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Louisiana Urban and Suburban Homeowners' Fertilizer Management Behavioral Beliefs, Intentions, and Past Behaviors

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LOUISIANA URBAN AND SUBURBAN HOMEOWNERS' FERTILIZER MANAGEMENT BEHAVIORAL BELIEFS, INTENTIONS, AND PAST BEHAVIORS

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ABSTRACT

Nutrient runoff of nitrogen and phosphorus from improper lawn and landscape fertilization practices contributes to water quality issues within the Mississippi River drainage basin and the Northern Gulf of Mexico (NRC, 2009a; Robbins & Birkenholtz, 2003). The implementation of fertilizer best management practices has become a critical strategy for reducing nutrient runoff (Carey et al., 2012a; Carey et al., 2013; U.S. EPA, 2005). The purpose of this study was to determine if relationships exist among selected perceptual measures regarding home lawn and landscape fertilizer management practices among Louisiana urban and suburban homeowners. Ajzen's (1991) Theory of Planned Behavior (TPB) was the theoretical framework used to study Louisiana homeowners' fertilizer management practices. An online semantic differential questionnaire assessed homeowners' TPB perceptual measures regarding 12 fertilizer management practices identified through pilot research. The homeowners of this study reported seldom past performance of the recommended *Soil testing* practice. The results further indicated that homeowners' intention to perform the *Soil testing* practice was the strongest determinant of past behavior, and perceived norm was the strongest determinant of intention to perform the practice. Homeowners further reported that they may intend to perform the improper *Watering in lawn fertilizer, rain event* practice, and homeowners' perceived control was the strongest determinant of intention to perform the practice. Lastly, homeowners reported that they slightly believed that if fertilizer was applied to areas other than the lawn and landscape that it would result in runoff that contributes to environmental issues in water. The researcher concluded that the *Soil testing* practice was infrequently performed by the participants of this study. The researcher further concluded that homeowners may intend to use a rain event to water in lawn fertilizer as they think it is a beneficial practice that they can control, and that

homeowners' only slightly believed that fertilizer runoff would result from the *Runoff from fertilizer spills* practice. To change homeowners' fertilizer management practices the researcher recommended that the strongest determinants of behavior and the underlying behavioral beliefs identified in this study be targeted in behavioral intervention programming designed by the Louisiana Cooperative Extension Service.

INTRODUCTION

The Mississippi/Atchafalaya River Basin (MARB) provides drainage for 41% of the contiguous United States (U.S.) and routes *nonpoint sources of pollution* through Louisiana's waterways ultimately to be deposited into the Gulf of Mexico (GOM) (Louisiana Department of Environmental Quality [LDEQ], 2017; National Research Council [NRC], 2008; National Research Council [NRC], 2009a) The environmental health of Louisiana's water resources have been predominantly affected by such nonpoint sources of pollution as sediment and nutrient runoff (NRC, 2008). Excessive nutrient loading into the MARB has disrupted natural processes and created water quality issues, such as decreased levels of dissolved oxygen in water bodies and an expansive hypoxic zone in the northern portion of the GOM during the summer months (Louisiana Department of Environmental Quality [LDEQ], 2017; NRC, 2009a). The large extent of land that the MARB drains and thus the amount of nutrient runoff entering Louisiana's waterways, as well as the state's own contribution to nutrient pollution has made it the foremost environmental issue in the state (LDEQ, 2017). Louisiana's government and environmental agencies have been working together to implement a *nutrient management strategy* to improve state's water quality (Louisiana Nutrient Management Strategy Interagency Team [LNMSIT], 2014). The framework of the nutrient management strategy includes stakeholder engagement within watershed communities to enhance the support of water quality restoration and protection through voluntary, incentive-based approaches (LNMSIT, 2014). All members of the watershed community can be stakeholders with a vested interest in protecting water quality by locally implementing nutrient management projects (LNMSIT, 2014).

Residential community members would be an important group to engage in the enhancement of water quality as research studies have found that it is a common practice in the

U.S. for individuals to apply nitrogen and phosphorous fertilizers to residential lawns, particularly in southern states (Fissore et al., 2012; Robbins & Sharp, 2003b). Research has further shown that urban and suburban residents may utilize improper home lawn and landscape fertilizer management practices that increase nutrient runoff in an effort to maintain the standards set forth by their residential communities (Robbins & Sharp, 2003b; United States Environmental Protection Agency [U.S. EPA], 2005). Improper home lawn and landscape fertilizer practices can lead to increased nonpoint source pollution from neighborhoods, such as excess fertilizer runoff into storm drains or directly into water bodies (National Research Council [NRC], 2009b; U.S. EPA, 2005; United States Environmental Protection Agency [U.S. EPA], 2014).

Robbins et al. (2001) discussed how lawn fertilizers, "are found in increasing abundance in the nations waterways" (p. 371) and how such fertilizers, "endanger human health and the biological health of waterways" (p. 371). Nutrient runoff from urban and suburban landscapes produces serious water quality issues, such as the growth of harmful algal blooms in water resources that can be toxic to humans when they come into contact with skin or when they are consumed in tainted water supplies (Anderson, Gilbert & Burkholder, 2002; Carey et al., 2013). Excess nutrients can also cause environmental issues, such as *eutrophication* that results in increased algal blooms and decreased amounts of dissolved oxygen in water resources (National Research Council [NRC], 2000; U.S. EPA, 2005). These human and environmental issues caused by excess nutrient loading into water resources have significant economic impacts from the extra money spent cleaning up water resources for human consumption/use to the loss of tens of millions of dollars in revenue from reduced fisheries and shellfish markets (U.S. EPA, 2005; United States Environmental Protection Agency [U.S. EPA]; 2012). It is therefore important to study the types of home lawn and landscape management practices used by urban and suburban residents as improper practices have the potential to contribute to water quality issues (Nielson & Smith, 2005; Robbins, Polderman & Birkenholtz, 2001; Schueler & Swann, 2000).

Rationale and Significance of the Study

Nutrient runoff is a serious form of water pollution in Louisiana and contributes to negative environmental consequences, such as impaired waterways that cannot meet their intended use (swimming, fishing, etc.) and the hypoxic or *dead-zone* in the Northern GOM where fish and shellfish cannot survive due to reduced oxygen levels (Louisiana Department of Environmental Quality [LDEQ], 2016; NRC, 2009a). The preservation and improvement of water quality in Louisiana is a high priority, as a significant portion of the state's financial revenue and employment are connected with fisheries in the GOM and the outdoor recreation tourism industry (LDEQ, 2016). In 2013, the commercial fisheries industry had a total economic effect of $2.1 billion in Louisiana, and out-of-state visitors to Louisiana state parks spent close to $12 million (LDEQ, 2016). Water quality in the state of Louisiana has been identified as being influenced by pollutants from urban and suburban runoff (LDEQ, 2016; Louisiana Department of Natural Resources [LDNR], 2008). Such nonpoint source runoff includes nutrients from fertilizers applied to maintain home lawns and landscapes in urban and suburban areas (NRC, 2009b; Robbins et al., 2001; U.S. EPA, 2005; U.S. EPA, 2012).

The intensive maintenance of a residential lawn that is kept, "green and homogeneous" (Nielson & Smith, 2005, p. 93) necessitates the use of synthetic fertilizers that are often applied in excessive amounts to achieve this aesthetic goal. The scale of synthetic fertilizer application for lawn and landscape maintenance has been increasing as the U.S. has been undergoing significant land use cover changes (Robbins et al., 2001). Between the years of 1982-2012 there have been 44 million acres of newly developed land or a 59% increase in constructed urban and suburban landscapes (United States Department of Agriculture Natural Resources Conservation Service, 2015). Within these urban and suburban expansions, 23% of the landscape is covered by lawns (Robbins & Sharp, 2003a). A nationwide estimate of lawn coverage puts it between 10 million and 16 million hectares of land (Robbins & Birkenholtz, 2003). If lawns were considered an agricultural crop, they would rank as the fifth largest grown in the U. S. based on the area of land coverage (Schueler & Swann, 2000). The pervasiveness of turfgrass present in residential areas and the implementation of improper fertilizer management practices that can impact water quality have made this an important environmental and social issue (Carey et al., 2012a; Nielson & Smith, 2005; Robbins et al., 2001).

Therefore, the fertilization practices that were identified as relevant to this study's population of urban and suburban homeowners were examined to learn how to reduce potential nutrient runoff from home lawns and landscapes in Louisiana. The 12 fertilizer management practices examined in this study were established in the literature as either recommended practices that reduce nutrient runoff or those that have the potential to impact water quality: 1) *Fertilizer product label*; 2) *Soil testing*; 3) *Calculating area of lawn*; 4) *Watering in lawn fertilizer*; 5) *Watering in lawn fertilizer, rain event*; 6) *Precision fertilizer application*; 7) *Fertilizer application, no schedule*; 8) *Fertilizer application, annual schedule*; 9) *Excess fertilizer runoff*; 10) *Runoff from fertilizer spills*; 11) *Community fertilizer best management practices*; 12) and *Fertilizer best management practices*. (Carey et al., 2012a; Florida-Friendly Landscaping [FFL], 2015; Louisiana State University Agricultural Center [LSU AgCenter], 2007; Louisiana State University Agricultural Center [LSU AgCenter], 2008; University of

Florida's Institute of Food and Agricultural Science Extension [UF IFAS Extension], 2004; U.S. EPA, 2005).

Further, studying social indicators can help to determine the nutrient management awareness and attitude of stakeholder groups that can be tracked over time to measure behavior changes (LNMSIT, 2014).Therefore, this study examined Louisiana urban and suburban homeowners' belief about, intention to perform, and past behavior of these particular home lawn and landscape fertilizer management practices to determine which gaps exist between the current practices used by this population and the recommended management practices that should be adopted. Studying this population's belief, intention and past behavior regarding the home lawn and landscape fertilizer management practices also provided information on which beliefs and determinants of intention and behavior should be targeted in an educational intervention program to change behavior where necessary. In addition, other important fertilization practices that were implemented by the population were examined in this study to further identify improper management practices and how to target such practices in an educational intervention program. Lastly, demographic information was collected to identify the background characteristics of the population in this study.

Purpose and Objectives

The primary purpose of this study was to determine if relationships exist among selected perceptual measures regarding home lawn and landscape fertilizer management practices among Louisiana urban and suburban homeowners. The perceptual measures examined include outcome evaluation, behavioral belief strength, behavioral belief, attitude, perceived norm, perceived control, intention, and past behavior. To accomplish the purpose of this study, the following specific objectives were formulated to:

1. Describe Louisiana urban and suburban homeowners on the following selected demographic characteristics.

a) number of people staying in the house, apartment, or mobile home

b) additional people staying in the household

c) sex

d) age

e) Hispanic, Latino, or Spanish origin

f) race

g) highest level of education completed

h) gross household income

2. Describe Louisiana urban and suburban homeowners on the following measures of community involvement.

a) type of community association membership

b) whether or not they have served as a board member of their community association

c) whether or not their community association has home lawn and/or landscape management restrictions or regulations

d) whether or not they consider themselves to be a community leader that influences the activities or behaviors of their neighborhood

3. Describe Louisiana urban and suburban homeowners on their use of the following selected fertilizer management practices.

a) whether or not they had ever applied fertilizer to their home lawn and/or landscape

b) types of fertilizers used in the home lawn and/or landscape

c) how much fertilizer is applied in a single application

d) whether or not they currently use a lawn care service/company to apply fertilizer to their lawn

e) type of fertilizer spreader primarily used to apply fertilizer to the lawn

4. Determine the factors that contribute to the decision not to apply fertilizer to the home lawn and/or landscape from selected factors provided to Louisiana urban and suburban homeowners who had never applied fertilizer.

5. Determine if a relationship exists between behavioral belief, as measured by the product of behavioral belief strength and outcome evaluation, and past behavior for the 12 fertilizer management practices examined in this study among Louisiana urban and suburban homeowners.

6. Determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the outcome evaluation construct for the 12 fertilizer management practices examined in this study.

7. Determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the behavioral belief strength construct for the 12 fertilizer management practices examined in this study.

8. Determine if attitude, perceived norm, and perceived control explained a significant portion of the variance in intention to perform each of the 12 fertilizer management practices examined in this study.

9. Determine if intention and perceived control explained a significant portion of the variance in past behavior for each of the 12 fertilizer management practices examined in this study.

Delimitations of the Study

A non-probability opt-in sampling method was used in this study. Based on this sampling design the interpretations of the results could only be applied to the respondents of this study.

Definitions

The following terms/concepts were defined from the literature and/or operationally for purposes of data collection. Where appropriate, these definitions were included in the instrument to help the study participants clarify and focus their responses to the items on the instrument.

1. Homeowner is defined as a person with a house, apartment or mobile home either: 1) owned by you or someone in the household with a mortgage or a loan (including home equity loans); or 2) owned by you or someone in the household free and clear (without a mortgage or loan) (United States Census Bureau, 2010).

2. *Calculating the area of lawn* is defined as measuring the square footage of your lawn to determine how much fertilizer to apply to that area (LSU AgCenter, 2007; UF IFAS Extension, 2004).

3. *Watering in lawn fertilizer* is defined as following the application of fertilizer to the lawn, water is applied to the grass to set the fertilizer into the soil (Carey et al., 2012a; LSU AgCenter, 2007; UF IFAS Extension, 2004).

The following terms/concepts were operationally defined for purposes of this study:

4. Louisiana resident is someone who currently lives in the state of Louisiana.

5. Type of community is defined as urban (50,000 or more), suburban (between 49,999-2,499), and rural (2,500 or less) (United States Census Bureau, 2016).

6. *Fertilizer product label* is the label found on the fertilizer product that provides information on how to use that product (LSU AgCenter, 2007; U.S. EPA, 2005).

7. *Soil testing* is a sample of soil that is taken from the home lawn and/or landscape that is tested to provide information about what specific fertilizer nutrients (e.g. nitrogen, phosphorous, potassium, etc.) should be applied to promote healthy plant growth (FFL, 2015; LSU AgCenter, 2007).

8. *Watering in lawn fertilizer, rain event* is coordinating the application of lawn fertilizer with a rain event to water the fertilizer into the soil (FFL, 2015; LSU AgCenter, 2007).

9. *Precision fertilizer application* is when lawn spreaders are used to provide uniform coverage of lawn care products (LSU AgCenter, 2008; UF IFAS Extension, 2004).

10. Fertilizer application schedule is the schedule that is used to determine when to apply fertilizer to the home lawn and/or landscape (Carey et al., 2012a).

11. *Fertilizer application, no schedule* is applying fertilizer to the lawn with no set schedule (Carey et al., 2012a).

12. *Fertilizer application, annual schedule* is an annual lawn and landscape fertilizer schedule (Carey et al., 2012a; LSU AgCenter, 2008).

13. *Excess fertilizer runoff* is when a large amount of fertilizer is applied to the lawn or landscape it cannot be taken up by the plants it was applied to and there is a potential for this excess fertilizer to runoff from these areas and enter streams, lakes, estuaries and groundwater (Carey et al., 2012a; U.S. EPA, 2005).

14. *Runoff from fertilizer spills* is when fertilizer is applied to areas, such as sidewalks, driveways or drainage ditches, it cannot be taken up by the plants it was intended for and there is a potential for this fertilizer to runoff from these areas and to enter streams, lakes, estuaries and groundwater. (FFL, 2015; LSU AgCenter, 2007; U.S. EPA, 2005).

15. *Community fertilizer best management practices* are the types of fertilizer management practices used in your community (Carey et al., 2012a).

16. *Fertilizer best management practices* are the types of fertilizer management practices that have been developed for your state/region that produce effective and efficient lawn and landscape care results (Carey et al., 2012a; LSU AgCenter, 2007).

REVIEW OF LITERATURE

Overview

This chapter reviews formative pieces of literature that have been written about the following topics: the Clean Water Act of 1972 and U.S. water quality issues (point source and nonpoint source pollution); U.S. urban and suburban impervious landscape design and surface runoff; U.S. fertilizer management practices in nursery crop production, commercial landscaping, and urban and suburban lawns and landscapes; U.S. Cooperative Extension Service and the adoption of water quality and environmental landscape management practices; Louisiana nutrient management programs; and the Theory of Planned Behavior theoretical framework.

U.S. Water Quality Issues

U.S. Clean Water Act of 1972.

Water quality is of great importance to any thriving nation due to its fundamental purpose of satisfying human physiological needs and its effect on human health and the safety of those in proximity to water resources; therefore, a safe and sufficiently accessible water supply is required to sustain life (Maslow, 1943; World Health Organization, 2011). These critical factors of water quality motivated the U.S. federal government to develop legislation that ultimately sought to address the essential human need for water. However, before addressing human need the first article of water pollution legislation in the U.S., the Rivers and Harbors Act of 1899, sought to address the water pollution and refuse being discharged into navigable waterways affecting transportation of economic goods (Ruhl, Nagle, Salzman & Klass, 2014). It was not until 1948 that the Water Quality Act was passed to specifically address the human health concerns being caused by poor water quality in the U.S. due to industrial chemicals and municipal waste being discharged into waterways (Ruhl et al., 2014). This movement towards improving water quality in the U.S. was further supported by the Water Quality Act of 1965 that required each state to establish, “water quality standards for interstate waters” (Ruhl et al., 2014, p. 206). The lack of compliance of a third of the states in developing these water quality standards and an increased demand for legal accountability of the pollutants being discharged in the U.S. ultimately lead to the development of the Federal Water Pollution Control Act of 1972, which following amendment became known as the Clean Water Act (Ruhl et al., 2014).

The Clean Water Act of 1972 sought, “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (United States Environmental Protection Agency, 2002, p. 3). It further sought to make waterways fishable and swimmable by 1983 and eliminate discharge of pollutants into navigable waters by 1985 (Ruhl et al., 2014). Neither of the goals was met by the original dates set, and these goals remain the top priorities of this federal legislation, which since its inception has undergone several amendments to help in achieving these goals (Ruhl et al., 2014). The first key component of the Clean Water Act (CWA) was Section 301 that addressed, “the discharge of any pollutant by any person” (U.S. EPA, 2002, p. 88) and imposed effluent limitations of pollutant discharge (Ruhl et al., 2014). Section 402 of the CWA complimented Section 301 by establishing the National Pollutant Discharge Elimination System (NPDES) permit program, and together these two sections of the CWA addressed the discharge of what has become known as *point source pollution* into navigable waters (Ruhl et al., 2014).

Point source pollution was defined in section 502(14) of the CWA as the following:

> The term “point source” means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture. (U.S. EPA, 2002, p. 214).

The CWA also sought to address the issue of nonpoint source pollution through Section 319 that requires states to identify the waterbodies/segments not meeting water quality standards and develop an action plan to reduce nonpoint sources of pollution (U.S. EPA, 2002). The U.S. EPA (2017c) has defined nonpoint source (NPS) pollution as the following:

> NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.
>
> Nonpoint source pollution can include:
>
> - Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas
> - Oil, grease and toxic chemicals from urban runoff and energy production
> - Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
> - Salt from irrigation practices and acid drainage from abandoned mines
> - Bacteria and nutrients from livestock, pet wastes and faulty septic systems
> - Atmospheric deposition and hydromodification (United States Environmental Protection Agency [U.S. EPA], 2017c, pp. 1)

Ruhl et al. (2014) stated, “EPA has identified agricultural pollution as the leading cause of impairment to our nation’s rivers, lakes, and wetlands, and not far behind in all of those cases is urban runoff” (p. 223).

Another important section of the U.S EPA’s (2002) CWA is Section 303/303(d) that sought to establish such state water quality standards (WQS) and Total Maximum Daily Loads (TMDLs) or, “the amount of a pollutant that can be discharged daily into a waterbody consistent with applicable water quality standards” (NRC, 2008, p. 78). Section 303 of the CWA prompted states to establish their own water quality criteria based on, “the physical, chemical, and biological characteristics of waters necessary to support the designated uses” (Ruhl et al., 2014, p. 229) and must be evaluated and updated every three years (U.S. EPA, 2002). Further, Section 303(d) established a requirement for states to use WQS based on the waterbody’s designated uses and water quality criteria to develop a list and rank of impaired waters that have not or could not meet those standards (U.S. EPA, 2002). Impaired waters are those that could not meet WQS for their designated use even with NPDES permits and are therefore required to have TMDLs developed for that specific waterbody or segment (Ruhl et al., 2014). The TMDL established will determine the maximum amount of a pollutant allowed to enter a waterbody/segment each day from point source pollution, nonpoint source pollution, and natural background sources at levels that do not exceed the water quality criteria, and help to determine, as well as maintain the WQS (Ruhl et al., 2014). The United States Environmental Protection Agency's (U.S. EPA, 2008) handbook for developing TMDLs lists nutrients as a common pollutant. Further, the U.S. EPA (2008) lists the common sources of nutrient pollution as coming from, "croplands (fertilizer application)" (p. 26) and, "landscaped spaces in developed areas (e.g. lawns, golf courses)" (p. 26). More specifically, the nutrients, nitrogen and phosphorous, that are commonly found in home lawn and landscape fertilizers are important to identify as possible sources of impairment in waterbodies not meeting WQS (Carey et al., 2012a; Carey et al., 2013; Fissore et al., 2012).

The TMDL program.

The TMDL program is a valuable section of the CWA because it provides the framework for addressing pervasive nonpoint source pollution (Ruhl et al., 2014). The efforts to address nonpoint source pollution through the CWA have been moderately effective due to a lack of compliance and financial support for implementation of the TMDL program (Ruhl et al., 2014). The establishment of TMDLs by each state has overall occurred slowly with approximately 50,000 TMDLs approved by the EPA since 1995 (Ruhl et al., 2014). The U.S. EPA (2014) has identified that, "more than 100,000 miles of rivers and streams, close to 2.5 million acres of lakes, reservoirs and ponds, and more than 800 square miles of bays and estuaries in the United States have poor water quality due to nutrient pollution" (p. 1) and will likely require the establishment of TMDLs to remediate. This matter is further complicated by the fact that the number of TMDLs being established is declining. There were 3,000 TMDLs approved between the years of 2010 to 2013, and this number is down from the 4,000 approved during the years of 2005 to 2009 (Ruhl et al., 2014). Further, there is a significant cost associated with establishing a TMDL upwards of $1 million, which has likely contributed to the limited number of TMDLs developed and approved (Ruhl et al., 2014). The TMDL program has generally not received as much emphasis in water quality enhancement as has point source reduction through the development of technology-based discharge standards through NPDES permits (NRC, 2008; Ruhl et al., 2014).

The Florida TMDL program directed by the Florida Department of Environmental Protection (FDEP) elucidates the complexity of the process of developing TMDLs and the time that is required. The program has a five phase process that takes place over the course of five years to develop TMDLs for the state (Florida Department of Environmental Protection [FDEP], 2016). It is first necessary to establish a baseline of environmental conditions, water quality, and pollutants through an initial assessment of the watershed basin (FDEP, 2016). This is followed by coordinated monitoring in the second year to further establish the conditions of the waterbodies in question, the extent of water quality issues, and possible management actions that can be taken for remediation (FDEP, 2016). It is in the third phase or year that TMDLs can be established from the data analysis that has identified the pollutant source or sources and quantifies the loading of pollutants (FDEP, 2016). In the fourth year, the FDEP coordinates the development of a basin management plan with local area stakeholders, to establish a plan for implementation and the responsibilities of the parties involved (FDEP, 2016). This phase also includes at least one workshop with the public to examine the basin management plan (FDEP, 2016). In the fifth and final year, the basin management plan is executed and includes obtaining permits, implementing best management practices, conducting restoration projects, and improvements of environmental infrastructure (FDEP, 2016). The cyclical design of this program and its reliance on the interaction and cooperation of local, state and federal partners to accomplish the goal of improving water quality makes it a relevant and important model to consider (FDEP, 2016).

Federal, state and local government's role in the CWA.

The development and implementation of required water quality standards set forth in the CWA has necessitated a level of cooperation between the federal government, or EPA, and the states. The responsibility of controlling point and nonpoint source pollution is the duty of the states, as they must develop NPDES permits, WQS and TMDLs; however, the EPA sets a technology based effluent standard limitation for NPDES and a water quality criteria that is often used by states as a reference in the development of WQS (NRC, 2008). The states must establish NPDES, WQS, and TMDLs, yet the EPA has final approval and determines if the state standards are acceptable; therefore, it is important for states to consider the most up to date federal standards and criteria (NRC, 2008). Water quality enhancement in the U.S. begins with federal and state oversight through the CWA; however, local government and stakeholders must also be involved to resolve an environmental issue of this scale (Greening & Elfring, 2002).

The structure of the Florida TMDL program further demonstrates how involvement of local government and stakeholder groups are necessary to succeed at water quality remediation and implementation of restoration projects within watershed basins in the state. Local governments and organizations are most effective at, “staffing, planning, and implementing projects” (p. 838), as well as developing, “specific, small-scale management actions” (Greening & Elfring, 2002, p. 839). Water quality restoration in the U.S. begins with the federal government as it provides the principal guidelines, technical assistance, funding, and leadership (U.S. EPA, 2005). At the state level, “officials interpret and coordinate federal mandates for implementation at the local level, establish state performance standards, and design criteria for runoff control” (U.S. EPA, 2005, p. 1-1). Ultimately the structure for restoration projects that are developed by small-scale levels of government are obtained from federal and state agencies; however, the local government is responsible for the day to day implementation of such projects operating within their jurisdiction (Greening & Elfring, 2002; U.S. EPA, 2005). Thus, this is a reciprocal process in which each level of administration from federal to local government should be well-informed and cooperative with the other.

Consequences of nonpoint source pollution.

In the U.S., the runoff of nonpoint source pollution has resulted in serious human health, environmental, and economic issues that have primarily been caused by nutrient pollution from sources such as animal manure, sewage treatment plant discharges, detergents, car and power plants, failing septic tanks, pet waste, and storm water runoff that includes home lawn fertilizers from overuse (U.S. EPA, 2012). The nonpoint source nutrient pollution in the U.S. has far reaching and financially significant effects (U.S. EPA, 2012). An estimated 78% of U.S. coastal waters experience an overgrowth of algae caused by nutrient pollution (U.S. EPA, 2012) Harmful algal blooms (HABs) can result in serious threats to human health (NRC, 2000; Anderson et al., 2002). HABs are caused by algal species that emit hepatoxins and neurotoxins in water that can cause stomach, liver, and neurological illness when they come in contact with people (Anderson et al., 2002; United States Environmental Protection Agency [U.S. EPA], 2017a). Additionally when disinfectants are added to reduce algal blooms, a harmful chemical reaction can occur that produces dioxins that have been linked to cancer and reproductive issues in humans (U.S. EPA, 2017a). Further, as nitrogen is the most limiting factor in plant growth it is generally applied in the greatest quantities to both agricultural and urban/suburban landscapes (Easton & Petrovic, 2004; U.S. EPA, 2005). The abundant application and the mobility of nitrates has been associated with an increase of nitrates found in ground and surface water from fertilizer runoff in both rural and urban/suburban areas (Easton & Petrovic, 2004). High levels of nitrates in drinking water can result in a serious and potentially lethal health issue for infants known as methemoglobinenimia or *blue baby syndrome* (U.S. EPA, 2005). The name of this syndrome comes from the reduced amount of oxygen in the blood and the decreased breathing that cause blue-tinted skin in infants (U.S. EPA, 2017a).

The environmental issues caused by nutrient pollution are a concern to the American public as this pollution results in approximately 100,000 miles of rivers and streams nationwide having impaired or reduced water quality (U.S. EPA, 2012). A significant waterbody affected by nutrient pollution in the U.S. has been the Mississippi River basin within which 70 million people reside and that spans 31 states (NRC, 2008; NRC, 2009a). Nutrient pollution in the Mississippi River basin comes from, “a variety of unconfined and unchanneled sources… such as runoff flowing across agricultural lands, forests, and urban lawns, streets, and other paved areas” (NRC, 2009a, p. 13) that enters the river throughout its 2,300 mile course and flows into the coastal waters of the Gulf of Mexico (GOM) (NRC, 2008). In the GOM, nutrient pollution from these sources result in vast dead zones or areas of low or depleted oxygen (NRC, 2009a). The average aerial extent of the dead zone in the U.S. has been measured at 13,800 square kilometers (NRC, 2009a). The dead zone in the GOM was measured as covering over 20,500 square kilometers in 2008, and will occur annually from late spring through the late summer months (NRC, 2009a). The dead zones are created when limiting nutrients, such as nitrogen and phosphorous are added through nutrient runoff to coastal areas allowing phytoplankton species to increase growth and therefore decomposition that deplete oxygen in the water column (NRC, 2009a; Sutton et al., 2013). The low oxygen levels or hypoxia of the water that occurs commonly results in the death of fish and shellfish that are unable to move out of range of the expansive dead zones (NRC, 2009a). Further, the same algal toxins that harm human health can cause illness and death of aquatic life, either to organisms that directly consume the algae, such as fish and shellfish, or through biomagnification of higher order animals that feed on organisms that consume the toxic algae (Anderson et al., 2002; NRC, 2009a).

The nitrogen that is transported into the GOM via the Mississippi River basin is 90% from nonpoint source pollution, with approximately 58% from fertilizer and mineralized soil nitrogen that enters the watershed primarily from its upper and middle portions where croplands are prevalent (NRC, 2008). In Louisiana, "57% of the state land area drains directly into the GOM through coastal bays and lakes, such as Lake Pontchartrain" (LNMSIT, 2014. p. 6). However, the other 43% of Louisiana's area of land drains into the MARB and, "contributes 1.7% nitrogen and 2.4% of the phosphorous load into these rivers" and ultimately into the GOM (LNMSIT, 2014, p. 6). Further, Louisiana's nutrient trends are measured at long-term water quality sampling stations located in 11 of the 12 watershed basins of the state (LDEQ, 2016). Agriculture production was found to be significantly correlated with higher concentrations of total phosphorous and total Kjeldahl nitrogen in the Louisiana Department of Environmental Quality's 2016 Louisiana Water Quality Integrated Report; however, watershed basins with the most agriculture production also showed decreasing trends in nutrient levels indicating improvements in nutrient management in these basins (LDEQ, 2016).

