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# Landscaping practices, community perceptions, and social indicators for stormwater nonpoint source pollution management

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ABSTRACT

This study sought to assess the relationship between regulatory and educational approaches to nutrient management and homeowner behaviors, perceptions, and knowledge of best management practices (BMPs). Fertilizers, and pesticides applied in excess by homeowners and landscapers can impair stormwater ponds and cause nuisance algae blooms, eutrophication and fish kills. They can also affect water quality in downstream creeks, and bays. To reduce the potential for nutrient-laden runoff to the aquatic environment, local and state governments passed different regulatory mechanisms that govern the use of BMPs and a fertilizer black out period. Interviews, surveys, and participant observation were used to gather quantitative and qualitative data in order to establish social indicator scores and evaluate knowledge and attitudes surrounding the fertilizer ordinance in a Master Planned community in Manatee County Florida. Results showed that most residents (69%) had not seen any materials related to the blackout period and lacked awareness of the components of the ordinance, including its restrictions on phosphorous and nitrogen applications and disposal of grass and landscape debris. The findings reveal the importance of social dimensions in sustainable stormwater management and suggest target areas for increasing awareness of the fertilizer ordinance and strengthening the link between social norms and environmental stewardship.



## 1. Introduction

In order to ameliorate anthropogenic induced water pollution, environmental technology is fundamental; however, complementary social indicators could add a measureable human dimension to water quality management. Social indicators allow environmental managers to measure progress toward goals by employing the use of a variety of social statistics (Bauer, 1966). In order to measure the success of environmental management practices, which are similar to environmental indicators, social indicators can measure stakeholder awareness, behavioral intentions, and changes in practices (Genskow & Prokopy, 2011; Ribaudo & Horan, 1999). The Social Indicator Planning and Evaluation System (SIPES) can be particularly beneficial in nonpoint source pollution (NPSP) management where there is no discernible origin of pollution and where pollution is largely the result of human behavior, emerging from various sources such as agriculture, landscaping and in urban settings (Carpenter et al., 1998; Fraser, Bazuin, Band, & Grove, 2013; Genskow & Prokopy, 2009). Increasingly, the fertilization of residential lawns is becoming a source of NPSP. For NPSP, the most relevant social indicators are those that relate to behaviors and factors that influence water quality improvement or protection.

Homeowners apply excessive amounts of fertilizer to their landscapes partly because they are motivated by social norms to conform to the homogenous landscapes within neighborhoods, and are held legally accountable by the enforcement of the rules of Homeowner Associations (HOAs) (Fraser et al., 2013; Nassauer, Wang & Dayrell, 2009). Fraser et al. (2013) found that residents in homes of higher value tended to over fertilize their landscapes compared to those who owned homes of lesser value. Additionally, HOAs encourage homeowners to maintain a certain aesthetic standard through legal means such as HOA covenants and deed restrictions. Whether through more subliminal or overt means, HOAs can "encourage higher usage of chemicals to attain those [high aesthetic] standards (Fraser et al., 2013, p.30)." The acreage of turfgrass continues to increase throughout the United States lead-

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ing to the growing use of lawn chemicals to maintain it. Typically, the homeowner will apply more chemicals per hectare than agricultural users (Robbins & Birkenholtz, 2003). While turf can provide various environmental and social benefits in the form of urban heat island protection and accelerated groundwater recharge, there are also concerns surrounding the efficiency of how lawn chemicals are used (Blaine, Clayton, Robbins, & Parwinder, 2012).

The perception of lawns in communities is linked to social status and acceptance. Using education to mitigate impacts of landscaping practices is more likely to influence the behavior of homeowners if it is targeted towards a group versus an individual (Blaine et al., 2012; Serrano & Delorenzo, 2008). With lawns creating a visual sense of community it is logical that related issues should be addressed as a community. An interdisciplinary approach is needed to explore homeowner norms and their ecological landscapes within neighborhoods to understand the complexity surrounding management practices and the ecological expression in lawns (Blaine et al., 2012; Cook, Hall & Larson, 2012). Landscaping perceptions and behaviors are complex, deeply rooted issues, which present a formidable challenge to environmental managers (Noiseux & Hostetler, 2010). Nassauer et al. (2009) examined the role cultural norms place in the appearance of landscapes and one in particular – an individual's internalized sense of what neighbors find to be acceptable- may affect how personal landscaping practices are formed and how that affects the surrounding ecosystem. Landscapes are powerful in that they are public reflections of an individual's status. Our goal in this study is to investigate the perceptions, awareness, and knowledge of individuals and communities in relation to their behaviors that may affect water quality. We use a conceptual framework that combines social indicators with the theory of planned behavior. The results of this research have larger implications not only for Master Planned communities guided by Homeowners Associations, but neighborhoods with deeply rooted social norms surrounding their landscapes (Robbins, 2007).

