



The effectiveness of water irrigation policies for residential turfgrass

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ARTICLE INFO

Article history:

Received 16 February 2012

Received in revised form 31 July 2012

Accepted 1 August 2012

Keywords:

Turfgrass

Domestic water policy

Restrictions

Citations

Lawns

ABSTRACT

Turfgrass irrigation policies have been implemented in various regions of the U.S. to reduce domestic water consumption. Mandatory restrictions are often enforced by issuing citations to violators with the intent to promote compliance and deter violations. This study provides a detailed investigation of past water restrictions and compliance, and attempts to determine which factors are related to high rates of water usage within communities of Tampa, FL. The adjusted rainfall rate had the most significant relationship with water usage in the communities under study. Water usage increased in each examined community after it transitioned to more stringent water usage restrictions, with cited restriction violators increasing usage to a greater extent than their uncited counterparts. This increase may primarily be attributed to conflicts between the local water consumption policy and binding homeowner association rules. When the once-a-week usage restriction was in place, the area faced drought conditions. Therefore, homeowners irrigated more to meet the water needs of their lawns despite the restrictions imposed on them by their local government.

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Introduction

An enormous amount of water is being used on turfgrass in many situations where water is limited or even scarce. For example, in the arid region of the American West, lawn irrigation by one measure exceeds 50% of domestic water usage (Mayer et al., 1999). Lawn irrigation represents the largest portion of domestic water usage across the U.S. (Mayer et al., 1999). In addition, lawn irrigation accounts for at least half of all water consumed by the domestic sector in most Australian capital cities (Brennan et al., 2007). Furthermore, automated systems typically do not distribute water uniformly to appropriately irrigate turf landscapes, and they have many inherent inefficiencies that increase water loss (Haley et al., 2010). Therefore, restricting outdoor water usage provides an excellent opportunity to mitigate domestic usage.

Kenney et al. (2004) examined data from regions with mandatory and voluntary water restrictions that primarily focused on limiting residential lawn watering during a prolonged Colorado drought. They found that mandatory restrictions resulted in more limited water use than voluntary restrictions, even when accounting for climatic variation across the studied areas. Water restrictions can be useful for mitigating domestic water usage, but a restrictive policy is only as effective as the enforcement mechanism. Extensive research is crucial to determine if whether current

restrictions should be maintained or restructured to further mitigate domestic water usage. The policies examined do not consider the amount of water required to sustain a healthy lawn but instead are designed to conserve water and only maintain the population's essential water requirements. St. Augustine and Bermuda grass, the grass species typically recommended by deed-restricted communities in Florida suburbs (Trenholm et al., 1991) require two or three scheduled irrigations a week to maintain acceptable quality during the summer months (Trenholm et al., 2002). Tampa's policies have historically alternated between prolonged periods of restricting irrigation to watering either once or twice a week; this requirement creates a dilemma for homeowners who are required by their binding community rules to maintain healthy turfgrass.

To better understand the compatibility of local policy and binding community directives, this study determined residential water use patterns and magnitudes within deed-restricted communities and mapped enforcement mechanisms using high-resolution geographic information system (GIS) analysis and other strategic mapping methods at the community level. Specifically, this study (1) developed GIS data sets that were used to quantitatively map water usage at the parcel level; (2) examined the relationship between domestic water usage and key environmental and recreational factors, such as rainfall, seasonality, and the presence of swimming pools; and (3) mapped the enforcement of residential lawn irrigation policy non-compliance to determine spatial relationships within and between the communities and to test the effectiveness of current enforcement practices. This study focused on three deed-restricted communities located in northern Tampa, FL. An in-depth investigation into domestic water usage in such

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Table 1
Irrigation restrictions enacted during different time periods in the City of Tampa.

City ordinance 2000-69	City ordinance 2003-316	City ordinance 2006-104
March 16th 2000 to November 24th 2003 Addresses ending with an even number or letters A through M, only on Tuesdays	November 25th 2003 to May 4th 2006 Addresses ending with an even number or letters A through M, only on Tuesdays and Saturdays	May 5th 2006 to December of 2010 Addresses ending with an even number or letters A through M, only on Tuesdays
Addresses ending with an odd number or letters N through Z, only on Sundays	Addresses ending with an odd number or letters N through Z, only on Sunday and Wednesday	Addresses ending with an odd number or letters N through Z, only on Sundays
Irrigation of properties was prohibited from 8:00 a.m. to 6:00 p.m. on permitted days	Irrigation of properties was prohibited from 8:00 a.m. to 6:00 p.m. on permitted days	Irrigation of properties was prohibited from 8:00 a.m. to 6:00 p.m. on permitted days
Irrigation prohibited at all times on Monday, Wednesday, Thursday, Friday, and Saturday	Irrigation prohibited at all times on Monday, Thursday, and Friday	Irrigation prohibited at all times on Monday, Wednesday, Thursday, Friday, and Saturday

communities would ultimately help environmental managers to effectively enact and enforce policies that are aimed at protecting our most precious resource.