The aforementioned human and environmental issues that are caused by nutrient pollution directly contribute to an increased financial burden on the U.S. economy (U.S. EPA, 2012). Increased incidences of algal blooms and high levels of nitrate in drinking water supplies drive up the cost of purifying water resources for human consumption and result in higher utility bills for customers (U.S. EPA, 2012). In the U.S., the environmental costs of restoring water quality of polluted waterbodies back to their designated use, such as for recreational activities and fisheries will cost billions of dollars to accomplish (U.S. EPA, 2012). While those waterbodies that remain impacted by nutrient pollution, such as the upper Mississippi River, have an estimated $1 billion economic loss to recreational activities (NRC, 2008). In addition, there is an annual loss of tens of millions of dollars to the commercial fisheries and shellfish industries in the U.S. due to lower yields when dead zones are widespread and when there are toxic algal blooms that reduce human consumption of these products (U.S. EPA, 2012).

U.S. Urban and Suburban Impervious Landscape Design and Surface Runoff

Growth of urban and suburban areas and impervious landscapes.

As of 2011, 82.4% of the U.S. population has been living in urban or suburban areas (Wu, Stewart, Thompson, Kolka & Franz, 2015). An estimated 675,000 hectares of land each year is being converted to urban and suburban landscapes that are characterized by expanses of paved areas or impervious surfaces that cannot be penetrated by precipitation (Robbins & Sharp, 2003a; Stone, 2004). Further, the pervious surfaces in urban and suburban developments that include forested, vegetative, turf, and landscaped areas can be highly fragmented, compacted, and saturated resulting in reduced water infiltration and retention of these surfaces (U.S. EPA, 2005).

An increase in human-made impervious surface areas from paved roadways, driveways, and buildings has increased urban and suburban runoff during rain events, or storm water runoff that increases erosion of waterways and inhibits water infiltration (NRC, 2009b; Stone, 2004). As the percentage of impervious surface area increases in a watershed, the water quality decreases (U.S. EPA, 2005). At 10% impervious surface area in a watershed, critical stream attributes and aquatic ecosystems begin to decline, and watersheds with 25% or greater impervious surface area experience severe impairments that inhibit water quality from being restored to pre-development conditions (U.S. EPA, 2005).

Research by Tilley and Solnecker (2007) found that the three largest quantities of impervious surfaces in the six watersheds studied came from buildings (29.1 %), roads (28.3 %), and parking lots (24.8 %). A study by Wu and Thompson (2013) reviewed how impervious surface area had changed in four cities from 1940 to 2011. The study found that the area of buildings increased the most, then parking lots, followed by roads and driveways (Wu & Thompson, 2013). The critical factor to consider about increased urban development and the conversion of land to impervious surface area is that these changes are typically permanent; therefore, the design of urban areas will affect the potential for urban and suburban runoff and water pollution (Wu & Thompson, 2013).

The design of urban and suburban single family residential parcels was studied by Stone (2004), to determine how to reduce impervious surface areas. Stone (2004) found the area of driveway accounted for 20% of the residential parcels' impervious surface area, and a 30% reduction in impervious surfaces could be achieved, without reducing square footage of the home, by reducing lot size, the area of the home's frontage, and the area of front yard setback (Stone, 2004). The U.S. EPA (2005) report on controlling nonpoint source pollution from urban and suburban areas recommended the implementation of an "open space ordinance" in housing subdivision to concentrate housing in clusters to reduce the lot size, the setback, and the frontage distance. In areas where the open space housing design was implemented there was up to a 58% decrease in impervious surfaces and up to a 66% decrease in runoff compared to conventional residential subdivisions.

Urban and suburban surface runoff.

The relationship between population growth in urban and suburban areas, the expansion/sprawl of these developments, and the landscape design exacerbates the issue of runoff (Carey et al., 2012b; Carey et al., 2013; Wu et al., 2015). The National Research Council's (2009b) report on urban storm water management in the U.S. defines this environmental problem as, "runoff from a landscape that has been affected in some fashion by human activities, during and immediately after rain… it is the water flow over the ground surface, which is… routed to a stream, river, lake, wetland, or ocean" (p. 27). The impervious surfaces that are common in urban and suburban landscapes intensify runoff and its negative environmental effects. In such, "highly urban areas (with very high percentages of impervious surface), aquatic conditions in local streams will be irreversibly changed" (NRC, 2009b, p. 35). Urban and suburban runoff is a complex environmental issue to solve because it can be generated from all impervious features of developed landscapes and is episodic, occurring with rainfall or snow melt events (NRC, 2009b).

Rain events and snow melts are important stimuli for runoff; however, another important conduit to consider is the irrigation practices used in urban and suburban landscapes. A study conducted by the National Research Council (1996a) reviewed how runoff from irrigated landscapes can become a significant source of nonpoint source pollution entering aquatic habitats, such as lakes, rivers, and wetlands. An irrigated landscape of particular concern in urban and suburban landscapes is turfgrass. As urban and suburban areas have expanded across the U.S., the areas of irrigated turfgrass, such as home lawns and golf courses have also increased. Improper turfgrass irrigation practices can result in the runoff of fertilizers and pesticides that can effect water quality and the health of aquatic organisms (National Research Council, 1996a). At the scale of 50 million or more home lawns and 14,000 golf courses in the U.S., the potential environmental effects of improper turfgrass irrigation practices can be significant (NRC, 1996a). Turfgrass also consumes a significant amount of water, as it must be irrigated throughout the growing season. As water is a limited and highly valuable resource, water conservation is another consideration associated with turfgrass irrigation practices. To address both the issue of wasteful overwatering and nonpoint source pollution entering water resources from runoff, the NRC (1996a) report recommended the implementation of water use efficiency turfgrass irrigation management practices. The NRC, (1996a) report recommended that turfgrass irrigation practices included: the use of native grasses or other varieties of grass that require less water; the use of drip irrigation for precision application; the use of sensors that indicate when soil moisture is at a level where irrigation is necessary; and the use of computerized controllers that apply irrigation at the optimal time of day and weather (i.e. switch off in rainy conditions). The NRC (1996a) report further recommended the development of an educational outreach program to teach urban and suburban residents how to effectively utilize these turfgrass irrigation practices in their home landscape that can conserve water and reduce runoff.

Another concern regarding surface runoff is what is being transported from these developed urban and suburban landscapes into water resources. Urban and suburban runoff has been shown to transport such things as sediment, accumulated waste, toxic substances, pathogenic pollutants, and excess nutrients from lawns into aquatic systems (Stone, 2004; U.S. EPA, 2005). The various effluents entering water resources can have different environmental and human health effects. Sediment deposition alone has been designated by the U.S. EPA (2005) as a substantial source of pollution, as it not only impairs aquatic habitats and taints drinking water supplies, but the finer particles of sediment can have toxic organic compounds, heavy metals, and phosphates attached that can further cause environmental and human health problems (U.S. EPA, 2005). The damage sediment runoff can cause is therefore measured as physical, chemical, and biological damage. As such, the annual cost of damages of sediment erosion and runoff into surface waters has been estimated at $16 billion (U.S. EPA, 2005).

Pathogenic organisms, such as bacteria, viruses, and protozoa can be moved by urban and suburban runoff into water resources and affect human health. As a result, elevated bacteria levels have been found to be the most common water quality metric that is above the established level in water systems throughout the U.S. (U.S. EPA, 2005). The violations of water quality standards for pathogens result in water supplies, recreational waters, and sources of seafood being contaminated and prohibited from use.

Nonpoint source pollutants of primary concern in this study are nutrients (nitrogen and phosphorous) that enter water resources from urban and suburban runoff. Nutrient loading of nitrogen and phosphorous into water resources is an important environmental issue to solve, as it can result in eutrophication or excess algal bloom growth that can be toxic to aquatic organisms and humans (Carey et al., 2013). The rapid growth of algal blooms in water resources can also cause the system to have discoloration, reduced transparency, and hypoxia or reduced dissolved oxygen levels (Carey et al., 2013). A system with reduced oxygen levels can cause the oxygen breathing organisms in those waters, such as fish or shellfish, to perish. Lastly, when nitrogen levels in drinking water exceed the established safety criteria it can have serious human health effects, as nitrates can reduce the availability of oxygen in the body, affecting infants most severely (U.S. EPA, 2005).

The types of pollutants commonly found in urban and suburban runoff come be from various sources and practices in the urban landscape. These practices include: the use of laundry, dish and car washing soaps high in phosphates; improper maintenance of septic systems; pet and yard waste disposal methods; and inaccurate applications of landscape and lawn fertilizers (Carey et al., 2013; Fissore et al., 2012; Wu et al., 2015). This study examined the inaccurate application of the plant nutrients, phosphorous and nitrogen that can lead to the water quality issues that have critical human, environmental, and economic costs.

Although nitrogen and phosphorous are both greatly important to the health of aquatic systems when the level of these nutrients exceeds the natural influx, due to excess nutrient inputs from urban and suburban human activities, serious impairment can occur (Carey et al., 2013). Excess nitrogen can cause eutrophication or the rapid growth of algae and the depletion of dissolved oxygen primarily in estuaries and coastal areas, while excess phosphorous runoff has been shown to cause eutrophication of inland fresh water systems and some coastal waters (NRC, 2000; U.S. EPA, 2005). Elevated phosphorous levels can also cause algal growth that includes harmful algal blooms (HABs) that produce red or brown tides on-shore and off-shore that can cause respiratory and neurological issues in humans and fatalities in fish and other aquatic organisms (Carey et al., 2013).

In a study by Fissore et al. (2012), household decisions were examined to determine how they affect the flux of elements such as nitrogen in the residential landscape. Fissore et al. (2012) found that nitrogen inputs in the residential area studied came primarily from fertilizer application and nitrogen was found to accumulate in the soil. The study also found that the application of nitrogen fertilizers to the home lawn and landscape can be highly variable and can be a household decision that changes on an annual basis; therefore, fertilizer application is a practice that is largely flexible and has the potential for change. Further, a small number of households can affect the total flux of nutrients across all households indicating the importance of household-specific activities as they can affect the biogeochemistry of the residential landscape (Fissore et al., 2012).

U.S. Fertilizer Management Practices

Nursery crop production fertilizer management practices.

The economic value of the nursery production industry and the scope of its potential environmental impact necessitated the development of best management practices (BMPs) (Fain, Gilliam, Tilt, Olive & Wallace, 2000; SNA, 2013). The Southern Nursery Association (SNA) estimated the scale of horticultural production in the U.S. to be approximately 981,625 acres (Southern Nursery Association [SNA], 2013). From 2007 to 2008 the U.S. Green Industry was estimated to have an economic impact of $176 billion (Southern Nursery Association [SNA], 2013). The design of container nursery production, requires the precise application of water and fertilizer to be made, due to the potential for nonpoint source pollution through improper management practices (SNA, 2013). The Clean Water Act does not specifically state how nonpoint source pollution from nursery production should be managed, rather it stipulates that regional boards set the standards for managing fertilizer runoff from this industry (Fain et al., 2000).

The Alabama Department of Environmental Management and the Alabama Nurserymen’s Association, in partnership with Auburn University, began developing BMPs in the early 1990s to address nitrogen and phosphorous fertilizer runoff from nursery production (Fain et al., 2000). The use of nursery production BMPs progressed across the southern states of the U.S. and with the assistance of the SNA and the regional universities, a refined BMP guide for the nursery crop industry was developed in 1997 that provided uniform production guidelines that were site-specific and that could be applied as needed (Fain, Gilliam, Tilt, Olive & Wallace, 2000; SNA, 2013). The SNA has since continued to update the BMP guide for nursery crops and the third edition was published in 2013. The SNA’s 2013 guide for producing nursery crops includes BMPs, “to control site runoff, ground water contamination, spillage or leaks, sludge or waste disposal, or drainage from raw material storage” (SNA, 2013, p. 3).

The guide contains a chapter on nutrient management and irrigation practices, as both of these practices must be performed in container plant production and both have the potential to cause nutrient runoff. The SNA (2013) guide states that the most important practice in reducing the potential for nutrient runoff is precision application of water and fertilizer. Precision application of water and fertilizer can be achieved in nursery production by monitoring the nutrient levels, applying fertilizer at the recommended rate, and minimizing leaching of nutrients through precise irrigation practices. The SNA (2013) guide further recommends that if any runoff from container nursery production should occur that it should be collected and recycled instead of allowing it to flow off the property, or alternatively nutrient levels in the runoff should be reduced before it leaves the site. Overall, the guide provides valuable best management practices that if followed by nursery crop production companies should help to reduce nutrient runoff and reduce inefficient irrigation practices that can lead to runoff.

Commercial landscaping fertilizer management practices.

The impact of improper management practices used in the commercial landscaping industry must also be considered, as improper fertilizer and irrigation practices can lead to nonpoint source pollution in the urban and suburban landscapes (Florida Department of Environmental Protection [FDEP], 2015). The 2012 revenue reported for the landscaping industry in the U.S. was approximately $51,908,000 (United States Census Bureau, 2015). As of 2015, there were 91,934 landscaping companies in the U.S. that employed 511,006 people (U.S. Census Bureau, 2015). The potential for nonpoint source pollution to be generated from lawn and landscape practices can vary by state due to unique geography and climates; therefore, regional best management practices (BMPs) have been developed. California and Florida are two such states for which regional lawn and landscape BMPs have been developed. However, these two regional examples also illustrate that similar lawn and landscape BMPs are recommended for use by the commercial landscaping industry to reduce runoff and waste pollution regardless of the geographical location.

In 2000, the FDEP, university staff, and Green Industry (GI) representatives, began working on BMPs for professional service providers that strive to reduce nonpoint source pollution and increase efficient water use (FDEP, 2015). Since the first publication in 2002, the manual has been updated and the new editions have been published with important updates to the BMPs discussed. The BMPs covered in this document focus on the establishment and maintenance of turfgrass, specifically the types of irrigation practices, pest management, and nutrient management that should be used. In Florida, the coarse, sandy soils have more potential for leaching and contamination of groundwater, which is of great concern to this state due to the shortage of freshwater supplies and its continued population growth (FDEP, 2015). Therefore, water conservation is a critical issue that the GI must prioritize. The manual covers irrigation BMPs that conserve water, such as applying only the amount of water the plant requires at the right time of day. Further, precision irrigation practices must also be used to decrease the potential for chemicals that gather on land surfaces and runoff as nonpoint source pollution. The issue of nonpoint source pollution is compounded by the rise in Florida's population. As rainfall events occur, nutrients from fertilizer applications can runoff from urban and suburban landscapes when improper management practices are employed. The manual indicates that one of the most important practices in the process of applying the proper amount of fertilizer is to first soil test to determine what nutrients are required and in what amounts they should be applied (FDEP, 2015). Since 2009, the Florida legislature has recognized the BMPs in this manual and has made training for professional fertilizer applicators a legal requirement. This legislative action speaks to the significance of applying fertilizer properly to the landscape to reduce environmental and water quality impacts.

In the Bay Area of Northern California, the public agency, StopWaste, developed sustainable landscaping practices for professional landscaping companies that take an environmentally-friendly, integrated approach to landscape design, construction and management (StopWaste, 2015). The agency is governed by the Alameda County Waste Management Authority, the Alameda County Source Reduction and Recycling Board, and the Energy Council that all support the prevention and/or reduction of waste and pollution to this urban landscape. The guide discusses methods for reducing fossil fuel use in yard maintenance, retaining yard clippings to build nitrogen and reduce waste, and nurturing the soil in such a way to reduce the use of synthetic fertilizers. The guide also discusses the use of natural fertilizers as well as ways to build organic matter rich in nutrients. This begins with the use of grass clippings from the yard and the addition of compost to turf. These practices alone can reduce the need for supplemental synthetic fertilization by 50%. The guide also recommends that if synthetic fertilizers are required to meet plant growth objectives then it should be applied in a slow-release form that allows nutrients to be available when needed. However, the guide stipulates that synthetic fertilizers should only be applied in the amount indicated by a soil test to reduce the potential for fertilizer runoff and to cut the cost of wasteful over application of these products.

Urban and suburban lawns and landscape fertilizer management practices.

Understanding the types of fertilizer management practices used by urban and suburban residents is critical since the U.S. national estimate of lawn coverage is between 10 million and 16 million hectares of land (Robbins & Birkenholtz, 2003). Further, the residential use of chemical lawn care and landscape products has been steadily increasing since the post-World War II era (Robbins & Sharp, 2003a). As of 1999, the U.S. annual spending on lawn care equipment and chemicals totaled $8.9 billion (Robbins and Sharp, 2003a). It is important to note the influence chemical companies have had on the lawn care practices used by urban and suburban populations as their objective has been to market and sell such products to this consumer base (Robbins & Sharp, 2003a; Robbins & Sharp 2003b). The aesthetic of chemical lawn care in residential communities is a norm that has been proliferated by lawn care companies through their efforts to attract new users by promoting the benefits of chemical based lawn care maintenance in urban and suburban areas (Robbins & Sharp, 2003a). Chemical companies have utilized *pull marketing*, or product branding, direct marketing, and sales to increase the number of individuals applying chemical products to their home lawn and landscape (Robbins & Sharp, 2003). However, the greater concern has been the use of marketing tactics to increase the amount of chemical products each consumer applies to their home lawn and landscape (Robbins & Sharp, 2003a). Further, the overuse of fertilizer or the management practice of over applying fertilizer beyond what is required by the plant is not recommended practice (Carey et al., 2012a; U.S. EPA, 2005). The fertilizer management practices used in urban and suburban landscapes are particularly important for nitrogen fertilizers as, "N cycling in household landscapes is complex and strongly influenced by management practices" (Fissore, et al., 2012, p. 2).

A review of turfgrass fertilizer management practices in the U.S. indicated that there were several recommended and improper management practices (Carey et al., 2012a; FFL, 2015; LSU AgCenter, 2007; LSU AgCenter, 2008; UF IFAS Extension, 2004; U.S. EPA, 2005). The Cooperative Extension Service in both Florida and Louisiana recommend the use of a soil test to determine what nutrients are present in the soil, which nutrients are needed for proper plant growth, and in what amount to apply fertilizer amendments (FFL, 2015; LSU AgCenter, 2007). However, nitrogen is not analyzed in the regions of Florida where sandy soils are present because nitrogen is highly mobile in such soils (FDEP, 2015). It is therefore recommended that when applying fertilizer to the home lawn and landscape that residents utilize regional management practices that have been developed for the specific needs of the plants being grown in that region (Carey et al., 2012a). The U.S. EPA (2005) recommends when fertilizers are applied for plant growth that the product label written on the fertilizer be followed precisely to decrease the risk of over-application of fertilizer and potential runoff. In Louisiana, residents are encouraged to read and understand the instructions listed on the fertilizer product label before applying such products (LSU AgCenter, 2007). The Florida-Friendly Landscaping (2015) yards and neighborhoods handbook further recommends that residents should under no circumstance apply more than the rate listed on the fertilizer label.

The U.S. EPA (2005) found that in residential areas, fertilizers were being applied at the same rate as row crops. The over application of fertilizer to residential lawns and landscapes can cause excess fertilizer runoff into waterways (U.S. EPA, 2005). The nitrogen and phosphorous content in the fertilizers become pollutants in water that stimulate algal growth, decomposition of aquatic vegetation, and reduced light/oxygen levels (U.S. EPA, 2005). Carey et al. (2012a) identified that the most crucial fertilizer best management practice to have residents use when applying fertilizer to their home lawn and landscape would be selection of appropriate fertilization rates, as this practice typically reduces the overall amount of fertilizer applied and decreases the potential for excess fertilizer runoff. Carey et al. (2012a) additionally found that fertilizer application rates should be based on the type of turfgrass being grown and the type of fertilizer (i.e. soluble and slow release) being applied. Further, it is recommended that the fertilizer rate be determined by calculating the square footage of lawn to which the product will be applied (LSU AgCenter, 2007). The recommendation for applying fast-release nitrogen to the lawn or landscape is to apply no more than one pound of nitrogen for every 1,000 square feet of lawn (LSU AgCenter, 2008; UF IFAS Extension, 2004).

A calibrated spreader is recommended for use to apply the right amount of fertilizer to the area of lawn that was measured (LSU AgCenter, 2008; UF IFAS Extension, 2004). The type of spreader used may vary; however, it is never recommended for the application of lawn fertilizer to be done by hand (LSU AgCenter, 2008). The LSU AgCenter (2007) Louisiana yards and neighborhood guide recommends filling spreaders on sidewalks where fertilizer granules if spilt can be swept up to reduce such excess product from running off. Further, if fertilizer is spilled onto grass it is recommended that as much fertilizer as possible be collected and not be washed into the grass as the fertilizer can leach and runoff from the soil (FFL, 2015). The U.S. EPA (2005) warns of the danger of nutrient runoff into water resources from accumulations of fertilizer product spilled on to sidewalks, roads, and lawns.

Carey et al. (2012a) reviewed the timing of fertilizer application and found that the potential for fertilizer runoff is greater when fertilizer is applied to turfgrass during periods of dormancy. In Louisiana, the fertilizer schedule is based on the type of grass being grown, the type of fertilizer (slow or quick release) applied, and the achievement of satisfactory growth (LSU AgCenter, 2008). It is additionally not recommended in Louisiana to apply fertilizer to warm season turfgrass during the months of October to February as these applications can be damaging as well as wasteful (LSU AgCenter, 2008). After applying lawn fertilizer, an important management practice for residents to complete is the light *watering in* of the product with irrigation to move the fertilizer off the leaf blades and into the soil; however, more than a quarter inch of water applied to the fertilized area will increase the risk of leaching and runoff (Carey et al., 2012a; UF IFAS Extension, 2004). Watering in fertilizer with rainfall is not a recommended practice, particularly when heavy precipitation is predicted, as the amount of moisture may exceed what is required and increase the risk of fertilizer runoff (FFL, 2015; LSU AgCenter, 2007). Further, improper irrigation practices and overwatering beyond the amount required by lawns can result in fertilizer leaching into groundwater and nutrient runoff into water bodies (FFL, 2015; LSU AgCenter, 2008). Lawn irrigation is recommended when there are signs of moisture stress, and only a half of an inch to three fourths of an inch of water is recommended (FFL, 2015; LSU AgCenter, 2007).

In addition to the proper or improper method of implementing fertilizer management practices, research indicates that there is a “human dimension” to lawn management through which community members influence the types of lawn management practices that one another use (Carey et al., 2012a; Robbins et al., 2001). Individuals are likely to use certain fertilization practices if their neighbors are also implementing that practice (Carey et al., 2012a; Robbins & Sharp, 2003b). Further, the research by Carey et al. (2012a) found, “individual lawn management practices (e.g., fertilizer application rates) have a strong social component that is dictated by community-oriented values” (p. 287), and, “fertilizer inputs for one resident tend to be related to the practices used by others in the community” (p. 288). Studies have found that even if homeowners understand that particular lawn management practices, such as applying fertilizers in excessive amounts, can cause nutrient runoff and negatively affect water quality, they are nevertheless likely to use these practices if it is valued within their community as the norm (Carey et al., 2012a; Robbins et al, 2001; Robbins & Sharp, 2003b). Additionally, Robbins and Birkenholtz (2003) found, “the use of lawn care inputs… to be positively associated with high levels of income and education and is disproportionately heavy amongst consumers who not only claim environmental concerns but who also acknowledge the negative effects of their actions” (p. 184).

In a multiphase mixed method study, Nielson and Smith (2005) examined the effect of yard care practices on water quality in the Tualatin Watershed of Oregon. The researchers sampled three neighborhoods to collect direct, discreet observations of lawn care practices that are connected to water quality because these behaviors can often be influenced by the practices of other neighbors (Nielson & Smith, 2005). The observations were followed up by a mailed survey that asked questions about knowledge of water quality issues, lawn care practices, factors that influence those practices, and respondents' environmental values (Nielson & Smith, 2005). Semi-structured interviews were conducted using a convenience sample of residents living in the three neighborhoods in the study (Nielson & Smith, 2005). Survey data indicated that the residents of this watershed were applying fertilizer more than the recommended number of times per year, with 26% of the respondents indicating three applications per year and 38% selecting two times per year (Nielson & Smith, 2005). Correlations between the frequency of fertilizer application and the observation data revealed that a possible explanation for a greater number of applications of fertilizer per year was its significant correlation with the greenness and the homogeneity of the lawns directly observed in the watershed (Nielson & Smith, 2005). The interview data revealed that the most important reason why homeowners maintained their yard was the aesthetic value or to keep it, "neat, clean, green, and nice" (Nielson & Smith, 2005, p. 102). The interview data indicated that common yard care practices came from a feeling of responsibility to the neighborhood and other residents, to keep the community looking maintained (Nielson & Smith, 2005). Lastly, 40% of the people interviewed indicated that the main source of knowledge about home yard care practices was learned from family and friends (Nielson & Smith, 2005). From the results of this study, Nielson and Smith (2005) determined that the yard care practices being used and how the home lawn and landscape are maintained is a *cultural phenomenon* that is influenced by the practices of the surrounding community and a feeling of obligation to comply with similar yard care practices used by neighbors. Nielson and Smith (2005) concluded that the specific practices used by residents should be determined in future studies to help to better understand the impact of those practices to be able to target and change improper practices and their underlying values.

The study by Morton and Padgitt (2005) found that when evaluating watershed management strategies the attitudes, values, and norms of residents need to be considered because they shape collective and individual behaviors. Social norms can also function as barriers or incentives to adopting and performing practices that have either environmentally positive or negative effects (Morton & Padgitt, 2005). Carey et al. (2012a) recommended that to decrease the use of fertilizer management behaviors that can lead to runoff, educational programs must be used to change residents' individual and collective attitudes and behaviors and enhance adoption of recommended practices. Further, Carey et al. (2012a) found that, "understanding and targeting the motivations and behaviors of watershed residents is an essential aspect of adopting appropriate fertilizer management practices" (p. 288).

Carey et al. (2012b) reviewed the importance of implementing best management practices (BMPs) in areas experiencing rapid population growth such as Florida and Michigan to sustain the environmental functions of water resources. In such states fertilizer restrictions have been enacted and fertilizer management educational programs had been developed to reduce nutrient pollution (Carey et al., 2012a). In Ann Arbor, Michigan, reduced phosphorous levels in the Huron River were achieved by implementing a restriction on phosphorous application to the home lawn and landscape, and by a fertilizer management education program offered to homeowners (Carey et al., 2012b). Since 1979 the state of Florida has implemented regulations to improve water quality, beginning with storm water treatment for new developments (Carey et al., 2012b). In 2007, the *Urban Turf Fertilizer Rule* was enacted in Florida to restrict the amount of nitrogen and phosphorous that could be applied to urban turf and lawns (Carey et al., 2012b). The restriction was accomplished by limiting the size of fertilizer bags sold in stores for home lawn and landscape application to less than 50 pounds and by limiting the amount of fertilizer that could be applied in a single application (Carey et al., 2012b). Further, Carey et al. (2012b) found that municipalities in the state of Florida have also implemented public education and outreach programs as a non-structural best management practice to control fertilizer application. Carey et al. (2012a) recommends that fertilizer management education programs be utilized in urban and suburban communities as an important method to change the home lawn and landscape fertilizer practices used by individuals. An educational organization that has been effective at diffusing and increasing adoption of research-based best management practices by the general public is the Cooperative Extension Service (National Research Council [NRC], 1995; National Research Council [NRC], 1996b).

U.S. Cooperative Extension Service

The history of the Cooperative Extension Service.

The Cooperative Extension Service (CES) was formed by the 1914 Smith-Lever Act which sought to extend the information gained from academic research to the public. Further, a land grant university system was established by the Morrill Act of 1862 which provided that universities should be established to teach agriculture and the mechanical arts (Comer, Campbell, Edwards, & Hillison, 2006; National Research Council [NRC], 1996b). The second Morrill Act of 1890 was an important piece of legislation for the land grant system as it established that federal funds would be given to these colleges/universities on an annual basis, allowing them to endure and progress (Comer et al., 2006; NRC, 1995). The vital research completed by the land grant university system was made possible by the Hatch Act of 1887 that mandated that these institutions conduct original research in agriculture and the mechanical arts to validate and support the teaching mission of these schools and established a network of state agricultural experiment stations (SAES) (Comer et al., 2006; NRC, 1995; NRC, 1996b). Together these important acts of legislation established the teaching, research, and extension missions of the land grant system.

Since its inception in 1914, the CES has been a partnership between local government (counties and parishes), states, and the federal government most recently through the United States Department of Agriculture's National Institute of Food and Agriculture (NIFA) (Comer et al., 2006; NRC, 1995; United States Department of Agriculture National Institute of Food and Agriculture [USDA NIFA], 2016a; Wang, 2014). NIFA was established from the 2008 Farm Bill to take the place of the Cooperative State Research, Education, and Extension Service to address the challenges of the 21st century (USDA NIFA, 2016a). The CES represents the important and vital *service function* of the land grant system that connects these institutions of higher education to their communities and society as a whole (NRC, 1996b; United States Department of Agriculture National Institute of Food and Agriculture [USDA NIFA], 2016b). The CES disperses the inquiry based, un-biased knowledge and technology developed through the education and research conducted at these institutions to the members of the public that can benefit from these scholastic and/or technical advances (NRC, 1996b; USDA NIFA, 2016b). The CES has been successful at diffusing such information and innovation to the community through non-formal education and hands-on learning/demonstrations (Comer et al., 2014; Gould, Steele & Woodrum, 2014; USDA NIFA, 2016b).

The CES has been integral in connecting the research in agricultural science conducted at the land grant institutions to the farming community in the U.S. by, "disseminating technology, shortening the period of technology adoption, bridging the gap between findings in the lab and practices on the farm" (Wang, 2014, p. 5). The CES has been recognized as a significant contributor to the growth in agricultural productivity in the U.S. through its dissemination of innovative farming practices and technologies (Henning, Buchholz, Steele, & Ramaswamy, 2014; Sparks, 2014; Wang, 2014; USDA NIFA, 2016b). The USDA's 2011 agricultural productivity estimate was 2.5 times greater than the productivity measured in 1948 (Wang, 2014). This increase in productivity has been achieved through the organization's focus on education and marketing to not only publicize agricultural innovations, but to help improve adoption of these practices and technologies by the public they sought to serve (Henning et al., 2014; Wang, 2014). The CES, in addition to supporting the adoption of agricultural innovations in crop systems and animal husbandry, also helped to propagate improvements in home economics, youth leadership (4-H), and nutrition/health (Gould et al., 2014; Henning et al., 2014). However, the informational and technological needs of the U.S. public that the CES continues to serve has changed as the demographics of the country have changed over the life of the program (Henning et al., 2014; NRC, 1995; USDA NIFA, 2016a).

