Lawn enforcement: How municipal policies and neighborhood norms influence homeowner residential landscape management

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1. Introduction

As urban environments grow in population and geographical area (United States Census Bureau, 2013), understanding the social and political factors that shape residential landscapes becomes increasingly important. Residential landscapes are an integral part of urban ecosystems, accounting for nearly 41 percent of all urban land (Nowak et al., 1996). Though urban areas include densely populated core cities, most growth throughout the twentieth century occurred in suburban areas, home to half of the United States population in 2000 (Hobbs and Stoops, 2002). As cities expand outward to suburbs and exurbs, residential land cover—especially lawns—is expanding as well.

Dominating vegetation in residential yards, turfgrass is the United States' largest irrigated crop (Milesi et al., 2005). While some studies suggest urban ecosystems may become more similar to each other than their surrounding rural landscapes (Groffman et al., 2014; McKinney, 2006), others point out an alternative scenario in which lawn care behaviors, specifically fertilizing and irrigating, across the urban gradient may be “more differentiated in practice than in theory” (Polsky et al., 2014).

Roy Chowdhury et al. (2011) argue that as urban environments develop, they are shaped by a variety of socioeconomic, political, and ecological factors across multiple scales, including individual/household decisions, neighborhood-level informal norms, and more formal rules and policies, all of which may play major roles in shaping residential landscapes. These three scales cover both formal (e.g., legally enforceable) and informal (e.g., socially sanctioned) institutions. For instance, formal institutions shape landscapes when local, regional, and state governments enact growth management policies (e.g. urban growth boundaries or development impact fees) to contain the spread of urban land cover (Bengston, Fletcher, and Nelson, 2004). While urban

containment policies tend to focus on the regional scale, municipal policies exemplify a formal institution influencing residential landscape management at the household level.

The interaction between these formal policies and informal norms about neighborhood lawn care normative expectations is complex (Larson and Brumand, 2014). Grass height ordinances may formalize social norms around residential landscape aesthetics by promoting ideal lawns, as documented in the American suburbs (Jenkins, 1994; Steinberg, 2006). Other ordinances, such as irrigation restrictions and fertilizer bans, may present a barrier to traditional yard management by limiting actions homeowners can take in pursuit of lawn perfection. Larson and Brumand (2014) report that although weed ordinances and bans on wasteful water use exist in Phoenix, Arizona, residents do not actively consider these rules in their landscape management, in part because they are seldom enforced.

The extent to which landscaping rules—both formal and informal—interact across the urban landscape is uncertain. Little empirical research has explored these institutional dynamics. These institutions certainly interact across scales, from household-level decision-making to neighborhood normative expectations and municipal governance. Individually or collectively, formal rules (e.g., ordinances), associated informal rules (e.g., norms), and household decisions could have broader regional implications on the aesthetics and ecological composition of residential landscapes in expanding urban, suburban, and exurban areas. Yet research is needed to examine policies that regulate landscaping practices, and the degree to which they are invoked and enforced in residents' land management.

In this paper, we examine grass height and lawn irrigation ordinances using municipal document review of seventeen municipalities, as well as homeowner and public official interviews, in the Minneapolis-St. Paul metropolitan area of the Midwestern United States. We

particularly explore how formal municipal policies regarding lawn maintenance and irrigation interact with informal neighborhood lawn-care norms and individual decision-making. The questions posed are: how do municipal policies influence residential landscape management, and how do policies interrelate to neighborhood normative expectations and individual decision-making?

2. Literature Review

The prevalence of the lawns in urban and suburban areas may be driven—at least in part—by normative behaviors and tradition. The desire for lawns in the United States dates back to the late 1700s, when wealthy landowners attempted to recreate the well-manicured turfgrass gardens of England and France on the American frontier (Jenkins, 1994; Steinberg, 2006). With the expansion of urban areas and the increase of detached single-family homes in “streetcar suburbs,” lawns gained some popularity among middle-class Americans in the 1870s (Bormann, Balmori, and Geballe, 1993; Steinberg, 2006). It was not until the suburban housing boom after World War II, though, that lawns made the transition from desirable to dominant as an American landscape feature (Jenkins, 1994; Steinberg, 2006).

Lawn management practices in the United States (e.g., mowing, weeding, fertilizing, etc.) are promulgated by a variety of factors. At the residential parcel scale, homeowners’ lawn preferences and management decisions are influenced by aesthetic, recreational, environmental, and low-maintenance considerations among others (Larson, Gustafson, and Hirt, 2009; Martini, Nelson, Hobbie, and Baker, 2013). Peer pressure and a desire to “fit in” may, however, be among the most powerful motivators of lawn/yard care management (Blaine, Clayton, Robbins, and Grewal, 2012; Fraser, Bazuin, Band, and Grove, 2013; Steinberg, 2006). In metropolitan Phoenix, Arizona, researchers found social norms played a dominant role—above and beyond

formal rules ‘on the books’—in influencing residents’ land management decisions; personal expectations for maintaining “neat” yards that were trimmed and well-maintained were especially pervasive (Larson and Brumand, 2014).

Homeowners actively maintain well-manicured lawns not only because it conforms to neighborhood landscaping norms, but also because an attractive lawn is a reflection of good character, work ethic, and caring (Clayton and Brook, 2005; Robbins and Sharp, 2003). Furthermore, in a market economy, homeowners may view the time, money, and effort expended on yard care as an investment. A lush, green lawn may bolster property values while a lawn that fails to conform to neighborhood norms may be perceived as a financial or social liability (Blaine et al., 2012; Clayton, 2007; Nassauer, 2009).

