2012

Heterogeneity in Residential Yard Care: Evidence from Boston, Miami, and Phoenix

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Recommended Citation

Harris, E., C. Polsky, K. Larson, R. Garvoille, D. Martin, J. Brumand, L.A. Ogden. 2012. Heterogeneity in Residential Yard Care: Evidence from Boston, Miami, and Phoenix. Human Ecology 40: 735-749.

This material is based upon work supported by the National Science Foundation through the Florida Coastal Everglades Long-Term Ecological Research program under Cooperative Agreements #DBI-0620409 and #DEB-9910514. Any opinions, findings, conclusions, or recommendations expressed in the material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Abstract

The management of residential landscapes occurs within a complex socio-ecological system linking householder decision-making with ecological properties, multi-scalar human drivers, and the legacy effects of past management. Conventional wisdom suggests that resource-intensive turfgrass yards are the most common landscaping outcome, resulting in a presumed homogeneous set of residential landscaping practices throughout North America. We examine this homogenization thesis through an interview-based, cross-site study of residential landscape management in Boston, Phoenix, and Miami. Counter to the homogeneity thesis, we find that yard management practices often exhibit heterogeneity, for example, in groundcover choice or use of chemical inputs. The degree of heterogeneity in management practices varies according to the scale of analysis, and is the outcome of a range of constraints and opportunities to which householders respond differently depending on their existing yard and landscaping preferences. This study highlights the importance of multi-scalar and cross-site analyses of decision-making in socio-ecological systems, and presents opportunities for longitudinal and cross-site research to examine the extent to which homogeneity is actually present in the management of residential landscapes over time and in diverse places.

Keywords: residential landscapes; yard management; lawns; heterogeneity; urban ecology;

Full citation: Edmund M. Harris, Colin Polsky, Kelli Larson, Rebecca Garvoille, Deborah G. Martin, Jaleila Brumand, Laura Ogden. 2012. *Heterogeneity in Residential Yard Care: Evidence from Boston, Miami, and Phoenix*. Human Ecology, 40(5), 735-749.

Introduction

Turfgrass lawns appear to be a ubiquitous feature of urban and suburban residential landscapes in the United States. An estimate for the lower 48 states suggests that U.S. turfgrass (including non-residential areas) may occupy an area three times greater than the largest irrigated crop (Milesi et al. 2005). A recent high-resolution, watershed-based study of a large suburban (1,143km^2) landscape in the Boston suburbs estimates total grass cover at 13.0% of the entire landscape, of which residential grass — "lawns" — represent 7.1% of the land cover (Polsky et al. 2012). These estimates demonstrate the dominance of turfgrass as a residential landscaping choice for urban and suburban residents. The presence of a lawn does not necessarily require the presence of resource-intensive lawn management, which can involve high inputs of water and chemical fertilizers, herbicides, insecticides and fungicides used to eliminate unwanted species from the desired monocultural turfgrass ecosystem. Yet the resource-intensive lawncare industry has boomed in recent years (Robbins 2007; Steinberg 2006). Given this variety of potential environmental and health impacts, significant criticism has emerged focusing specifically on water, chemicals, human health, and fossil fuel-based machinery (e.g., Mayer et al. 1999; Dietz et al. 2004; Glennon 2009; Robbins et al. 2001; Milesi et al. 2005; Sears et al. 2006; Hirsch and Baxter 2009; Lehman et al. 2009). Critics of the lawn have also focused on its role as a cultural landscape, arguing that lawns contribute to the homogeneity or "placelessness" of suburban sprawl, where an aesthetically perfect lawn equates with morality and good citizenship, and therefore higher social status (Pollan 1989; Jenkins 1994; Bormann et al. 2001; Robbins 2007).

The conventional wisdom that emerges in these criticisms is that monocultural lawns have grown rapidly in extent, closely following suburban expansion, and that lawns are managed in a

homogeneous fashion using significant quantities of water and potentially harmful chemicals (Bormann et al. 2001; Steinberg 2006; Robbins 2007), an idea that we refer to as the *homogenization thesis*. The result is, presumably, a residential landscape in which yard management practices are increasingly homogeneous. In this context, researchers have recently sought to understand the factors that influence the management of residential landscapes as complex socio-ecological systems (e.g., Cook et al. 2011; Roy Chowdhury et al., 2011). To address concerns about intensive yard management, it is important to understand how householders actually make management decisions.

In this article, we present findings from three coordinated qualitative studies conducted in the suburbs of three U.S. metropolitan areas. We focus on understanding how yard management decisions are affected and determined by the different components of the socio-ecological framework in which the decisions are made, including the ways in which individual householder experiences, motivations and values shape these decisions. In our analysis, we utilize a recently developed conceptual framework (Cook et al. 2011) for understanding the socio-ecology of residential landscape management that links management decisions to three other components: ecological properties, multi-scalar human drivers, and the legacy effects of previous management decisions. We extend existing work by focusing on three areas highlighted for further research by Cook et al. (2001): the real-world practices represented by *interactions* within this framework (rather than the dynamics of single components), attention to the *multi-scalar* nature of management drivers, and the advantages of a *cross-site* research design. In assessing the drivers of different yard management regimes, we balance the variety of external, structural drivers of decision-making with consideration of householder agency. While previous studies document a host of factors driving homogeneity in residential landscapes, our findings indicate that

heterogeneity prevails in management practices at a variety of scales. We argue that such heterogeneity is the outcome of interactions between a range of constraints and opportunities to which householders respond differently depending on their existing yard and landscaping preferences.

The Homogenization Thesis: Explaining Residential Landscape Management?

Attempts to understand the management of residential landscapes have hypothesized a variety of socio-cultural, political-economic, and ecological drivers operating at a variety of scales (Cook et al. 2011, Roy Chowdhury et al. 2011). Robbins' recent analysis (2007) has been particularly influential, combining data from an in-depth study in Columbus, Ohio with a national survey to examine how the external socio-economic processes that produce certain lawn management regimes combine with the ecological processes of turfgrass species themselves. Robbins divides the socio-economic drivers between the political economy and moral economy of lawn management, referencing first the pressure to consume lawn-care products and services, and second, the sense of moral responsibility to maintain one's lawn in order to uphold the social standards of the neighborhood (Robbins and Sharp 2003). In combination with the ecological needs of turfgrass, these drivers produce both industrial, chemical lawns and "lawn people" who manage resource-intensive turfgrass despite concerns about the risks for human and ecological health and declining amounts of time spent in the yard (Robbins 2007).

This analysis, most clearly expounded by Robbins (2007) but similar to others' (Jenkins 1994; Bormann et al. 2001; Larson et al. 2010; Steinberg 2006), casts "lawn people" as passive subjects[i] whose yard management practices are driven by a network of external forces that reach out from the household in circles of increasing scale: the needs of the turfgrass itself, the opinions of neighbors, neighborhood characteristics and institutions, regional norms and rules,

and ultimately nationwide drivers including the chemical industry, corporate advertising campaigns, and the cultural ideal of the perfect American lawn. This analysis produces what we term the *homogenization thesis*: a picture of a uniform residential landscape covered with a turfgrass monoculture, against which some householders struggle in vain to adopt alternative ground cover types or management regimes. The result, then, should be a homogeneous landscape, driven by homogeneous management practices.