When the CES began, half of the population in the U.S. resided on farms in rural communities and were in need of advancements in agricultural practices and technologies (NRC, 1996b). Over time the U.S. population has shifted, with only 2% residing in rural farming areas, and only 15% living in "non-metropolitan counties" (Henning et al., 2014, p. 3; NRC, 1996b). As the demographic of people in the U.S. has changed, the CES has adapted its programs and approaches to be able to meet the needs of a more diverse and economically challenged suburban and urban clientele (Gould et al., 2014; Henning et al., 2014). To improve the economic and social environments in the U.S, the CES has shifted to more family/consumer science (health, nutrition, food safety/security) and community development (Gould et al., 2014; Henning et al., 2014; USDA NIFA, 2016a). Further, an important shift in CES programs has occurred in agriculture, as the research from the land grant institutions began to transition in the 1960's to consider the impact of agriculture on the environment and to consider more sustainable and environmentally conscious farming practices (Henning et al., 2014; NRC, 1996b; USDA NIFA, 2016a). In addition, the research at the land grant universities shifted to focus on pertinent natural resource and environmental issues; therefore Extension programs have been developed to address such topics as climate change, integrated pest management, and sustainable agriculture (soil conservation and nutrient management) (Henning et al., 2014; Sparks, 2014; Wang, 2014; USDA NIFA, 2016a).

The experience of the CES in developing educational programs for its now greater urban and suburban clientele has made it an organization with the skills to diffuse and increase adoption of best management practices performed by the residents of these communities (Henning et al., 2014; NRC, 1996; USDA NIFA, 2016b). The shifts in research at the land grant institutions to address the current social, economic and environmental issues in the U.S. and the subsequent change in CES educational outreach programs makes the CES qualified to address such issues as home lawn and landscape management practices that contribute to impaired water resources (Henning et al., 2014; U.S. EPA, 2005; U.S. NIFA, 2016b). The U.S. EPA (2005) advocated for the use of Extension educational outreach to teach recommended fertilizer best management practices and increase implementation on residential lawns and landscapes. The CES has in fact been developing educational programs and conducting research on the adoption of water quality and conservation practices, as well as the adoption of environmental landscape management practices in urban and suburban areas.

CES education programs: Adoption of water quality management practices.

The study by Borisova et al. (2012) reviewed the public's participation in three types of volunteer programs that had water resource protection modules in eight southern states, including Louisiana. These volunteer programs included the Master Gardener (MG) program, water quality monitoring, and water resource management. Following participation in one of the three volunteer programs, Borisova et al. (2012) surveyed participants' implementation of specified yard management practice that either conserve water or protect water quality. The survey had a response rate of 50.9%, and of those that responded, 13% indicated that they participated in at least one of the three volunteer programs (Borisova et al., 2012). The researchers used U.S. census data from the eight states in this study to extrapolate the 13% to be approximately 6 million people that have been reached or have participated in these volunteer programs. Borisova et al. (2012) found that participation in the MG program was greatest in the states of Alabama, Florida, and Mississippi. Individuals were more likely to participate in the MG program if they were 65 years of age and older, and specifically wanted opportunities to learn about water conservation and water quality preservation (Borisova et al., 2012). The study by Borisova et al. (2012) found that of the total population of respondents, 70% reported that they had implemented at least one of the specified yard management practices that can either conserve water or protect water quality. Of the respondents that indicated participation in one of the three volunteer programs examined in this study, 85% implemented at least one yard management practice listed in the survey (Borisova et al., 2012).

A study by Huang and Lamm (2015) examined *high water users* in Florida to determine their perceptions of and experiences with water quality, and their level of participation in Extension programs. The purpose of studying the population of high water users was to better understand their specific behavior patterns to develop tailored Extension intervention programs to improve water conservation within the state (Huang & Lamm, 2015). The objective of this web-based survey research study was to understand how public awareness of water quality and engagement in Extension programs influenced their behaviors (Huang & Lamm, 2015). The results indicated that poor quality of drinking water was experienced by the greatest number of respondents and clean drinking water was considered to be extremely important (Huang & Lamm, 2015). This result provided insight into strategies for combatting water quality issues through Extension programs by identifying a water quality issue that was personally relevant to this decisive population (Huang & Lamm, 2015). Participation was not very high in the Extension programs reviewed in this study; however, to enhance program participation the data on the importance of clean drinking water could be used to develop Extension programming that focuses on teaching behavioral practices that improve drinking water quality (Huang & Lamm, 2015). Framing Extension programming around the water quality issues that are personally relevant to this population was found to have a greater potential to activate interest in water quality protection and lead to effective behavioral change (Huang & Lammn, 2015).

Further, the research by Warner, Rumble, Martin, Lamm and Cantrell (2015) studied how Extension professionals can effectively communicate about water conservation practices through tailored messages. The Theory of Planned Behavior (TPB) and framing theory were used to examine how tailored messages can be used to encourage the adoption of recommended irrigation practices by urban residents (Warner et al., 2015). The attitude and perceived behavioral control TPB constructs were studied to determine how to increase intention to perform the recommended practices (Warner et al., 2015). Two types of message frames (gain and loss) were studied, as the method of framing a message had been shown to influence how a message is interpreted by the target audience (Warner et al., 2015). The results of this study indicated that the two messages that framed the performance of recommended irrigation practices as a gain significantly increased participants' attitudes toward and perceived control of such practices (Warner et al., 2015). This result confirmed that the method of presenting a strategic message is important and framing the performance of a practice as a gain to the targeted audience can increase adoption of the recommended water conservation practices (Warner et al., 2015).

CES education programs: Environmental landscape management practices.

Israel, Easton and Knox (1999) completed a survey research study to investigate three different types of educational delivery methods used in the Florida Cooperative Extension Service's environmental landscape management (ELM) education programs. The three types of ELM programs studied were: 1) Master Gardener (MG) program that required 50 hours of training on landscape management and 50 hours of volunteer service to gain experience; 2) ELM seminars or workshops (from one to six hours) with accompanying publications; 3) and ELM publications only (Israel et al., 1999). This study compared the effectiveness of the three types of delivery methods in program participants' adoption of recommended ELM practices with a nonparticipant comparison group (Israel et al., 1999). A survey was used to collect data on the ELM practices used, homeowner characteristics, and attitude about landscape management. The data was collected from the program participants before participation and six months after completion of the program. The results of the study revealed that six months after the participation in the three programs the average number of ELM practices used by participants was larger than nonparticipants (Israel et al., 1999). Further, the type of program significantly influenced ($F = 31.7$, $p = 0.001$) the change in the number of ELM practices implemented by participants (Israel et al., 1999). Overall, Israel et al. (1999) found that the MG (6.9 practices) and the seminar/workshop programs (4.3 practices) had a greater rate of adoption of the ELM practices than did the publications only (2.6 practices) program method.

The ELM recommended practices examined in this study included fertilization practices, such as using slow release fertilizers and applying the correct amount of nitrogen (Israel et al., 1999). The post-program results indicated that the participants in all three delivery methods significantly increased use of slow release fertilizers, with seminar/workshop participants having the greatest increase and nonparticipants with no change (Israel et al., 1999). Six months after program completion the application of the proper amount of fertilizer was the fertilizer practice with the largest percent increase for the MG (38.1%) and seminar/workshop (17.5%) participants, respectively (Israel et al., 1999). Israel et al. (1999) discussed that the greater adoption rate of practices in the MG and the seminar/workshop programs may be due to the participants' direct interaction with educated, trained Extension faculty that can explain the recommended ELM practices in meaningful, relevant terms to motivate participants' adoption. Further, Israel et al. (1999) discussed how in the MG and seminar/workshop program participants have an opportunity to speak directly with Extension faculty about any concerns, and provide Extension faculty with an opportunity to discuss how ELM practices can save homeowners time and reduce costs. Israel et al. (1999) concluded that to increase the adoption of recommended ELM practices that ELM educational programs should focus more on seminars or workshops that are accompanied by supplemental publications. However, Israel et al. (1999) further recommended that to improve participants' adoption of ELM practices in a publications only education program that additional information on how to, "address issues that facilitate or inhibit homeowners making changes in how they manage the landscape" (p. 266) should be included.

The research by Israel and Hague (2002) considered the differences between the participants of Extension homeowner landscaping educational programs and nonparticipants to determine which factors influence participation in these Extension programs and to recruit and attract *at risk* homeowners, or the people that have the greatest environmental impact. Israel and Hague (2002) utilized socio-psychological factors, behavioral characteristics, residential landscape features, and demographics to investigate *coverage bias* resulting from recruitment practices for lawn and landscape maintenance educational programs. The survey contained measures to assess homeowners' participation in the Florida Yards and Neighborhood (FYN) program. The survey was distributed to FYN program participants after attending a workshop. The same survey was mailed to a comparison group that was obtained through a stratified random sample of homeowners from single-family residences. The results showed that the following demographic and landscape characteristics of the FYN program participants made the greatest contributions in distinguishing them from the homeowner comparison group: higher percentage of post graduate education; higher mean age; lower mean number of years lived in Florida; lower percentage of male population; higher percentage of white, non-Hispanic race; lower percentage of single-family residence; higher percentage of a permanent irrigation system; and higher percentage of hours per week spent on yard work. Additionally the following behavioral and socio-psychological factors also had a net effect on participation in the FYN program: time homeowners spent on the yard work; use of Extension services in the past year; networking to share information with friends and neighbors; and less concern for neighborhood norms than nonparticipants.

However, Israel and Hague (2002) found that FYN participants did not differ from nonparticipants in their program enrollment based on the use of environmental best management practices. Therefore, the researchers concluded that only the aforementioned demographic, landscape characteristics, behavioral, and socio-psychological factors influenced participation in the FYN program. Israel and Hague (2002) recommended that the FYN program enhance participation of the underrepresented segments of the population (males, Hispanics, long-term state residents, etc.) identified in this study by asking program participants who reported that they network and share information to tell their friends and neighbors that have not attended the program about the benefits of participating. Israel and Hague (2002) further recommended that the FYN program use multiple communication channels that reach a broad cross-section of the population to recruit new participants to the program. Additionally, since lack of participation in Extension programs was associated with a concern for neighborhood norms, Israel and Hague (2002) recommend showcasing alternative practices/methods through demonstration sites in neighborhoods or community areas. Israel and Hague (2002) further recommended that participants be recruited for the FYN program from other Extension programs in which participants had a positive experience.

In 2009, Brown reviewed the adoption of environmental landscape practices by former participants of the FYN program, administered by the Florida Extension Service. The goal of the FYN program was to change participants' behavior on nine major practices that included such practices as *fertilize appropriately*, *reduce storm water runoff*, and *protect the waterfront* (Brown, 2009). A survey was sent out to past participants of the FYN program, to determine the demographic profile of the respondents, their current use of six landscape practices, and which demographic characteristics were associated with the adoption of the six environmental landscape practices. The survey response rate was 76% and the majority of respondents were college educated, female, over the age of 56, lived in Florida for more than 10 years, and resided in urban/suburban communities that were not deed-restricted or gated (Brown, 2009). The results further showed that 32% of respondents worked eight to 15 hours per month in the yard and 33%

of respondents spent approximately $700 per year on the yard (Brown, 2009). The six landscape practices evaluated in the survey included such practices as the type of fertilizer applied and the irrigation schedule that were used (Brown, 2009).

When the demographic characteristics were correlated with the adoption of all six practices, the demographic characteristic of not living in a deed restricted or gated community and maintaining your own lawn had a significant relationship with adoption of the most *environmentally friendly approaches* (Brown, 2009). Further, the demographic characteristic of spending less money per year on the yard was found to be strongly correlated with the adoption of the most environmentally friendly approaches to the landscape practices studied (Brown, 2009). This finding was important as it could be used to encourage the adoption of environmentally friendly landscape practices by showing how these practices can produce long-term savings to residents. Overall, the results showed that for all six practices the majority of former FYN participants surveyed in this study adopted the most environmentally friendly approaches (Brown, 2009). For example, when respondents were asked what type of fertilizer they used 83% reported the use of slow-release fertilizers (Brown, 2009). The results of this study and of similar studies led Brown (2009) to state that participants of such Extension educational programs, or people that have been exposed to Extension educational information from such programs are more likely to adopt environmentally friendly landscape practices.

Lastly, a study by Hefner, Robertson, Coulter, and Stevens (2009) identified the key components for a successful *urban nutrient management plan* by studying the obstacles faced by homeowners in a residential area of Springfield, Missouri. The program was funded by the local watershed partnership and soil and water conservation district to enlist the Natural Resource Conservation Service and the University of Missouri Extension to develop urban nutrient management plans for homeowners in the James River Basin that had been experiencing elevated phosphorous levels and associated algal blooms. Nutrient management issues began with many homeowners having difficulty knowing what types of fertilizer to buy, what size of bags, and how many were needed (Hefner, 2009). Further, homeowners did not know how to accurately calculate the area of the lawn and therefore could not figure out the correct amount of fertilizer to apply (Hefner et al., 2009). The program began with soil tests of the homeowners' lawns to obtain a baseline of the soil nutrient levels, as well as soil pH and organic matter (Hefner et al., 2009). A post-evaluation survey revealed that prior to involvement in the program only 21% of participants had a current soil test (Hefner et al., 2009). The soil test results revealed that 51% of the lawns analyzed had excessive amounts of phosphorous in the soil caused by the use of a *balanced fertilizer* and a lack of soil testing prior to fertilizer application (Hefner, 2009).

The objective of the educational intervention program was to improve nutrient management practices through the development of lawn nutrient management plans for homeowners that perform *self-service lawn care* (Hefner et al., 2009). To meet the program objective, from 2002 to 2008 trained technicians made on-site visits to the homes of the 600 program participants to survey current lawn conditions and discuss lawn care goals (Hefner et al, 2009). The urban nutrient management plans were then tailored to meet the needs of the program participants' home lawns, and provided relevant information about what types of fertilizers were needed, what time of year to apply the amendments, and in what amount to apply them using a *spreader calibration procedure* (Hefner, 2009). After the establishment of the nutrient plan a technician would meet again with the homeowners for a consultation session to discuss the details of the plan and educate homeowners about nutrient management and the health of their watershed (Hefner et al., 2009). The nutrient management plan then served as a *fertilizer* *shopping list* to assist homeowners when purchasing fertilizer products (Hefner et al., 2009). Program participants were asked to evaluate the program by responding to post-evaluation surveys. The researchers found that the top three reasons reported for participating in this program were: 1) to enhance the appearance of their lawn by following *science based recommendations*; 2) to have a written conservation plan that provides information about the type of fertilizer to use, the amount to apply, and the timing of fertilizer application; and 3) the opportunity to save money by correctly applying amendments (Hefner et al., 2009). After participating in this program, 68% of participants reported that they were purchasing the type of fertilizer and applying the amount designated in the nutrient plan (Hefner et al., 2009). Therefore, the nutrient management plan was evaluated as an effective method of engaging and educating urban homeowners about practices that can decrease nutrient runoff into nearby water resources (Hefner et al., 2009).

Louisiana Nutrient Management Programs

Louisiana Nutrient Management Strategy.

Development of the Louisiana Nutrient Management Strategy began in 2013 with a public outreach and stakeholder engagement phase that determined the content to be included in the strategy (LDEQ, 2017). In 2014, the Louisiana Nutrient Management Interagency Team (LNMSIT), comprised of the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Agriculture and Forestry (LDAF), the Louisiana Department of Natural Resources (LDNR), and the Coastal Protection Authority of Louisiana (CPRA) published the strategy, which sought to improve, restore, and protect Louisiana's waterbodies (LNMSIT, 2014). As part of the nutrient management strategy, the team recommended the reduction of nonpoint source pollution (LNMSIT, 2014). The LDAF, the LDEQ and the LDNR developed a nonpoint source pollution management plan for Louisiana that included control measures for agriculture, forestry, home sewage systems, and urban storm water runoff (LNMSIT, 2014). It was recommended that nonpoint source pollution in Louisiana be addressed through best management practices (BMPs) and conservation practices (LNMSIT, 2014). The recommended BMPs for nonpoint source pollution have been covered in manuals developed by state agencies to reduce nonpoint source pollution, such as nutrient sources found in urban storm water runoff from fertilizers applied to residential lawns and landscapes. The Louisiana Department of Natural Resources (2008) developed a BMP manual for urban storm water runoff in coastal Louisiana as this area is particularly susceptible to storm water contaminants, such as fertilizer nutrients entering the Gulf of Mexico. A critical BMP that the LDNR (2008) recommends for coastal urban and suburban areas of Louisiana is soil testing in the preparation and maintenance of developed landscapes to reduce nutrient runoff.

The LNMSIT (2014) additionally reviewed new science-based methods for fertilizer application such as the fertilizer industry's *4R nutrient stewardship* concept. The 4R philosophy involves the right timing, right source, right rate, and right placement of fertilizer as these practices support efficient use of fertilizer (LNMSIT, 2014). Further, the 4R nutrient philosophy promotes implementation of best management practices that result in fertilizer being applied in an amount that matches the needs of the plant, to improve uptake and reduce excess fertilizer runoff (LNMSIT, 2014). The LNMSIT (2014) further reviewed the use of *Enhanced Efficiency Fertilizers* that slowly release fertilizer to the plant or that convert it to more stable forms of nitrogen that are less susceptible to runoff. Overall, nutrient best management practices should enhance the efficiency of nutrient uptake by plants to reduce the amount of nutrient lost during application (LNMSIT, 2014). The LNMSIT (2014) additionally discussed how community educational outreach programs can be used to further control the discharge of fertilizer pollutants found in storm water runoff in residential areas by increasing residents' adoption of best management practices that reduce fertilizer runoff.

Louisiana Department of Environmental Quality TMDL Program.

The Louisiana TMDL program is overseen by the Louisiana Department of Environmental Quality (LDEQ). The current status of Louisiana's impaired waterways are reviewed in the LDEQ's biennial water quality inventory integrated report (LDEQ, 2016). The integrated report is approved by the EPA and is published to meet the requirements of the Clean Water Act, specifically to address sections 303(d) and 305(b). Total Maximum Daily Loads (TMDLs) are established to address section 303(d) for the segments of waterways with impairments that have been identified through water quality monitoring.

The water quality integrated report has eight category designations to which waterbodies and water impairments can be assigned (LDEQ, 2016). These designations of water body impairments can then indicate how the impairment should be approached, to improve compromised water resources. The development of a TMDL in Louisiana is a six step process (LDEQ, 2016). The first step is to identify the subsegment for which the TMDL will be established and state the problem causing the impairment. Second, there is a description of the pollution controls that will be used and how those will accomplish the desired Water Quality Standards (WQS). Third, a projected or estimated time will be established for when the WQS will be achieved. Fourth, a specific schedule will be designated for when to implement the pollution controls. Fifth, a monitoring plan will be established to track the effectiveness of the pollution controls implemented. Lastly, a commitment is made to revise the pollution controls as necessary.

The LDEQ's 2016 Integrated Report reviewed the subsegments or portions of watersheds that were delineated for water quality monitoring. The three primary designated uses evaluated were: primary contact recreation (PCR or swimming); secondary contact recreation (SCR or boating); and fish and wildlife recreation (FWP or fishing) (LDEQ, 2016). The PCR and SCR showed moderate improvement in supporting the designated use since the 2014 report (LDEQ, 2016). Of the subsegments not meeting the PCR (34%) and the SCR (5%) designated use, the majority were due to elevated levels of fecal coliform (LDEQ, 2016). Fecal coliform ranked second in the number of subsegments impacted by this suspected source of impairment with a 129 in total (LDEQ, 2016).

Since the 2014 report, the FWP showed a moderate decrease in the overall designated use (LDEQ, 2016). Of the subsegments not meeting the FWP designated use (73%), the suspected source of impairment for the majority of subsegments was low dissolved oxygen levels (LDEQ, 2016). Dissolved oxygen impacted the largest number of subsegments with a 188 in total (LDEQ, 2016). The nitrate/nitrite suspected cause of impairment was found to have impacted 44 total (38 rivers and 6 lakes) water body subsegments, and the total phosphorous impacted 42 total (36 rivers and 6 lakes) subsegments (LDEQ, 2016). Overall, the LDEQ (2016) reported that 40% of the subsegments in Louisiana were impacted by nonpoint source pollution from storm water runoff from such areas as urban residential. Although there were no TMDLs established for nutrient impairments in the LDEQ's 2016 Integrated Report, other sources of water quality impairment, for which TMDLs have been established showed success in improving water quality.

A recent example of such success in water quality restoration involved the Natalbany River watershed that was impaired due to high levels of fecal coliform bacteria. Through restoration efforts this watershed has been reinstated to its primary contact recreation (PCR) designated use (United States Environmental Protection Agency [U.S. EPA], 2018). The Natalbany River watershed contains the towns of Albany and Springfield (U.S. EPA, 2018). The major source of impairment of the Natalbany River was found to be high bacteria emanating from improperly managed septic systems located in these residential areas of the watershed (U.S. EPA, 2018). The Natalbany River was added to the 303(d) list of impaired waterways due to the fecal coliform levels that exceeded those for PCR during the 2001 sampling year (U.S. EPA, 2018). The TMDL for this watershed was not developed until 2012 due to a court-ordered schedule (U.S. EPA, 2018). The TMDL established was set to reduce fecal coliform levels by 50% in the summer and 87.5% in the winter to restore the Natalbany River to the PCR designated use (U.S. EPA, 2018).

Sub-basin pollution tracking in Tangipahoa Parish began in 2005 by the Lake Pontchartrain Basin Foundation (LPBF) (U.S. EPA, 2018). Further, the LDEQ funded positions to support watershed restoration activities from 2008 to 2014 (U.S. EPA, 2018). As part of the restoration activities, the LPBF established the *Water Quality Monitoring and Education in North Shore Watersheds* in 2011 to track sources of pollution, educate the parties responsible for the impairment, educate the general public about the environmental issues associated with the pollution, and assist in pollution reduction (U.S. EPA, 2018). The LPBF additionally worked in partnership with the Tangipahoa Parish Department of Health during 2013 and 2014 to conduct 254 sewage inspections of home wastewater systems located in the Natalbany watershed (U.S. EPA, 2018). Following the wastewater repairs, the 2013 to 2014 water quality monitoring showed that fecal coliform did not exceed the 25% rate limit and the PCR designated use was fully supported (U.S. EPA, 2018). Even with the Natalbany River remaining on the impaired list, as it continues to fail the fish and wildlife propagation designated use, this example illustrates how water quality remediation can be achieved through pollution reduction and education (U.S. EPA, 2018).

Louisiana Cooperative Extension Service.

The Louisiana Cooperative Extension Service has been working to reduce the number of Louisiana's waterways being designated as *impaired*, or having such environmental issues as low dissolved oxygen, excess amounts of fecal bacteria, and nitrogen and phosphorous nutrient pollution (LNMSIT, 2014; LDEQ, 2016).The LCES has established a number of nutrient management education programs directed through the Louisiana State University Agricultural Center (LSU AgCenter) to address the water quality issues attributed to improper management practices used in agriculture and urban/suburban landscapes.

An important LCES nutrient management education program to address production agriculture, a significant contributor to nonpoint source pollution in the state, has been the Louisiana Master Farmer Program (LMFP) that began in 2001 (LSU AgCenter, 2006; LNMSIT, 2014). The LMFP is a voluntary conservation management program developed for agricultural producers to address improper management practices that increase soil erosion and excess fertilizer runoff into waterways (LSU AgCenter, 2006; United States Environmental Protection Agency [U.S. EPA], 2017a). The LMFP is a three phase program that includes: Phase I, classroom instruction on various topics related to environmental stewardship; Phase II, participation in a field day to observe how conservation best management practices (BMPs) have been implemented on local farmland; and Phase III, the development and implementation of a Resource Management Systems (RMS) conservation plan that is developed to address any soil and water resource concerns specific to each individual producers' farmland (LSU AgCenter, 2006; LSU AgCenter, 2017a). Once the RMS conservation plan is fully implemented the producer is granted Master Farmer certification by the Louisiana Department of Agriculture and Forestry and is considered to be in compliance with Louisiana's state soil and water conservation requirements (LNMSIT, 2014; LSU AgCenter, 2017a). As of January 2018, 238 producers have become certified Master Farmers (D.S. Morgan, personal communication, January 31, 2018). The success experienced through this voluntary Extension education program has been an important step towards reducing impaired waterways in Louisiana by promoting implementation of effective BMPs that reduce nutrient pollution.

In addition to educating agricultural producers, the LSU AgCenter has designed educational programs for the urban and suburban population in the state to address residential management practices that have the potential to contribute to nutrient pollution (LNMSIT, 2014). The Louisiana Yards and Neighborhoods (LYN) program was developed to teach residents how to design and maintain a home landscape that minimizes surface runoff and nonpoint source pollution (LSU AgCenter, 2007). The LYN program has an integrated approach to landscaping that teaches seven principles, which include watering efficiently, fertilizing appropriately, and protecting surface waters (LSU AgCenter, 2007). The LYN program's primary engagement with the states' residential population consists of providing online resources, such as webpages and PowerPoint presentations, and an educational handbook publication that can be ordered online or a printed copy can be obtained from the local parish Extension office (LSU AgCenter, 2007; LSU AgCenter, 2012). In addition to the LYN program, the LSU AgCenter has created other publications that promote the use of BMPs that reduce fertilizer runoff from residential lawns and landscapes. The *Louisiana Lawns Best Management Practices (BMPs)* reviews essential lawn care best management practices, such as soil testing, types of fertilizers/fertilizer selection, fertilizer application schedules, precision fertilizer application, and irrigation practices (LSU AgCenter, 2008).

The LCES further utilizes the LSU AgCenter's Louisiana Master Gardener volunteer program located in 28 parishes of the state to train volunteers to assist in extending educational outreach to Louisiana residents (LSU AgCenter, 2017d) In 2016, the total number of Master Gardeners in the program provided the equivalent number of volunteer hours as 37 full-time employees (LSU AgCenter, 2017d). The instruction that Master Gardeners receive makes them highly trained and skilled at disseminating the LCES' research-based educational materials within their local communities. The program volunteers must complete a minimum of 40 hours of course training and pass an exam to become a Louisiana Master Gardener (LSU AgCenter, 2017b). Program volunteers must also be recertified each year to maintain their Master Gardener status. In 2015, the Advanced Louisiana Master Gardener program began to further the breadth of topics and knowledge of the Master Gardeners in the program (LSU AgCenter, 2017c). The educational subjects in the Advanced Master Gardener program include coursework on Nutrient Management that prepares volunteers to educate the public about fertilizer best management practices (LSU AgCenter, 2017c). The nutrient management education of Master Gardeners in Louisiana is an important development in bolstering the number of qualified individuals available to teach the residential population about fertilizer best management practices.

The LCES has additionally begun to develop educational programming to improve the lawn and landscape management practices used by commercial landscaping companies in Louisiana (B.R. Leonard, personal communication, January 18, 2017). The green industry in Louisiana has been growing since the 1990s, and includes the landscaping and horticulture service area that designs and maintains landscapes (Louisiana State University Agricultural

Center [LSU AgCenter], 2003). In 2001 the landscaping and horticulture service area contributed $266.1 million to the state's economy and employed 9,361 people (LSU AgCenter, 2003). As of 2012 there were over 750 landscaping establishments in Louisiana (United States Census Bureau, 2015). The types of lawn and landscape management practices used by landscaping companies can be addressed with an educational program that teaches essential landscaping BMPs that reduce nutrient pollution and protect the health of water resources, as was done in Florida through the Florida-Friendly Landscaping Green Industry BMP program (FDEP, 2015).

The LCES has further sought to engage *point of sale* operations, such as home and garden stores (B.R. Leonard, personal communication, January 18, 2017). The Louisiana Turfgrass Association (LTA) (2010) reported that fertilizer products sold by garden centers and large retail stores are advertised to make consumers (residents and lawn care professionals) believe they are necessary for general lawn maintenance; however, such products are in fact not appropriate for all lawn care. The example given by the LTA (2010) was that of winterizing fertilizers which are advertised to consumers in Louisiana but are in fact not recommended for southern turfgrass. Winterizing fertilizers can be detrimental to the health of such turfgrass as these products contain a higher nitrogen content than is required for winter growth and can result in nitrogen leaching or running off from the soil (LTA, 2010). In Florida, the *Urban Turf Fertilizer Rule* was enacted in 2007 to address such concerns as, the types of fertilizer products that are available for domestic use (Carey et al., 2012b). To improve nutrient management in residential areas, the legislation restricted retail stores from selling fertilizer bags over 50 pounds for home lawn and landscape application (Carey et al., 2012b).

Theoretical Framework

Ajzen's Theory of Planned Behavior.

The study by Morton and Padgitt (2005) reviewed the importance of using a theoretical framework to study the relationship between society and ecosystem management, and underlying values, beliefs, attitudes, and norms. Further, the study by Carey et al. (2012a) found that the adoption of recommended management practices is contingent on the attitudes, values, and norms of residents, and are affected by collective and individual behaviors. Ajzen's (1991) Theory of Planned Behavior (TPB) was selected as the theoretical framework for this study as it can be used to, "predict and explain human behavior in specific contexts" (Ajzen, 1991, p. 181). The TPB theoretical framework was used to guide the methodological design, data collection, and analysis of Louisiana urban and suburban homeowners' behavioral belief, attitude, perceived norm, perceived control, intention, and past behavior regarding specific home lawn and landscape fertilizer management practices.

According to the TPB, human behavior is influenced by three kinds of considerations: 1) *behavioral beliefs* or beliefs about the likely outcomes of the behavior and the evaluations of those outcomes; 2) *normative beliefs*, or beliefs about the normative expectations of others and motivation to comply with such expectations; and 3) *control beliefs*, or beliefs about the presence of factors that may facilitate or impede the performance of a behavior and the perceived power of those factors (Figure 1) (Ajzen, 1991). The TPB illustrated in Figure 1 exhibits how the behavioral beliefs that people have produce either a favorable or unfavorable *attitude toward the behavior*, the normative beliefs result in perceived social pressure or *subjective norms*, and control beliefs influence *perceived behavioral control* or whether a person believes that they have the resources and opportunities to complete a certain behavior (Ajzen, 1991; Ajzen, 2017).

As shown in Figure 1, the attitude toward the behavior, the subjective norm, and perceived behavioral control may all influence the formation of the *intention* to perform a behavior (Ajzen, 1991). However, the relative importance of these three independent determinants of intention will depend on the particular behavior being studied (Ajzen, 1991). The general rule is that the more favorable the attitude and subjective norm are, and the greater perceived control people have, the more likely people will have a strong intention to perform the behavior in question (Ajzen, 1991). In the TPB, intention is considered to be, "the immediate antecedent of behavior" (Ajzen, 2017, p. 1).