A social norm can be broadly defined as “a rule that is neither promulgated by an official source, such as a court or a legislature, nor enforced by the threat of legal sanctions, yet is regularly complied with” (Posner, 1997, 365). McAdams theorizes that norms arise based on people’s desire for others’ to view them positively (1997). This may explain homeowners’ desires to conform to lawn management norms, as residents may be seeking the good opinion and respect of their neighbors.

Indeed, research suggests normative lawn behaviors are often clustered at the neighborhood scale and homeowners’ lawn management practices are associated with a greater connection to their community (Robbins, 2007). The appeal of social inclusion and belonging is strong enough that homeowners may at times be willing to overlook their own landscaping preferences, environmental concerns, or health in favor of conformity, particularly when it comes to more intensive lawn management norms, like chemical fertilizer application (Fraser, Bazuin, and Hornberger, 2015). Yet, lawn management norms are not simply tied to maintaining

a consistent neighborhood aesthetic, or even a neighborhood culture; they are more broadly an expression of affluence, socio-economic status, and group identity (Robbins, 2007).

The interaction of norms and laws is complex and depends largely on the strength of the norm and the type of behavior being regulated. Laws can mandate that citizens behave in a manner either consistent or inconsistent with social norms (McAdams, 1997). Although not the same as municipal laws, homeowners associations (HOAs) can enforce restrictive covenants that formalize otherwise informal lawn management norms. In these cases, the mere presence of HOA enforcement ability may strengthen and perpetuate lawn care norms in a given neighborhood (Fraser et al., 2013; Fraser et al., 2015). As informal and formal rules, norms and laws both incentivize and punish human behavior working to complement, substitute, or preclude the other (McAdams, 1997; Posner, 1997).

While turfgrass and ‘the lawn norm’ emerged with the expansion of cities and the development of suburbs, little is known about norm-law interaction across the urban-suburban-exurban gradient. Previous studies have separated urban density categories or acknowledged unique challenges faced by urban, suburban, or exurban areas, particularly regarding natural resource or landscape management. For example, Hill and Polsky found differences in socio-political dynamics and structural (policy-based) forces between suburban and urban areas in drought response and water management (2006). Given the unique policy-based forces in urban, suburban, and exurban communities, the interaction between social norms and municipal policies may be unique as well.

Municipal codes can either reinforce informal rules regarding lawn management through aesthetic policies like grass height ordinances, or they may present a barrier to traditional yard care through restrictive regulations such as lawn irrigation or fertilizer bans. The following

sections provide a brief historical context and review of literature surrounding vegetation ordinances and irrigation restrictions.

2.1 Weed and Grass Height Ordinances

Prior to the start of the twentieth century, approximately twenty-five states adopted statutes addressing the spread of weeds. All of these statutes were rationalized as a policy mechanism to curtail the spread of weeds across agricultural lands, thus reducing crop losses (Falck, 2002; Smith, 2006). Through these ordinances, state legislatures delegated enforcement power to local governments. The ordinances may have been the first addressing noxious weed growth as a “nuisance”, but they rarely, if ever, focused on residential properties (Falck, 2002; Smith, 2006). The adoption of weed nuisance ordinances gained momentum as the nation entered the Progressive Era in the early 1900s and “moral reformers” emphasized the importance of beautifying America’s large cities. One of their primary objectives was eliminating noxious weed cover in the urban core (Smith, 2006; Steinberg, 2006). It was in this transition to a focus on urban spaces where policies originally aimed at agricultural “weeds” expanded to address excessive grass height in residential neighborhoods.

Advocates of weed and grass height ordinances framed the issue as a form of urban pollution and a public health threat—reformers argued that excessive weed and grass growth provided habitat to rats and other pests, emitted allergens, and posed fire risks (Falck, 2002; Smith, 2006). However, Smith (2006) argues that weed/grass height is—at most—tangentially related to these public health and safety concerns, and the overarching purpose of these ordinances was almost purely based on aesthetics and a desire to “clean up the city.”

The legality of weed and grass height ordinances—or any ordinance with the purpose of maintaining community aesthetics—has been subject to scrutiny (Smith, 2006; Steinbach, 1970). Early cases at the beginning of the 20th century upheld the constitutionality of weed and grass height ordinances only if they could be tied to a legitimate public purpose, such as public health or safety (Falck, 2002; Steinbach, 1970). Cases in the 1950s and 1960s, however, showed growing acceptance in the courts for aesthetic-related ordinances intended to beautify cities and maintain property values (Smith, 2006; Steinbach, 1970). Nevertheless, weed and grass height ordinances have been successfully challenged in recent decades, particularly with the proliferation of the natural landscaping movement (Jenkins, 1994; Smith, 2006).

2.2 Water conservation ordinances

Outdoor water use accounts for 50% or more of residential water consumption (Mayer and DeOreo, 1999). Given the significance of outdoor uses, municipalities frequently adopt ordinances to restrict nonessential water uses (e.g., lawn irrigation) in times of water scarcity. While lawn-sprinkler restrictions and bans lack the controversial history of weed and grass height ordinances, debate exists about the societal acceptance, compliance, and effectiveness of these municipal water ordinances (Kenney, Klein, and Clark, 2004; Ozan and Alsharif, 2013).