The monocultural lawn is undoubtedly a familiar feature in residential landscapes. However, our research has demonstrated that desires, and in some cases actions, to implement alternative management regimes also may not be uncommon (Harris et al. 2012). The lawn landscape might appear homogeneous (a similar green, manicured, and weed-free turfgrass aesthetic across a neighborhood), but in fact exhibit heterogeneity in management practices, with some people using a chemically intensive approach while others opt for an organic management regime (Nielson and Smith 2005). Heterogeneity in lawn management may also manifest in non-lawn land uses, such as edible food gardens, significant tree cover, patio courtyards, and xeric yards (see Robbins et al. 2003, Mustafa et al. 2010). Indeed, as public opposition to monocultural lawns focuses on the deleterious effects of chemical use and excessive water consumption, some citizen action groups have mounted successful campaigns for pesticide restrictions and lawn management ordinances in several Canadian and U.S. municipalities (e.g. Charkes 2008; City of Toronto 2010; SafeLawns.org 2010a, 2010b), and to promote low water-use landscaping in desert cities of the U.S. Southwest (Larson et al. 2009a). Studying how alternative residential landscapes emerge in the face of powerful drivers of resource-intensive management suggests ways in which we might be able to transition toward more sustainable residential landscapes in the future that require fewer harmful inputs.

To avoid the situation in which the outcomes of socio-ecological interactions in residential landscapes appear pre-determined by the power of external driving forces, expanding the agency of the householder in our conceptual frameworks is a crucial step in a critical examination of the homogeneity thesis. Two recent studies have expanded understandings of householder subjectivity, through the role of cognitive values, beliefs and attitudes (Larson et al. 2010), and through the role of emotion in yard management practices (Harris et al. 2012). These studies highlight the diversity in individual experiences of and motivations behind yard management practices, producing contextually sensitive analyses that reveal the potential agency of householders in combination with the external, structural forces highlighted by Robbins (2007). This paper contributes to the existing literature by testing the notion of homogeneity in residential yard management practices, using a conceptual framework that links householder subjectivities and decision making to the external drivers described above.

A Conceptual Framework for the Socio-Ecology of Residential Landscapes

In this article, we adopt and expand a conceptual framework proposed by Cook et al. (2011). Drawing on existing approaches in human and urban ecology as well as an analysis of 256 separate studies of residential landscape management[ii], this framework divides the socio-ecological system into four components: management decisions, ecological properties, multi-scalar human drivers, and legacy effects. We use a simplified version of this conceptual framework, detailed in Figure 1. Interactions between framework components are illustrated by bi-directional arrows. The labels A – E in Figure 1 highlight the interactions that directly influence management decisions examined in this study.

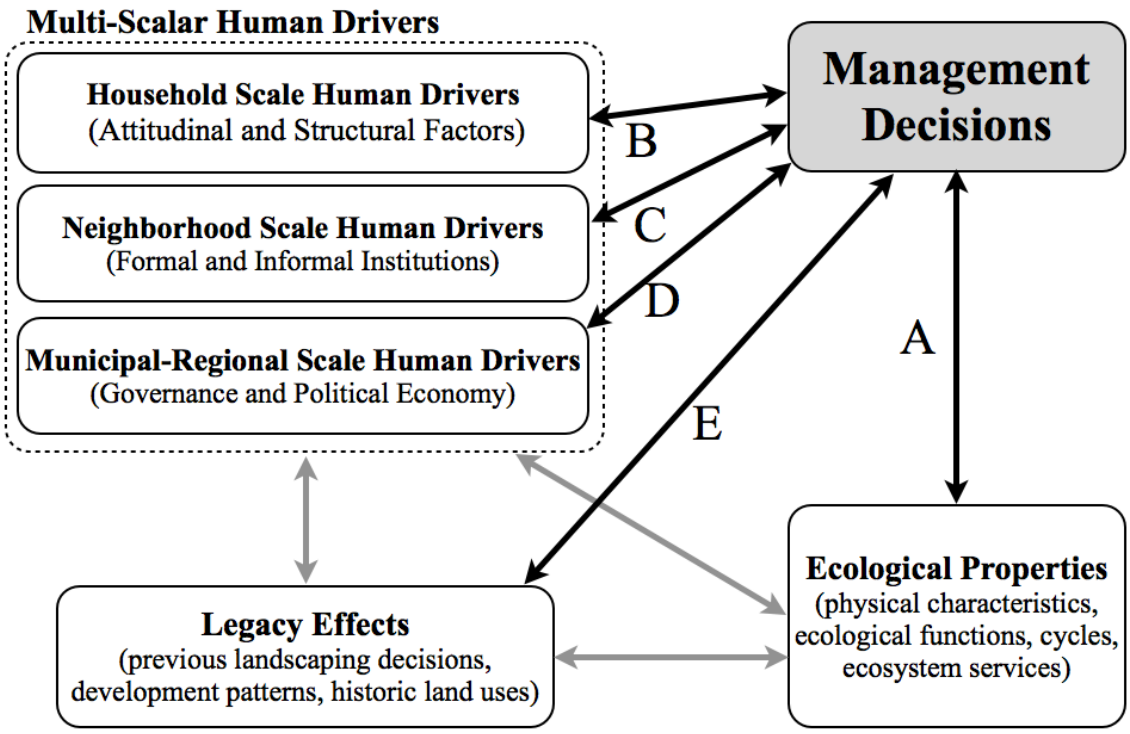


Figure 1: Conceptual Framework of multi-scalar social-ecological interactions of residential landscapes (Source: Cook et al. 2011)

To better understand the emergence of diverse residential landscapes, our study investigates the ways in which "management decisions" are influenced, constrained, or enabled through interactions with the other components of the framework. "Management decisions" captures the decision-making processes that result in a householder's landscaping regime, which potentially include groundcover choices and inputs, as well as basic maintenance such as mowing, trimming and tidying, and more complex interventions such as planting vegetation, removing features, and installing technological systems such as irrigation.

Within the multi-scalar human drivers, Cook et al. (2011, 16) follow Stern (2000) in dividing household-scale human drivers into two sections: (i) "cognitive factors [that] encompass attitudes and related judgments, such as values, beliefs, and norms," and (ii) "household and urban structure [that] involves personal and property attributes such as wealth and housing age." This distinction mirrors the division of human drivers used in other studies between the agency of individuals and structural factors (e.g. Larson et al. 2010). Neighborhood-scale human drivers refer to the formal and informal mechanisms through which norms and standards for management are reproduced and enforced, including formal neighborhood governance institutions such as Homeowners Associations. Municipal and regional-scale human drivers operate at a broader scale than the neighborhood, in both the realms of public governance and the economy, including the lawn care service and product industries. Finally, legacy effects refer to the impacts of all previous management decisions on the site, made by previous owners of the property, builders or developers, or the previous management of the site for a different land use. The elements of this framework echo arguments in political ecology for the importance of a multi-scalar perspective (Gezon and Paulson 2005; Neumann 2009), and in historical ecology for the significant role played by the legacies of past ecologies, including in urban and suburban areas (Ramalho and Hobbs 2012).