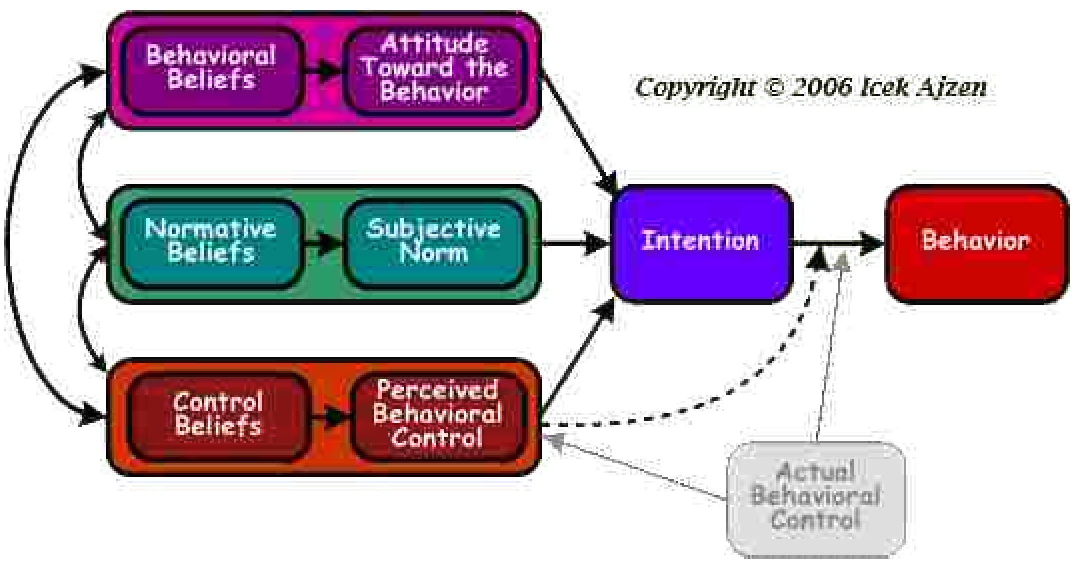

Figure 1. Diagram of Ajzen's Theory of Planned Behavior (Ajzen, 2018).

If there is an adequate amount of *actual behavioral control* over performing the behavior, such as the opportunity to perform and the resources required to perform (time, skill, money, etc.) then people are expected to carry out their intentions (Ajzen, 1991) (See Figure 1). However, many behaviors have inherent difficulties of performance that can limit *volitional control* or the ability to perform the behavior (Ajzen, 2017). Therefore, the theory recommends the consideration of *perceived behavioral control* (PBC) in addition to intentions when trying to determine behavioral performance, and PCB will be increasingly important in the prediction of behavior when volitional control is low (Ajzen, 1991) (See Figure 1). The TPB further states that depending on the degree that PBC is *veridical* or accurate, it may serve as a proxy for *actual behavioral control* (Ajzen, 2017) (See Figure 1). Therefore, intention and PBC can be used to predict the performance of the behavior; however, the contribution of these independent determinants of behavior will vary depending on the behavior being studied and only one of the predictors may be necessary (Ajzen. 1991).

Theory of Planned Behavior: Fertilizer management practices.

This study utilized TPB's constructs to measure Louisiana urban and suburban homeowners' outcome evaluation, behavioral belief strength, behavioral belief, attitude, perceived norm, perceived control, intention, and past behavior regarding specific lawn and landscape fertilizer management practices. Human behavior can ultimately be determined from the *salient* beliefs held about the performance of a particular behavior, as those beliefs are the principal determinants of intention and action (Ajzen, 1991; Fishbein & Ajzen, 2010). *Behavioral belief* consists of the belief that the performance of a behavior will result in a positive or a negative outcome (*outcome evaluation*) and the strength of the belief that the behavior will produce that outcome (*behavioral belief strength*) (Ajzen, 1991; Fishbein & Ajzen, 2010). Therefore, outcome evaluation and behavioral belief strength were measured in this study to determine the underlying components of homeowners' behavioral belief about specific fertilizer management practices (Figure 2) (Fishbein & Ajzen, 2010).

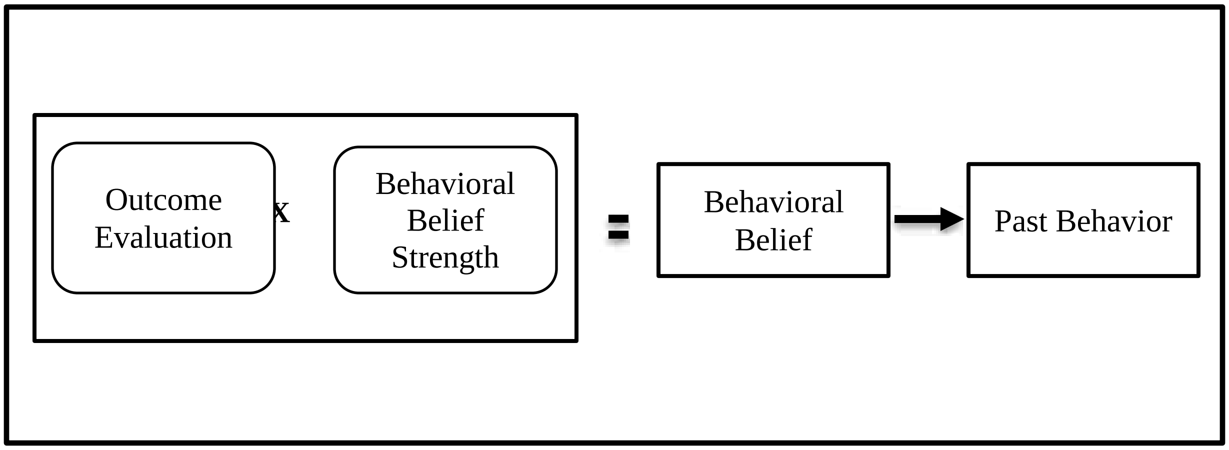

Figure 2. The Influence of Outcome Evaluation and Behavioral Belief Strength on Behavioral Belief and Past Behavior Regarding Selected Fertilizer Management Practices.

Examining homeowners' behavioral belief provided the means to study the determinants of fertilizer management practices, and identify how the underlying behavioral belief constructs (outcome evaluation and behavioral belief strength) influenced past behavior of the fertilizer management practices examined in this study (See Figure 2) (Fishbein & Ajzen, 2010). Furthermore, beliefs can explain differences in intentions and actions between those that intend to perform a behavior and those that do not (Fishbein & Ajzen, 2010). Therefore, to understand differences in behavioral belief regarding the performance of the fertilizer management practices examined in this study, the underlying behavioral belief components (outcome evaluation and behavioral belief strength) were studied for homeowners who had applied fertilizer and those who had not (Fishbein & Ajzen, 2010).

In this study, it was further sought to determine the combined effect of attitude, perceived norm and perceived control on homeowners' intention to perform the fertilizer management practices examined in this study (Figure 3). Rather than use belief-based indices, Fishbein and Ajzen (2010) recommended direct measures of attitude, perceived norm, and perceived control be, "obtained by means of standard scaling procedures" (p. 184) to ensure the items were good indicators of the underlying constructs. Direct measures of attitude were assessed to determine the favorable or unfavorable evaluations homeowners had about the fertilizer management practices examined in this study, and to assess the contribution of attitude to the explanation of intention to perform the practices (See Figure 3) (Ajzen, 1991; Fishbein & Ajzen, 2010).

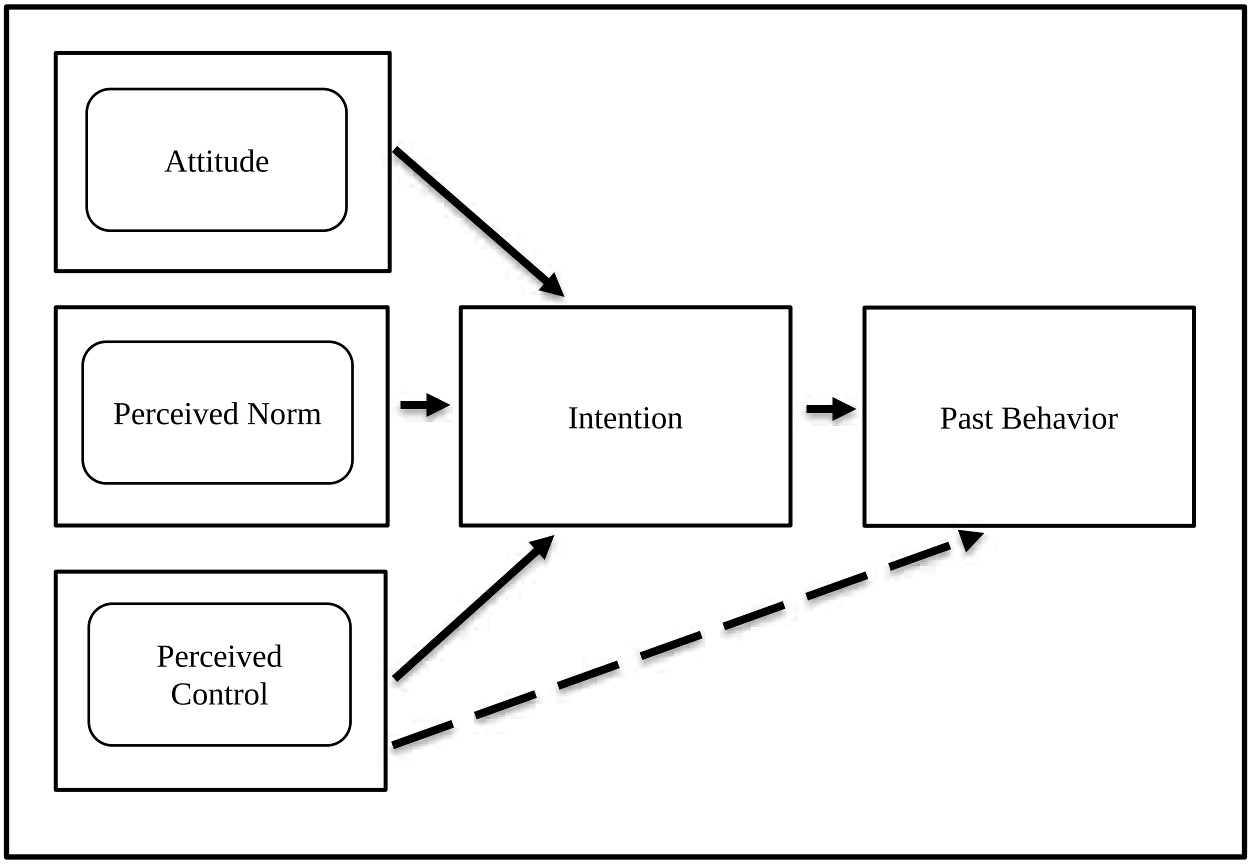

Figure 3. Direct Measures of Attitude, Perceived Norm, and Perceived Control and the Constructs' Contribution to Intention, and Intention and Perceived Control's Contribution to Past Behavior of Selected Fertilizer Management Practices.

Direct measures of perceived norm were assessed to determine homeowners' perceived social expectation to perform or not perform the fertilizer management practices examined, and to assess the contribution of perceived norm to the explanation of intention to perform each practice (See Figure 3) (Ajzen, 1991; Fishbein & Ajzen, 2010). Further, direct measures of perceived control were assessed to determine homeowners' perceived difficulty or ease in performing the fertilizer management practices examined in this study, and to assess the contribution of perceived norm to the explanation of intention to perform each practice (See Figure 3) (Ajzen, 1991; Fishbein & Ajzen, 2010). Direct measures of intention were assessed to determine the contribution of attitude, perceived norm and perceived control to the explanation of intention, and to assess the contribution of intention to the explanation of past behavior (See Figure 3) (Ajzen, 1991; Fishbein & Ajzen, 2010). Lastly, direct measures of past behavior of the fertilizer management practices examined in this study were collected, as research has shown that past behavior is highly correlated with future behavior and may be used as a proxy for future behavior (Fishbein & Ajzen, 2010). Therefore, measures of intention and perceived control can be used to provide an estimate of the ability to predict the behavior being studied (See Figure 3) (Fishbein & Ajzen, 2010). However, Fishbein and Ajzen (2010) stated that if intention and perceived control, "cannot account for much of the variance in past behavior, they are unlikely to predict future behavior" (p. 327-328), thus targeting either construct would not likely change behavior.

To change human behavior, the Theory of Planned Behavior (TPB) can be applied to *behavioral interventions* or interventions that are designed to address the theory's determinants of intentions (attitude, subjective norm, and perceived behavioral control) to be able to change behavior. Given adequate control over the desired behavior and the right circumstances the new intentions will then be carried out following the intervention (Ajzen, 2017). It is recommended that the intervention target the determinant that accounts for significant variance in intention and behavior (Ajzen, 2017). Further, in an intervention the constructs that have *room for change* or those determinants that have a greater degree of variability should be targeted (Ajzen, 2017). To change attitudes, subjective norms, and perceived behavioral control, the underlying behavioral, normative and control beliefs can be targeted in an intervention (Ajzen, 2017). However, the theory cannot specifically indicate what kind of intervention (mass media message, discussions, workshops, observational modeling, experiential learning, etc.) would be most effective at changing the desired behavior (Ajzen, 2017). The format of the intervention should be one that can best address the determinants of the behavior that have been identified through TPB formative research of the targeted population (Ajzen, 2017).

RESEARCH METHODOLOGY

Research Design

An exploratory design was used in this study, in which a qualitative pilot study was conducted for the development of a quantitative questionnaire (Creswell & Plano-Clark, 2011). The data from the pilot study was used to determine the homeowners' most commonly held behavioral beliefs and to develop the direct measures of homeowners' attitude, perceived norm, perceived control, intention, and past behavior concerning the lawn and landscape fertilizer management practices examined in this study (Fishbein & Ajzen, 2010; Ajzen, 2017). The responses from the pilot study were analyzed and used to develop a final questionnaire with a semantic differential response scale about urban and suburban homeowners' landscape and lawn care fertilizer management practices (Fishbein & Ajzen, 2010; Ajzen, 2017).

Research Population

The target population for this study was Louisiana urban and suburban homeowners. The definitions for urban and suburban used in this study were derived from the 2016 United States Census Bureau's "Urban and Rural Classification" that states "urbanized areas" have 50,000 or more people, and "urban clusters" have less than 50,000 people but at least 2,500. However, in this study the term "urban" was used instead of "urbanized area" and the term "suburban" was used instead of "urban clusters". The "rural" classification was any other housing unit that did not meet the criteria to be an "urbanized areas" or "urban clusters" (United States Census Bureau, 2016). Homeowners in urban and suburban communities were the target population of this study because a comparison of the amount of housing units from the 2000 census and the 2010 census indicated that urban housing developments were increasing while rural areas were decreasing (United States Census Bureau American FactFinder, 2016c; United States Census

Bureau American FactFinder, 2016d). The increase in urban and suburban housing is important as these landscapes increase the amount of impervious surfaces, such as pavement and rooftops that increase nonpoint source runoff (U.S. EPA, 2005). Further, urban and suburban communities increase the amount and area of lawns present (Robbins et al., 2001; Robbins & Birkenholtz, 2003; Robbins & Sharp, 2003a). The target population of this study also included Louisiana homeowners because the majority of housing units in this state are owner-occupied (United States Census Bureau American FactFinder, 2016b). The definition of homeowner was derived from the United States Census Bureau's (2010) demographic questionnaire. The respondents of this study self-identified as homeowners by either selecting that they or someone in the household owned the home with a mortgage or a loan, or they or someone in the household owned the home free and clear without a mortgage or loan. The homeowner population was targeted in this study because it was presumed that homeowners control lawn and landscape maintenance, whereas renters may or may not have the ability to make such maintenance decisions.

Additionally, community association membership was measured in this study as there were approximately 265 active community associations in East Baton Rouge (EBR) Parish alone (M. Fontenot, personal communication, March 26, 2015). All members of community associations adhere to a set of covenants, conditions, and restrictions (CCR's) or bylaws that are enforced through different methods, such as peer pressure in more liberal Neighborhood and Civic Associations or through fines in stricter Homeowners and Property Owners Associations (Community Associations Institute [CAI], 2006; HOA-USA, 2010). Further, most community associations have rules and regulations that pertain to the maintenance of home lawns and landscapes (CAI, 2006). In an effort to maintain these standards set forth in the association's bylaws, association members may be encouraged to use improper home landscaping and lawn care practices that can create sources of nutrient runoff from these urban communities (U.S. EPA, 2005). Improper home landscaping and lawn care practices can lead to increased nonpoint source pollution, such as excess fertilizer runoff into storm drains or other water bodies (U.S. EPA 2005). Therefore, it was important to study homeowners' membership in the following types of community associations: Civic Associations; Homeowners Associations (HOA); Neighborhood Associations; and Property Owners Associations (POA).

The sample for the pilot study was a residents' association for one community located in the city of Baton Rouge, in East Baton Rouge Parish, Louisiana. East Baton Rouge Parish was selected as the parish from which the pilot sample should be drawn because it had the greatest population of residents based on the 2010 census data (United States Census Bureau American FactFinder, 2016a). The residents' association used in the pilot study was chosen because it was well established and contained a representative sample of the target population of urban and suburban homeowners in Louisiana (M. Fontenot, personal communication, March 26, 2015). Therefore, following approval from the Institutional Review Board (IRB) to conduct this study, a sample of the homeowners from the selected residents' association were interviewed to obtain the qualitative pilot data. A copy of the IRB approval is included in Appendix A.

Qualitative Pilot Study

Eliciting and measuring salient beliefs.

The qualitative pilot study consisted of a semi-structured group interview of a sample of homeowners' from a residents' association. As the researcher was given access to this group for a single group interview, the semi-structured group interview method was used to collect qualitative data on homeowners' salient behavioral, normative, and control beliefs about fertilizer management practices using the Theory of Planned Behavior (TPB) framework (Ajzen, 1991; Cohen & Crabtree, 2006; Fishbein & Ajzen, 2010). The residents' association president was contacted in April 2015 to organize the interview. The date of the interview was set for Monday April 27th, 2015, to follow an association meeting. This strategy was recommended by the association president to improve potential interview participation, as members would already be gathered together for an association meeting. A handout that contained information about the interview and invited the association members to participate was distributed through the association's email listserv two weeks prior to the date of the interview (See Appendix B). On average, the attendance of association meetings was 20 to 30 members or about 10% of the association membership (T. Lawrence, personal communication, April 9, 2015). Therefore, a similar participation rate of 10% of the association meeting attendance was expected for the semi-structured group interview.

A TPB interview protocol was developed prior to the group interview to guide data collection of the homeowners' beliefs about five specific fertilizer management practices and provide opportunities for additional relevant topics to be discussed through an open response format (Cohen & Crabtree, 2006; Fishbein & Ajzen, 2010). A copy of the interview protocol is provided in Appendix C. The fertilizer practices selected for discussion in the interview were determined from the literature review on the types of home lawn and landscape practices that if not implemented properly can result in fertilizer runoff (U.S. EPA, 2005; LSU AgCenter, 2007; LSU AgCenter, 2008; Carey et al., 2012a; FFL, 2015). The qualitative TPB question format used in the semi-structured group interview was derived from Fishbein and Ajzen's (2010) intervention methodology. The semi-structured group interview was completed on the evening of April 27th, 2015. The interview was conducted at a third party location where the association conducts its meetings. The same interview informational handout (See Appendix B) that had been emailed to the association members two weeks prior was distributed to the participants prior to conducting the interview. The association members were interviewed as a group. A single interviewer followed the semi-structured TPB interview protocol that provided guiding questions about the fertilizer management practices that were designed to elicit the interviewees' salient beliefs in an open response format (Cohen & Crabtree, 2006; Fishbein & Ajzen, 2010). A total of three homeowners participated in the semi-structured interview. These homeowners' responses were recorded with an audio recorder and were transcribed for analysis.

A content analysis was completed from the transcript, to construct a list of modal accessible beliefs or a list of the most commonly held beliefs in the research population (Ajzen, 2017; Elo & Kyngas, 2008; Fishbein & Ajzen, 2010). An inductive content analysis method was used to move the data acquired from the semi-structured group interview, "from the specific to the general" (Elo & Kyngas, 2008, p. 109), or from what was observed in this sample and combining that into the greater population of urban and suburban homeowners in Louisiana. The analysis process began with open coding of the transcript followed by the construction of categories and lastly abstraction or, "formulating a general description" of this populations' beliefs about specific fertilizer management practices (Elo & Kyngas, 2008, p. 111). The results from the content analysis were used to inform the content of the questions developed for inclusion in the quantitative semantic differential questionnaire, as well as the fertilizer management practices to be examined (Ajzen, 2017; Fishbein & Ajzen, 2010).

The original IRB approval was contingent on the researcher providing a copy of the questionnaire instrument that was developed from the original pilot study. The request for exemption from institutional oversight submitted to the IRB was updated and amended following the development of the instrument. The instrument was then included in the exemption request update (See Appendix D). Additionally, the original request specified that the sample would be selected from community association members. However, the updated request modified this population to include a broader population of urban and suburban homeowners without the designation that they must be members of a community association. The updates and modifications to the original IRB were approved for exemption by the LSU IRB office (See Appendix D).

Quantitative Semantic Differential Questionnaire

Behavioral beliefs and direct construct measures.

Following the pilot study and the development of the list of modal accessible beliefs, the researcher developed a quantitative questionnaire with semantic differential response scale using the Theory of Planned Behavior (TPB) questionnaire construction from Fishbein and Ajzen's (2010) behavioral intervention methodology. The content analysis revealed the following 12 fertilizer management practices as central to the investigation of this target population: 1) *Fertilizer product label*; 2) *Soil testing*; 3) *Calculating area of lawn*; 4) *Watering in lawn fertilizer*; 5) *Watering in lawn fertilizer, rain event*; 6) *Precision fertilizer application*; 7) *Fertilizer application, no schedule*; 8) *Fertilizer application, annual schedule*; 9) *Excess fertilizer runoff*; 10) *Runoff from fertilizer spills*; 11) *Community fertilizer best management practices*; 12) and *Fertilizer best management practices*. In the questionnaire sent to the respondents of this study, the fertilizer practices were presented as 10 practices rather than 12. This was done due to the conceptual similarity of the two aspects of the practices. However, two practices of watering in fertilizer were examined in this study, specifically, watering in fertilizer and watering in fertilizer with a rain event. Two practices of fertilizer application schedule were also examined in this study. The first set of questions dealt with fertilizer application with no schedule and the second set of questions addressed applying fertilizer with an annual schedule. Therefore, this study examined 12 practices that were organized under 10 headings in the questionnaire distributed to the respondents of this study.

Ajzen's (1991) TPB constructs that comprise behavioral belief, behavioral belief strength and outcome evaluation, were evaluated in this questionnaire (See Appendix E). Direct measures of the TPB constructs attitude, perceived norm, perceived control, and past behavior were also measured in the questionnaire (See Appendix E) for the aforementioned 12 fertilizer management practices: (Fishbein & Ajzen, 2010). Furthermore, the urban and suburban homeowners who had never applied fertilizer were asked to select which of the following factors contributed to their decision not to apply fertilizer to the home lawn and/or landscape: not having the physical strength; not having the time in their schedule; not having the financial means; not being able to find a fertilizer product that also controls pests; not being able to find an expert in their area to consult with; not being able to get all of the fertilizer supplies needed from one location (store/company); any application of fertilizer will result in runoff that contributes to environmental issues, particularly in water; and respondents were additionally asked to specify other factors that contributed to their decision not to apply fertilizer (See Appendix E).

The use of non-probability sampling methods and *panels of volunteers* have been increasing in social science survey research (Baker et al., 2013). In this study, a non-probability opt-in survey sampling method was accomplished by working in partnership with Qualtrics, a third party public opinion survey research company. Following the IRB approval of the updated data collection method, Qualtrics distributed the developed questionnaire by sending a link that allowed the 737 individuals that were invited to participate in this study access to the questionnaire. This study utilized three criteria to determine participant eligibility: 1) current Louisiana residence; 2) residence in an urban and/or suburban area; and 3) home ownership. The non-probability opt-in sampling method allowed the sample of respondents that met the three eligibility criteria to be collected gradually (Qualtrics, 2014).

Cochran's sample size determination formula was used to establish the minimum number of useable responses to maintain the researcher's established margin of error. This calculation was based on a 2% acceptable margin of error (2% of a 7 point semantic differential scale); a 5% risk (alpha level) of obtaining a sample that exceeds the acceptable margin of error (1.96); and an estimate of the variance in the population of 1.0 (highest scale score of 7 minus the lowest scale score of 1 = 6 divided by 6 standard deviations that normally capture the range of scores = 1 which when squared = 1). The minimum number of useable responses based on these calculations was 196. These calculations are presented as follows: *n*

$$n = \frac{t^2 s^2}{d^2} = \frac{(1.96)^2 (1)^2}{[(0.02)(7)]^2} = \frac{(3.8416)(1)}{(0.14^2)} = \frac{3.8416}{0.0196} = 196$$

Where t^2 was the risk of getting a sample that exceeds the acceptable margin of error, s^2 was the estimated variance in the population, and d^2 was the acceptable margin of error.

The use of a non-probability sampling method presented limitations to this study and restricted the interpretations of the results to only the respondents of this study (Baker et al., 2013). The method of drawing an opt-in panel from a relatively small number of sites that invite individuals to complete the online questionnaire may exclude members of the target population, for example, those without internet access. Additionally, only a portion of the individuals that receive an invitation to join the panel may decide to opt in, and only a portion of the individuals who attempt to complete the questionnaire will be eligible to participate. As a result of this data collection method, the final set of responses collected are subject to exclusion, selection, and nonparticipation biases (Baker et al., 2013). In this study, of the 737 individuals invited to complete the online questionnaire, a total of 670 individuals attempted to respond to the questionnaire. Of the 670 individuals that attempted to respond, there were 260 individuals that met the three eligibility requirements and provided usable responses for data analysis.

Instrumentation

The semantic differential questionnaire measured the sample of urban and suburban homeowners' behavioral belief strength and outcome evaluation for important home lawn and landscape fertilizer management practices (Fishbein & Ajzen, 2010). In addition, the questionnaire included direct measures of attitude, perceived norm, perceived control, intention, past behavior, and demographic information (Ajzen, 2017; Fishbein & Ajzen, 2010). A semantic differential using a seven-point scale with polar adjective pairs were used for the majority of the items in this questionnaire. In addition, dichotomous, multiple choice, and fill in response questions were used when applicable. The reliability of the scales for the constructs measured in this study were analyzed ex post facto using Cronbach's alpha coefficients. The reliability analysis yielded acceptable Cronbach's alpha coefficients for this study according to the standards published by Hair, Black, Babin, and Anderson (2010) that states alpha coefficients between .60 and .70 are the lower limit of acceptability for exploratory studies.

The fertilizer management practices questionnaire was divided into the following sections: 1) introductory questions; 2) fertilizer practices that are used to manage your home lawn and/or landscape; 3) fertilizer practices used by people in your community to manage the home lawn and/or landscape; 4) factors that may facilitate or impede your performance of fertilizer management practices; and 5) demographic information (See Appendix E). The following sections were included in this current study: section one; section two, part of section four; and section five.

Section one of the questionnaire included screening questions (resident of Louisiana, type of community they currently lived in urban, suburban or rural, and ownership status of their house, apartment or mobile home) to determine if participants qualified to participate in the study. If the responses to these questions met the three eligibility criteria of this study then the respondent proceeded on to the remainder of the questionnaire, if not the questionnaire ended. Further, the respondents were asked questions about their community involvement and their fertilizer application practices using dichotomous (yes, no) and multiple choice questions.

Section two included questions about fertilizer management practices and had items that addressed the outcome evaluation and the behavioral belief strength of the 12 fertilizer management practices. The scale used for the outcome evaluation construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *bad* and *good*, where the lower value was associated with the descriptor bad and the higher value was associated with the descriptor good. The behavioral belief strength construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *unlikely* and *likely*, where the lower value was associated with the descriptor unlikely and the higher value was associated with the descriptor likely. The reliability for the construct, outcome evaluation, for the 12 fertilizer management practices was calculated and had an acceptable Cronbach's alpha value of .693. The reliability of the construct, behavioral belief strength, for the 12 fertilizer management practices was calculated and had an acceptable Cronbach's alpha of .719.

Section two also included the direct measures of attitude, perceived norm, perceived control, intention, and past behavior measured for the 12 fertilizer management practices. The attitude construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *harmful* and *beneficial*, where the lower value was associated with the descriptor harmful and the higher value was associated with the descriptor beneficial. The perceived norm construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *disagree* and *agree*, where the lower value was associated with the descriptor disagree and the higher value was associated with the descriptor agree. The perceived control construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *not at all* and *completely,* where the lower value was associated with the descriptor not at all and the higher value was associated with the descriptor completely. The intention construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *definitely do not* and *definitely do*, where the lower value was associated with the descriptor definitely do not and the higher value was associated with the descriptor definitely do. Past behavior was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *never* and *almost always*, where the lower value was associated with the descriptor never and the higher value was associated with the descriptor almost always. The reliability of the construct, attitude, for the 12 fertilizer management practices was calculated and had an acceptable Cronbach's alpha of .629. The reliability of the construct, perceived norm, for the 12 fertilizer management practices was also calculated and had an acceptable Cronbach's alpha of .768. The reliability for the construct, perceived control, for the 12 fertilizer management practices was calculated and had a Cronbach's alpha of .877 or a relatively high internal consistency. The reliability of the construct, intention, for the 12 fertilizer management practices was calculated and had a Cronbach's alpha of .846 or relatively high internal consistency. Lastly, the reliability of the construct, past behavior, for the 12 fertilizer management practices was also calculated and had a Cronbach's alpha of .872 or a relatively high internal consistency.

The part of section four from the questionnaire that was included in this study reported information for respondents that had not applied fertilizer to their home lawn and/or landscape. In this part of section four, the respondents were provided a list of potential factors contributing to them not applying fertilizer and were asked to select all of the responses that applied to them.