Cultural perspectives on the lawn

The current ideal of the monoculture lawn can be traced to the landscapes constructed by privileged French and British individuals in the 16th and 17th centuries and is a variation on their scale and structure (Feagan and Ripmeester, 2001). It has also been tied to statesmen such as Andrew Jackson Downing and Thomas Jefferson, who envisioned the landscape as being intertwined with the progress of democracy, liberty, and moral health (Feagan and Ripmeester, 2001). Downing held that people's pride in their country was tied to pride in their homes, and to show patriotism and pride, they must tend to their homes appropriately. This ideology was perpetuated throughout the formation and industrialization of the United States. Currently, a lawn is no longer an elitist means of displaying patriotism. Americans have become more affluent and have expanded their personal landholdings to the suburbs, which have promoted the expansion of the lawn (Robbins and Birkenholtz, 2003). The post-World War II era of nationalism, identity, and community led to shifts in work and leisure activities. The lawn has become associated with private enterprise and personal property. It has grown beyond its physical presence to become a symbol of public order. A well-maintained lawn is an essential element in developing an appropriate social and moral order (Feagan and Ripmeester, 2001). The commodification of the lawn and the esthetics associated with it are now a reflection of purity, cleanliness, and decency within the American suburb (Feagan and Ripmeester, 2001).

Researchers suggest that the aspiration to maintain one's yard may be motivated in part by the desire for neighborhood solidarity and/or conflict avoidance (Hirsch and Baxter, 2009). In addition, residents may perceive conformity with water restrictions as a sign of neighborhood degradation, and they therefore are encouraged to avoid conflicts with neighbors by maintaining yard care standards (Hirsch and Baxter, 2009). Arguably, the lawn's greatest role in the social process is ideological; it supports a set of concepts and norms regarding the way a society should be organized (Feagan and Ripmeester, 2001).

In addition to the aspiration for community solidarity, many homeowners are obligated to follow the directives of their homeowner associations. In Florida, many homeowner associations have adapted their own lawn policies. For example, Hunter's Green Community Association, a community included in this study, permits only St. Augustine turfgrass; it also mandates that irrigation systems must cover 100% of the lawn; and that watering must comply with local and state policies (Hunter's Green Community Association Inc., 2012). On the other hand, the West Meadows

Community Association permits St. Augustine, Bahia, Bermuda, and Zoysia grass, and holds the homeowner responsible for maintaining a healthy and acceptable lawn (West Meadows Property Owners Association Inc., 2012). Thus, the homeowners must have the knowledge necessary to meet their community associations' policies and healthy lawn requirements. Noncompliance due to a lack of knowledge is not considered an excuse. In addition, some of the language in the homeowners' manuals is open to interpretation. For example, how does the West Meadows Homeowners Association define a healthy and acceptable lawn? Is lawn health a matter of the individual homeowner's subjective interpretation or are there criteria specified in a document?

Tampa's historical local irrigation policy

The water demanded by Tampa citizens has periodically exceeded availability over the past few decades; in these instances, water was purchased from suppliers to meet demand. Contributing factors include inadequate rainfall, escalating irrigation demands, and decreased flows into the Hillsborough River (Water Restrictions, 2009). In addition, the decreased flows into the Hillsborough River have caused Tampa's reservoir levels to decline more rapidly and recover more slowly than in past years. Tampa's reservoir provides 90% of the treated water distributed to Tampa Water Department customers and is the primary source of drinking water for the city. To conserve water resources, water usage restrictions have been enacted to help ensure a sufficient quantity of indoor water for the Tampa community (City of Tampa, 2009). The City of Tampa's outdoor water use restrictions are in effect for all residents within the incorporated city limits and for residents outside the incorporated city limits to the extent permitted by law. However, hand watering of new and existing lawns was not restricted. For the past decade, Tampa's water restrictions have oscillated between once a week and twice a week automated lawn irrigation to curb demand and preserve water resources. The irrigation restrictions were enacted at different times and covered different time periods (Table 1). As Table 1 shows, the restrictions controlled the days and times that homeowners could irrigate their lawns. In addition, both once and twice a week policies were used.

More stringent policies were in effect in Tampa during the Spring of 2009. This policy restricted lawn irrigation to hand watering only. This common water restriction is usually implemented to completely ban the use of automated, in-ground sprinkler systems and permits households to substitute for it with labor-intensive hand-held watering (Brennan et al., 2007).

Policy effectiveness

There are four primary types of domestic water conservation and mitigation strategies used in the United States: rationing

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