The synthesis provided by Cook et al. (2011) demonstrates the wealth of research about the dynamics of individual framework components, such as the ecology of residential yards (e.g. Thompson et al. 2003; Loram et al. 2007) or the neighborhood-scale human drivers of management decisions (e.g. Nassauer et al. 2009). Yet this review of the residential landscapes literature also highlights critical gaps in existing research. First, Cook, et al. conclude that "research efforts to date have focused primarily on the individual components of the system …

and far less is known about the interactions and tradeoffs that occur among these components" (2011, 25). The authors also note that the patterns and feedbacks that characterize these interactions "emerge across scales [and] across multiple sites and regions," highlighting two further aspects that "have not been extensively studied and are not well understood" (2011, 25). In our study of heterogeneity in residential landscape management, we focus explicitly on the *interactions* within the conceptual framework (represented by arrows in Figure 1), and draw from *cross-site* research that allows us to examine the dynamics of residential landscapes both at *multiple scales* within each site but also between three different regional ecologies.

Studying phenomena occurring at multiple scales presents an analytical challenge. As Cook et al. (2011) acknowledge, the degree of heterogeneity visible in residential landscapes depends on the scale of analysis. Specifically, while "green lawns with shade trees are often perceived as a homogeneous manifestation of 'the American Dream'" because of their presence in yards throughout the country in diverse biomes, residential landscapes vary considerably between parcels within a neighborhood, and between neighborhoods in a city (Cook et al. 2011, 22). It is only when this parcel- or neighborhood-scale variation is aggregated that the familiar picture of homogeneity can come into focus (2011, 9). This observation makes clear the influence of the researcher's choice of scalar extent on research findings regarding homogeneity or heterogeneity in residential landscapes. To address this difficulty in seeing processes operating simultaneously at multiple scales, we follow Cook et al. (2011) and Roy Chowdhury et al. (2011) by taking a multi-scalar approach to our qualitative study.

The cross-site approach outlined in the following section combines detailed, interview-based examinations of householder practices, in specific suburban neighborhoods across three different metropolitan areas with different socio-economic and biophysical characteristics. We pay

attention to the definition of heterogeneity from the perspective of the householder, whose understanding of their yard management practices often involves an understanding of their degree of difference or same-ness to those in the surrounding neighborhood. Together, this suggests a route toward an understanding of heterogeneity as a category of practice as well as a category of analysis (Moore 2008).

Research Methods

This article draws on three coordinated, in-depth qualitative studies of householder yard management conducted in single-family, suburban residential neighborhoods across Boston, Miami and Phoenix — metropolitan regions selected in order to build upon and extend existing research under the Long-Term Ecological Research program (LTER)[iii]. Using a research methodology developed through collaboration between research teams at each site, we collected a total of thirty detailed accounts of how householders manage their yards: nine interviews were conducted in the Boston region, nine in the Miami region, and twelve in the Phoenix region. Three single-family, suburban neighborhoods were selected within each metropolitan study site, chosen to represent a range of different types of residential areas. Interviewees were purposively selected from an income-stratified sample of neighborhoods, and to represent diverse demographic characteristics, yard types (ground cover), and chemical-use patterns, based on prior survey work in Boston and Phoenix (Harris, et al., 2012; Larson et al. 2010), and based on their historic ties to the area, gender and place of residence within the Miami study site. The contextual data presented in Table 1 compare the selected neighborhoods according to their demographic composition, density of family households (those with two or more related residents), proportion of owner-occupation, income, and housing age. As a function of our focus on single-family neighborhoods, the majority of the census tracts represented in this study fit the

suburban stereotype of a majority of middle- to upper-income households, and with high proportions of owner-occupancy compared to the national average (Figure 2)[iv].

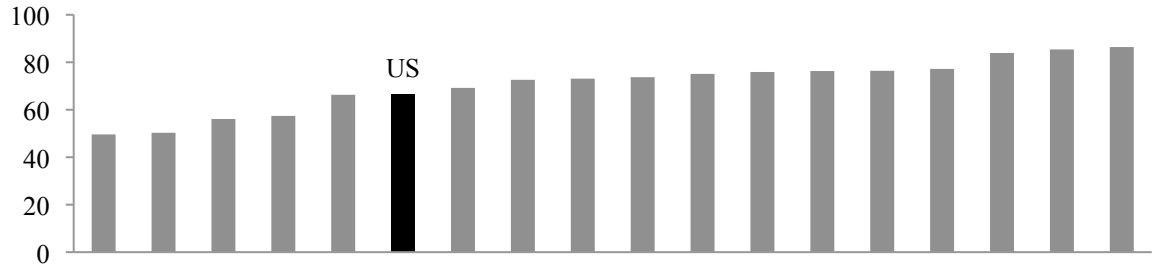
Overall, the neighborhoods studied represent a diverse sample of residents. For example, the median building age varies from pre-1939 in the oldest neighborhoods studied through the 2000s in the newest suburbs or subdivisions. In Figure 2, the census tracts included in the study are represented graphically in relation to the U.S. averages, indicating that in general the context for these interviews are neighborhoods built in the past fifty years, with household incomes at or above the U.S. average, occupied by majorities of home-owning, family households. These charts also illustrate the diversity within these neighborhoods, which is demonstrated in greater detail by the statistics presented in Table 1.

In each of the three study sites, interviewers conducted semi-structured interviews with householders. Interviewers used a thematic interview guide to guide the conversation and ensure that householders discussed the different components of the Cook et al. (2011) conceptual framework used in this study. The interviews took place in situ with householders giving a tour of their yard while describing their management practices, following a method similar to the "walking interview" that develops specific connections between the interview conversation and the objects and places being discussed (Jones et al. 2008; Inwood and Martin 2010) and has been used in research on this topic by Harris et al. (2012). Our qualitative methodology also offers the additional advantage of seeing householders' yards, since as Cook et al. observe, many studies focus only on front yards "because they are readily surveyed through field observations" (2011, 6).