Lastly, in section five, the respondents were asked a series of demographic questions that were structured based on the United States Census Bureau's 2010 census form including: number of residents in the household, sex, race/ethnicity, age, education completed, and gross household income. Fill in response, multiple choice and dichotomous items were used to measure the demographics.

In order to ensure face and content validity of the instrument an eight member panel of experts reviewed the questionnaire. The panel of experts included: two professors from the Louisiana State University (LSU) School of Plant, Environmental, and Soil Science with expertise in turfgrass and watershed management; two LSU faculty in higher education with expertise in instrument design; three community and civic association administrators; and a doctoral student currently engaged in a survey research study.

RESULTS

Objective 1.

The first objective of this study was to describe Louisiana urban and suburban homeowners on selected demographic characteristics. One of the measures was how many people were staying in the house, apartment or mobile home of the homeowner, as of the date of response. The mean number of people reported as residing in the home was 2.63 (*SD* = 1.27), with a minimum of one and a maximum of seven people reported. Only one homeowner did not provide a response to the question of the number of people residing in the household. The largest group of respondents indicated two people (40.9%, *n* = 106). The second largest group of respondents (21.2%, *n* = 55) reported three people in the household, and another 15.8 percent selected one person (*n* = 41) (See Table 1).

Table 1. Number of People Staying in the Residence of Louisiana Urban and Suburban Homeowners

Number of People	*n*	%
One	41	15.8
Two	106	40.9
Three	55	21.2
Four	33	12.8
Five	16	6.2
Six	6	2.3
Seven	2	0.8
Total	259[a]	100

Note. Mean number of people staying in residence = 2.63 (*SD* = 1.27).
[a] One study participant did not provide a response to this question.

Homeowners were also asked if any additional people resided in their home. The majority of the respondents, 93.2 percent (*n* = 233), indicated that no additional people were staying in their house, apartment or mobile home. Of the 17 (6.8%) who responded yes to this question, 47.0 percent (*n* = 8) indicated that a newborn or foster child was staying in the home, and 35.3 percent of respondents (*n* = 6) indicated that relatives were staying in the house. An additional 11.8 percent (*n* = 2) and 5.9 percent (*n* = 1), respectively, indicated that non-relatives and temporary visitors were staying in the home. There were 10 homeowners that did not respond to the question of additional people staying in their household.

The homeowners were also asked to indicate their sex. The ratio determined from the 260 respondents was 70.4 percent female (*n* = 183) and 29.6 percent male (*n* = 77). Homeowners were also asked to indicate their age as of the date of response. The minimum age reported was 18 years old and the maximum age was 82. The mean of the ages reported was 49.56 years (*SD* = 16.39). Three respondents did not provide an answer to the question of age.

The homeowners were asked to indicate if they were of Hispanic, Latino or Spanish origin. The majority of respondents, 98.8 percent (*n* =255), indicated that they were not of Hispanic, Latino, or Spanish origin. Of the three respondents who indicated that they were of Hispanic, Latino or Spanish origin, 33 percent (*n* =1) specified that they were Puerto Rican. The two other respondents (66 %) selected that they were other Latino origin, and they specified Spaniard (*n* = 1) and Columbian (*n* = 1). There were two homeowners that did not provide a response to the question of Hispanic, Latino or Spanish origin.

In response to the question of the homeowner's race, the majority of respondents, 82.7 percent (*n* = 215), indicated Caucasian as their race. The second most frequently selected race was African American (*n* =36, 13.8 %). There were also three respondents (1.2 %) that selected American Indian or Alaskan Native as their race. The question of race allowed homeowners to select all options that apply, as respondents may identify with more than one race; therefore there were 265 total responses for this question (See Table 2).

Table 2. Race of Louisiana Urban and Suburban Homeowners

Race Category	Yes		No		Total	
	n	%	*n*	%	*n*	%
White or Caucasian	215	82.7	45	17.3	260	100
Black or African Am.	36	13.8	224	86.2	260	100
Other Race[a]	5	1.9	255	98.1	260	100
American Indian or Alaska Native[b]	3	1.2	257	98.8	260	100
Asian Indian	2	0.8	258	99.2	260	100
Chinese	1	0.4	259	99.6	260	100
Japanese	1	0.4	259	99.6	260	100
Korean	1	0.4	259	99.6	260	100
Vietnamese	1	0.4	259	99.6	260	100

Note. Responses do not total to 260 as respondents were asked to select all the race categories that applied.
Note. Race categories of Filipino, other Asian, Native Hawaiian, Guamanian or Chamorro, Samoan, and other Pacific Islander were reported by zero respondents.
[a] The other races specified were: American (*n* = 1), Mixed (*n* = 2), Cajun (*n* = 1), and Sicilian (*n* =1).
[b]The reported American Indian or Alaska Native enrolled or principal tribes were: Blackfoot (*n* =1) and Chitamacha (*n* =1). One respondent did not specify their enrolled or principal tribe.

The homeowners were asked to indicate their highest level of education completed as of the date of response. The largest group of respondents, 35.8 percent (*n* = 92), indicated that the highest level of education completed was a high school diploma. Further, 31.1 percent of respondents (*n* = 80), selected an associates degree, and 12.8 percent (*n* = 33) indicated a doctoral degree. There were three homeowners that did not provide a response to the question of highest level of education completed. Responses to the question of highest level of education completed are shown in Table 3.

Homeowners were also asked to provide their gross household income as of the date of response. A total of 240 useable responses to this question were obtained. The minimum gross household income reported was $12,000 and the maximum income was $250,000. The mean gross household income was $70,074.26 (*SD* = $43,738.01). There were 20 respondents that did not provide a useable response to the question of gross household income.

Table 3. Education Level Completed by Louisiana Urban and Suburban Homeowners

Education Level	*n*	%
Grade Level[a]	7	2.7
GED	7	2.7
High School Diploma	92	35.8
Associates Degree	80	31.1
Bachelors Degree	28	10.9
Masters Degree	10	3.9
Doctoral Degree	33	12.9
Total	257[b]	100

[a] The grade levels specified were: first grade (n = 1), ninth grade (n = 2), tenth grade (n = 1),two years of college (n = 2), and some college (n =1).
[b] Three study participants did not provide a response to this question.

Objective 2.

The second objective of this study was to describe Louisiana urban and suburban homeowners on measures of community involvement. The 260 respondents were asked to specify the type of community association of which they were a member, if any, from six categories provided, as well as an "other" option. There were 174 respondents (66.9 %) that selected that they were "not a member" of a community association. There were 56 respondents (21.5%) that specified they were a member of a "homeowners association (HOA)", and 21 respondents (8.1 %) who selected that they were a member of a "neighborhood association" (See Table 4).

The 86 respondents who selected that they were a member of a community association were asked if they had ever served as a board member for a community association of which they were a member. A total of 80 responses were obtained for this question. The largest group of respondents, 76.2 percent (n = 61), reported "No" they had not served as a board member for their community association, and 23.8 percent (n = 19), reported "Yes" they had served as a board member.

Table 4. Type of Community Association Membership of Louisiana Urban and Suburban Homeowners

Community Association Category	*n*	%
Not a member	174	66.9
Homeowners Association (HOA)	56	21.5
Neighborhood Association	21	8.1
Civic Association	8	3.1
Property Owners Association (POA)	1	0.4
Other (please specify)	0	0
Total	260	100

The 86 respondents that reported that they were a member of a community association were also asked whether there were home lawn and/or landscape management restrictions or regulations in their association. The response options for this question were: yes; no; and unsure. The largest group of respondents, 50.0 percent (*n* = 43), selected “Yes”. There were 34.9 percent of respondents (*n* = 30) that selected “No”, and 15.1 percent of respondents (*n* = 13) that selected “Unsure”.

The 260 homeowners that participated in this study were asked to respond “Yes” or “No”, to whether they considered themselves to be a community leader that influences the activities or behaviors of their neighborhood. A total of 243 responses were obtained for this question. The majority of respondents, 77.0 percent (*n* = 187), selected “No” they did not consider themselves to be a community leader, and 23.0 percent (*n* = 56) selected “Yes” they did consider themselves to be a community leader that influences the activities or behaviors of their neighborhood.

Objective 3.

Objective three was to describe Louisiana urban and suburban homeowners on their use of selected fertilizer management practices. The 260 homeowners that participated in this study were asked if they had ever applied fertilizer to their home lawn and/or landscape at their current or former residence. There were 260 responses to this question. The majority of respondents, 73.8 percent (n = 192), selected “Yes” they had applied fertilizer, and 26.2 percent (n = 68), selected “No” they had never applied fertilizer.

The 192 homeowners that responded “Yes” they had applied fertilizer, were provided five different types of fertilizers and asked to select all of the types of fertilizers they had applied to their home lawn and/or landscape. Additionally they were offered the option to select “Other (please specify)” as a response. The type of fertilizer that was selected by the largest number of respondents was “Weed & feed” (n = 126, 65.6 %). The “All-in-one fertilizer” category had the second largest number of responses (n = 71, 37.0 %) (See Table 5).

Table 5. Types of Fertilizer that have been Applied to Louisiana Urban and Suburban Homeowners’ Home Lawn and/or Landscape

Type of Fertilizer Applied	*n*	%
Weed & feed	126	65.6
All-in-one (pest control & fertilizer)	71	37.0
Slow release	43	22.4
Organic	30	15.6
Quick release	23	12.0
Other (please specify)[a]	3	1.6
Total	296	

Note. Responses do not total to 192 as respondents were asked to select all of the types of fertilizers that they have applied.
[a] The other types of fertilizer specified were: specific formulation for centipede grass (n = 1), Miracle Grow (n = 1), and do not know (n = 1).

The 192 homeowners that responded “Yes” they had applied fertilizer, were also asked to indicate the amount of fertilizer they would consider applying for a single application to their lawn. The majority of respondents 77.6 percent (n = 149) reported that they “Apply amount listed on the product label”. The response selected by the second largest group (n = 35, 18.2%) was “Apply the entire bag” (See Table 6).

Table 6. Amount of Fertilizer that Louisiana Urban and Suburban Homeowners' would consider Applying to their Lawn in a Single Application

Amount of Fertilizer Applied	*n*	%
Apply amount listed on the product label	149	77.6
Apply the entire bag	35	18.2
Not sure	7	3.7
Apply at a rate of (please specify)[a]	1	0.5
Total	192	100

[a] The application rate of fertilizer specified was: 4 (*n* = 1).

The 192 homeowners that responded "Yes" they had applied fertilizer, were also asked to indicate the type of fertilizer spreader they primarily used to apply fertilizer to their home lawn. The homeowners were provided four categories and an "Other (please specify)" option. The largest group of respondents (*n* = 77, 40.1%) reported that they primarily used a "Broadcast spreader" to apply fertilizer to their lawn. The second largest group of respondents (*n* = 57, 29.7%) selected "Hand spreader" (See Table 7).

Table 7. Type of Fertilizer Spreader Louisiana Urban and Suburban Homeowners Primarily Use to Apply Fertilizer to the Home Lawn

Type of Fertilizer Spreader	*n*	%
Broadcast spreader	77	40.1
Hand spreader	57	29.7
Drop spreader	29	15.1
Do not use a spreader	27	14.1
Other (please specify)[a]	2	1.0
Total	192	100

[a] The other type of fertilizer spreaders specified were: pour from the bag onto the lawn (*n* = 1), and water hose for liquid fertilizer application (*n* = 1).

The 260 homeowners that participated in the study were asked to respond, "Yes" or "No", to the question "Do you currently use a lawn care service to apply fertilizer to your lawn". The majority of respondents (*n* = 229, 88.1 %) reported "No" they did not currently use a lawn care service to apply fertilizer. There were 31 respondents (11.9 %) that reported “Yes” they currently used a lawn care service to apply fertilizer.

Objective 4.

Objective four was to determine the factors that contribute to the decision not to apply fertilizer to the home lawn and/or landscape from selected factors provided to Louisiana urban and suburban homeowners who had never applied fertilizer. The homeowners that replied “No” (n = 68) to the question of whether or not they had ever applied fertilizer to their home lawn and/or landscape at their current or former residence were asked to select all the factors that contributed to them not applying fertilizer from seven possible response options. Additionally they were provided the option to select “Other (please specify)” as a response. The factor that was selected by the largest group of respondents (n = 25, 36.8 %) was “I do not have the financial means to apply fertilizer to my home lawn or landscape”. The factor selected by second largest group of respondents (n = 21, 30.9 %) was “I do not have the time in my schedule to apply fertilizer to my home lawn or landscape”, and the factor selected by the third largest group of respondents (n = 16, 23.5 %) was “I do not have the physical strength to apply fertilizer to my home lawn or landscape”. Further, the “Other (please specify)” response option was selected by 22.1 percent of respondents (n = 15). The specified factors are presented in Table 8 with the number of respondents who selected each factor.

Table 8. Factors that Contribute to Louisiana Urban and Suburban Homeowners not Applying Fertilizer

Factor	*n*	%
I do not have the financial means to apply fertilizer to my home lawn or landscape	25	36.8
I do not have the time in my schedule to apply fertilizer to my home lawn or landscape	21	30.9
I do not have the physical strength to apply fertilizer to my home lawn or landscape	16	23.5
Other (please specify)[a]	15	22.1
Any application of fertilizer will result in runoff that contributes to environmental issues, particularly in water	10	14.7
Not able to find a fertilizer product that also controls pests	6	8.8
Not able to find an expert in the area to consult with about recommended best management practices	5	7.3
Not able to get the fertilizer application supplies that are needed in one location (store/company)	3	4.4
Total	101	

Note. Responses do not total to 68 as respondents were asked to select all of the factors that contribute to them not applying fertilizer.

[a] The other factors specified were: never done this and would want to make sure I'm doing it right and not doing anything harmful to animals or environment (n = 1), Louisiana soil doesn't need fertilizer unless it's destroyed by commercial farming (n = 1), the patch of lawn I have isn't worth it (n = 1), done by lawn service – if at all (n = 1), someone else in my household does it (n = 1), do not do the lawn (n = 1), have never fertilized (n = 1), do not use fertilizer because I let my lawn grow wild and only cut it (n = 1), lawn grows without using it (n = 1), I do not need it (n = 1), do not fertilize my garden or grass (n = 1), and lack of interest (n = 2). There were two respondents that selected other but did not specify the factor that contributed to them not applying fertilizers.

Objective 5.

Objective five was to determine if a relationship exists between behavioral belief, as measured by the product of behavioral belief strength and outcome evaluation, and past behavior for the 12 fertilizer management practices examined in this study among Louisiana urban and suburban homeowners. The respondents indicated their outcome evaluation, behavioral belief strength, and past behavior responses for the 12 fertilizer management practices. Behavioral belief was then computed by multiplying the outcome evaluation responses by the behavioral belief strength responses. The 12 behavioral belief products were then correlated with the 12 past behavior responses.

The outcome evaluation construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *bad* and *good*, where the lower value was associated with the descriptor bad and the higher value was associated with the descriptor good. An interpretive scale, based on the work of Fishbein and Ajzen (2010), was established to interpret the outcome evaluation scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was extremely bad, 1.51 to 2.50 was quite bad, 2.51 to 3.50 was slightly bad, 3.51 to 4.49 was neither bad nor good, 4.50 to 5.49 was slightly good, 5.50 to 6.49 was quite good, and 6.50 to 7.00 was extremely good. The highest outcome evaluation mean was 6.50 (*SD* = 0.80) for the item, “Determining how much fertilizer is being applied to the lawn is”. The lowest outcome evaluation mean was 1.98 (*SD* = 1.69) for the item, “Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is” (See Table 9).

Table 9. Outcome Evaluation Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Outcome Evaluation Item	*n*	*M*	*SD*	Interpretive Scale[a]
Determining how much fertilizer is being applied to the lawn is (*Precision fertilizer application*)	260	6.50	0.80	extremely good
Watering in lawn fertilizer correctly is (*Watering in lawn fertilizer, rain event*)	260	6.39	1.05	quite good
Producing the lawn growth I desire is (*Fertilizer application, no schedule*)	260	6.37	0.91	quite good
Determining how much fertilizer to apply is (*Calculating the area of lawn)*	260	6.36	0.95	quite good
Keeping the fertilizer product in the soil is (*Watering in lawn fertilizer*)	260	6.35	0.97	quite good
Producing effective and efficient lawn and landscape care results is (*Fertilizer best management practices*)	260	6.34	1.01	quite good
Achieving the plant growth I desire is (*Fertilizer application, annual schedule*)	260	6.20	1.13	quite good
Determining what nutrients the soil needs and in what amount they should be applied is (*Soil testing*)	260	6.05	1.12	quite good
Satisfying the standards and preferences of my neighborhood is (*Community fertilizer best management practices*)	260	5.77	1.49	quite good
Producing the lawn and landscape care results I desire is (*Fertilizer product label*)	260	5.56	1.28	quite good

(table continued)

Outcome Evaluation Item	*n*	*M*	*SD*	Interpretive Scale[a]
Excess fertilizer runoff that contributes to environmental issues, particularly in water is (*Excess fertilizer runoff*)	260	2.23	1.80	quite bad
Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is (*Runoff from fertilizer spills*)	260	1.98	1.69	quite bad

Note. Outcome evaluation was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *bad* and *good*, where the lower value was associated with the descriptor bad and the higher value was associated with the descriptor good.
[a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is extremely bad; 1.51 to 2.50 is quite bad; 2.51 to 3.50 is slightly bad; 3.51 to 4.49 is neither bad nor good; 4.50 to 5.49 is a slightly good; 5.50 to 6.49 is quite good; and 6.50 to 7.00 is extremely good.

The behavioral belief strength construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *unlikely* and *likely*, where the lower value was associated with the descriptor unlikely and the higher value was associated with the descriptor likely. An interpretive scale, based on the work of Fishbein and Ajzen (2010), was established to interpret the behavioral belief strength scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was extremely unlikely, 1.51 to 2.50 was quite unlikely, 2.51 to 3.50 was slightly unlikely, 3.51 to 4.49 was neither unlikely nor likely, 4.50 to 5.49 was slightly likely, 5.50 to 6.49 was quite likely, and 6.50 to 7.00 was extremely likely. The highest behavioral belief strength mean was 6.14 (*SD* = 1.19) for the item "Calculating the area of lawn will help to determine how much fertilizer to apply". The lowest behavioral belief strength mean was 3.14 (*SD* = 1.82) for the item "Applying fertilizer to the lawn with NO set schedule will produce the lawn growth I desire" (See Table 10).

Table 10. Behavioral Belief Strength Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Behavioral Belief Strength Item	*n*	*M*	*SD*	Interpretive Scale[a]
Calculating the area of lawn will help to determine how much fertilizer to apply (*Calculating the area of lawn*)	260	6.14	1.19	quite likely
Watering in the fertilizer applied to the lawn will keep the product in the soil (*Watering in lawn fertilizer*)	260	6.07	1.15	quite likely
A soil test will determine what nutrients the soil needs and in what amount they should be applied (*Soil testing*)	260	6.07	1.22	quite likely
Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region will produce effective and efficient lawn and landscape care results (*Fertilizer best management practices*)	260	6.01	1.13	quite likely
Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn (*Precision fertilizer application*)	260	5.90	1.34	quite likely
Following an annual home lawn and landscape fertilizer schedule will achieve the plant growth I desire (*Fertilizer application, annual schedule*)	260	5.88	1.21	quite likely
Selecting fertilizer practices based on the type of grass being grown and the size of my yard will satisfy the standards and preferences of my neighborhood (*Community fertilizer best management practices*)	260	5.80	1.47	quite likely

(table continued)

Behavioral Belief Strength Item	*n*	*M*	*SD*	Interpretive Scale[a]
Following the directions specified on the fertilizer product label will produce the lawn care results I desire (*Fertilizer product label*)	260	5.80	1.13	quite likely
Over application of fertilizer to the lawn or landscape will result in excess fertilizer runoff that contributes to environmental issues, particularly in water (*Excess fertilizer runoff*)	260	5.62	1.72	quite likely
Coordinating the application of lawn fertilizer when rain is expected will water in the product correctly (*Watering in lawn fertilizer, rain event*)	260	5.40	1.62	slightly likely
Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water (*Runoff from fertilizer spills*)	260	5.19	1.98	slightly likely
Applying fertilizer to the lawn with NO set schedule will produce the lawn growth I desire (*Fertilizer application, no schedule*)	260	3.14	1.82	slightly unlikely

Note. Behavioral belief strength was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *unlikely* and *likely*, where the lower value was associated with the descriptor unlikely and the higher value was associated with the descriptor likely.
[a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is extremely unlikely; 1.51 to 2.50 is quite unlikely; 2.51 to 3.50 is slightly unlikely; 3.51 to 4.49 is neither unlikely nor likely; 4.50 to 5.49 is a slightly likely; 5.50 to 6.49 is quite likely; and 6.50 to 7.00 is extremely likely.

Past behavior was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *never* and *almost always*, where the lower value was associated with the descriptor never and the higher value was associated with the descriptor almost always. The researcher established an interpretive scale to interpret the past behavior scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was never, 1.51 to 2.50 was rarely, 2.51 to 3.50 was seldom, 3.51 to 4.49 was irregularly, 4.50 to 5.49 was occasionally, 5.50 to 6.49 was frequently, and 6.50 to 7.00 was almost always. The highest past behavior mean was 5.65 (*SD* = 1.40) for the item, "I have followed the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire". The lowest past behavior mean was 2.18 (*SD* = 1.62) for the item, "I have applied fertilizer to areas other than the lawn or landscape that resulted in runoff that contributes to environmental issues, particularly in water" (See Table 11).

Table 11. Past Behavior Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Past Behavior Item	*n*	*M*	*SD*	Interpretive Scale[a]
I have followed the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire (*Fertilizer product label*)	260	5.65	1.40	frequently
I have watered in the fertilizer applied to the lawn to keep the product in the soil (*Watering in lawn fertilizer*)	260	5.15	1.94	occasionally
I have selected fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood (*Community fertilizer best management practices*)	260	4.82	2.04	occasionally
I have used a fertilizer spreader to determine how much fertilizer is being applied to the lawn (*Precision fertilizer application*)	260	4.81	2.29	occasionally

(table continued)

Past Behavior Item	*n*	*M*	*SD*	Interpretive Scale[a]
I have selected fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results (*Fertilizer best management practices*)	260	4.79	2.07	occasionally
I have followed an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire (*Fertilizer application, annual schedule*)	260	4.57	2.15	occasionally
I have coordinated the application of lawn fertilizer when rain is expected, to water in the product correctly (*Watering in lawn fertilizer, rain event*)	260	4.29	2.20	irregularly
I have calculated the area of lawn to determine how much fertilizer to apply (*Calculating the area of lawn*)	260	4.23	2.30	irregularly
I have applied fertilizer to my lawn with NO set schedule to produce the lawn growth I desire (*Fertilizer application, no schedule*)	260	3.29	1.98	seldom
I have used a soil test to determine what nutrients the soil needs and in what amount they should be applied (*Soil testing*)	260	2.85	2.17	seldom
I have over applied fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water (*Excess fertilizer runoff*)	260	2.29	1.65	rarely

(table continued)

Past Behavior Item	*n*	*M*	*SD*	Interpretive Scale[a]
I have applied fertilizer to areas other than the lawn or landscape that resulted in runoff that contributes to environmental issues, particularly in water (*Runoff from fertilizer spills*)	260	2.18	1.62	rarely

Note. Past behavior was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *never* and *almost always*, where the lower value was associated with the descriptor never and the higher value was associated with the descriptor almost always. [a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is never; 1.51 to 2.50 is rarely; 2.51 to 3.50 is seldom; 3.51 to 4.49 is irregularly; 4.50 to 5.49 is occasionally; 5.50 to 6.49 is frequently; and 6.50 to 7.00 is almost always.

The outcome evaluation and behavioral belief strength responses were multiplied to produce a behavioral belief score for the 12 fertilizer management practices evaluated in this study. However, prior to computing the behavioral belief measures, the two outcome evaluation items (*Excess fertilizer runoff* and *Runoff from fertilizer spills*) and the two behavioral belief strength items (*Watering in lawn fertilizer, rain event* and *Fertilizer application, no schedule*) that utilized a reverse coding had to be recoded so that in all cases, the higher value response represented the more positive response. An example of reverse coding for the behavioral belief strength item is as follows: a response of unlikely or a value of 1 for the item “Coordinating the application of lawn fertilizer when rain is expected will water in the product correctly” would be the more positive response. The item was recoded so that an unlikely response was assigned a value of 7, to enable the researcher to correctly compute the behavioral belief scores.

An interpretive scale was developed for the behavioral belief score with a possible score of 1 to 49, where 1 to 7 was an extremely negative belief, 8 to 14 was moderately negative belief, 15 to 21 was a slightly negative belief, 22 to 28 was a neutral belief, 29 to 35 was a slightly positive belief, 36 to 42 was moderately positive belief, and 43 to 49 was an extremely positive belief. An example of a computed score and its corresponding interpretation would be the selection of 1 on the outcome evaluation semantic differential scale and a selection of 1 on the behavioral belief strength scale. The behavioral belief score computed would be 1 multiplied by 1 equaling 1 and would be interpreted as an extremely negative belief. Another example would be the selection of 7 on the outcome evaluation semantic differential scale and a selection of 7 on the behavioral belief strength scale. The behavioral belief score computed would be 7 multiplied by 7 equaling 49 and would be interpreted as an extremely positive belief. In this study, the analysis of the behavioral belief score resulted in six of the items being classified as moderately positive, five items classified as slightly positive, and one item classified as slightly negative (See Table 12).

Table 12. Behavioral Belief[a] of Louisiana Urban and Suburban Homeowners Regarding Selected Fertilizer Management Practices

Fertilizer Management Practice	*n*	*M*	*SD*	Interpretive Scale[b]
Calculating the area of lawn	260	39.76	11.11	moderately positive
Watering in lawn fertilizer	260	39.09	10.86	moderately positive
Precision fertilizer application	260	38.84	11.09	moderately positive
Fertilizer best management practices	260	38.70	10.10	moderately positive
Soil testing	260	37.48	11.85	moderately positive
Fertilizer application, annual schedule	260	37.19	11.50	moderately positive
Community fertilizer best management practices	260	34.82	13.95	slightly positive
Fertilizer product label	260	32.93	11.11	slightly positive

(table continued)

Fertilizer Management Practice	*n*	*M*	*SD*	Interpretive Scale[b]
[c]*Excess fertilizer runoff*	260	32.88	15.81	slightly positive
[d]*Runoff from fertilizer spills*	260	31.47	16.28	slightly positive
[e]*Fertilizer application, no schedule*	260	31.12	13.05	slightly positive
[f]*Watering in lawn fertilizer, rain event*	260	16.28	10.72	slightly negative

[a]Behavioral belief was computed from the product of the outcome evaluation and behavioral belief strength responses.
[b]The interpretive scale ranges from 1 to 49 and is labeled as follows: 1 to 7 is an extremely negative belief; 8 to 14 is moderately negative belief; 15 to 21 is a slightly negative belief; 22 to 28 is a neutral belief; 29 to 35 is a slightly positive belief; 36 to 42 is moderately positive belief; and 43 to 49 is an extremely positive belief.
[c]Negatively worded outcome evaluation items were reverse coded prior to computing the behavioral belief products.
[d]Negatively worded behavioral belief strength items were reverse coded prior to computing the behavioral belief products.

Pearson's Product Moment correlations were performed to examine the relationship between the behavioral belief and past behavior items measured for the 12 fertilizer management practices. However, prior to computing the correlations, the four past behavior items (*Watering in lawn fertilizer, rain event*, *Fertilizer application, no schedule*, *Excess fertilizer runoff*, and *Runoff from fertilizer spills*) that utilized a reverse coding had to be recoded so that in all cases, the higher value response represented the more positive response. An example of this reverse coding can be seen on the past behavior item, "I have coordinated the application of lawn fertilizer when rain is expected, to water in the product correctly". A response of never to this item is the more positive response, therefore recoding the item so that a never response is assigned a value of 7 enabled the researcher to correctly compute the correlations. The Davis (1971) descriptors of effect size were used to interpret the correlations in this study. These descriptors include: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association. The practice for which the highest correlation was found was *Fertilizer application, no schedule* (r = .54, p < .001). The correlation is positive even though the past behavior item is negatively worded since the coding was reversed prior to computing the correlation. The fertilizer management practice *Soil testing* was the only practice that did not have a statistically significant correlation (r = .06, p = .381) (See Table 13). Overall, one of the relationships was classified as substantial, eight as moderate, two as low, and one as negligible.

Table 13. Relationship between Behavioral Belief and Past Behavior for Selected Fertilizer Management Practices among Louisiana Urban and Suburban Homeowners

Fertilizer Management Practice	*n*	*r*	*p*	Davis' Descriptors[a]
[b]*Fertilizer application, no schedule*	260	.54	<.001	Substantial
Community fertilizer best management practices	260	.49	<.001	Moderate
[b]*Watering in lawn fertilizer, rain event*	260	.47	<.001	Moderate
[b]Excess fertilizer runoff	260	.47	<.001	Moderate
[b]*Runoff from fertilizer spills*	260	.43	<.001	Moderate
Fertilizer best management practices	260	.38	<.001	Moderate
Fertilizer product label	260	.38	<.001	Moderate
Precision fertilizer application	260	.37	<.001	Moderate

(table continued)

Fertilizer Management Practice	*n*	*r*	*p*	Davis' Descriptors[a]
Watering in lawn fertilizer	260	.36	<.001	Moderate
Fertilizer application, annual schedule	260	.25	<.001	Low
Calculating the area of lawn	260	.20	<.001	Low
Soil testing	260	.06	.381	Negligible

[a]Davis' descriptors were used for interpretation of the correlation coefficient. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.
[b]Negatively worded past behavior items were reverse coded prior to computing the correlations.

Objective 6.

Objective six was to determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the outcome evaluation construct for the 12 fertilizer management practices examined in this study. These comparisons were made using independent t-tests. Of the outcome evaluation items for the 12 practices examined, only two tests were significant and the other 10 were not significant. The *Fertilizer product label* practice's mean outcome evaluation for the item "Producing the lawn and landscape care results I desire is" was significantly higher ($t_{97.5} = 2.58$, $p = .011$) for homeowners that had applied fertilizer ($M = 5.69$, $SD = 1.17$) than those that had not applied fertilizer ($M = 5.18$, $SD = 1.50$). The *Fertilizer application, no schedule* practice's mean outcome evaluation for the item "Producing the lawn growth I desire is" was also significantly higher ($t_{95.1} = 2.10$, $p = .038$) for homeowners that had applied fertilizer ($M = 6.45$, $SD = 0.82$) than those that had not applied fertilizer ($M = 6.15$, $SD = 1.10$) to their home lawn and/or landscape (See Table 14).