Lawn irrigation ordinances differ from grass height ordinances in that water policies are not rooted in maintaining aesthetics, but rather restricting access to a resource in times or geographic regions of low supply and high demand. As such, ordinances restricting lawn irrigation take a variety of forms. Some communities offer voluntary or mandatory restrictions on the dates (e.g., odd or even dates) or times of day that watering can occur during times of low water supply, as was the case during a 1999 drought in central Massachusetts (Hill and Polsky,

2006). The arid city of Phoenix, Arizona, on the other hand, attempts to reduce demand on the water supply through a “wasteful water” ordinance banning residents from allowing water to run into the streets during irrigation (Larson and Brumand, 2014).

The effectiveness of such community ordinances at reducing water demand by limiting lawn irrigation is uncertain. Studies have documented both decreases and increases in water consumption under voluntary and mandatory restrictions (Ozan and Alsharif, 2013; Kenney et al., 2004). In one particular study, households cited for violating the water restrictions generally failed to decrease their water usage, suggesting a disregard for the municipal policy (Ozan and Alsharif, 2013). Ozan and Alsharif (2013) attribute this disregard for the ordinance to a combination of lax enforcement, a relatively small fine for noncompliance, and conflicting policies. Municipalities frequently lack the financial resources and manpower to enforce watering restrictions city-wide (de Loë et al., 2001; Ozan and Alsharif, 2013). Moreover, a small fee for violating the sprinkler ban may not be a strong enough disincentive, particularly when ordinances are not enforced and when residents have invested in expensive landscaping (Dyckman, 2008; Saltoun, 1959).

Complying with residential irrigation restrictions can be particularly problematic in the presence of stringent neighborhood or municipal landscaping policies that directly conflict with water conservation measures (Dyckman, 2008; Ozan and Alsharif, 2013; Steinberg, 2006). Where grass height ordinances generally reinforce traditional lawn aesthetics and may complement neighborhood policies, lawn irrigation restrictions may present a barrier to maintaining the lush, green lawn required in many covenants. Homeowners like John Connors in West Covina, California have been cited for failing to maintain their landscaping in severe drought conditions (Steinberg 2006), and some HOAs prohibit certain landscaping measures that

could conserve water (e.g., xeriscaping) because they do not maintain the desired aesthetic within the development (Dyckman, 2008; Steinberg, 2006). As more lawmakers recognize the finite nature of water resources, several states and municipalities have adopted statutes banning HOAs from restricting water conservation measures. However, outdated covenants, codes and restrictions remain in place and indirectly discourage water conservation (Dyckman, 2008; Steinberg, 2006).

More broadly, the role of public attitudes and public education in the adoption and effectiveness of water conservation ordinances is significant. De Loë et al. surveyed representatives from 153 municipalities in Ontario, Canada on various water conservation measures, including ordinances (2001). Respondents identified public concerns about water supplies and political will as factors that could encourage the adoption of water conservation ordinances, but enforcement costs, public resistance, and a lack of public education were identified as significant barriers to adoption (de Loë et al., 2001). These findings suggest that attitudes toward lawn irrigation restrictions may be more positive when neighbors perceive a legitimate water shortage, but that communities may lack sufficient resources to make individuals aware of these ordinances in the first place.

Overall the literature suggests both formal policies and informal social norms can play a strong role in shaping individual lawn care choices and, consequently, broader residential landscapes. However, less is known about how these interact with each other in urban systems. So, in respect to residential lawns, how does a formal municipal policy influence residential landscape management, specifically weeds, grass height, and water use? First, what city policies exist that might influence homeowner residential landscape management in urban, suburban, and exurban areas? Secondly, are homeowners aware of these policies, and does awareness vary

across the urban gradient? Thirdly, what enforcement challenges exist? And finally, how do the policies interact with informal neighborhood normative expectations surrounding yard management?

3. Methods

3.1 Study site

The study site is the thirteen-county Minneapolis-Saint Paul metropolitan area in Minnesota, and part of a larger project evaluating homogenization of urban ecosystems in six U.S. Census Bureau-designated metropolitan statistical areas (MSA) covering the major climatic regions of the U.S.: Phoenix, AZ, Miami, FL, Baltimore, MD, Boston, MA, Los Angeles, CA, and Minneapolis-Saint Paul, MN. Each MSA encompasses urban, suburban, and exurban areas surrounding a core city (Groffman et al., 2014). This interdisciplinary study was designed to evaluate hypotheses about the homogenization of the residential yard within the United States. In each city we randomly selected households that were stratified to reach a diversity of residential neighborhoods based on urban density, socioeconomic status, and life stage from Claritas PRIZM classes (see Polsky et al., 2014 for more details). The stratification scheme for the preliminary telephone survey provided the sample for the homeowner interviews, with 5,797 (61%) of the six city phone survey respondents agreeing to further contact; for our study site 1,647 Minneapolis-St. Paul metropolitan area households agreed to further contact. In each gradient classification—urban, suburban, exurban—respondents were sent information letters and then randomly selected for an invitation to conduct a personal interview. In Minneapolis-St. Paul, we obtained a sample of 21 interviews with three calling attempts during diverse periods of the day. The targeted number was 20-25 interviews. To address the key questions guiding this paper, three distinct methods were employed: collection of city codes and relevant ordinances for

water irrigation and vegetation management in residential yards, homeowner interviews, and interviews with municipal officials involved with city code enforcement.