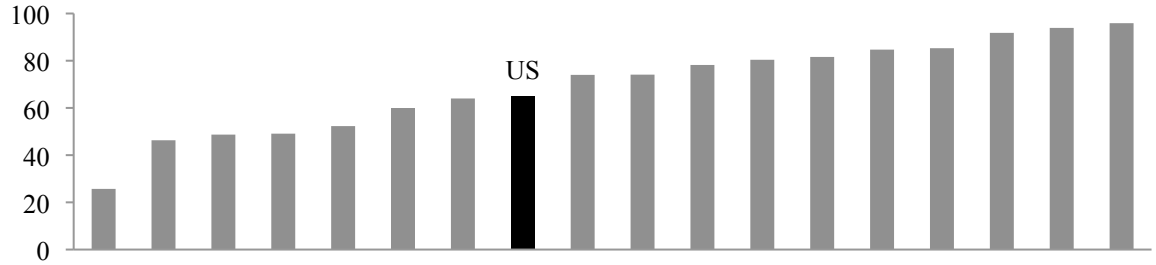
Site and neighbourhood		Census tract	Family households (%)[a,b]	Owner-occupied households units (%)[a]	Median household income ($)[c]	Median year structure built[d]	Number of households[a]	Population[a]
Boston, MA (*n*=9)	A	3321	83.9	95.9	107,431	1965	2,017	5,972
		3323	76.4	80.4	77.895	1963	2,408	6,677
	B	2113	76.3	85.3	89,792	1965	2490	6,967
		2114	66.3	78.2	77,766	1988	2,476	6,072
	C	2232	56.1	59.8	63,542	1939-	1,625	3,740
		2233	72.6	84.7	104,216	1980	2,208	5,555
	D	3333	57.4	48.7	59,333	1939-	1,706	4,063
		3335	69.2	74.0	81,048	1939-	1,946	5,001
Miami, FL (*n*=9)	E	103	77.2	81.6	60,947	1984	2,674	8,085
	F	112.02	75.1	46.3	37,720	1963	2,108	7,809
	G	110.01	73.1	25.7	31,219	1990	2,907	9,130
		110.07	75.9	64.0	46,722	2004	1,923	5,728
		114.01	73.7	52.3	49,203	2002	5,359	15,387
Phoeniz, AZ (*n*=12)	H	1119	49.6	74.1	70,500	1939-	1,064	2,239
	I	6169	50.3	49.1	55,609	1998	2,038	4,288
	J	1167.28	85.4	91.8	151,603	1996	1,568	4,612
		1167.29	86.4	93.9	129,150	1994	1,442	4,303
USA			66.4	65.1	51,452	1975		

Table 1: Study Area Contextual Data

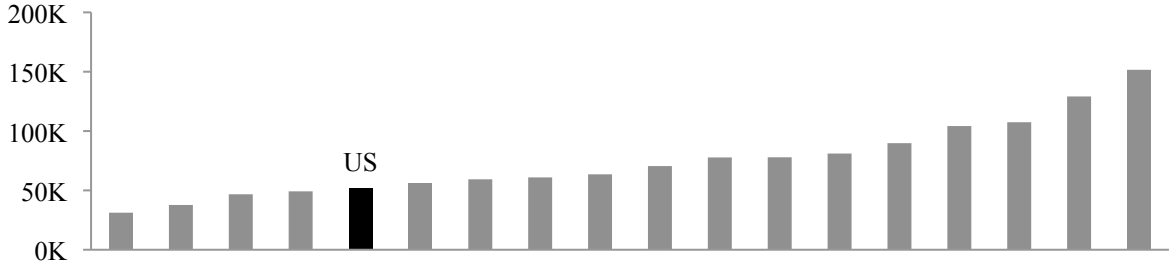
a. Family Households (%)



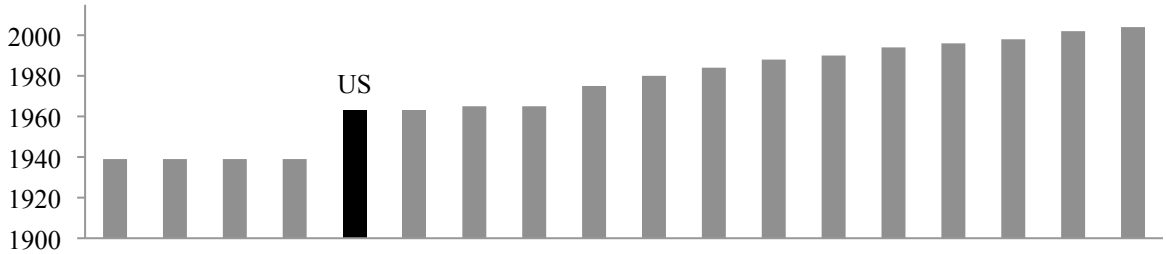
b. Owner-Occupied Household Units (%)



c. Median Household Income ($)



d. Median Year Structure Built (entries at 1939 represent median year structure built 1939 or earlier)



Data Sources:

See notes, Table 1.

Figure 2: Study Area Census Tracts in Comparison to National Average

Following transcription, we used thematic content analysis to develop codes, interpret their meaning and inter-relationships, and to develop analytic themes that iterate with and extend existing theory. Themes are defined as "recurrent and distinctive features of participants' accounts, characterizing particular perceptions and/or experiences" (King and Horrocks 2010, 150). Themes were organized into the component categories used in the conceptual framework: management decisions, ecological properties, human drivers at three scales — household, neighborhood, and municipal-regional, and legacy effects. The descriptive coding was further developed through a process of memo-writing to establish analytic themes, short statements that describe the interactions between framework components (see King and Horrocks 2010, 152–158; Emerson et al. 1995, 142–168).

Examining Interactions in the Social-Ecological Dynamics of Yardcare

To explore the homogeneity/heterogeneity of residential yard management practices, we examine how residential landscape management practices in our study sites emerged using the conceptual framework presented by Cook et al. (2011) (Figure 1). The following five sub-sections address the interactions that connect "Management Decisions" to the other components, highlighted with dark arrows labeled A – E in Figure 1.

A. Interactions between Ecological Properties and Management Decisions

Our interviewees' descriptions of their yard ecologies revealed varying levels of awareness of ecological properties and functions, including plant growth cycles and needs for sunlight, nutrients and water, species hardiness zones, the presence of wildlife, the existence of specific

microclimates within the yard, broader climatic patterns such as precipitation levels or seasonal solar tracks, and flows of water through the yard. Through an iterative analysis of thematic codes developed across the interview transcripts, the *modifiability* of different ecological properties emerged as a key factor in the relationship between management decisions and yard ecologies. We present this theme in Figure 3 by qualitatively ranking the ecological properties of yards according to their modifiability, starting with ecological features that are easy to modify, and ending with those that cannot be modified. Interviewees' explanations of their management decisions were frequently justified with comments about the ease or difficulty of modifying different ecological properties. Figure 3 includes quotes from interviewees who reference such ease or difficulty in their interview responses.