Table 14. Comparison of Outcome Evaluation Scores for Selected Fertilizer Management Practices by whether or not Louisiana Urban and Suburban Homeowners had applied Fertilizer

Outcome Evaluation Item	Fertilizer Applied *M (SD)*	No Fertilizer Applied *M (SD)*	*t*	*df*	*p*
Producing the lawn and landscape care results I desire is (*Fertilizer product label*)	5.69 (1.17)	5.18 (1.50)	2.58	97.5[a]	.011
Producing the lawn growth I desire is (*Fertilizer application, no schedule*)	6.45 (0.82)	6.15 (1.10)	2.10	95.1[a]	.038
Excess fertilizer runoff that contributes to environmental issues, particularly in water is (*Excess fertilizer runoff*)	2.34 (1.83)	1.93 (1.67)	1.65	258	.100
Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is (*Runoff from fertilizer spills*)	2.07 (1.71)	1.74 (1.59)	1.42	258	.156
Keeping the fertilizer product in the soil is (*Watering in lawn fertilizer*)	6.39 (0.91)	6.24 (1.12)	1.10	258	.273
Watering in lawn fertilizer correctly is (*Watering in lawn fertilizer, rain event*)	6.42 (0.99)	6.29 (1.20)	0.86	258	.390

(table continued)

Outcome Evaluation Item	Fertilizer Applied *M* (*SD*)	No Fertilizer Applied *M* (*SD*)	*t*	*df*	*p*
Determining what nutrients the soil needs and in what amount they should be applied is (*Soil testing*)	6.02 (1.14)	6.15 (1.06)	0.83	258	.406
Satisfying the standards and preferences of my neighborhood is (*Community fertilizer management practices*)	5.73 (1.53)	5.87 (1.39)	0.63	258	.528
Determining how much fertilizer is being applied to the lawn is (*Precision fertilizer application*)	6.51 (0.75)	6.46 (0.94)	0.48	258	.631
Producing effective and efficient lawn and landscape care results is (*Fertilizer best management practices*)	6.36 (1.01)	6.29 (1.01)	0.46	258	.647
Achieving the plant growth I desire is (*Fertilizer application, annual schedule*)	6.20 (1.17)	6.22 (1.01)	0.14	258	.887
Determining how much fertilizer to apply is (*Calculating the area of the lawn*)	6.36 (0.90)	6.35 (1.06)	0.05	258	.962

[a]The degrees of freedom were lower for this test due to the use of the separate variance estimate necessitated by the violation of the assumption of homogeneity of variance.

Objective 7.

Objective seven was to determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the behavioral belief strength construct for the 12 fertilizer management practices examined in this study. These comparisons were made using independent t-tests. Of the behavioral belief strength items for the 12 practices examined, five tests were significant and the other seven were not significant. The behavioral belief strength construct for the *Precision fertilizer application* practice had the highest degree of difference ($t_{87.4} = 2.67$, $p = .009$) for the item “Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn”. The homeowners that had applied fertilizer had a significantly higher mean ($M = 6.06$, $SD = 1.12$) than those that had not applied fertilizer ($M = 5.46$, $SD = 1.75$) to their home lawn and/or landscape. All comparisons are presented in Table 15.

Table 15. Comparison of Behavioral Belief Strength Scores for Selected Fertilizer Management Practices by whether or not Louisiana Urban and Suburban Homeowners had applied Fertilizer

Behavioral Belief Strength Item	Fertilizer Applied *M* (*SD*)	No Fertilizer Applied *M* (*SD*)	*t*	*df*	*p*
Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn (*Precision fertilizer application*)	6.06 (1.12)	5.46 (1.75)	2.67	87.4[a]	.009

(table continued)

Behavioral Belief Strength Item	Fertilizer Applied *M* (*SD*)	No Fertilizer Applied *M* (*SD*)	*t*	*df*	*p*
Following an annual home lawn and landscape fertilizer schedule will achieve the plant growth I desire (*Fertilizer application, annual schedule*)	5.99 (1.16)	5.57 (1.30)	2.34	107.5[a]	.021
Selecting fertilizer practices based on the type of grass being grown and the size of my yard will satisfy the standards and preferences of my neighborhood (*Community best management practices*)	5.93 (1.37)	5.43 (1.66)	2.25	101.3[a]	.026
Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water is (*Runoff from fertilizer spills*)	5.03 (1.99)	5.65 (1.88)	2.24	258	.026
Following the directions specified on the fertilizer product label will produce the lawn care results I desire (*Fertilizer product label*)	5.90 (1.08)	5.54 (1.23)	2.09	106.2[a]	.039

(table continued)

Behavioral Belief Strength Item	Fertilizer Applied *M* (*SD*)	No Fertilizer Applied *M* (*SD*)	*t*	*df*	*p*
Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region will produce effective and efficient lawn and landscape care results (*Fertilizer best management practices*)	6.08 (1.09)	5.81 (1.24)	1.73	258	.085
Coordinating the application of lawn fertilizer when rain is expected will water in the product correctly (*Watering in lawn fertilizer, rain event*)	5.49 (1.54)	5.13 (1.83)	1.57	258	.118
Watering in the fertilizer applied to the lawn will keep the product in the soil (*Watering in lawn fertilizer*)	6.14 (1.06)	5.87 (1.37)	1.49	96.7[a]	.139
Applying fertilizer to the lawn with NO set schedule will produce the lawn growth I desire (*Fertilizer application, no schedule*)	3.20 (1.80)	2.97 (1.92)	.903	258	.367

(table continued)

Behavioral Belief Strength Item	Fertilizer Applied *M* (*SD*)	No Fertilizer Applied *M* (*SD*)	*t*	*df*	*p*
Over application of fertilizer to the lawn or landscape will result in excess fertilizer runoff that contributes to environmental issues, particularly in water (*Excess fertilizer runoff*)	5.59 (1.67)	5.68 (1.87)	.339	258	.735
A soil test will determine what nutrients the soil needs and in what amount they should be applied (*Soil testing*)	6.08 (1.25)	6.04 (1.17)	.227	258	.821
Calculating the area of lawn will help to determine how much fertilizer to apply (*Calculating the area of the lawn*)	6.15 (1.16)	6.12 (1.28)	.167	258	.867

[a]The degrees of freedom were lower for this test due to the use of the separate variance estimate necessitated by the violation of the assumption of homogeneity of variance.

Objective 8.

Objective eight was to determine if attitude, perceived norm, and perceived control explained a significant portion of the variance in intention to perform each of the 12 fertilizer management practices examined in this study. The attitude construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *harmful* and *beneficial*, where the lower value was associated with the descriptor harmful and the higher value was associated with the descriptor beneficial. An interpretive scale, based on the work of Fishbein and Ajzen (2010), was established to interpret the attitude scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was extremely harmful, 1.51 to 2.50 was quite harmful, 2.51 to 3.50 was slightly harmful, 3.51 to 4.49 was neither harmful nor beneficial, 4.50 to 5.49 was slightly beneficial, 5.50 to 6.49 was quite beneficial, and 6.50 to 7.00 was extremely beneficial. The highest attitude mean was 6.25 (*SD* = 1.03) for the item, "Calculating the area of lawn to determine how much fertilizer to apply is". The lowest attitude mean was 2.12 (*SD* = 1.68) for the item, "Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is" (See Table 16).

Table 16. Attitude Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Attitude Item	*n*	*M*	*SD*	Interpretive Scale[a]
Calculating the area of lawn to determine how much fertilizer to apply is (*Calculating the area of lawn*)	260	6.25	1.03	quite beneficial
Using a soil test to determine the nutrients the soil needs and in what amount they should be applied is (*Soil testing*)	260	6.22	1.05	quite beneficial

(table continued)

Attitude Item	*n*	*M*	*SD*	Interpretive Scale[a]
Using a fertilizer spreader to determine how much fertilizer is being applied to the lawn is (*Precision fertilizer application*)	260	6.17	1.08	quite beneficial
Watering in the fertilizer applied to the lawn to keep the product in the soil is (*Watering in lawn fertilizer*)	260	6.15	1.18	quite beneficial
Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results is (*Fertilizer best management practices*)	260	6.07	1.16	quite beneficial
Following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire is (*Fertilizer application, annual schedule*)	260	6.05	1.10	quite beneficial

(table continued)

Attitude Item	*n*	*M*	*SD*	Interpretive Scale[a]
Following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire is (*Fertilizer product label*)	260	5.92	1.09	quite beneficial
Selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood is (*Community fertilizer best management practices*)	260	5.89	1.39	quite beneficial
Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is (*Watering in lawn fertilizer, rain event*)	260	5.75	1.49	quite beneficial
Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is (*Fertilizer application, no schedule*)	260	3.46	1.56	slightly harmful

(table continued)

Attitude Item	*n*	*M*	*SD*	Interpretive Scale[a]
Over application of fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water is (*Excess fertilizer runoff*)	260	2.27	1.76	quite harmful
Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is (*Runoff from fertilizer spills*)	260	2.12	1.68	quite harmful

Note. Attitude was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *harmful* and *beneficial*, where the lower value was associated with the descriptor harmful and the higher value was associated with the descriptor beneficial.
[a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is extremely harmful; 1.51 to 2.50 is quite harmful; 2.51 to 3.50 is slightly harmful; 3.51 to 4.49 is neither harmful nor beneficial; 4.50 to 5.49 is a slightly beneficial; 5.50 to 6.49 is quite beneficial; and 6.50 to 7.00 is extremely beneficial.

The perceived norm construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *disagree* and *agree*, where the lower value was associated with the descriptor disagree and the higher value was associated with the descriptor agree. An interpretive scale, based on the work of Fishbein and Ajzen (2010), was established to interpret the perceived norm scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was extremely disagree, 1.51 to 2.50 was quite disagree, 2.51 to 3.50 was slightly disagree, 3.51 to 4.49 was neither disagree nor agree, 4.50 to 5.49 was slightly agree, 5.50 to 6.49 was quite agree, and 6.50 to 7.00 was extremely agree. The highest perceived norm mean was 5.91 (*SD* = 1.17) for the item, “Most people whose opinion I value would approve of me following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire”. The lowest perceived norm mean was 2.48 (*SD* = 1.99) for the item, “Most people whose opinion I value would approve of me applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water” (See Table 17).

Table 17. Perceived Norm Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Perceived Norm Item	*n*	*M*	*SD*	Interpretive Scale[a]
Most people whose opinion I value would approve of me following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire (*Fertilizer product label*)	260	5.91	1.17	quite agree
Most people whose opinion I value would approve of me using a fertilizer spreader to determine how much fertilizer is being applied to the lawn (*Precision fertilizer application*)	260	5.82	1.42	quite agree

(table continued)

Perceived Norm Item	*n*	*M*	*SD*	Interpretive Scale[a]
Most people whose opinion I value would approve of me watering in the fertilizer applied to the lawn to keep the product in the soil (*Watering in lawn fertilizer*)	260	5.76	1.39	quite agree
Most people whose opinion I value would approve of me calculating the area of lawn to determine how much fertilizer to apply (*Calculating the area of lawn*)	260	5.76	1.25	quite agree
Most people whose opinion I value would approve of me selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results (*Fertilizer management practices*)	260	5.74	1.33	quite agree

(table continued)

Perceived Norm Item	*n*	*M*	*SD*	Interpretive Scale[a]
Most people whose opinion I value would approve of me following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire (*Fertilizer application, annual schedule*)	260	5.68	1.35	quite agree
Most people whose opinion I value would approve of me selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood (*Community fertilizer management practices*)	260	5.62	1.42	quite agree
Most people whose opinion I value would approve of me using a soil test to determine what nutrients the soil needs and in what amount (*Soil testing*)	260	5.60	1.33	quite agree

(table continued)

Perceived Norm Item	*n*	*M*	*SD*	Interpretive Scale[a]
Most people whose opinion I value would approve of me coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly (*Watering in lawn fertilizer, rain event*)	260	5.38	1.66	slightly agree
Most people whose opinion I value would approve of me applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire (*Fertilizer application, no schedule*)	260	3.34	1.75	slightly disagree
Most people whose opinion I value would approve of me over applying fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water (*Excess fertilizer runoff*)	260	2.56	1.98	slightly disagree

(table continued)

Perceived Norm Item	*n*	*M*	*SD*	Interpretive Scale[a]
Most people whose opinion I value would approve of me applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water *(Runoff from fertilizer spills*)	260	2.48	1.99	quite disagree

Note. Perceived norm was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *disagree* and *agree*, where the lower value was associated with the descriptor disagree and the higher value was associated with the descriptor agree.
[a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is extremely disagree; 1.51 to 2.50 is quite disagree; 2.51 to 3.50 is slightly disagree; 3.51 to 4.49 is neither disagree nor agree; 4.50 to 5.49 is a slightly agree; 5.50 to 6.49 is quite agree; and 6.50 to 7.00 is extremely agree.

The perceived control construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *not at all* and *completely*, where the lower value was associated with the descriptor not at all and the higher value was associated with the descriptor completely. The researcher established an interpretive scale to understand the perceived control scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was not at all, 1.51 to 2.50 was to a very small extent, 2.51 to 3.50 was to a small extent, 3.51 to 4.49 was to a moderate extent, 4.50 to 5.49 was to a large extent, 5.50 to 6.49 was to a very large extent, and 6.50 to 7.00 was completely. The highest perceived control mean was 6.14 (*SD* = 1.25) for the item, "Calculating the area of lawn to determine how much fertilizer to apply is under my control". The lowest perceived control mean was 5.05 (*SD* = 1.92) for the item, "Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is under my control" (See Table 18).

Table 18. Perceived Control Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Perceived Control Item	*n*	*M*	*SD*	Interpretive Scale[a]
Calculating the area of lawn to determine how much fertilizer to apply is under my control (*Calculating the area of lawn*)	260	6.14	1.25	very large extent
Selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood is under my control (*Community fertilizer best management practices*)	260	6.10	1.27	very large extent
Watering in the fertilizer applied to the lawn to keep the product in the soil is under my control (*Watering in lawn fertilizer*)	260	6.10	1.23	very large extent
Using a fertilizer spreader to determine how much fertilizer is being applied to the lawn is under my control (*Precision fertilizer application*)	260	6.09	1.22	very large extent

(table continued)

Perceived Control Item	*n*	*M*	*SD*	Interpretive Scale[a]
Following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire is under my control (*Fertilizer application, annual schedule*)	260	6.08	1.15	very large extent
Using a soil test to determine the nutrients the soil needs and in what amount is under my control (*Soil testing*)	260	6.00	1.30	very large extent
Following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire is under my control (*Fertilizer product label*)	260	6.00	1.21	very large extent
Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results is under my control (*Fertilizer management practices*)	260	5.94	1.32	very large extent

(table continued)

Perceived Control Item	*n*	*M*	*SD*	Interpretive Scale[a]
Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is under my control (*Runoff from fertilizer spills*)	260	5.69	1.57	very large extent
Over applying fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water is under my control (*Excess fertilizer runoff*)	260	5.62	1.67	very large extent
Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is under my control (*Watering in lawn fertilizer, rain event*)	260	5.36	1.73	to a large extent
Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is under my control (*Fertilizer application, no schedule*)	260	5.05	1.92	to a large extent

Note. Perceived control was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *not at all* and *completely*, where the lower value was associated with the descriptor not at all and the higher value was associated with the descriptor completely. [a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is not at all; 1.51 to 2.50 is to a very small extent; 2.51 to 3.50 is to a small extent; 3.51 to 4.49 is to a moderate extent; 4.50 to 5.49 is to a large extent; 5.50 to 6.49 is to a very large extent; and 6.50 to 7.00 is completely.

The intention construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *definitely do not* and *definitely do*, where the lower value was associated with the descriptor definitely do not and the higher value was associated with the descriptor definitely do. The researcher established an interpretive scale to understand the intention scores. The possible scores ranged from 1.00 to 7.00, where 1.00 to 1.50 was definitely do not, 1.51 to 2.50 was probably do not, 2.51 to 3.50 was maybe do not, 3.51 to 4.49 was may or may not, 4.50 to 5.49 was maybe do, 5.50 to 6.49 was probably do, and 6.50 to 7.00 was definitely do. The highest intention mean was 6.12 (*SD* = 1.15) for the item, "I intend to follow the directions specified on the fertilizer product label to achieve the lawn and landscape care results I desire". The lowest intention mean was 1.92 (*SD* = 1.64) for the item, "I intend to apply fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water" (See Table 19).

Table 19. Intention Regarding the use of Selected Fertilizer Management Practices as Discerned by Louisiana Urban and Suburban Homeowners

Intention Item	*n*	*M*	*SD*	Interpretive Scale[a]
I intend to follow the directions specified on the fertilizer product label to achieve the lawn and landscape care results I desire (*Fertilizer product label*)	260	6.12	1.15	probably do
I intend to water in the fertilizer applied to my lawn to keep the product in the soil (*Watering in lawn fertilizer*)	260	5.48	1.83	maybe do

(table continued)

Intention Item	*n*	*M*	*SD*	Interpretive Scale[a]
I intend to select fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results (*Fertilizer management practices*)	260	5.32	1.78	maybe do
I intend to use a fertilizer spreader to determine how much fertilizer is being applied to the lawn (*Precision fertilizer application*)	260	5.28	2.06	maybe do
I intend to select fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood (*Community fertilizer best management practices*)	260	5.12	1.94	maybe do
I intend to follow an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire (*Fertilizer application, annual schedule*)	260	5.07	1.87	maybe do
I intend to calculate the area of lawn to determine how much fertilizer to apply (*Calculating the area of lawn*)	260	4.86	2.04	maybe do

(table continued)

Intention Item	*n*	*M*	*SD*	Interpretive Scale[a]
I intend to coordinate the application of lawn fertilizer when rain is expected, to water in the product correctly (*Watering in lawn fertilizer*, *rain event*)	260	4.83	2.05	maybe do
I intend to use a soil test to determine what nutrients the soil needs and in what amount (*Soil testing*)	260	3.85	1.92	may or may not
I intend to apply fertilizer to my lawn with NO set schedule to produce the lawn growth I desire (*Fertilizer application, no schedule*)	260	3.03	2.04	maybe do not
I intend to over apply fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water (*Excess fertilizer runoff*)	260	1.93	1.66	probably do not
I intend to apply fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water (*Runoff from fertilizer spills*)	260	1.92	1.64	probably do not

(note continued)

Note. Intention was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *definitely do not* and *definitely do*, where the lower value was associated with the descriptor definitely do not and the higher value was associated with the descriptor definitely.
[a]The interpretive scale ranges from 1.00 to 7.00 and is labeled as follows: 1.00 to 1.50 is definitely do not; 1.51 to 2.50 is probably do not; 2.51 to 3.50 is maybe do not; 3.51 to 4.49 is may or may not; 4.50 to 5.49 is maybe do; 5.50 to 6.49 is probably do; and 6.50 to 7.00 is definitely do.

Regression analyses were completed, to accomplish the objective of determining whether the independent variables (attitude, perceived norms, and perceived control) explained a significant portion of the variance in the dependent variable, intention to perform the 12 fertilizer management practices examined in this study. The first practice analyzed was *Fertilizer product label*. In the model, the dependent variable was intention and the independent variables were, attitude, perceived norm, and perceived control. When the bivariate correlations were examined, all three independent variables had significant correlations with intention. The independent variables, attitude (r = .55, p < .001) and perceived control (r = .54, p <.001) were described as substantial associations based on Davis' (1971) descriptors for the magnitude of the correlation coefficients (See Table 20).

Table 20. Relationship between *Fertilizer product label* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	n	r	p	Davis' Descriptors[a]
Attitude	260	.55	<.001	substantial
Perceived Control	260	.54	<.001	substantial
Perceived Norm	260	.47	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Fertilizer product label* practice. The coefficient of determination (R^2 = .411) for the explanation of intention from attitude, perceived norm and perceived control accounted for 41.1% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 21). Attitude made the greatest contribution to the explanation of intention to perform the practice *Fertilizer product label* (β = .330, t = 5.62, p < .001). Perceived norm contributed the least (β = .156, t = 2.64, p = .009) to the explanation of intention (See Table 21).

Table 21. Regression of Intention in performing the *Fertilizer product label* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	46.64	59.5	<.001	
Residual	256	.784			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.641	.411	.411	59.5	<.001
Variable	β	*t*	*p*		
Attitude	.330	5.62	<.001		
Perceived Control	.289	4.86	<.001		
Perceived Norm	.156	2.64	.009		

The model used to analyze the practice *Soil testing* had intention as the dependent variable and attitude, perceived norm, and perceived control as the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 22). The variable perceived norm (r = .31, p < .001) had a moderate association. The variables attitude (r = .18, p = .002) and perceived control (r = .20, p = .001) had a low association with the dependent variable, intention (See Table 22).

Table 22. Relationship between *Soil testing* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Perceived Norm	260	.31	<.001	moderate
Perceived Control	260	.20	.001	low
Attitude	260	.18	.002	low

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry regression analysis was conducted with attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Soil testing* practice. The coefficient of determination (R^2 = .103) for the explanation of intention from attitude, perceived norm and perceived control accounted for 10.3% of the variance in intention. The individual contributions of each of the independent variables was also examined. Perceived norm was the only independent variable that had a standardized beta coefficient with a significant t-value, and perceived norm made the greatest contribution to the explanation of intention to perform the practice *Soil testing* (β = .275, t = 3.98, p < .001) (See Table 23). Attitude contributed the least (β = .003, t = 0.05, p = .962) to the explanation of the dependent variable, intention (See Table 23).

Table 23. Regression of Intention in performing the *Soil testing* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	32.88	9.78	<.001	
Residual	256	3.36			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.321	.103	.103	9.78	<.001
Variable	β	*t*	*p*		
Perceived Norm	.275	3.98	<.001		
Perceived Control	.096	1.40	.163		
Attitude	.003	0.05	.962		

The practice *Calculating the area of lawn* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention. The variables perceived norm (r = .40, p < .001), perceived control (r = .37, p < .001), and attitude (r = .34, p < .001) were all described as moderate associations (See Table 24).

Table 24. Relationship between *Calculating the area of lawn* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Perceived Norm	260	.40	<.001	moderate
Perceived Control	260	.37	<.001	moderate
Attitude	260	.34	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the

Calculating the area of lawn practice. The coefficient of determination (R^2= .211) for the explanation of intention from attitude, perceived norm and perceived control accounted for 21.1% of the variance in intention. The individual contributions of each of the independent variables was also examined. The independent variables perceived norm and perceived control had standardized beta coefficients with significant t-values, and the variable attitude had a non-significant t-value (See Table 25). Perceived norm made the greatest contribution to the explanation of intention to perform the practice *Calculating the area of lawn* (β = .259, t = 3.79, p < .001). Attitude contributed the least (β = .087, t = 1.23, p = .221) to the explanation of the dependent variable, intention (See Table 25).

Table 25.
Regression of Intention in performing the *Calculating the area of lawn* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	75.82	22.8	<.001	
Residual	256	3.32			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.459	.211	.211	22.8	<.001
Variable	β	*t*	*p*		
Perceived Norm	.259	3.79	<.001		
Perceived Control	.209	3.13	.002		
Attitude	.087	1.23	.221		

The practice *Watering in lawn fertilizer* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 26). The variables perceived control (r = .47, p < .001), perceived norm (r = .46, p < .001), and attitude (r = .45, p = .001) all had a moderate association with intention (See Table 26).

Table 26.
Relationship between *Watering in lawn fertilizer* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Perceived Control	260	.47	<.001	moderate
Perceived Norm	260	.46	<.001	moderate
Attitude	260	.45	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control variables as the independent variables and intention as the dependent variable for the *Watering in lawn fertilizer* practice. The coefficient of determination (R^2 = .310) for the explanation of intention from attitude, perceived norm and perceived control accounted for 31.0% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 27). Perceived control made the greatest contribution to the explanation of intention to perform the practice *Watering in lawn fertilizer* (β = .282, t = 4.58, p < .001). Attitude contributed the least (β = .151, t = 2.12, p = .035) to the explanation of the dependent variable, intention (See Table 27).

Table 27. Regression of Intention in performing the *Watering in lawn fertilizer* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	89.49	38.4	<.001	
Residual	256	2.33			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.557	.310	.310	38.4	<.001
Variable	β	*t*	*p*		
Perceived Control	.282	4.58	<.001		
Perceived Norm	.239	3.48	.001		
Attitude	.151	2.12	.035		

The practice *Watering in lawn fertilizer, rain event* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control variables were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 28). The variables attitude (r = .55, p < .001) and perceived norm (r = .54, p < .001) had a substantial association. The variable perceived control (r = .49, p < .001) had a moderate association (See Table 28).

Table 28. Relationship between *Watering in lawn fertilizer, rain event* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.55	<.001	substantial
Perceived Norm	260	.54	<.001	substantial
Perceived Control	260	.49	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Watering in lawn fertilizer, rain event* practice. The coefficient of determination (R^2 = .415) for the explanation of intention from attitude, perceived norm and perceived control accounted for 41.5% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 29). Perceived control made the greatest contribution to the explanation of intention to perform the practice *Watering in lawn fertilizer, rain event* (β = .303, t = 5.81, p < .001). Perceived norm contributed the least (β = .227, t = 3.07, p = .002) to the explanation of intention (See Table 29).

Table 29. Regression of Intention in performing the *Watering in lawn fertilizer, rain event* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	149.92	22.8	<.001	
Residual	256	2.47			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.644	.415	.415	60.6	<.001
Variable	β	*t*	*p*		
Perceived Control	.303	5.81	<.001		
Attitude	.265	3.59	<.001		
Perceived Norm	.227	3.07	.002		

The practice *Precision fertilizer application* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control variables were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 30). The variables perceived norm (r = .57, p < .001) and attitude (r = .54, p < .001) had a substantial association. Perceived control (r = .46, p < .001) had a moderate association (See Table 30).

Table 30. Relationship between *Precision fertilizer application* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Perceived Norm	260	.57	<.001	substantial
Attitude	260	.54	<.001	substantial
Perceived Control	260	.46	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Precision fertilizer application* practice. The coefficient of determination ($R^2 = .412$) for the explanation of intention from attitude, perceived norm and perceived control accounted for 41.2% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 31). Perceived norm made the greatest contribution to the explanation of intention to perform the practice *Watering in lawn fertilizer, rain event* ($\beta = .332$, $t = 5.47$, $p < .001$). Perceived control contributed the least ($\beta = .209$, $t = 3.30$, $p = .001$) to the explanation of intention (See Table 31).

Table 31. Regression of Intention in performing the *Precision fertilizer application* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	151.12	59.7	<.001	
Residual	256	2.53			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.642	.412	.412	59.7	<.001
Variable	β	*t*	*p*		
Perceived Norm	.332	5.47	<.001		
Attitude	.256	4.13	<.001		
Perceived Control	.209	3.30	.001		

The practice *Fertilizer application, no schedule* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 32). The variables attitude (r = .64, p < .001) and perceived norm (r = .63, p < .001) had a substantial association. Perceived control (r = .24, p < .001) had a low association (See Table 32).

Table 32. Relationship between *Fertilizer application, no schedule* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.64	<.001	substantial
Perceived Norm	260	.63	<.001	substantial
Perceived Control	260	.24	<.001	low

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the

Fertilizer application, no schedule practice. The coefficient of determination (R^2 = .495) for the explanation of intention from attitude, perceived norm and perceived control accounted for 49.5% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 33). Attitude made the greatest contribution to the explanation of intention to perform the practice *Fertilizer application, no schedule* (β = .405, t = 6.77, p < .001). Perceived control contributed the least (β = .123, t = 2.72, p = .007) to the explanation of intention (See Table 33).

Table 33. Regression of Intention in performing the *Fertilizer application, no schedule* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	177.92	83.7	<.001	
Residual	256	2.13			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.704	.495	.495	83.7	<.001
Variable	β	*t*	*p*		
Attitude	.405	6.77	<.001		
Perceived Norm	.330	5.43	<.001		
Perceived Control	.123	2.72	.007		

The practice *Fertilizer application, annual schedule* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention. The variables attitude (r = .48, p < .001), perceived norm (r = .43, p < .001), and perceived control (r = .41, p < .001) had a moderate association with intention (See Table 34).

Table 34. Relationship between *Fertilizer application, annual schedule* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.48	<.001	moderate
Perceived Norm	260	.43	<.001	moderate
Perceived Control	260	.41	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Fertilizer application, annual schedule* practice. The coefficient of determination (R^2 = .271) for the explanation of intention from attitude, perceived norm and perceived control accounted for 27.1% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 35). Attitude made the greatest contribution to the explanation of intention to perform the practice *Fertilizer application, annual schedule* (β = .252, t = 3.25, p = .001). Perceived control contributed the least (β = .173, t = 2.57, p = .011) to the explanation of intention (See Table 35).

Table 35. Regression of Intention in performing the *Fertilizer application, annual schedule* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	81.88	31.7	<.001	
Residual	256	2.59			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.520	.271	.271	31.7	<.001
Variable	β	*t*	*p*		
Attitude	.252	3.25	.001		
Perceived Norm	.187	2.68	.008		
Perceived Control	.173	2.57	.011		

The practice *Excess fertilizer runoff* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, the independent variables attitude (r = .70, $p < .001$) and perceived norm (r = .61, $p < .001$) had significant correlations with intention (See Table 36). The independent variable perceived control (r = -.03, p = .323) had a non-significant correlation with intention (See Table 36).

Table 36. Relationship between *Excess fertilizer runoff* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.70	<.001	very strong
Perceived Norm	260	.61	<.001	substantial
Perceived Control	260	-.03	.323	negligible

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the

Excess fertilizer runoff practice. The coefficient of determination (R^2 = .517) for the explanation of intention from attitude, perceived norm and perceived control accounted for 51.7% of the variance in intention. The individual contributions of each of the independent variables was also examined. The independent variables attitude and perceived norm had standardized beta coefficients with significant t-values (See Table 37). Attitude made the greatest contribution to the explanation of intention to perform the practice *Excess fertilizer runoff* (β = .528, t = 8.82, p < .001). Perceived control contributed the least (β = .027, t = 0.63, p = .529) to the explanation of intention (See Table 37).