3.2 City codes and ordinances

To compare municipal ordinances to local social norms and homeowner awareness, we collected and searched codes for 17 cities in the Minneapolis-Saint Paul MSA in 2013. The goal was to identify relevant policies regarding lawn irrigation restrictions (in the study site, commonly referred to as “sprinkling bans”) and grass height ordinances, often associated with language about ‘weeds’ thought of as unmanaged vegetative growth. Nearly all city codes were obtained electronically, except for one obtained directly from city employees.

In cases where the full city code was just one document, the entire code was searched for key words and phrases, including but not limited to: water conservation, lawn, irrigation, drought, weed, grass, height, vegetation, seed, and mow. When the city code was divided into multiple documents based on section, the same key words and phrases were used to search relevant sections. These sections include: public utilities/public works, nuisance, public health, public safety, property maintenance, zoning, land use, miscellaneous, general regulations, natural resources, water utility, and building and housing among others.

Once the ordinances were obtained, we first determined the percentage of communities that had a lawn watering restriction or grass height ordinance in place. Next, all ordinances were analyzed for similarities, differences, and trends across the urban gradient in the type of policy, specific requirements, and enforcement. For example, lawn irrigation ordinances were separated into restrictions that were in effect year-round/seasonally and restrictions that only took effect during a drought.

3.3 Homeowner interviews

In 2012, we explored homeowner awareness of codes and lawn norms based on the 21 in-depth interviews with homeowners. Interviewers completed all trainings and complied with institutional/legal requirements for research involving human subjects. Personal interviews were recorded and varied in length from 1 to 1.5 hours, depending on how long the homeowner wanted to spend walking around their yard discussing the vegetation.

The interviews consisted of a semi-structured interview approach, followed by a short survey with closed-ended questions, concluding with a walk through out the entire yard designed to ask open-ended questions about the homeowner's management of the vegetation in the yard and their plans for any future changes. Interview questions addressed multiple subjects, including yard preferences, management choices (e.g. mowing, fertilizing, etc.), how homeowners use the yard, and the characteristics of the neighborhood. Two topics were of particular interest for this paper. First, homeowners were asked a series of questions to determine whether or not they were aware of any government policies, programs, or regulations regarding various yard management actions—specifically lawn watering, vegetation and tree choices, and grass height. For example, 'Are there city or other government policies, rules or programs that influence your yard choices and management? If so, provide an example' then prompts for water use, tree choice, and lawns. Second, homeowners were asked about their neighbors' expectations for what they should be doing in their yard. For example, 'What features of your yard do you think matter most to the neighbors?' followed by 'Do your neighbors have expectations for what you should be doing in your yard? If so, please provide an example.' And then, 'Do you talk with your neighbors about yard care choices? If so what do you talk about?'

All the interviews were fully transcribed. Content analysis was conducted with a word search and descriptive statistics for closed-ended questions. Responses to the questions regarding

awareness of government policies, programs, or regulations were compiled into a spreadsheet using a binary code (1 if the homeowner was aware of a policy, program, or regulation, 0 if he or she was not) and analyzed for percentages across urban, suburban, and exurban classifications. Responses to the question regarding whether or not neighbors had expectations for what they should be doing in their yard were similarly coded and analyzed. Additionally, we coded for three specific neighborhood expectations: an expectation of green grass, a weed-free yard, and a mowed lawn, as these three norms most closely align with municipal lawn irrigation restrictions and weed and grass height ordinances. While the responses to the specific question regarding neighborhood expectations were most critically analyzed, the entire transcript was searched as homeowners frequently mentioned common management practices indicative of a neighborhood norm (e.g., “everyone mows”) and expectation throughout the interview.

3.4 City official interviews

Finally, to provide a contextual understanding of how ordinance implementation happens, in 2013 we conducted five targeted interviews with municipal officials across the urban gradient: two urban officials, one suburban official, and two exurban officials. Interviewed officials were involved in code enforcement, natural resource management, or public utilities. Sampling was stratified to include at least one official from three density classifications. This small sample is not intended to serve as a general representation of code enforcement across the MSA. Rather, the goal was to obtain “key informant” interviews to gain a better understanding of the rationale for lawn irrigation and weed and grass height ordinances and how these policies are enforced in select municipalities.

Interviews took approximately 45 minutes. All were recorded and transcribed. Questions were open-ended, covering topics ranging from community character to the official’s perceptions

of homeowner attitudes about municipal ordinances to similarities and differences in policies among cities. First, understanding protocols for enforcing the ordinances allowed insights into how homeowners interact with the larger policy scale. Second, officials were asked why the ordinance was important for the city in order to understand the city's motivation for maintaining these policies. Third, interviewees were asked what steps the city takes to make homeowners aware of each ordinance as this could provide additional context for the homeowner awareness data. Fourth, city officials identified challenges associated with enforcing each ordinance in the community, as the challenges municipal governments face regarding these ordinances could help explain the variation in policy, enforcement, and awareness across the cities. Finally, we asked the officials to share how they believe each ordinance and its enforcement may change in the future to help us understand how the policy scale evolves over time.

We coded transcripts and pulled quotes relating to the previously mentioned five key topics based on irrigation and grass height. All responses were analyzed for similarities and differences among cities regarding reasons for the ordinance, enforcement protocol and challenges, tactics to improve homeowner awareness, and potential changes in the future.

The three methods—ordinance document review, homeowner interviews, and city official interviews—while distinct, work synergistically to contribute to our understanding of municipal ordinances, homeowner awareness of ordinances, and how they relate to homeowner expectations—social norms—for residential landscape management.