	Easily Modified	⟷		**Impossible to Modify**
Ecological properties	Annual flowers; presence of birds and insects; use of kitchen waste	Grass growth cycles; trees that shade or risk property damage; shortage of shade	Drainage patterns; flow of water; yard permeability	Climatic patterns; natural hazards
Examples of related management decisions	Planting annual flowers; birdfeeders, butterfly houses; composting	Adjust watering, fertilizer inputs to grass; remove trees; plant trees	Replacing groundcovers; re-grading yard to change drainage patterns	Management focused on mitigating effects; e.g. removing trees
Examples from interviews	"I like flowers. So I was able to add more color. Try and reduce the water footprint a little bit too. Not that the rose bushes aren't water soakers . … I'm pretty comfortable changing anything in the yard. So that's easy stuff." (P)	"the thing that stopped me from [seeding part of the yard] is why do it if we have too much slope … what I'd really like to do if I had a lot of money is to get some stone, or something to make this level step down to that level" (B) "the limestone is very hard, so planting anything outside of these [raised beds] is very difficult" (M)		"There's just the legacy of Hurricane Andrew here and the destruction that Hurricane Andrew caused. People think if they plant trees they are just going to get knocked down … [at my last house] I came home one day and [my neighbor's trees had been removed] … she was just so nervous that a hurricane was going to come along and knock them into her house." (M)

(M = Miami; P = Phoenix; B= Boston)

Figure 3: Ecological Properties Ranked by Modifiability

Linking management decisions to the ease with which ecological properties can be modified illustrates how some management decisions are guided by the biophysical characteristics of the yard and setting. However, the ways in which these characteristics ultimately affect management decisions are further determined by multi-scalar human drivers that establish the desirability of different characteristics, the resource constraints surrounding yard management, and the neighborhood and municipal contexts in which decisions are made. These components are examined in the following sections.

B. Interactions between Household-Scale Human Drivers and Management Decisions

Following Cook et al. (2011), we examine household-scale human drivers as the primary determinants of whether or not the householder decides to modify the ecological composition of their yard. These drivers are divided between cognitive factors (e.g., values, beliefs, attitudes) and household and property characteristics (e.g., income, age of housing). The thematic coding of our interviews focused initially on revealing a set of "yard preferences," an exercise that replicated many of the preferences reported by other studies (e.g., Larsen and Harlan 2006; Larson et al. 2009a). The most important factors reported by our sample of homeowners include aesthetic preferences, the desire for familiar landscapes or comfortable microclimates, preference for varying degrees of "order" (or tolerance for "disorder"), and degree of concern for the environment or sustainability (see similar findings in Larsen and Harlan 2006; Hirsch and Baxter 2009; Mustafa et al. 2010). The coding of preferences in this study supports the categorization observed in a two-sample study in the Phoenix area (Brumand 2012), where appearance,

environment, maintenance, and recreation were highlighted as the most significant factors in determining yard preferences, followed by climate, familiarity, and health or safety issues.

In addition to these "cognitive" preferences, we also note the significance of householders' affective and embodied experiences of their yards in determining their management decisions, following recent research examining the role of emotions in shaping yard management practices (Harris et al. 2012). As a distinctive attitudinal (or "cognitive") factor, the role of emotion in determining management decisions emphasizes the need to consider householders' embodied experiences of yard management, in addition to their values and beliefs. This attention to emotional interactions between householder and yard lead us to develop a further pair of thematic codes to examine this expanded "cognitive realm": the balance between "caring" and "controlling" in yard management (Figure 4). For example, a householder who exhibits a more controlling subjectivity in their management decisions might see the yard as a struggle or a challenge to maintain, and as a space in which appearance and ecology must be managed through pest control, fertilizer and herbicide application, and the removal of waste. For some interviewees, control of the yard also functioned to control their appearance to others in the neighborhood, demonstrating the extension from household management to the social aspects of neighborhood management addressed in the following section (the last quotation in Figure 4 illustrates this aspect of the controlling subjectivity). A householder who exhibits a more caring subjectivity sees the yard as a space to be nurtured, and enjoys working with the ecological characteristics rather than chemical inputs to create their desired landscapes.

Figure 4: Examples of "caring" or "controlling" approaches to yard management

Caring Subjective Orientation ⟷	**Controlling Subjective Orientation**
"I really, really wanted vegetables. I really wanted to grow my own stuff. I really wanted flowers and things. And	"I feel a constant pressure to keep up on the grass, and, so, it hangs over me … prior to getting the riding mower it was a two-hour mow and every Saturday I'd be thinking about it and if I didn't get it

I really found [gardening] therapeutic so I just stuck with it." (B)

"I don't use any pesticides in my vegetable garden … They're not here now, but this afternoon this clothes line had about 15 dragonflies on it. They just perched there, looking out and they'll take off. They'll eat the bugs … I created a situation where it's welcoming for the good guys and they take care of things for me." (B)

"I enjoy when I am working in the yard … I feel like I am taking care of it, and it's kind of relaxing and nurturing." (M)

"[In Minnesota] I had roses that I took care of every year and babied and did a lot of just annual flowers and that sort of thing, but [in Phoenix] it's so different and it's hard to get anything to live in the summertime so I just kind of gave up on trying to… we do some potted stuff, some container gardening, but not a lot. I have a little strawberry pot right now that I'm doing with my granddaughter and so she enjoys looking at it everyday and seeing the progress that coming and making sure we get it watered and so that's about the extent of my gardening." (P)

done by Sunday I'd be upset but I wouldn't be able to get to it until the next Saturday so it would grow for another week and then I'd have to bag it." (B)

"Weeds really bother me. So, I was looking to get rid of the weeds, so I used the [brand name chemical product], I think, and my friend told me that it isn't the most effective way to do it, that I should be using the spray stuff off of my garden hose and that adheres better and it does a better job, and I'm noticing that I'm getting a lot of crabgrass now, and that bothers me. I was trying to get rid of all that stuff." (B)

"[The landscaper] just fertilizes the grass. He doesn't seem to do anything with plants other than trim them … occasionally we'll see like ants or something out in the yard and then we actually tell the guy that sprays for bugs and he does the back." (P)

"We have a pest control person come once a month … that's for insects. We do have rabbits. Once in a while. And we usually either try to dig them out or drown them out to keep them from burrowing all along the walls." (P)

"[The yard] was overgrown with weeds. I went in there and hired a crew and had them clean up everything. And then I put cement borders up, put in some plants, put some monstera [split-leaf philodendron] in the back, some ferns, replanted a couple of other things. Improved the landscaping. Trimmed the bougainvillea that was hanging over the fence. Watered the plants. Moved a couple things around. Put down mulch and everything like that. I had neighbors come around, "like, oh my gosh." And they had to do theirs too, which is funny about south Florida. You do your yard and notice everybody in their block has to do theirs because now you are making them look bad. It really improves the block. It improves all the homes because they are going to try to keep up or beat you." (M)

(M = Miami; P = Phoenix; B= Boston)

Figure 4: Examples of interviewees' expressions of "caring" or "controlling" subjectivities

When discussing the second area of household-scale human drivers — those relating to household and urban characteristics that involve personal and property attributes — our interviewees described a series of factors experienced as constraints on their yard management decision-making. The gap between yard ideals and yard realities is most often attributed to a shortage of time and money. Household composition also affects yard management practices; for example, in many multi-person households some division of labor exists between management of different parts of the yard, with lawn maintenance remaining a male-gendered role.

Access to knowledge and expertise surrounding yard management is also a household-scale structural variable, in which some households are able to make different management choices because they have an arborist in the family, or a friend who is a landscaper. Many interviewees also expressed a desire to make certain management decisions that were blocked by a lack of know-how or access to specialized knowledge.

