do not enjoy or have time for yard work, they might prioritize a yard that resembles neighbors' yards structurally but minimizes yard care. Indeed, in our study, the most common plants tended to be low maintenance, perennial species (e.g. hostas and yews), which could indicate that people want their yards to look attractive, cared for, and socially acceptable, but do not value or recognize plant biodiversity. This may be related to lack of knowledge or lack of interest in the benefits biodiversity provides.

Parkway gardens represent an additional level of stewardship that goes beyond simply maintaining a socially acceptable yard. While it is the homeowner's legal responsibility to maintain the parkway, most residents choose to leave the parkway covered in turf grass. This was especially true in neighborhoods with more children, older residents, and Hispanic residents. However, we found that if a parkway had plantings, then nearby parkways tended to as well. It is possible that some people may be influenced to engage in more stewardship when others in the neighborhood are also doing so. A similar pattern was found in Ann Arbor, Michigan (Hunter and Brown 2012). Again, the desire to keep up with the neighbors' yard seems strong in Chicago.

Social norms are important drivers of pro-environmental behaviors such as recycling (Schultz 1999), energy conservation efforts (Nolan *et al.* 2008), and hotel towel reuse (Goldstein *et al.* 2008), but their potential to shift yard-related behaviors has never been fully explored. The spatial autocorrelation evident in yard design suggests that wildlife-friendly yard designs could catch on and 'spread' across a neighborhood. Emerging programs like Cornell Lab of Ornithology's YardMap attempt to harness the power of social norms and online social networking to encourage pro-environmental behavior in yards (Dickinson *et al.* 2013). Since several of our neighborhoods had one or zero homes with parkway gardens, our findings suggest that planting a few more parkway gardens might act as a catalyst, prompting others to do the same.

Neighborhood plant diversity is an emergent property that comes from the combination of all yards in a neighborhood. Although the percent of Hispanic residents and household income were positively related to neighborhood plant diversity, yard-scale plant diversity (which is associated with the former two variables) was not. This suggests that maximizing plant diversity at the neighborhood scale does not necessarily require great plant diversity from individual yards. In other words, many neighbors acting collectively could each do a small part in contributing to a species-rich neighborhood overall. One might speculate that neighborhood-scale plant diversity would also be higher in neighborhoods where mimicry was lower (i.e. plant composition differed from yard to yard), although we did not have enough homes in each neighborhood to examine spatial autocorrelation at that scale. More research would help shed light on whether certain neighborhoods express greater levels of mimicry than others, and what factors may be driving those differences.

The differences in vegetation heterogeneity, yard-scale plant diversity, and neighborhood-scale plant diversity among our neighborhoods likely lead to differences in provision of ecosystem services and wildlife habitat. The choices people make in their yards may have subtle or not-so-subtle effects on their quality of life and urban biodiversity. For example, increased vegetation structure and biodiversity are likely linked

with human well-being (Fuller *et al.* 2007; Luck *et al.* 2011), improved air quality (Nowak *et al.* 2006), and decreased noise (Islam *et al.* 2012), among other benefits. As our cities continue to urbanize, it is important that we not only preserve large green spaces but that we also consider the benefits that private yards provide. Indeed, the decisions that individuals make at the yard level are collectively important, yet oftentimes overlooked. By understanding the motivations behind yard decisions, we can start modifying behavior and improving the long-term sustainability of our cities.

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