4. Findings

Municipal ordinances represent an intersection of three scales shaping residential landscapes: individual parcel-level management decisions, neighborhood-level norm processes, and municipal policy institutions. In this study, the majority of municipalities have adopted

ordinances addressing lawn watering through sprinkling bans, as well as yard aesthetics through weed and grass height restrictions, yet a significant portion of homeowners in the study were unaware of such policies. This gap in homeowner awareness—combined with strained government resources—poses a challenge to ordinance enforcement and effectiveness. Municipalities rarely sought out code violations. Instead, ordinance enforcement was largely complaint-driven, providing neighbors the opportunity to use these policies as a mechanism to require compliance with neighborhood yard management norms.

4.1 What policies are in place?

Lawn irrigation restrictions were present in nearly every city code analyzed; the language of these restrictions targets the use of irrigation systems most commonly associated with lawn watering. Of all the communities in the study, approximately 88% ($n=15/17$) included ordinances restricting lawn irrigation in some way. Communities generally approach watering restrictions in two manners: some cities adopt ordinances consistently restricting outdoor water use, either year-round or seasonally, while others only impose restrictions once a shortage prompts a water emergency. In communities with lawn irrigation restrictions, 60% enact restrictions only during a water emergency, while 40% enact year-round or seasonal restrictions (Table 1).

Out of the 17 cities, ten had a restriction on the time of day lawn irrigation can take place. Lawn irrigation is least efficient during the middle of the day due to excessive evaporation (Trenholm, Gilman, Knox, and Black, 2002), therefore municipal policies generally restrict lawn watering between mid-morning and early evening. Six of the communities adopted odd/even-day watering bans wherein residents with odd address numbers are prohibited from watering on even dates and vice versa. Some municipalities enacting restrictions only during water shortages left ordinances vague, giving government officials flexibility to adopt regulations on a situational

basis. Eight cities do not specify hours during which lawn irrigation will be restricted but give government officials authority to create more detailed regulations once a water emergency is declared.

Lawn and landscaping irrigation policies may include exceptions, especially in the case of establishing new lawns. In addition, ordinances in four communities allow for other outdoor watering uses, either by allowing hand watering and watering of flowers and shrubs or by clearly stating that the restriction applies only to lawn areas, grass, or turf. Nearly all of the water restrictions identified across the cities were mandatory.

Similar to lawn irrigation restrictions, grass height ordinances were nearly ubiquitous across the municipalities. Of the city codes analyzed, approximately 94% (n=16/17) included an ordinance limiting grass growth to a specific height between six inches and one foot (Table 2). Most grass height ordinances were found in portions of the code addressing public health nuisances. Some communities listed “noxious weeds and rank growth of vegetation” as a public health nuisance but specified grass height restrictions in a different portion of the code. Two exurban communities—Hastings and Elk River—adopted the International Property Maintenance Code (IPMC), a model code developed by the International Code Council that includes a specific ordinance limiting grass height on private property, but jurisdictions must designate a specific height limitation.

Table 2 illustrates a possible trend regarding maximum grass heights across the urban gradient. Urban and suburban areas generally specified a maximum grass height of around eight inches, with some variation among suburbs. Exurban communities had a similar average maximum grass height but with greater variation. Communities in the exurban category had both the most and least restrictive grass height limitations in the study area.

4.2 Homeowner awareness of policies

Despite the fact that these grass height and lawn irrigation ordinances were present in nearly every community, homeowner awareness of such policies was less consistent. Of the households on public water systems, approximately 67% (n=12/18) of the residents were aware of some type of lawn irrigation restrictions (three exurban homeowners with private wells were excluded). Of the homeowners who were aware that a restriction existed, seven specifically mentioned an odd-even address watering restriction while just one mentioned a restriction on the time of day watering could take place.

Homeowners expressed various perceptions of enforcement across the cities. One suburban resident stated, "I don't know how much people follow it (the restriction) but you do get fined if somebody turns you in or you get caught." Other residents across the urban gradient admitted that they had not been following the ordinance, but not necessarily to water the lawn more frequently. Another suburban resident watered every other day, but did not follow the odd-even guideline. A third suburban homeowner watered every third day, so while the practices violated the ordinance they believed they conserved more water.

More than half of the homeowners were aware of a grass height restriction, with approximately 52% (n=11/21) of interviewees aware of a city policy, regulation, or ordinance limiting grass height. Few homeowners, however, were able to provide any specifics about the policies. A suburban resident echoed the responses of many, stating, "The only thing that I've heard of is if you don't mow they're going to come do it for you. Whatever that height is, eighteen inches or something."

Some homeowners felt the ordinance was rarely, if ever, enforced. However, of the eleven homeowners aware of a grass height restriction, five cited a personal experience where

they, or someone they knew, had been cited for violating the restriction. “Absolutely, we’ve had some people who have gotten yelled at so I’ve been told. But there is [an ordinance]. I don’t know what it is, it’s like 10 inches or something, but there definitely is and the city will enforce it,” said an Eagan resident.

Tables 3 and 4 illustrate trends in awareness across urban, suburban, and exurban areas. Suburban homeowners showed high rates of awareness of both residential irrigation and grass height ordinances, with awareness rates well above 75% among suburban homeowners. Determining statistical significance is difficult given the small sample size. However, the results of a Fisher’s Exact Test—used for relatively small sample sizes generating expected values less than five—indicate that differences in awareness across the urban gradient are statistically significant ($p = 0.022$ for lawn irrigation restrictions; $p = 0.017$ for grass height restrictions). The variation among urban, suburban, and exurban homeowners in awareness of municipal ordinances suggests a trend that may warrant further investigation with a larger study.