C. Interactions between Neighborhood-Scale Human Drivers and Management Decisions

Our interviews indicate that neighborhood-scale human drivers interact with management decisions, both as drivers of specific types of residential landscape management that fit "neighborhood standards," and as constraints for desired decisions that do not fit these standards. While interviewees referenced the existence of some sense of "neighborhood standards" in Boston, Miami and Phoenix, the norms for the codification, institutionalization, enforcement and homogeneity of these standards vary widely both between neighborhoods, and regionally between the study sites. These differences, as described below, are illustrated in Figure 5.

The most formal Homeowners Association (HOA)[v] landscaping rules reported by our interviewees involved a list of species that can be planted, an approval procedure for landscaping changes, and active enforcement to maintain standards. In other HOA neighborhoods, however, regulation of management decisions is more informal than implied by governing covenants, codes, and restrictions. In these neighborhoods, particularly in Phoenix, interviewees often did not cite HOA restrictions as a direct influence on their management decisions, but expressed a general sense that action might be taken if a resident's yard was not maintained (Brumand 2012). In these cases, the emphasis was on maintaining a minimum standard of orderliness, rather than on regulating species selection or landscape type. Some respondents also noted that HOA landscaping restrictions only applied to their front yards.

HOAs are common in many of the Miami and Phoenix metropolitan area suburbs where we conducted interviews, but less common in Boston. Despite this formal codification of neighborhood standards, however, almost all interviewees still described a strong sense of tacit neighborhood expectations that often hold more influence over householders' management decisions that the formal rules of an HOA. In the neighborhoods selected in the Boston metropolitan area, none of the Boston interviewees lived in neighborhoods with HOAs. Yet all Boston-area interviewees expressed some familiarity with informal neighborhood standards or norms regarding tidiness, regular upkeep, and lawn mowing.

In all locations, the degree to which householders feel pressured by neighborhood standards, formal or informal, varies according to neighborhood, and according to the personal disposition of the householder. Interviewees demonstrated a variety of personal approaches to the question of "fitting in" or "keeping up with" one's neighbors. In all locations, however, neighborhood standards function as a constraint on management decisions, often driving yard management choices that householders' report would not be their own preferred choice.

HOA with strict rules and enforcement	Permissive HOA with little enforcement	"Neighborhood standards," but no formal institutions
"I would definitely put in more seasonal planting of flowers in the front. But … chances are they're gonna [pause] although I do think they allow certain seasonal flowers. I'll have to double-check the list." (M)	"You will get what's called a friendly reminder on your door if your yard is really out of control. That means like the grass hasn't been cut in three months or the hedges are way out of control. You may have a neighbor – I have heard cases where somebody on the block wants things to be in much neater condition and they will complain about a neighbor, so maybe somebody will get the friendly reminders then. But in general there is not much oversight." (M)	"I think as long as [neighborhood yards] look well-kept or reasonably well-kept then the neighbors probably think that that's just fine." (P)
"[The HOA] does other trips up and down the streets at different times of the year. For example, where they walk everyone's yard … to record what every single person had in their yard and take pictures." (M)	"If you're going to change your landscaping you have to get it okayed by the association, you can't just put in whatever … They favor the desert side,	"Just have [the yard] look nice. People don't have to be totally into it and spend a lot of money. Just groom it. Make it look halfway appropriate." (P)
		"I think we have a responsibility as part of this neighborhood, even though there isn't a cohesiveness in the neighborhood to maintain our property to a certain standard, you know, a higher standard as opposed to a lower standard." (B)

"The HOA is using the change of property title to force people to address their violations – that is, people have to remove any unsanctioned plants before they can close on the sale of their property." (M)	but they don't say you can't put in a yard that isn't desert … I think the expectations are that it needs to be neat." (P) "I think you're supposed to stay within certain guidelines but nobody has ever talked to me about desert [landscaping]. In this neighborhood people mind their own business." (P)	"I think we expect everybody to keep their lawn mowed. To keep it so that it doesn't bring the value of the neighborhood down. I would say that that's the expectation. It's not… horrendously competitive like some neighborhoods are. But I think there is an expectation that you keep your lawn neat and clean and mowed." (B)

(M = Miami; P = Phoenix; B= Boston)

Figure 5: Examples of interviewees' references to neighborhood governance

D. Interactions between Municipal- and Regional-scale Human Drivers and Management Decisions

The set of factors most frequently referenced by our interviewees include municipal or regional regulations or services that impact yard management, and the housing development and yard-care service provider industries, referencing the "governance" and "political economy" aspects of this framework component. The importance of different scales of governance varied between the sites, with municipal regulations perceived to be stronger influences in Miami and Boston than in Phoenix (Brumand 2012). At the municipal scale, interviewees reported a variety of factors that acted to both constrain and enable different yard management practices. Examples of drivers at the municipal scale include water bans in Massachusetts towns in response to actual or anticipated shortages in municipal water supply (cf. Hill and Polsky 2007), zoning policies that can influence landscaping choices or minimum lot sizes for new developments, or services provided to support yard management such as municipal composting or leaf collection. Some interviewees reported looking for information about alternatives to resource-intensive lawns from municipal sources, indicating that municipalities could help householders better manage their yards by providing information, following the model of master gardener or agricultural extension services.

Evidence from the interviews also points to considerable differences between neighboring municipalities within regions. In the Boston metropolitan area, the pattern of relatively small towns each managing their own municipal water supply results in, according to our interview responses, considerable diversity in the frequency of summer watering bans, depending on each town's relative access to water supplies. As such, some householders reported regular watering bans in the summer, in contrast to neighboring towns that imposed no watering restrictions. One interviewee compared municipal water policy in Phoenix to nearby Tucson, where municipal government has taken a more aggressive stance in promoting water use efficiency and xeric landscaping.

Two economic sectors were elucidated in our interviews as human drivers operating at the municipal or regional-scale: housing developers and yard-care service providers. Within the housing development industry, common practices surrounding vegetation removal, replanting, and landscaping before sale play a significant role in determining future yard management practices in regions with high levels of new home construction. In all of the new developments in Phoenix and Miami in which we conducted interviews, the effects of developers' landscaping practices were influential, and are examined further in the following section concerning the legacy effects of previous decisions made by external household forces.

In all neighborhoods where we conducted interviews, the common practices of the yard-care service industry played a significant role. Some interviewees in each neighborhood reported using or having used yard-care service providers currently or in the past, including lawn mowing, fertilizing, pesticide and herbicide application, pest control, leaf raking, blowing or collection, tree maintenance, landscaping, or gardening. Some service providers are local contractors, others are local franchises of regional or national companies, and in some cases are managed by HOAs

rather than individual households. The question of service provider practices is particularly important with reference to yard care. For example, if the local landscaping companies only offer chemical-based lawn management, householders that would like to transition to an organic lawn-care regime are limited in their choice because of prevailing industry practices. Conversely, if local service providers started offering organic alongside chemical management, or if a new organic service provider became established, householders who had been considering a change in management might find it easier to make that change when supported by local service providers. These findings suggest that inertia or change in the practices of yard service providers play a role, respectively, in maintaining homogeneity or encouraging heterogeneity in yard management practices.