Table 37. Regression of Intention in performing the *Excess fertilizer runoff* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	122.29	91.3	<.001	
Residual	256	1.34			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	p of ΔF
	.719	.517	.517	91.3	<.001
Variable	β	*t*	*p*		
Attitude	.528	8.82	<.001		
Perceived Norm	.248	4.14	<.001		
Perceived Control	.027	0.63	.529		

The practice *Runoff from fertilizer spills* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control variables were the independent variables. When the bivariate correlations were examined, the independent variables attitude (r = .69, p < .001) and perceived norm (r = .62, p < .001) had significant correlations with intention (See Table 38). The independent variable perceived control (r = -.07, p = .129) had a non-significant correlation with intention (See Table 38).

Table 38. Relationship between *Runoff from fertilizer spills* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.69	<.001	substantial
Perceived Norm	260	.62	<.001	substantial
Perceived Control	260	-.07	.129	negligible

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Runoff from fertilizer spills* practice. The coefficient of determination ($R^2 = .521$) for the explanation of intention from attitude, perceived norm and perceived control accounted for 52.1% of the variance in intention. The individual contributions of each of the independent variables was also examined. The independent variables attitude and perceived norm had standardized beta coefficients with significant t-values (See Table 39). Attitude made the greatest contribution to the explanation of intention to perform the practice *Runoff from fertilizer spills* ($\beta = .504$, $t = 8.74$, $p < .001$). Perceived control contributed the least ($\beta = .019$, $t = 0.43$, $p = .670$) to the explanation of intention (See Table 39).

Table 39. Regression of Intention in performing the *Runoff from fertilizer spills* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	120.28	92.9	<.001	
Residual	256	1.29			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.722	.521	.521	92.9	<.001
Variable	β	*t*	*p*		
Attitude	.504	8.74	<.001		
Perceived Norm	.286	4.98	<.001		
Perceived Control	.019	0.43	.670		

The practice *Community fertilizer best management practices* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 40). The variables attitude (r = .59, p < .001) and perceived norm (r = .55, p < .001) both had a substantial association with intention. The independent variable, perceived control (r = .47, p < .001), had a moderate association with intention (See Table 40).

Table 40. Relationship between *Community fertilizer best management practices* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Attitude	260	.59	<.001	substantial
Perceived Norm	260	.55	<.001	substantial
Perceived Control	260	.47	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control as the independent variables and intention as the dependent variable for the *Community fertilizer best management practices* practice. The coefficient of determination (R^2 = .414) for the explanation of intention from attitude, perceived norm and perceived control accounted for 41.4% of the variance in intention. The individual contributions of each of the independent variables was also examined. All three independent variables had standardized beta coefficients with significant t-values (See Table 41). Attitude made the greatest contribution to the explanation of intention to perform the practice *Community fertilizer best management practices* (β = .322, t = 4.79, p < .001). Perceived control contributed the least (β = .167, t = 2.88, p = .004) to the explanation of intention (See Table 41).

Table 41. Regression of Intention in performing the *Community fertilizer best management practices* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	134.02	60.3	<.001	
Residual	256	2.22			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.644	.414	.414	60.3	<.001
Variable	β	*t*	*p*		
Attitude	.332	4.79	<.001		
Perceived Norm	.255	3.97	<.001		
Perceived Control	.167	2.88	.004		

The practice *Fertilizer best management practices* was analyzed with the model where intention was the dependent variable and attitude, perceived norm, and perceived control were the independent variables. When the bivariate correlations were examined, all three independent variables had significant correlations with intention (See Table 42). The independent variable, perceived norm (r = .58, $p < .001$), had a substantial association with intention, and the variables attitude (r = .46, $p < .001$) and perceived control (r = .42, $p < .001$) had a moderate association with intention (See Table 42).

Table 42. Relationship between *Fertilizer best management practices* Intention and Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Perceived Norm	260	.58	<.001	substantial
Attitude	260	.46	<.001	moderate
Perceived Control	260	.42	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with the attitude, perceived norm and perceived control variables as the independent variables and intention as the dependent variable for the *Fertilizer best management practices* practice. The coefficient of determination (R^2 = .369) for the explanation of intention from attitude, perceived norm and perceived control accounted for 36.9% of the variance in intention. The individual contributions of each of the independent variables was also examined. The independent variables perceived norm and perceived control had standardized beta coefficients with significant t-values (See Table 43). Perceived norm made the greatest contribution to the explanation of intention to perform the practice *Fertilizer best management practices* (β = .458, t= 6.98, p < .001). Attitude contributed the least (β = .058, t = 0.82, p = .412) to the explanation of intention (See Table 43).

Table 43. Regression of Intention in performing the *Fertilizer best management practices* Practice on Attitude, Perceived Norm and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	3	100.87	49.9	<.001	
Residual	256	2.02			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.607	.369	.369	49.9	<.001
Variable	β	*t*	*p*		
Perceived Norm	.458	6.98	<.001		
Perceived Control	.186	3.08	.002		
Attitude	.058	0.82	.412		

Objective 9.

Objective nine was to determine if intention and perceived control explained a significant portion of the variance in past behavior for each of the 12 fertilizer management practices examined in this study. The first practice analyzed was *Fertilizer product label*. In the model, the dependent variable was past behavior and the independent variables were intention and perceived control. When the bivariate correlations were examined for the *Fertilizer product label* practice, the two independent variables had significant correlations with past behavior (See Table 44). The independent variables, intention (r = .63, p < .001) and perceived control (r = .60, p <.001), had substantial associations with past behavior based on Davis' (1971) descriptors for the magnitude of the correlation coefficients (See Table 44).

Table 44. Relationship between *Fertilizer product label* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.63	<.001	substantial
Perceived Control	260	.60	<.001	substantial

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Fertilizer product label* practice. The coefficient of determination (R^2 = .493) for the explanation of past behavior from intention and perceived control accounted for 49.3% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The two independent variables had standardized beta coefficients with significant t-values (See Table 45). Intention (β = .431, t = 8.20, p < .001) made the greatest contribution to the explanation of past behavior for the *Fertilizer product label* practice (See Table 45).

Table 45. Regression of Past Behavior in performing the *Fertilizer product label* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	125.07	125.1	<.001	
Residual	257	1.00			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.702	.493	.493	125.1	<.001
Variable	β	*t*	*p*		
Intention	.431	8.20	<.001		
Perceived Control	.370	7.02	<.001		

The model used to analyze the practice *Soil testing* had past behavior as the dependent variable and intention and perceived control as the independent variables. When the bivariate correlations were examined, the independent variable intention (r = .63, p < .001) had a significant correlation and a substantial association with past behavior (See Table 46). The variable perceived control (r = .08, p = .098) had a non-significant correlation with past behavior (See Table 46).

Table 46. Relationship between *Soil testing* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.63	<.001	substantial
Perceived Control	260	.08	.098	negligible

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Soil testing* practice. The coefficient of determination (R^2 = .402) for the explanation of past behavior from intention and perceived control accounted for 40.2% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .642, t = 13.05, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Soil testing* practice (See Table 47).

Table 47. Regression of Past Behavior in performing the *Soil testing* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	245.79	86.5	<.001	
Residual	257	2.84			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.634	.402	.402	86.5	<.001
Variable	β	*t*	*p*		
Intention	.642	13.05	<.001		
Perceived Control	.05	0.91	.361		

The practice *Calculating the area of lawn* was analyzed with the model where the dependent variable was past behavior and the independent variables were intention and perceived control. When the bivariate correlations were examined, the two independent variables had significant correlations with past behavior (See Table 48). The variable intention (r = .77, p < .001) had a very strong association with past behavior. Perceived control (r = .29, p <.001) had a low association with past behavior (See Table 48).

Table 48. Relationship between *Calculating the area of lawn* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.77	<.001	very strong
Perceived Control	260	.29	<.001	low

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Calculating the area of lawn* practice. The coefficient of determination (R^2= .594) for the explanation of past behavior from intention and perceived control accounted for 59.4% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .767, t = 17.91, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Calculating the area of lawn* practice (See Table 49).

Table 49. Regression of Past Behavior in performing the *Calculating the area of lawn* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	406.10	187.7	<.001	
Residual	257	2.16			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.770	.594	.594	187.7	<.001
Variable	β	*t*	*p*		
Intention	.767	17.91	<.001		
Perceived Control	.009	0.23	.827		

The practice *Watering in lawn fertilizer* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the two independent variables had significant correlations with the dependent variable, past behavior (See Table 50). The independent variable intention (r = .81, p < .001) had a very strong association with past behavior. Perceived control (r = .41, p <.001) had a moderate association with past behavior (See Table 50).

Table 50. Relationship between *Watering in lawn fertilizer* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.81	<.001	very strong
Perceived Control	260	.41	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Watering in lawn fertilizer* practice. The coefficient of determination ($R^2 = .659$) for the explanation of past behavior from intention and perceived control accounted for 65.9% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention ($\beta = .795$, $t = 19.29$, $p < .001$), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Watering in lawn fertilizer* practice (See Table 51).

Table 51. Regression of Past Behavior in performing the *Watering in lawn fertilizer* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	320.45	248.8	<.001	
Residual	257	1.29			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.812	.659	.659	248.8	<.001
Variable	β	*t*	*p*		
Intention	.795	19.29	<.001		
Perceived Control	.036	0.88	.381		

The practice “Watering in lawn fertilizer, rain event” was analyzed with the model where past behavior was the dependent variable and intention and perceived control variables were the independent variables. When the *Watering in lawn fertilizer, rain event* bivariate correlations were examined, the two independent variables had significant correlations with past behavior (See Table 52). The independent variable intention (r = .79, p < .001) had a very strong association with the dependent variable, past behavior. Perceived control (r = .47, p <.001) had a moderate association with past behavior.

Table 52. Relationship between *Watering in lawn fertilizer, rain event* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.79	<.001	very strong
Perceived Control	260	.47	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Watering in lawn fertilizer, rain event* practice. The coefficient of determination (R^2 = .629) for the explanation of past behavior from intention and perceived control accounted for 62.9% of the variance in past behavior. The individual contributions of each of the independent variables were also examined. Intention and perceived control had standardized beta coefficients with significant t-values (See Table 53). Intention (β = .735, t = 16.91, p < .001) made the greatest contribution to the explanation of past behavior for the *Watering in lawn fertilizer, rain event* practice (See Table 53).

Table 53. Regression of Past Behavior in performing the *Watering in lawn fertilizer, rain event* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	393.95	218.3	<.001	
Residual	257	1.80			
Total	259				
Model Summary					
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.793	.629	.629	218.3	<.001
Variable	β	*t*	*p*		
Intention	.735	16.91	<.001		
Perceived Control	.109	2.51	.013		

The practice *Precision fertilizer application* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the two independent variables had significant correlations with past behavior (See Table 54). The variable intention (r = .80, p < .001) had a very strong association with past behavior. Perceived control (r = .31, p <.001) had a moderate association with past behavior (See Table 54).

Table 54. Relationship between *Precision fertilizer application* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.80	<.001	very strong
Perceived Control	260	.31	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Precision fertilizer application* practice. The coefficient of determination (R^2 = .640) for the explanation of past behavior from intention and perceived control accounted for 64.0% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .830, t = 19.72, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Precision fertilizer application* practice (See Table 55).

Table 55. Regression of Past Behavior in performing the *Precision fertilizer application* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	431.59	228.9	<.001	
Residual	257	1.89			
Total	259				
			Model Summary		
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.800	.640	.640	228.9	<.001
Variable	β	*t*	*p*		
Intention	.830	19.72	<.001		
Perceived Control	.069	1.65	.101		

The practice *Fertilizer application, no schedule* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the two independent variables had significant correlations with past behavior (See Table 56). The variable intention (r = .78, p < .001) had a very strong association with past behavior. Perceived control (r = .22, p <.001) had a low association with past behavior (See Table 56).

Table 56. Relationship between *Fertilizer application, no schedule* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.78	<.001	very strong
Perceived Control	260	.22	<.001	low

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Fertilizer application, no schedule* practice. The coefficient of determination (R^2 = .611) for the explanation of past behavior from intention and perceived control accounted for 61.1% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .771, t = 19.28, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Fertilizer application, no schedule* practice (See Table 57).

Table 57. Regression of Past Behavior in performing the *Fertilizer application, no schedule* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	310.99	202.1	<.001	
Residual	257	1.54			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.782	.611	.611	202.1	<.001
Variable	β	*t*	*p*		
Intention	.771	19.28	<.001		
Perceived Control	.041	1.02	.308		

The practice *Fertilizer application, annual schedule* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the two independent variables had significant correlations with past behavior (See Table 58). The variable intention (r = .80, p < .001) had a very strong association with past behavior. Perceived control (r = .31, p <.001) had a moderate association with past behavior.

Table 58. Relationship between *Fertilizer application, annual schedule* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.80	<.001	very strong
Perceived Control	260	.31	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Fertilizer application, annual schedule* practice. The coefficient of determination (R^2= .636) for the explanation of past behavior from intention and perceived control accounted for 63.6% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .807, t = 19.56, p < .001), had a standardized beta coefficient with a significant t-value, and the variable perceived control was not significant. Intention made the greatest contribution to the explanation of past behavior for the *Fertilizer application, annual schedule* practice (See Table 59).

Table 59. Regression of Past Behavior in performing the *Fertilizer application, annual schedule* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	380.90	224.5	<.001	
Residual	257	1.70			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.798	.636	.636	224.5	<.001
Variable	β	*t*	*p*		
Intention	.807	19.56	<.001		
Perceived Control	.024	0.58	.560		

The practice *Excess fertilizer runoff* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the independent variable intention ($r = .72$, $p < .001$) had a significant correlation with past behavior. The independent variable, perceived control, ($r = -.04$, $p = .259$) had a non-significant correlation with past behavior (See Table 60).

Table 60. Relationship between *Excess fertilizer runoff* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.72	<.001	very strong
Perceived Control	260	-.04	.259	negligible

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Excess fertilizer runoff* practice. The coefficient of determination ($R^2 = .517$) for the explanation of past behavior from intention and perceived control accounted for 51.7% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (*β* = .718, *t* = 16.56, $p < .001$), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Excess fertilizer runoff* practice (See Table 61).

Table 61. Regression of Past Behavior in performing the *Excess fertilizer runoff* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	181.88	137.5	<.001	
Residual	257	1.32			
Total	259				
			Model Summary		
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.719	.517	.517	91.3	<.001
Variable	β	*t*	*p*		
Intention	.718	16.56	<.001		
Perceived Control	.020	0.45	.650		

The practice *Runoff from fertilizer spills* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the independent variable intention (r = .76, $p < .001$) had a significant correlation and a very strong association with past behavior. The independent variable perceived control ($r = -.11$, $p = .034$) had a significant, negative correlation and a low association with past behavior (See Table 62).

Table 62. Relationship between *Runoff from fertilizer spills* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.76	<.001	very strong
Perceived Control	260	-.11	.034	low

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the *Runoff from fertilizer spills* practice. The coefficient of determination (R^2= .587) for the explanation of past behavior from intention and perceived control accounted for 58.7% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .760, t = 18.92, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Runoff from fertilizer spills* practice (See Table 63).

Table 63. Regression of Past Behavior in performing the *Runoff from fertilizer spills* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	200.23	182.9	<.001	
Residual	257	1.10			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.766	.587	.587	182.9	<.001
Variable	β	*t*	*p*		
Intention	.760	18.92	<.001		
Perceived Control	.060	1.48	.139		

The practice *Community fertilizer best management practices* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the independent variable intention (r = .82, p < .001) had a significant correlation and a very strong association with past behavior. The independent variable perceived control (r = .41, p < .001) had a significant correlation and a moderate association with past behavior (See Table 64).

Table 64. Relationship between *Community fertilizer best management practices* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.82	<.001	very strong
Perceived Control	260	.41	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the practice *Community fertilizer best management practices*. The coefficient of determination (R^2= .670) for the explanation of past behavior from intention and perceived control accounted for 67.0% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .803, t = 19.85, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the practice *Community fertilizer best management practices* (See Table 65).

Table 65. Regression of Past Behavior in performing the *Community fertilizer best management practices* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	360.88	261.5	<.001	
Residual	257	1.38			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.819	.670	.670	261.5	<.001
Variable	β	*t*	*p*		
Intention	.803	19.85	<.001		
Perceived Control	.033	0.82	.414		

The practice *Fertilizer best management practices* was analyzed with the model where past behavior was the dependent variable and intention and perceived control were the independent variables. When the bivariate correlations were examined, the independent variable intention (r = .78, p < .001) had a significant correlation and very strong association with past behavior. The independent variable perceived control (r = .37, p < .001) had a significant correlation and a moderate association with past behavior (See Table 66).

Table 66. Relationship between *Fertilizer best management practices* Past Behavior and Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Variable	*n*	*r*	*p*	Davis' Descriptors[a]
Intention	260	.78	<.001	very strong
Perceived Control	260	.37	<.001	moderate

[a]Davis' descriptors were used for interpretation of the correlation coefficients. The following interpretations were used: .70 or higher = very strong association; .50 to .69 = substantial association; .30 to .49 = moderate association; .10 to .29 = low association; and .01 to .09 = negligible association.

A full model entry analysis was conducted with intention and perceived control as the independent variables and past behavior as the dependent variable for the practice *Fertilizer best management practices*. The coefficient of determination (R^2= .610) for the explanation of past behavior from intention and perceived control accounted for 61.0% of the variance in past behavior. The individual contributions of each of the independent variables was also examined. The independent variable, intention (β = .757, t = 17.64, p < .001), had a standardized beta coefficient with a significant t-value and made the greatest contribution to the explanation of past behavior for the practice *Fertilizer best management practices* (See Table 67).

Table 67. Regression of Past Behavior in performing the *Fertilizer best management practices* Practice on Intention and Perceived Control among Louisiana Urban and Suburban Homeowners

Model	*df*	*MS*	*F*	*p*	
Regression	2	337.01	201.1	<.001	
Residual	257	1.68			
Total	259				
		Model Summary			
Model	*R*	R^2	ΔR^2	ΔF	*p* of ΔF
	.781	.610	.610	201.1	<.001
Variable	β	*t*	*p*		
Intention	.757	17.64	<.001		
Perceived Control	.053	1.24	.216		

DISCUSSION AND CONCLUSIONS

Summary of Purpose and Objectives

Purpose and objectives.

The primary purpose of this study was to determine if relationships exist among selected perceptual measures regarding home lawn and landscape fertilizer management practices among Louisiana urban and suburban homeowners. The perceptual measures examined include outcome evaluation, behavioral belief strength, behavioral belief, attitude, perceived norm, perceived control, intention, and past behavior. To accomplish the purpose of this study, the following specific objectives were formulated to:

1. Describe Louisiana urban and suburban homeowners on the following selected demographic characteristics.

   a) number of people staying in the house, apartment, or mobile home
   b) additional people staying in the household
   c) sex
   d) age
   e) Hispanic, Latino, or Spanish origin
   f) race
   g) highest level of education completed
   h) gross household income

2. Describe Louisiana urban and suburban homeowners on the following measures of community involvement.

   a) type of community association membership
   b) whether or not they have served as a board member of their community association

c) whether or not their community association has home lawn and/or landscape management restrictions or regulations

d) whether or not they consider themselves to be a community leader that influences the activities or behaviors of their neighborhood

3. Describe Louisiana urban and suburban homeowners on their use of the following selected fertilizer management practices.

a) whether or not they had ever applied fertilizer to their home lawn and/or landscape

b) types of fertilizers used in the home lawn and/or landscape

c) how much fertilizer is applied in a single application

d) whether or not they currently use a lawn care service/company to apply fertilizer to their lawn

e) type of fertilizer spreader primarily used to apply fertilizer to the lawn

4. Determine the factors that contribute to the decision not to apply fertilizer to the home lawn and/or landscape from selected factors provided to Louisiana urban and suburban homeowners who have never applied fertilizer.

5. Determine if a relationship exists between behavioral belief, as measured by the product of behavioral belief strength and outcome evaluation, and past behavior for the 12 fertilizer management practices examined in this study among Louisiana urban and suburban homeowners.

6. Determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the outcome evaluation construct for the 12 fertilizer management practices examined in this study.

7. Determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the behavioral belief strength construct for the 12 fertilizer management practices examined in this study.

8. Determine if attitude, perceived norm, and perceived control explained a significant portion of the variance in intention to perform each of the 12 fertilizer management practices examined in this study.

9. Determine if intention and perceived control explained a significant portion of the variance in past behavior for each of the 12 fertilizer management practices examined in this study.

Summary of Methodology

The target population for this study was Louisiana urban and suburban homeowners. Homeowners in urban and suburban communities were the target population of this study, as a comparison of the amount of housing units from the 2000 census and the 2010 census indicated that urban housing developments were increasing while rural areas were decreasing (United States Census Bureau American FactFinder, 2016c; United States Census Bureau American FactFinder, 2016d). The target population of this study also included Louisiana homeowners because the majority of housing units in the state are owner-occupied (United States Census Bureau American FactFinder, 2016a). The homeowner population was targeted in this study because it was presumed that homeowners control the lawn and landscape maintenance, whereas renters may or may not have the ability to make those decisions.

A pilot study was conducted to determine homeowners' most commonly held beliefs about fertilization practices and to develop the direct measures of homeowners' attitude, perceived norm, perceived control, intention, and past behavior concerning the lawn and landscape fertilizer management practices examined in this study. The sample for the pilot was a residents' association of a community located in the city of Baton Rouge, in East Baton Rouge Parish, Louisiana.

The qualitative pilot study consisted of a semi-structured group interview of a sample of homeowners' from the residents' association. The homeowners' responses were recorded with an audio recorder and were transcribed for analysis. A content analysis was completed from the transcript, to construct a list of the most commonly held beliefs in the research population (Ajzen, 2017; Elo & Kyngas, 2008; Fishbein & Ajzen, 2010). The results from the content analysis were used to inform the questions developed for inclusion in the quantitative semantic differential questionnaire (Ajzen, 2017; Fishbein & Ajzen, 2010).

Following the pilot study and the development of the list of modal accessible beliefs, the researcher developed a semantic differential questionnaire using the Theory of Planned Behavior (TPB) questionnaire construction from Fishbein and Ajzen's (2010) intervention methodology. The content analysis revealed the following 12 fertilizer management practices as central to the investigation of this target population: 1) *Fertilizer product label*; 2) *Soil testing*; 3) *Calculating area of lawn*; 4) *Watering in lawn fertilizer*; 5) *Watering in lawn fertilizer, rain event*; 6) *Precision fertilizer application*; 7) *Fertilizer application, no schedule*; 8) *Fertilizer application, annual schedule*; 9) *Excess fertilizer runoff*; 10) *Runoff from fertilizer spills*; 11) *Community fertilizer best management practices*; 12) and *Fertilizer best management practices*.

Ajzen's (1991) TPB constructs that comprise behavioral belief, behavioral belief strength and outcome evaluation, were evaluated in the questionnaire (See Appendix E). Direct measures of the attitude, perceived norm, perceived control, and past behavior TPB constructs were also measured in the questionnaire (See Appendix E) for the aforementioned 12 fertilizer management practices (Fishbein & Ajzen, 2010). Furthermore, the urban and suburban homeowners who had never applied fertilizer were asked to select the factors that contributed to their decision not to apply fertilizer to the home lawn and/or landscape.

In this study, a non-probability opt-in survey sampling method was accomplished by working in partnership with Qualtrics, a third party public opinion survey research company. Qualtrics distributed the developed questionnaire by sending a link that allowed 737 individuals that were invited to participate in this study access to the questionnaire. This study utilized three criteria to determine participant eligibility: 1) current Louisiana residency; 2) residence in an urban and/or suburban area; and 3) home ownership. The non-probability opt-in sampling method allowed the sample of respondents that met the three eligibility criteria to be collected gradually (Qualtrics, 2014). The use of a non-probability sampling method presented limitations to this study. Therefore, the final set of responses collected were subject to exclusion, selection, and nonparticipation biases (Baker et al., 2013). Of the 737 individuals invited to complete the online questionnaire, a total of 670 individuals attempted to respond to the questionnaire. Of the 670 individuals that attempted to respond, there were 260 individuals that met the three eligibility requirements and provided usable responses for data analysis.

The fertilizer management practices questionnaire was divided into the following sections: 1) introductory questions; 2) fertilizer practices that are used to manage your home lawn and/or landscape; 3) fertilizer practices used by people in your community to manage the home lawn and/or landscape; 4) factors that may facilitate or impede your performance of fertilizer management practices; and 5) demographic information (See Appendix E).

In order to ensure face and content validity of the instrument a seven member panel of experts reviewed the questionnaire. The panel of experts included faculty in higher education with expertise in turfgrass and watershed management, faculty in higher education with expertise in instrument design, community and civic association administration, and a doctoral student currently engaged in research.

Summary of Major Findings

The major findings of this study are discussed by objective.

Objective 1.

This objective was to describe Louisiana urban and suburban homeowners on selected demographic characteristics.

The question of the number of people staying in the residence of the homeowners in this study had a minimum of one person and a maximum of seven people reported, and a mean value of 2.63 (*SD* = 1.27). The largest group of respondents indicated two people (40.9%, *n* = 106). For the question of additional people staying in the residence of the homeowners in this study, the majority of respondents, 93.2 percent (*n* = 233), indicated that no additional people were staying in their house, apartment or mobile home.

The sex ratio of the 260 homeowners in this study was 70.4 percent female (*n* = 183) and 29.6 percent male (*n* = 77). Homeowners were also asked to indicate their age as of the date of response. The minimum age reported was 18 years old and the maximum age was 82. The mean of the age reported was 49.56 years of age (*SD* = 16.4).

For the question of Hispanic, Latino or Spanish origin of homeowners in this study, the majority of respondents, 98.8 percent (*n* =255), indicated that they were not of Hispanic, Latino, or Spanish origin. The question of homeowners' race allowed respondents to select all the options that applied, as the homeowners may have identified with more than one race. The majority of respondents, 82.7 percent (*n* = 215), indicated their race as Caucasian. The second most frequently selected race was African American (*n* =36, 13.8 %).

For the question of the highest level of education completed by the homeowners in this study, the largest group of respondents, 35.8 percent (*n* = 92), indicated a high school diploma. Further, 31.1 percent of respondents (*n* = 80), selected an associates degree, and 12.8 percent (*n* = 33) indicated a doctoral degree. Lastly, for the question of the homeowners' gross household income, the minimum income reported was $12,000 and the maximum income reported was $250,000. The mean gross household income was $70,074.26 (*SD* = $43,738.01).

Objective 2.

This objective was to describe Louisiana urban and suburban homeowners on measures of community involvement.

The 260 homeowners in this study indicated their type of community association membership, if any, from six categories provided and an "other" option. There were 174 respondents (69.9 %) that selected that they were "not a member" of a community association. There were 56 respondents (21.5%) that specified they were a member of a "homeowners association (HOA)", and 21 respondents (8.1 %) who selected that they were a member of a "neighborhood association".

The 86 homeowners that selected that they were a member of a community association were asked if they had ever served as a board member for a community association of which they were a member. A total of 80 responses were obtained for this question. The largest group of respondents 76.2 percent (*n* = 61) reported, "No", they had not served as a board member for their community association, and 23.8 percent (*n* = 19) reported, "Yes", they had served as a board member.

The 86 homeowners that reported that they were a member of a community association were further asked whether there were home lawn and/or landscape management restrictions or regulations in their association. The response options for this question were: yes; no; and unsure. The largest group of respondents, 50.0 percent (*n* = 43) selected “Yes”. There were 34.9 percent of respondents (*n* = 30) that selected “No”, and 15.1 percent of respondents (*n* = 13) that selected “Unsure”.

The 260 homeowners in this study were asked to respond “Yes” or “No”, to whether they considered themselves to be a community leader that influences the activities or behaviors of their neighborhood. A total of 243 responses were obtained for this question. The majority of respondents, 77.0 percent (*n* = 187), selected “No” they did not consider themselves to be a community leader, and 23.0 percent of respondents (n = 56) selected “Yes” they influence the activities or behaviors of their neighborhood.

Objective 3.

This objective was to describe Louisiana urban and suburban homeowners on their use of selected fertilizer management practices.

The 260 homeowners that participated in this study were asked if they had ever applied fertilizer to their home lawn and/or landscape at their current or former residence. The majority of respondents, 73.8 percent (*n* = 192), selected “Yes” they had applied fertilizer, and 26.2 percent (*n* = 68), selected “No” they had never applied fertilizer.

The 192 homeowners that responded “Yes” they had applied fertilizer, were provided a list of five different types of fertilizers, and were asked to select all of the types of fertilizers they had applied to their home lawn and/or landscape. The type of fertilizer that was selected by the largest number of respondents was “Weed & feed” (*n* = 126, 42.6 %). The “All-in-one fertilizer” category had the second largest number of responses (*n* = 71, 24.0 %).

The 192 homeowners that responded “Yes” they had applied fertilizer, were also asked to indicate the amount of fertilizer they would consider applying for a single application to their lawn. The majority of respondents 77.6 percent (n = 149) reported that they “Apply amount listed on the product label”. The response selected by the second largest group (n = 35, 18.2%) was “Apply the entire bag”.

Objective 4.

This objective was to determine the factors that contribute to the decision not to apply fertilizer to the home lawn and/or landscape from selected factors provided to Louisiana urban and suburban homeowners who had never applied fertilizer.

The 68 homeowners that replied “No” to the question of whether or not they had ever applied fertilizer to their home lawn and/or landscape at their current or former residence were asked to select all the factors that contributed to them not applying fertilizer from seven possible response options. The factor that was selected by the largest group of respondents (n = 25, 36.8 %) was “I do not have the financial means to apply fertilizer to my home lawn or landscape”. The factor selected by second largest group of respondents (n = 21, 30.9 %) was “I do not have the time in my schedule to apply fertilizer to my home lawn or landscape”.

Objective 5.

This objective was to determine if a relationship exists between behavioral belief, as measured by the product of behavioral belief strength and outcome evaluation, and past behavior for the 12 fertilizer management practices examined in this study among Louisiana urban and suburban homeowners.

The Louisiana urban and suburban homeowners’ first indicated their outcome evaluation, behavioral belief strength, and past behavior responses to the 12 fertilizer management practices.

The outcome evaluation construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *bad* and *good*, where the lower value was associated with the descriptor bad and the higher value was associated with the descriptor good. The highest outcome evaluation mean was 6.50 (SD = 0.80) with a scale interpretation of extremely good for the item, “Determining how much fertilizer is being applied to the lawn is”. The lowest outcome evaluation mean was 1.98 (SD = 1.69) with a scale interpretation of quite bad for the item, “Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water”.