## 2. Conceptual framework – theory of planned behavior and the social indicators

The conceptual basis for much of the research on social indicators used to influence pro-environmental behavior is the Theory of Planned Behavior (TPB) (Ajzen, 1991). Research on the use of Social Indicators in NPSP management is fairly new, emerging within the last few years in the form of the Social Indicator Planning and Evaluation System designed by researchers in the Great Lakes Regional Water Program (Genskow & Prokopy, 2011). According to the authors, it is a system to measure progress towards environmental goals by looking at social outcomes (Genskow & Prokopy, 2011).

The Theory of Planned Behavior (TPB) involves predicting the intention of individuals by considering the subjective norms (perceived social pressure), perceptions (perceived behavioral control) and attitudes (attitude toward the behavior) of the individual (Ajzen, 1991, 2011). Together, subjective norms, perception, and attitudes create "behavioral intentions." Strong intentions (as a precursor to actual behavior change) to adopt or maintain a behavior are associated with positive attitudes (Ajzen, 1991, 2011). The TPB is the basis for much of the literature on the use of social indicators in resource management and health fields (Gaston & Kok, 1996; Corbett, 2002; Tonglet, Phillips & Read, 2004). This model has been refined over the years in various contexts (Ajzen, 1991; Kakoko, Astrom, Lugoe, & Lie, 2006; Forward, 2009; Ajzen, 2011).

The use of social indicators in nonpoint source pollution (NPSP) management is fairly new; as a result, there is a lack of published literature on the topic. There are studies which have linked landscaping practices to nitrogen and phosphorous sources in runoff which affect lakes (Blaine et al., 2012; Serrano & DeLorenzo, 2008).The Great Lakes Regional Water Quality Program, land grant universities, and a total of six states in the Midwest have worked in conjunction with the United States Environmental Protection Agency (USEPA) to create a conceptual model which integrates social indicators into the planning and evaluation of nonpoint source water quality projects to supplement the USEPA watershed management handbook (Genskow and Prokopy, 2013). Social indicators are used as a measurement tool to gauge change of behavioral action of the individual throughout the timeline of a project. While there are social components to many NPSP projects such as educational outreach, workshops, and financial incentives, what is lacking is a measure of the effectiveness of management changes and agency efforts with land owners. The indicator system is based on TPB by linking awareness and attitudes, with the barriers and abilities of homeowners to adopt behaviors that protect or risk water quality (Genskow & Prokopy, 2007). In addition, there are various influences to behavioral intention: education, socioeconomic status, age, all of which need to be placed in a local context to interpret accurately.

After the launching of the Great Lakes Social Indicators for NPSP Management Project, Genskow and Prokopy (2009) made note of considerations involved in indicator development process. Building capacity with stakeholders to understand and interpret social data enables effective participation and accountability of the outcomes. The need for a strong participatory component to engage a wide scope of stakeholders is, therefore, essential. Most importantly, focusing on a small set of core regional indicators ensures regional consistency, while supplemental indicators retain local flexibility. The result is an indicator system that can be used on multiple levels and scales, geographically and agency-wide (Genskow & Prokopy, 2009; Borisova, Racevskis, & Kipp, 2012). Because the indicators are a precursor to behavior change, awareness of the problems of water quality is assumed to lead to awareness of what to do about the problem (actions and behavior changes). The indicators also show the constraints to adoption and the influence of social norms as well as the capacity of a community to respond to water quality problems (Genskow & Prokopy 2009). Our goal is to add to this salient area of research.

## 3. Study area

The research took place in Manatee County, in southwest coastal Florida (Fig. 1). It is an area encompassing various natural environments from coastal lowlands and hardwood swamps to marshes and mesic flatwoods (SWFWMD, 2001; FDEP, 2013). The rivers in Manatee County drain into the lower Tampa Bay estuary. The climate is humid, sub-tropical characterized by high annual rainfall during warm summers with frequent thunderstorms. Water quality issues in the county include nutrient loading, elevated levels of dissolved copper, mercury, lead, and zinc in various water bodies (FDEP, 2013). We studied a single Master Planned golf community of 7000 acres, begun in 1995 and only partially built out with approximately 6000 homes in 2014. It is considered a green community and received its certification from the Florida Green Building Coalition based on meeting standards within various categories including environmental education, ecosystem protection and natural resource conservation. Manatee County is one of the fastest growing counties in the state, and Master Planned communities such as this are helping to drive local growth by attracting retirees (Manatee County Water Atlas, 2012; SWFWMD, 2001).

The community is one of immaculate, green, manicured lawns and "lakefronts" largely devoid of aquatic and shoreline (littoral) plants. This social norm is seen in many communities throughout

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