E. Interactions between Legacy Effects and Management Decisions

When discussing legacy effects with owners of recently constructed homes, it became apparent how developers' landscaping choices and practices clearly constrained the set of possible yard management options available to householders. Interviewees noted that preparing a new subdivision for construction often involves the removal of all existing vegetation, with new landscaping installed at the end of the project prior to sale. In Phoenix and Miami, interviewees living in newer developments reported that their front and back yards had been landscaped by developers (or in some cases that the back yards had not been landscaped at all). Interviewees explained how developers created different aesthetics for front and back yards in Miami's newer suburbs, but many emphasized that developers often used a standard array of inexpensive trees and ornamental plants not well suited to the local environmental conditions that the householders would not have selected. These findings support the discussion above of the existing of heterogeneity within parcels in some areas and between neighborhoods at the municipal scale,

linked to the age of housing and development norms at the time, but also suggests potential homogeneity within neighborhoods. Again, the selected scale appears to influence the extent to which heterogeneity or homogeneity emerges in the analysis.

Discussion of landscaping change revealed a high degree of inertia in almost all households, with householders unlikely to make wholesale changes to their yards due to the significant investments of time and money necessary to develop a substantially different residential landscape, as noted in the framework component addressing household-scale human drivers. More likely are changes in the management of the existing landscape. For example, cancelling a lawn-care service used by the previous owners, or adding planters to a xeric yard rather than installing conventional garden beds. For these reasons, our research suggests that legacy residential landscapes and management regimes exert a strong influence on contemporary management decisions, echoing similar findings by Robbins (2007) and Larson et al. (2010).

The effects of past natural hazards or weather events also exert legacy effects. For example, almost all interviewees in the Miami suburbs discussed the effects of Hurricane Andrew which devastated yards and led many to avoid planting non-native trees for fear of property damage during hurricane season (Figure 3).

Drivers of Heterogeneity in Residential Landscape Management Decisions

Our analysis of the interview data through the Cook et al. (2011) conceptual framework leads us to develop two arguments regarding the presence and dynamics of heterogeneity in the management of residential landscapes. First, at odds with the homogeneity thesis, our data demonstrate that yard management practices exhibit considerable heterogeneity — depending on the scale of analysis. Second, we build on the Cook et al. (2011) framework using cross-site

fieldwork to show how the degree of heterogeneity in a given residential landscape is the outcome of interactions between social and ecological variables at a range of scales, presenting unique constraints and opportunities for yard management.

Seeing Heterogeneity

As noted above, scale affects the perception of homogeneity or heterogeneity, whether from the viewpoint of the researcher or the interviewee. Fine-scale, parcel-level heterogeneity in the management of residential landscapes may appear homogeneous when aggregated at the regional-scale, as illustrated in Figure 6. At the municipal scale, some interviewees noted significant differences between cities. In the desert Southwest, the varying influence of municipal drivers is clear in the comparison drawn by one interviewee between Phoenix, where historically municipal policy has condoned higher water use, and Tucson, where water conservation has been a priority (see Larson et al. 2009b).

Our study also demonstrates that at the neighborhood or the parcel scale, residential landscapes that might suggest homogeneity in management practices can contain significant diversity when examined in detail. This heterogeneity might exist between neighborhoods, whose residents observe subtle differences in neighborhood governance, between parcels within a neighborhood, where residents respond differently to neighborhood standards, or even within a parcel, when a resident chooses to landscape their front and back yards differently (Figure 6). The existence of varying forms and degrees of heterogeneity in management practices at different scales speaks to the complexity of yards as socio-ecological systems, and to the importance of multi-scalar and cross-site research in assessing their management. In particular, this finding highlights the need for a careful approach to generalization in studies of residential landscape management, since variation can be obscured either by a focus on a single scale of analysis, or by a methodological

approach that cannot gain insight into the full array of differences or similarities held by the managers themselves.

Regional	"every region is different. We don't have to worry about having that white stuff all over the ground protecting our summer grass from the winter — snow … you want to keep it native. Keep less invasive plants away. Or, more invasive plants away and ultimately just keep it regionalized. You want to protect your region." (P)
Municipal	"different neighborhoods try to do different things. The older neighborhoods still have some really beautiful lawns and landscaping and most of the newer neighborhoods have desert landscaping. You know, 15 or 20 years ago it was a big deal down here to conserve water, it's still a big deal, but, you heard more about it then, so a lot of people like myself put in low water use plants and drip systems rather than sprinkler systems." (P)
Neighborhood	"there's one neighbor… They don't take very good care of their lawn. And the people across the street are spotty… They let it get way too long and then they cut it. Which is ironic because the people before them were like the neighborhood maniacs on their lawn. And it was perfect, perfect, perfect. I think they took a measuring tape out and measured how tall the grass was." (B)
Parcel	"the front yard [is for] curb appeal, the back yard is family friendly for the most cases." (B) "I would say that the front yard is a little bit more formal than the back yard." (M) "In doing my walks [around the neighborhood], a lot of people do have some aesthetic to the front of their homes, but I don't think it's a garden. I differentiate it from landscaping where it looks very nice and manicured and maintained. So a lot people landscape their homes. I do know in my walks there are about two or three homes where it actually looks like they garden. Not necessarily in the front but somewhere in the back or on the side." (M)

(M = Miami; P = Phoenix; B= Boston)

Figure 6: Examples of interviewees' perceptions of heterogeneity at different scales

Constraints and Opportunities for Yard Management Decisions

As we have demonstrated in this paper, factors associated with each of the framework components can act as constraints or opportunities for yard management decisions, which can either remain the same or can change over time. Given the numerous ways in which these factors can combine, it is unsurprising that processes of yard management are heterogeneous across even our small sample of people and places. We synthesize our specific findings reported above to propose that the interactions among constraints and opportunities (and the potential for these

interactions to produce changes in management practices) may be better understood by considering the relationships between a householder's *existing* management practices, and their *preferred* management practices. This comparison helps both to illuminate the ways in which the householders and components within the conceptual framework interact, as well as to highlight productive avenues for longitudinal research examining changes or legacy effects in householder management practices.

We outline four characterizations of householders to illustrate this argument based on their existing and preferred yard management practices (Figure 7). These types are inevitably a simplification and are examined here for heuristic purposes. They do, however, reflect the terms in which Robbins discusses householders — as "lawn people" or "not-yet-lawn people" (2007, 130) — and a broad division of householders into those content with a resource-intensive management regime, and those whose management practices require fewer resource inputs.

		***Existing* Yard Management Practices**	
		Resource-Intensive Maintenance	**Other Management Regime**
***Preferred* Yard Management Practices**	**Resource-Intensive Maintenance**	A. Existing practices match preferred practices and dominant management practices (n = 10)	B. Existing practices do not match preferred practices or dominant management practices (n = 0)
	Other Management Regime	C. Existing practices match dominant management practices, but are not preferred practices (n = 12)	D. Existing practices match preferred practices, but do not match dominant management practices (n = 8)

Figure 7: Householder types, based on existing and preferred management practices

The existing literature demonstrates the range of socio-economic forces driving householders to follow resource-intensive, lawn management practices. For householder A, therefore, a change in management practices seems unlikely since they both prefer, and already manage, a resource-

intensive yard. Our data support this finding, and indicate that the only potential constraints faced by householder A to maintaining their resource-intensive management approach are the cost of water, other inputs and yard service providers, or a future change in preferences based on shifting aesthetics or concerns about the environment or the health of pets or children. Ten of our thirty interviewees fit this category, and many of them noted the expense of maintaining a lush, green lawn with water and chemical inputs applied by yard service providers. Some expressed limited concern about the environmental or health impacts of these management choices, but not to a sufficient degree to prompt a change in practices. As such, householder A fits Robbins' (2007) description of a "lawn person."