4.3 Enforcement challenges

The significant gap in homeowner awareness—from one-third to nearly half of all homeowners—was one of several challenges identified by city officials when discussing code enforcement. One suburban code enforcement officer explained that most people simply were not “well-versed” in the city’s code, making it challenging to enforce restrictions on irrigation and grass/weed height. In many cases, city governments play the role of educator rather than enforcer. “Other than the ordinance, they don’t know,” said an exurban code enforcement officer. “There’s nothing, I mean, unless we tell them. Whether it be the grass ordinance or any other ordinance they’ll say, ‘I don’t know,’ and we just educate them and tell them and they’re usually okay with that.”

When it comes to making residents aware of the ordinances, most municipalities relied on seasonal newsletters, website announcements, or government public access television channels. For example, the suburban community of Eden Prairie has been using its city manager's blog to announce when lawn irrigation restrictions go into effect. Additionally, the ordinances may not receive equal attention. As one exurban, code enforcement official pointed out, "...the grass and weed one isn't one that is publicized on the TV. It's not like the watering ban."

The most frequently identified challenge facing code enforcement, however, was a lack of resources—including money and personnel—to enforce violations. Just one code enforcement official stated that the city actively sought out code violations—including the frequently ignored weed and grass height restrictions—and admitted that this was unique among municipal governments. One urban code enforcement official echoed the sentiments of other city officials, saying, "...What ends up happening—because you have such a broad geographic area—if you're enforcing something citywide, unless you have adequate staff, essentially you just end up responding to complaints."

4.4 Neighborhood expectations

The complaint-driven enforcement of these ordinances introduces the neighborhood-level scale to the relationship between homeowners and policy. One code enforcement official explained, "We depend on our residents to tell us when somebody is doing something wrong." But a resident's definition of "wrong" may hinge largely on the norms surrounding yard care in their respective neighborhood.

A majority of homeowners indicated some form of neighborhood expectations, with 71% of homeowners interviewed (n=15/21) indicating there were neighborhood expectations for what they do in their yards. Expectations were essentially evenly distributed across the urban—

gradient, as urban (100%), suburban (69%), and exurban (66.7%) homeowners indicated neighborhood expectations (n= 2/2, 9/13, 4/6, respectively). While expectations of a weed-free and mowed lawn were identified by more than half of the homeowners (Table 5), an expectation of green grass occurred the least frequently (14.3% overall).

When discussing whether or not neighbors had expectations for what they do in the yard, many homeowners generally felt there was a minimum amount of yard maintenance expected in the neighborhood. Typical responses indicating the presence of neighborhood expectations included: “We do have sort of expectations that people at least maintain their property and when they don’t then it becomes more noticeable.” Other references emphasize keeping up landscapes, in part for maintaining property values. Others shared specific experiences where homeowners in the neighborhood had not managed their yards in accordance with the neighborhood norms:

“People do notice I will say, because like this house kitty-corner is a foreclosure and there were dandelions, huge dandelions over there this spring and the neighbors were very upset about it... Yeah, they do talk about it.”

The neighborhood norms described by homeowners align closely with the aesthetic values formalized by weed and grass height ordinances. Most homeowners expressed a minimum acceptable level of property maintenance, which included keeping grass to a reasonable height and limiting weed growth. In this nexus of homeowner management decisions and policy, the expectations described in the interviews suggest that neighbors may use the municipal ordinances to enforce social norms surrounding yard care, thus achieving a desired neighborhood aesthetic, but no one reported making such a call during the interviews.

6. Discussion

The findings suggest the interaction between policy institutions, neighborhood-level social norm processes, and individual homeowners varies as homeowner awareness of policies differs across the urban population density gradient. The policy type and its objectives can also influence its compliance and enforcement.

6.1. Variation in homeowner awareness

Given the small sample size, determining statistical significance is extremely difficult. However, the data suggest a trend toward high rates of homeowner awareness in suburban communities, possibly more so than high-density urban neighborhoods and lower density exurban neighborhoods. But this raises questions about what drives suburban homeowners' familiarity with their municipality's residential landscape management policies. Do suburbs have pronounced social norms and therefore residents know the policies in place and how to enforce them? Do suburban communities have more resources to enforce lawn management policies, thus leading to high awareness and perhaps compliance? These questions can be addressed in future research that will build on the existing understanding of lawn policies and neighborhood lawn norms (Jenkins, 1994; Nassauer, 2009; Steinberg, 2006).

Lawn norms were common throughout the study site, regardless of urban-suburban-exurban classification. This would suggest there is nothing exceptional about lawn management norms in suburban communities and variation in homeowner awareness of ordinances must be attributed to other factors. But while social norms were prevalent in most communities, the strength of these norms was not evaluated. Lawns gained traction as the standard residential landscape with the expansion of urban areas and the development of "streetcar suburbs" (Bormann et al., 1993; Jenkins, 1994; Steinberg, 2006) and have persevered as a cultural background and identity of suburbia. Thus, while homeowners in every density classification

identified the norms of green, mowed lawns, it is possible these norms are simply stronger in suburban communities.

Norms are just one factor potentially accounting for the variation in homeowner awareness of municipal policies, though. Nearly half of homeowners aware of a grass height restriction cited a specific instance where the ordinance had been enforced on either their own property or a neighbor's lawn. It is possible, therefore, that communities with greater enforcement ability would have higher rates of homeowner awareness. But issuing citations for excessive grass height or sprinkler ban violations requires government resources, a constraining factor when it comes to enforcement of formal policies (Larson and Brumand, 2014). In interviews with five code enforcement officials, only the suburban official actively sought out grass height restriction or sprinkler ban violations. The other officials stated that limited resources prohibited them from active enforcement and forced them to rely on complaint-driven enforcement. Urban areas struggled to enforce lawn management policies over geographically large and densely populated areas while exurban communities lack a large enough tax base to provide sufficient resources for code enforcement. This limited study did not collect data on each municipality's income and expenditures, but the trends in the data suggest that the balance of tax revenue, population, and geographic area in suburban communities may make them more conducive to code enforcement, thus helping to explain the higher rate of homeowner awareness in these communities.

6.2 Grass height ordinances

While communities varied on the specific parameters of grass height regulations, these ordinances were nearly ubiquitous across the study site. Throughout the interview process, officials regularly cited limited resources in municipal government as the primary reason for

complaint-driven enforcement of weed and grass height ordinances. The complaint-driven nature of enforcement allows neighborhood norms to play an integral role in facilitating compliance with grass and vegetation height ordinances. In fact, if municipalities possessed adequate resources, it is possible neighborhood norms would be redundant as cities—rather than neighbors—would apply pressure to maintain a “well kept” lawn.

When it comes to grass and vegetation height regulation, the relationship between policy and neighborhood level processes is largely one of efficiency. Patrolling neighborhoods in search of unkempt lawns requires expenditures of time and money from city governments. Municipalities may perceive complaint-driven enforcement as the most economical solution, saving government resources and allowing officials to target enforcement efforts where residents see the greatest need.

The popularity of natural landscaping, articulated by Bormann et al. (1993), may force cities to redefine weed and grass height ordinance enforcement. A growing body of case law challenging traditional lawn ordinances suggests cities may be facing an enforcement conundrum—torn between the ecological value of natural landscaping and the longstanding neighborhood norms promoting a mowed lawn (Jenkins, 1994; Smith, 2006; Steinberg, 2006). Some code enforcers noted this struggle during the interviews. While cities recognize the ecological value of natural landscapes, interviewees were concerned that “naturalized” lawns could become a loophole for poorly managed properties. Multiple officials noted that updating archaic ordinance language to protect homeowners who want to plant a natural lawn can be a challenging process, and enforcement even more difficult as code enforcers are not botanists—many may be unable to differentiate between a planted natural landscape and merely an unkempt lawn. To combat these challenges, code enforcers can benefit from partnering with more

knowledgeable natural resources and forestry department staff as well as providing detailed officer training in order to develop a clear policy and enforcement protocol for natural lawns and alternative vegetation.

6.3 Lawn irrigation restrictions

Unlike weed and grass height ordinances, which are primarily aesthetics-focused, municipal lawn irrigation restrictions are intended to conserve a common pool natural resource. While the majority of homeowners were aware of a lawn irrigation restriction, they were not always aware of the appropriate ordinance. Some homeowners believed their community implemented an “odd-even” watering ban when, in actuality, restrictions only went into effect during a drought declaration, and vice versa. This confusion may become more common in large urban regions comprised of many municipalities. In many cases, communities draw from different water sources, meaning water scarcity affects each community uniquely and different policies are used in response to community specific scarcity or conservation values. Furthermore, it is possible that climatic variation across urban regions may impact some communities’ water supply differently than others’. In large urban regions where resident movement among cities over a lifetime is frequent, confusion about regulations is likely to increase. This speaks to issues of public perception and information surrounding water ordinances. As outlined by de Loë et al. (2001), a lack of public education is a barrier to adoption of a lawn irrigation restriction, while public perception of a water scarcity problem was identified as a driver of ordinance adoption. Our findings suggest that even once an ordinance exists, confusion and lack of awareness exist among homeowners which may reduce the effectiveness of the ordinance. An ordinance alone is not sufficient to achieve water conservation, unless it is backed up by supportive programs (e.g., information sharing, community organizing).

Finally, aesthetics may influence the enforcement of and compliance with lawn irrigation restrictions, particularly in areas where enforcement is complaint-driven and neighborhood-level norms play a role. While norms generally reinforce the desired aesthetic incorporated in a weed and grass height ordinance, norms can run counter to sprinkler ban requirements. In many areas weekly water irrigation is necessary to maintain a ‘well kept’ lawn. In our study the social norm for a green lawn was not particularly common, but it was present. In addition we did not identify policy conflicts between lawn irrigation restrictions and municipal or HOA landscaping requirements, as has been discussed in other studies (Dyckman, 2008; Steinberg, 2006). Others have demonstrated, however, that lawn maintenance—including green grass—is often considered by neighbors to be a reflection of good character and a positive work ethic (Clayton and Brook, 2005; Jenkins, 1994; Nassauer, 1988). It is possible that homeowners might be willing to overlook a lawn irrigation restriction violation in favor of living next to a well-kept green lawn that signals good character within the neighborhood. Lawn irrigation ordinances restrict access to a preferred lawn aesthetic in some neighborhoods, thus, unlike weed and grass height ordinances, it is unclear whether neighbors are capable of policing themselves through social norms when it comes to lawn watering.