Our research did not reveal any instances for householder B, the hypothetical type who would prefer to practice resource-intensive, lawn management, but currently maintains a different type of yard. We construe this absence as further evidence for the lack of constraints to resource-intensive yard management: lawns are the cultural norm in most neighborhoods, and are supported by the presence of a range of yard service providers that practice conventional resource-intensive management. If a householder wishes to maintain a resource-intensive lawn, it is relatively easy to do so. However, the most significant constraints appear to be financial and ecological — although dry or drought conditions have not prevented householders maintaining lawns in Phoenix or Miami. The effect of financial and time limitations on yard maintenance was represented in some interviews, but these householders reported simply cutting back on yard-related expenses, as opposed to changing yard management altogether.

Householder C was the most common type in our study, represented by twelve of our thirty interviewees. These householders maintained — albeit reluctantly — a conventional lawn with varying degrees of water and chemical resource-intensity. All, however, expressed a preference

for a different management regime. The interviews revealed a variety of constraints that we have described above, including a lack of knowledge about alternative management practices, restrictions imposed by HOAs, and a lack of time or money to commit to yard management.

Householder D was also amply represented in our study, fitting eight interviewees. These householders follow a management regime that does not focus on resource-intensive lawn maintenance, but covers a wide variety of alternatives including organic lawn care, edible gardens, ornamental gardens, and desert or drought-tolerant landscaping. The match between these householders' existing practices and their preferences suggests a stable situation in which management practices are unlikely to change. However, some interviewees in this category did report facing pressure from HOAs or informal neighborhood norms to maintain a monocultural lawn, particularly in their front yards. For this reason, and despite the match between existing and preferred practices, these householders face some constraints that might force a change in their management regimes. This indicates that homogeneity in residential landscapes reflects householders "fitting in" with existing neighborhood practices or maintaining a landscape established by developers.

Conclusions

The picture of uniform residential lawns painted both by academic (Robbins 2007) and popular (Pollan 1989; Steinberg 2006) literature suggests that U.S. suburbs are (increasingly) homogeneous with respect to turfgrass outcomes (e.g., monospecies, green, short) and processes (e.g., water- and chemical-intensive management practices). In this paper, we draw from a cross-site, interview-based qualitative study of householder management practices to examine the extent to which this homogeneity thesis reflects actual management practices, using the conceptual framework developed by Cook et al. (2011) to examine the complex socio-ecological

system within which management decisions are made. This framework allows us to separate interactions that influence or determine management decisions within the system into those related to ecological properties, human drivers at the household, neighborhood, and municipal-regional-scales, and the legacy effects of past management.

This cross-site study demonstrates that there is significant heterogeneity in yard management practices, and that these differences vary according to the scale of analysis from the region to the neighborhood. We also illustrate how different components within the conceptual framework interact to present constraints and opportunities to which householders respond differently depending on their yard and landscaping preferences. A challenge for future research will be to better understand the emergence of different yard management practices over time, as a means to theorizing how householders respond differently to the interactions we have outlined in this paper. We suggest that this question can be approached through a consideration of householders' *existing* and *preferred* management practices, and the reasons for consistencies and inconsistences between the two.

In concluding, it is also important to note the role of the national economy as a human driver of yard management decisions expressed at the household, neighborhood and municipal scales. The effects of the recent economic downturn were evident in many of our interviews, as homeowners reported reduced amounts of time or money to spend on yard management. The dynamics of the housing market have also shifted considerably, with new record lows reached in residential mobility between 2010 and 2011 (U.S. Census Bureau 2011). As housing turnover slows and HOAs struggle with limited budgets, the impacts of the economic downturn may manifest in new patterns of householders' yard management practices. Further research might examine whether

these macroeconomic changes will result in, on balance, more or less heterogeneity in residential landscape management practices.

[i] While the "lawn people" described by Robbins (2007) still maintain their lawns and remain active in that sense, Robbins' thesis ultimately renders the lawn subject as passive, with their management decisions determined by external factors and struggling to express any agency in the management of their yards. Even in situations where the householder "succeeds" in choosing an alternative management regime, Robbins argues that "the logic of consuming alternatives matches that of maintaining the lawn, leaving the subjective experience of being lawn people largely unchallenged" (2007, 130).

[ii] We use a slightly simplified version of the original conceptual framework presented by Cook et al. (2011). The "Ecological Properties" component is divided into three sub-sections in the original framework: "ecological properties," "ecological function," and "ecosystem services." We found that our interviewees' discussion of the ecology of their yards was insufficiently nuanced to sub-divide this framework component into three sub-sections, so we simply retained the overall title of "ecological properties" for our coding and analysis.

[iii] For further details of the Long-Term Ecological Research program. See http://www.lternet.edu/. The study areas from which households are selected in this project include the northern suburbs of Boston, which fall within the Plum Island Ecosystem (PIE) LTER site, Phoenix within the Central Arizona Project (CAP) site, and Miami with the Florida Coastal Everglades (FCE) site.

[iv] The number of Census Tracts in each neighborhood varies, dependent on the number of residents. Therefore in Table 1 and Figure 2, the number of census tracts varies between one and three, depending on the location of interviewees within the neighborhood.

[v] The primary mechanism for the institutional codification of neighborhood standards for yard management is through a Homeowners Association (HOA), a legal corporation designed initially for the marketing, and later management, of Common Interest Developments (CIDs) that are now home to an estimated 20% of the U.S. population (McKenzie 2011,2). HOAs are often established by the developers of a new subdivision or housing development, with management ownership and management transferred to the residents once a certain number of units have been sold. In some neighborhoods membership of the HOA is optional, but more often it is mandatory, and delinquency in HOA fees can result in foreclosure.

Acknowledgements

The authors wish to thank the anonymous reviewers and J. Morgan Grove of the US Forest Service for invaluable ideas and feedback. This material is based upon work supported by the US National Science Foundation (NSF) Grant Nos. BCS-0948984, BCS-0709685, BCS-1026865, DBI-0620409, DEB-0423704, SES-0849985, OCE-0423565, and OCE-1058747, and through the US National Science Foundation's Long-Term Ecological Research program, especially the Plum Island Ecosys- tems, Baltimore Ecosystem Study, Central Arizona Project, and Florida Coastal Everglades sites. Any opinions, findings and con- clusions or recommendations expressed in this material do not necessarily reflect the views of the NSF. The Clark University O'Connor'78 Endowment also supports this research.

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