7. Conclusion

Lawn irrigation restrictions and grass height ordinances represent a nexus of individual homeowner decision-making, neighborhood-level processes, and municipal-level policy institutions. The complaint-driven enforcement of these ordinances opens the door for neighborhood lawn management norms to play an integral role in policy implementation. Furthermore, homeowner awareness of policies was high in suburban areas, where the lawn first made the transition from a landscape of opulence to the American residential landscape standard.

Looking to the future, the two policies—water irrigation and grass height—may need to be revisited in response to changing homeowner values and resource availability. As public opinion regarding lawns changes and natural yards gain traction as environmentally-friendly landscaping alternatives, municipalities must determine how to balance individual homeowner lawn freedom with neighborhood and community interests. Training code enforcers to identify an unkempt lawn as opposed to a natural landscape is a challenge cities are currently addressing and will continue to do so.

However, lawn irrigation restrictions may require more active enforcement in the years to come. With uncertainties such as climate change's influences on precipitation patterns and temperature, water scarcity may become an issue of increasing concern for some municipal governments. Where weed and grass height ordinance enforcement is more closely tied to public preferences and aesthetics, lawn irrigation restrictions work against these preferences in order to conserve common pool resources. Some cities in the western U.S. are turning to more stringent enforcement of water restrictions in times of drought (e.g., Las Vegas), but in an era of limited government resources, municipalities may rely on novel concepts like volunteer water patrols, where a minority of water-conscious residents enforces irrigation restrictions on the majority pursuing the ideal green grass lawn.

This study contributes to the ongoing examination of multi-scalar influences on urban ecosystems (Roy Chowdhury et al., 2011). While it is a qualitative approach focused exclusively on the Minneapolis-St. Paul MSA, future research might attempt to determine if the trends identified in this paper hold true in other communities. Do suburban homeowners consistently post high rates of awareness of municipal landscape management policies in Baltimore, Maryland or Phoenix, Arizona? How do lawn irrigation policies and/or grass height ordinances

vary across cities and why? Do most city officials rely on neighbor complaints to enforce grass and other herbaceous vegetation height ordinance violations and if so, is this an effective approach? Do ordinances, homeowner awareness, norms, and enforcement differ in small towns outside of larger metropolitan areas? Understanding trends and interactions among homeowner awareness-neighborhood norms-city ordinances across urban areas in the United States is important as it informs land managers, both public and private, about the evolving discourse about lawns and vegetation in the residential landscape.

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Table 1: Lawn Irrigation Restriction Type by Community (n = 17)

	City	Regular or Seasonal Sprinkler Bans/Restrictions	Sprinkler Ban/Restriction During Shortage	No Sprinkler Ban/Restriction
Urban	St. Paul		X	
Suburban	Mound	X		
	Cottage Grove		X	
	Stillwater		X	
	West St. Paul		X	
	New Hope		X	
	Savage		X	
	Bloomington		X	
	Eagan		X	
	Inver Grove Heights		X	
	Eden Prairie	X		
Exurban	Ham Lake			X
	Hastings	X		
	Jordan	X		
	Elk River		X	
	Lino Lakes	X		
	Afton			X

Table 2: Grass Height Restrictions by City (n = 17)

	City	Maximum Weed/Grass Height				
		6"	8"	10"	12"	Unknown
Urban	St. Paul		X			
Suburban	Mound		X			
	Cottage Grove		X			
	Stillwater		X			
	West St. Paul		X			
	New Hope		X			
	Savage			X		
	Bloomington				X	
	Eagan		X			
	Inver Grove Heights		X			
	Eden Prairie			X		
Exurban	Ham Lake	X				
	Hastings				X	
	Jordan	X				
	Elk River					X
	Lino Lakes		X			
	Afton					X

Table 3: Cross Tabulation of Homeowner Awareness of Lawn Irrigation Restrictions (n = 18)

	Urban	Suburban	Exurban
Aware	0	11	1
	0%	85%	33%
Not Aware	2	2	2
	100%	15%	67%
	100%	100%	100%

Table 4: Cross Tabulation of Homeowner Awareness of Grass Height Ordinances (n = 21)

	Urban	Suburban	Exurban
Aware	0	10	1
	0%	77%	17%
Not Aware	2	3	5
	100%	23%	83%
	100%	100%	100%

Table 5: Neighborhood Yard Care Expectations (n = 21)

Neighborhood Expectations (x = mention; - = not mentioned)					
	Resident identified by City	Expectation	Green Grass	Weed Free	Mowed Lawn
Urban	St. Paul	X	-	-	-
	St. Paul	X	-	-	-
Suburban	Mound	X	-	X	X
	Cottage Grove	X	-	X	X
	Mound	-	-	-	-
	Stillwater	X	-	-	X
	Cottage Grove	X	X	X	-
	West St. Paul	X	-	X	X
	Stillwater	-	-	-	-
	New Hope	-	-	-	-
	Savage	-	-	-	-
	Bloomington	X	-	X	X
	Eagan	X	X	X	X
	Inver Grove Heights	X	-	X	X
	Eden Prairie	X	X	X	X
Exurban	Ham Lake	-	-	-	-
	Hastings	X	-	X	X
	Jordan	X	-	X	X
	Elk River	X	-	X	-
	Lino Lakes	-	-	-	-
	Afton	X	-	-	X
	Totals (%) :	71.4%	14.3%	52.4%	52.4%

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