The behavioral belief strength construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *unlikely* and *likely*, where the lower value was associated with the descriptor unlikely and the higher value was associated with the descriptor likely. The highest behavioral belief strength mean was 6.14 (SD = 1.19) with a scale interpretation of quite likely for “Calculating the area of lawn will help to determine how much fertilizer to apply”. The lowest behavioral belief strength mean was 3.14 (SD = 1.82) with a scale interpretation of slightly unlikely for “Applying fertilizer to the lawn with NO set schedule will produce the lawn growth I desire”.

The past behavior was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *never* and *almost always*, where the lower value was associated with the descriptor never and the higher value was associated with the descriptor almost always. The highest past behavior mean was 5.65 (SD = 1.40) with a scale interpretation of frequently for the item, “I have followed the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire”. The lowest past behavior mean was 2.18 (SD = 1.62) with a scale interpretation of rarely for the item, “I have applied fertilizer to areas other than the lawn or landscape that resulted in runoff that contributes to environmental issues, particularly in water”.

The outcome evaluation and behavioral belief strength constructs were multiplied to produce a behavioral belief score that was calculated for the 12 fertilizer management practices studied. However, prior to computing these behavioral belief measures, the four items that utilized a reverse coding had to be recoded so that in all cases, the higher value response represented the more positive response.

An interpretive scale was developed for behavioral belief with a possible score of 1 to 49, where 1 to 7 was an extremely negative belief, 8 to 14 was moderately negative belief, 15 to 21 was a slightly negative belief, 22 to 28 was a neutral belief, 29 to 35 was a slightly positive belief, 36 to 42 was moderately positive belief, and 43 to 49 was an extremely positive belief. In this study, the analysis of the behavioral belief score resulted in six of the items being classified as moderately positive, five items classified as slightly positive, and one item classified as slightly negative.

Pearson’s Product Moment correlations were performed to examine the relationship between the behavioral belief and past behavior items measured for the 12 fertilizer management practices. However, prior to computing the correlations, the four past behavior items that utilized a reverse coding had to be recoded so that in all cases, the higher value response represented the more positive response. The Davis (1971) descriptors of effect size were used to interpret the correlations in this study. The practice for which the highest correlation was found was *Fertilizer application, no schedule* ($r = .54$, $p < .001$). This indicates that a more positive score on behavioral belief is associated with a more positive response on past behavior. The correlation is positive even though the past behavior item is negatively worded since the coding was reversed prior to computing the correlation. The fertilizer management practice *Soil testing* was the only practice that did not have a significant correlation (r = .055, p = .381). Overall, one of the relationships was classified as *substantial,* eight as *moderate,* two as *low*, and one as *negligible*.

Objective 6.

This objective was to determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on the outcome evaluation construct for the 12 fertilizer management practices examined in this study.

The comparison of the homeowners who applied fertilizer to those that had not applied fertilizer on the outcome evaluation scores for the 12 practices resulted in two significant and 10 non-significant tests. The mean outcome evaluation for the fertilizer management practice "Producing the lawn and landscape care results I desire is" was significantly higher ($t_{97.5}$ = 2.58. p = .011) for homeowners that had applied fertilizer (mean= 5.69) than those that had not applied fertilizer (M = 5.18). The mean outcome evaluation for the fertilizer management practice "Producing the lawn growth I desire is" was also significantly higher ($t_{95.1}$ = 2.10, p = .038) for homeowners that had applied fertilizer (M = 6.45) than those that had not applied fertilizer (M = 6.15) to their home lawn and/or landscape.

Objective 7.

This objective was to determine if differences exist between Louisiana urban and suburban homeowners that applied fertilizers and those that had never applied fertilizers on behavioral belief strength construct for the 12 fertilizer management practices examined in this study.

Comparisons of the homeowners who applied fertilizer to those that had not applied fertilizer were made with independent t-tests on the behavioral belief strength construct for the

12 fertilizer management practices, and resulted in five significant and seven non-significant tests. The behavioral belief strength construct for the fertilizer management practice, *Precision fertilizer application*, had the highest degree of difference ($t_{87.4} = 2.67$, $p = .009$) for the item "Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn". The homeowners that had applied fertilizer had a significantly higher mean (*M* = 6.06, *SD* = 1.12) than those that had not applied fertilizer (*M* = 5.46, *SD* = 1.75) to their home lawn and/or landscape.

Objective 8.

This objective was to determine if attitude, perceived norm, and perceived control explained a significant portion of the variance in intention to perform each of the 12 fertilizer management practices examined in this study.

The attitude construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *harmful* and *beneficial*, where the lower value was associated with the descriptor harmful and the higher value was associated with the descriptor beneficial. The highest attitude mean was 6.25 (SD = 1.03) with a scale interpretation of quite beneficial for the item, "Calculating the area of lawn to determine how much fertilizer to apply is". The lowest attitude mean was 2.12 (SD = 1.68) with a scale interpretation of quite harmful for the item, "Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is".

The perceived norm construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *disagree* and *agree*, where the lower value was associated with the descriptor disagree and the higher value was associated with the descriptor agree. The highest perceived norm mean was 5.91 (SD = 1.17) with a scale interpretation of quite agree for the item, “Most people whose opinion I value would approve of me following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire”. The lowest perceived norm mean was 2.48 (SD = 1.99) with a scale interpretation of quite disagree for the item, “Most people whose opinion I value would approve of me applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water”.

The perceived control construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *not at all* and *completely,* where the lower value was associated with the descriptor not at all and the higher value was associated with the descriptor completely. The highest perceived control mean was 6.14 (SD = 1.25) with a scale interpretation of very large extent for the item, “Calculating the area of lawn to determine how much fertilizer to apply is under my control”. The lowest perceived control mean was 5.05 (SD = 1.92) with a scale interpretation of to a large extent for the item, “Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is under my control”.

The intention construct was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *definitely do not* and *definitely do*, where the lower value was associated with the descriptor definitely do not and the higher value was associated with the descriptor definitely do. The highest intention mean was 6.12 (SD = 1.15) with a scale interpretation of probably do for the item, “I intend to follow the directions specified on the fertilizer product label to achieve the lawn and landscape care results I desire”. The lowest intention mean was 1.92 (SD = 1.64) with a scale interpretation of probably do not for the item, “I intend to over apply fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water”.

Regression analyses were completed, to accomplish the objective of determining whether the independent variables (attitude, perceived norms, and perceived control) explained a significant portion of the variance in the dependent variable, intention to perform the 12 fertilizer management practices examined in this study. All 12 of the regression models were significant. For these 12 tests, the coefficient of determination (R^2) ranged from .103 to .521. Perceived norm was the only independent variable that significantly contributed to all the models.

Seven of the 12 tests had models in which all three independent variables (attitude, perceived norm, and perceived control) made a significant contribution. There were four of the 12 tests that had two independent variables that made a significant contribution to the model. For the practices *Excess fertilizer runoff* and *Runoff from fertilizer spills*, attitude and perceived norm made a significant contribution to the model, and for the practices *Calculating the area of lawn* and *Fertilizer best management practices*, perceived norm and perceived control made a significant contribution. Of the 12 tests analyzed, only the *Soil testing* practice had a model in which a single independent variable, perceived norm, made a significant contribution.

Objective 9.

The ninth objective was to determine if intention and perceived control explained a significant portion of the variance in past behavior for each of the 12 fertilizer management practices examined in this study.

Past behavior was measured on a seven-point semantic differential scale. The polar adjectives used in the scale were *never* and *almost always*, where the lower value was associated with the descriptor never and the higher value was associated with the descriptor almost always. The highest past behavior mean was 5.65 (SD = 1.40) with a scale interpretation of very frequently for the item, “I have followed the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire". The lowest past behavior mean was 2.18 (SD = 1.62) with a scale interpretation very rarely for the item, "I have applied fertilizer to areas other than the lawn or landscape that resulted in runoff that contributes to environmental issues, particularly in water". All 12 of the regression models were significant. For these 12 tests, the coefficient of determination (R^2) ranged from .402 to .670. Of the 12 tests, only the Fertilizer product label practice and the Watering in lawn fertilizer, rain event had a model in which both independent variables (intention and perceived control) made a significant contribution to the model. The other 10 tests analyzed had a model in which only the independent variable intention made a significant contribution to the model.

Conclusions, Implications, and Recommendations

Based on the findings of this study, the researcher has derived the following conclusions, implications, and recommendations:

Conclusion One

The majority of homeowners in this study have applied fertilizer, and have implemented both improper and recommended fertilizer management practices.

This conclusion was based on the finding that the majority of respondents, 73.8 percent (n = 192), selected "Yes" they had applied fertilizer to their home lawn and/or landscape. This study's findings are consistent with the literature on the extensive use of fertilizers in residential areas. The research by Robbins et al. (2001) found that, "70 million out of 95 million households in the US (74%) use industrial pesticides and fertilizers" (p. 371). The research by Robbins and Sharp (2003a) found that in the U.S. the annual spending on lawn care purchases totaled $8.9 billion. The study by Nielson and Smith (2005) found that the majority of the respondents applied lawn fertilizer and only a fifth of respondents did not. Further, the review of turfgrass fertilizer management practices by Carey et al. (2012a) found intensive lawn management to be proportional to growing urban areas, as high chemical inputs were more readily used by residents in communities where their neighbors were also applying these products.

This conclusion was further based on the 192 homeowners' responses to the question of the types of fertilizers they had applied to their home lawn and/or landscape. The type of fertilizer that was applied by the largest number of respondents was "Weed & feed" (n = 126, 65.6 %), the fertilizer applied by the second largest number was "All-in-one fertilizer" (n = 71, 37.0 %), and the third largest fertilizer reported was "Slow release" (n = 43, 22.4%). Consistent with the findings of this study, the research by Nielson and Smith (2005) also determined that the majority of respondents of that study who applied lawn fertilizer also used weed and feed products. However, the literature does not support the broadcast application of *weed-and-feed* fertilizer products to the lawn as they contain pesticides (FFL, 2015; LSU AgCenter, 2007). If the homeowners of this study were broadly applying these products it would not be a recommended practice. The recommendation for fertilizer products that contain pesticides would be to apply it only to the affected area of lawn or for spot treatment (FFL, 2015; LSU AgCenter, 2007). The type of fertilizer that is recommended for home lawn and landscape application would be slow release fertilizers, as such products provide nutrients to the plant over an extended timeframe and reduce the potential for nutrient leaching and runoff (FFL, 2015; LSU AgCenter, 2007). Although less than a fourth of the homeowners surveyed in this study reported that they have applied slow release fertilizers, the study by Carey et al. (2012a) recommended the use of slow release fertilizers, especially compared to more soluble sources that enhance the potential for leaching.

Further, this conclusion was based on the 192 homeowners' responses to the question regarding how much fertilizer they apply in a single application to their lawn. The majority of respondents (*n* = 149, 77.6%) reported that they "Apply amount listed on the product label". This management practice used by the homeowners of this study was consistent with the U.S. EPA's (2005) recommendation that the application instructions listed on the fertilizer product label be followed to decrease the risk of over application of fertilizer and the potential for excess fertilizer runoff. However, the second largest group of respondents (*n* = 35, 18.2%) in this study selected that they "Apply the entire bag" when asked how much fertilizer they apply in a single application. This finding indicated that this group of homeowners may be using an improper fertilizer management practice by applying the entire bag of fertilizer rather than applying the amount or rate listed on the product label (LSU AgCenter, 2007; U.S. EPA, 2005).

In the study by Carey et al. (2012a), the findings indicated that the most important management practice for urban lawns and landscapes is the selection of a proper fertilization rate as a proper fertilizer rate, "maximizes nutrient utilization efficiency and reduces the risk for nutrient loss to waterbodies" (Carey et al., 2012, p. 288). The results from this research study in which homeowners reported that they apply the entire bag of fertilizer in a single application to the lawn indicated the possible use of an improper fertilization rate. This is an important result to consider as improper application of fertilizer to the home lawn and/or landscape in urban and suburban areas can cause excess fertilizer to run off into storm drains or directly into water bodies (Carey et al., 2012a; NRC, 2009b; U.S. EPA, 2005).

In this study, the Theory of Planned Behavior (TPB) was used to examine Louisiana urban and suburban homeowners' behavioral belief, attitude, perceived norm, perceived control, intention, and past behavior regarding 12 home lawn and landscape fertilizer management practices. The TPB was used to determine which constructs had the greatest influence on intention to perform, past performance, and the underlying foundation of belief regarding the 12 management practices. This information was then used to determine how improper management practices should be targeted in an educational intervention program to change homeowners' behaviors (Ajzen, 2017).

Huang and Lamm (2015) found that there was a greater potential to activate interest in water quality protection and produce effective behavioral change when an Extension program was tailored to the experience of the participants. Further, Huang and Lamm (2015) found that Extension programs that are tailored to the needs of the target population can enhance the positive impact of those programs. Extension programs that are tailored around the practices that are personally relevant to the target population can have the greatest impact on behavioral change (Huang & Lamm, 2015). Therefore, a tailored education program or educational message can be developed to enhance Louisiana urban and suburban homeowners' participation in a behavioral intervention program and improve homeowners' adoption of important fertilizer best management practices that protect Louisiana's valuable water resources.

A study of the Florida Yards and Neighborhoods (FYN) Extension education program by Brown (2009) was completed to examine the adoption of environmentally friendly landscape practices by former program participants. A survey was distributed to past FYN program participants that asked respondents to indicate their approach to six landscape practices. The survey included questions about such landscape practices as the type of fertilizer respondents applied (Brown, 2009). Overall, the results showed that for each of the six practices the majority of former FYN participants surveyed in this study adopted the most environmentally friendly landscape practice (Brown, 2009). This included the use of slow-release fertilizers by 83% of the respondents and pesticide spot treatment of the lawn by 53% of respondents (Brown, 2009). The results of this study were used by Brown (2009) to support that participants in Extension educational programs, or those that have been exposed to the educational information from such programs are more likely to adopt environmentally friendly landscape practices. Therefore, the information gathered in this study about the population of Louisiana urban and suburban homeowners, such as their past performance, intention to perform, and the basis of their beliefs about the 12 fertilizer management practices can be applied to develop tailored Extension educational programming based on the target population's personal experiences.

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that behavioral intervention programming be developed to address the improper fertilizer management practices being used by urban and suburban homeowners in Louisiana. The researcher further recommends that the Louisiana Cooperative Extension Service design and implement tailored programming through its established Louisiana Yards and Neighborhoods (LYN) education program to teach relevant fertilization best management practices (BMPs). The LYN fertilizer management education programming should be taught to the population of urban and suburban homeowners in the state, to increase the adoption and implementation of the recommended fertilizer BMPs that have been established through research to protect and enhance water quality in Louisiana. The LSU AgCenter's (2008) best management practices (BMP) manual for Louisiana lawns and the LSU AgCenter's (2007) guide to landscaping should be used as primary resources for the recommended fertilizer management practices taught in the tailored segments of the LYN education program.

The research by Israel et al. (1999) can be used to help inform the delivery methods to be used in the LYN educational segments on fertilizer management. Israel et al. (1999) studied three types of Florida Cooperative Extension Services' Environmental Landscape Management (ELM) programs (Master Gardener, seminars/workshops, and informational publications), to determine participants' adoption of recommended (ELM) practices. The study compared the ability of the different educational delivery methods used in the three programs to increase participants' adoption of ELM practices between programs and with a nonparticipant comparison group (Israel et al., 1999). The results of the study revealed that participation in the Master Gardener program and in the seminar/workshop program lead to adoption of more practices than did the publications only program, or nonparticipation (Israel et al., 1999). Therefore, Israel et al., (1999) recommended the use of the face-to-face delivery methods that allow participants to interact with trained Extension faculty to enhance adoption of ELM practices. Israel et al., (1999) further recommended that publications be used to supplement seminars/workshops. The results of the study by Israel et al. (1999) support the use of the Master Gardener program and educational seminars/workshops with informational publications to enhance LYN program participants' adoption of the recommended fertilizer BMPs.

The researcher further recommends that Louisiana Cooperative Extension Service offices, in parishes with urban and suburban populations, engage and develop relationships with the coordinating bodies of community and neighborhood associations. The leaders of such organizations should serve as a point of contact for Cooperative Extension offices, to further engage the urban and suburban homeowner population to participate in the fertilizer management segments of the LYN education program. The presidents of such associations should be engaged by Cooperative Extension County Service Agents to develop relationships with their local Cooperative Extension office. The relationships established with association board members should be used to develop tailored LYN fertilizer management programming for these communities. County Agents can use the relationships established with the coordinating bodies of associations to distribute fertilizer management educational publications to its members and attend community meetings. At such meetings, County Agents should establish contacts with more community/neighborhood members to encourage their participation in LYN fertilizer management workshops and seminars designed to teach relevant fertilizer BMPs.

The research by Israel and Hague (2002) found that a lack of participation in Extension education programs was related with a concern for neighborhood norms and recommended that alternative practices be showcased through demonstration sites in neighborhoods and community areas. Ultimately, the value of having demonstration sites or field day events that take place within the communal spaces of neighborhoods would be to increase the normative value of recommended practices within these communities (Israel & Hague, 2002). Therefore, the researcher recommends that Cooperative Extension Service offices establish demonstration sites within neighborhoods and community areas of the parish to showcase fertilizer BMPs. Further, the researcher recommends that field day events be held at demonstration sites to teach homeowners how to implement relevant fertilizer BMPs. The Florida Cooperative Extension Service's Environmental Landscape Management programs have used trained volunteers to directly assist homeowners in a number of counties of the state (Israel et al., 1999). Due to the extensive investment of time and human resources it would take to establish demonstration sites and coordinate field day events, the researcher further recommends that the Louisiana Master Gardeners that have completed the nutrient management training provide assistance with such LYN program developments (LSU AgCenter, 2017d). The Master Gardeners may also serve as liaisons between the Cooperative Extension Service office and the community or neighborhood where they reside to further establish relationships and build trust with community members.

Conclusion Two

The factors that contributed to homeowners not applying fertilizer to their home lawn and/or landscape were a scarcity of resources, specifically of their time and money.

This conclusion was based on the 68 homeowners that responded that they had never applied fertilizer, of which the largest group of respondents (n = 25, 36.8 %) selected that the factor that contributed to them never applying fertilizer was “I do not have the financial means to apply fertilizer to my home lawn or landscape”. Further, the factor selected by second largest group of respondents (n = 21, 30.9 %) was “I do not have the time in my schedule to apply fertilizer to my home lawn or landscape”.

This conclusion was supported by the research of Robbins et al. (2001) that underscored how the availability of time and funds are constraints homeowners face in applying fertilizer to their home lawn and landscape. The research by Huang and Lamm (2015) recommended that tailored Extension programs be developed to focus on what is relevant to the target audience, such as learning how to adopt lawn and landscape best management practices (BMPs) that can help save time and money. The research by Brown (2009) on the adoption of environmental landscape practices by former program participants in the Florida Yards and Neighborhood program found that the demographic characteristic of spending less money per year on the yard was strongly correlated with the adoption of the most environmentally friendly landscape practices. The finding by Brown (2009) regarding the long-term savings that result from implementing environmentally friendly landscape practices can be used to encourage the adoption of such practices by the homeowners of this study that indicated that they have not had the financial means to apply fertilizer.

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service's Louisiana Yards and Neighborhood (LYN) program be used to deliver tailored educational programming about home lawn and landscape BMPs that can save homeowners time and money. There are several time and money saving lawn and landscape BMPs discussed in the LSU AgCenter's (2007) guide to Louisiana friendly landscaping that can be taught, such as the reduction of turfgrass in the yard to reduce the amount of time and money spent maintaining a larger area of lawn and replace it with low maintenance plants. Additionally, the most environmentally friendly lawn and landscape management practices that were found by Brown (2009) to save residents time and money, such as irrigating as needed and spot treating with pesticides, can also be taught in the LYN educational program.

Another finding to consider in this study from the homeowners' responses to the question of the factors that contributed to them never applying fertilizer was that only 14%, or 10 of the 68 respondents, selected a concern for environmental issues in water caused by fertilizer runoff as a factor in their decision not to apply fertilizer. This finding indicated that for the homeowners that do not apply fertilizer in this study the environmental implications of applying fertilizer may not be an important factor in their fertilizer application decision. However, it must also be considered that the respondents may not have selected this factor because it ranked lower on their hierarchy of needs, and if they had ample time and money more of them may have selected the environmental concern factor (Maslow, 1943). Conversely, if time and money saving BMPs were taught to this population through the LYN education program it may result in a greater potential for this population to apply fertilizer now that those needs have been satisfied.

Therefore, it is also important for this population to learn about fertilizer best management practices and how to decrease the potential for fertilizer runoff that can negatively impact water quality. Additionally, Israel and Hague (2002) found that the participants of an Extension landscaping educational program networked to share information with friends and neighbors. Thus, if this population participated in the LYN program and were taught to have a strong belief in the fertilizer management practices that reduce fertilizer runoff they could then have a normative effect on their peers, such as their neighbors and friends regarding their beliefs about the negative environmental issues fertilizer runoff can cause in water regardless of whether or not they decide to apply fertilizer (Fishbein & Ajzen, 2010; Israel et al. 2002).

Conclusion Three

A soil test is an infrequent practice used by the homeowners of this study.

This conclusion was based on the 260 homeowners' responses to the past behavior item for the fertilizer management practice *Soil testing*. The past behavior item "I have used a soil test to determine what nutrients the soil needs and in what amount they should be applied" had a mean of 2.85 with a scale interpretation of *seldom*.

It is important for homeowners to utilize the *Soil testing* fertilizer management practice, as soil testing is a critical first step in understanding what nutrients the soil does need and in what amount (FFL, 2015). In the Twin Cities Metropolitan Area of Minnesota a restriction was implemented on a major component of fertilizer, phosphorous, as soil testing revealed that high levels of this nutrient occurred naturally in the lawns of that region (Carey et al., 2012a). The study by Hefner et al. (2009) examined the obstacles faced by homeowners in developing a successful urban lawn nutrient management plan. An initial assessment of the lawns in the study by Hefner et al. (2009) revealed that 51% had excessive amounts of phosphorous in the soil, due to the use of *balanced fertilizer* products and a lack of soil testing prior to fertilizer application. The study by Hefner et al. (2009) illustrated how excess fertilizer application begins with homeowners not understanding what type of fertilizer product to use and what amount of fertilizer to apply.

The LSU AgCenter (2007) recommends a routine soil test to provide essential information about the nutrient content of the soil and aid in the selection of appropriate fertilizer products to amend the soil. In the Florida-Friendly Landscaping (FFL) (2015) publication, a soil test is recommended prior to fertilizer application to determine what nutrients are needed and in what amount to correctly apply the fertilizer product needed for proper plant growth. The FFL (2015) publication further recommended the use of soil testing to save both time and money long term by putting out less fertilizer and using targeted fertilizer applications. The use of a soil test prior to fertilizer application not only has the potential to help plants grow better, but it can also protect water quality by reducing the potential for fertilizer runoff (FFL, 2015).

The research by Fishbein and Ajzen (2010) on changing behavior recommends that the determinants of intention to perform a practice and the determinants of behavior be examined to determine the construct to target in a behavioral intervention program. Therefore, this study's *Soil testing* past behavior and intention bivariate correlations and regression analyses were examined from this study. The *Soil testing* bivariate correlations between the independent variables, perceived control and intention, and the dependent variable, past behavior, revealed that intention had a positive, substantial association with past behavior (r = .63), and perceived control had a non-significant association with past behavior (r =.08). Intention and perceived control accounted for 40.2% of the variance in past behavior. Intention had the highest standardized beta regression coefficient (β = .642) and contributed the most to the explanation of past behavior. The intention item “I intend to use a soil test to determine what nutrients the soil needs and in what amount” had a mean of 3.85, which was classified as *may or may not* using the interpretative scale established in the study.

Examination of the *Soil testing* bivariate correlations between the independent variables attitude, perceived norm and perceived control and the dependent variable, intention, revealed that perceived norm had a positive, moderate association with intention (r = .31). Perceived control (r = .20) and attitude (r = .18) had positive, low associations with intention. The *Soil testing* independent variables combined to account for 10.3% of the variance in intention. Perceived norm was the only independent variable that had a standardized beta coefficient (β = .275) with a significant t-value and made the greatest contribution to the explanation of intention. In this study, perceived norm was the strongest determinant of intention and intention was the strongest determinant of past behavior. These findings indicated that to change homeowners’ intention to perform the *Soil testing* practice, and therefore future performance, that the perceived norm construct should be targeted in a behavioral intervention program (Fishbein & Ajzen, 2010).

Research by Carey et al. (2012a) discussed the strong social component influencing the types of fertilizer management practices used by residents of a community, and how the practices implemented are based on the values of the group of individuals. The study by Nielson and Smith (2005) additionally determined that the decision about the types of yard care practices used by urban residents and how the home lawn and landscape were maintained was influenced by the practices of the community and a feeling of obligation to comply with similar home lawn and landscape practices used by neighbors. Further, the study by Robbins et al. (2001) found that home lawn care was perceived by residents as an obligation and social responsibility, and that lawn management was a collective behavior and a means of participating in civic life.

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service design a segment of the Louisiana Yards and Neighborhoods (LYN) education program to strengthen the communal support of soil testing within urban and suburban communities. A study by Israel and Hague (2002) found that lack of participation in extension programs was associated with a concern for neighborhood norms and recommended that alternative practices/methods be showcased through demonstration sites in neighborhoods and community areas. Therefore, to strengthen communal support for soil testing, the researcher recommends that County Agents or Advanced Master Gardeners with nutrient management training develop relationships with the presidents of residential associations, to establish a demonstration site within neighborhoods where an Extension field day event can be held. The field day event would then take place at the demonstration site and would teach residents how to collect a representative soil test sample for home lawns and landscapes, explain how to interpret soil test results, and explain how to use the results to select fertilizers to meet the needs of the soil. Building confidence within a community on how to soil test properly and how to select fertilizer based on the results can help increase the social acceptance of soil testing and increase the social obligation to use this management practice (Robbins et al., 2001). This can foster a neighborhood support system in these communities where neighbors not only help teach each other how to soil test properly but also encourage one another to soil test regularly.

Based on the low explanation of variance of intention to perform the *Soil testing* practice, the research recommends that an *implementation intention* additionally be developed with LYN program participants to strengthen the transformation of the targeted perceived norm construct into intention and performance of soil testing (Ajzen, 2017). An LYN soil testing workshop can be used to help program participants design their implementation intention or a specific plan that details how, when, and where they would perform the recommended practice (Ajzen, 2017). A detailed plan such as this would simplify implementation of the intention to perform the recommended practice and strengthen its connection to actual behavior (Ajzen, 2017). Therefore, in addition to targeting perceived norm through communal demonstration sites and field day events, participants would also have a strategic plan for implementing their newly formed intention to perform soil testing.

The researcher further recommends that the cost of the soil test be aided through a rebate program, as was used in the study by Hefner et al. (2009). In the study by Hefner et al. (2009) that examined the development of urban nutrient management plans for lawns, the soil analysis of home lawns were initially paid for by the homeowners; however, following the completion of a nutrient plan with a trained technician they were presented with a rebate coupon to reimburse the cost of the soil test. The results from a post-evaluation survey of the program participants' reasons for adopting the lawn nutrient management plan revealed that 42% of respondents selected that it was the qualification for reimbursement of the cost of the soil test through a rebate (Hefner et al., 2009). Therefore, the researcher recommends providing free soil testing to Louisiana residents. However, to qualify for a soil testing rebate coupon the researcher further recommends that residents must participate in one of the LYN's fertilizer management seminars, workshops, or field day events. This method of incentivizing homeowners' program participation would not only help to encourage soil testing but it would also promote the adoption of recommended fertilizer management practices. Further, providing the opportunity for free soil testing to Louisiana residents would help to determine if aspects beyond perceived norm, such as financial constraints are responsible for homeowners not utilizing soil tests in their home lawn and landscape. As discussed by the LNMSIT (2014), funds for a soil testing rebate program can be acquired from such agencies as the United States Environmental Protection Agency, the Louisiana Department of Environmental Quality, or Louisiana parish governments.

Conclusion Four

Homeowners in this study may intend to use a rain event to water in lawn fertilizer as they think it is a beneficial practice that they can control.

This conclusion was based on the responses of the 260 homeowners' regarding their attitude, perceived control, and intention for the fertilizer management practice *Watering in lawn fertilizer, rain event*. The attitude item "Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is" had a mean of 5.75 with a scale interpretation of *quite beneficial*. The perceived control item "Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is under my control" mean was 5.36 with a scale interpretation of *to a large extent*. Lastly, the intention item "I intend to coordinate the application of lawn fertilizer when rain is expected, to water in the product correctly" had a mean of 4.83 with a scale interpretation of *maybe do*.

It is important that homeowners believe that coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly, is an improper fertilizer management practice to implement. The literature supports that lightly watering in lawn fertilizer after it has been applied to the lawn is an important practice to move the product into the soil (UF IFAS Extension, 2004). However, watering in lawn fertilizer with rainfall, especially when heavy rainfall is expected, creates the potential for fertilizer to runoff, due to the lack of precision of this watering in practice (FFL, 2015; LSU AgCenter, 2007). Carey et al. (2012a) found that the time between application of fertilizer to turfgrass and a rain event could to a large extent determine the amount of nutrient loss from the lawn or landscape. Therefore, Carey et al. (2012a) recommended that fertilizer not be applied to the lawn or landscape if rain was forecasted within the next 24 hour time period, as rain can cause fertilizer to leach and run off the soil.

The research by Fishbein and Ajzen (2010) on changing behavior recommends that the determinants of intention to perform a practice and the determinants of behavior be examined to determine the construct to target in a behavioral intervention program. Therefore, the *Watering in lawn fertilizer, rain event* past behavior and intention bivariate correlations and regression analyses from this study were examined.

The past behavior mean for the item "I have coordinated the application of lawn fertilizer when rain is expected, to water in the product correctly" was 4.29 and had a scale interpretation of *irregularly*. Further, the *Watering in lawn fertilizer, rain event* bivariate correlations between the independent variables, intention and perceived control, and the dependent variable, past behavior resulted in intention having a very strong association (r = .79) with past behavior. Perceived control (r = .47) had a moderate association with past behavior. The coefficient of determination for the explanation of past behavior from intention and perceived control accounted for 79.3% of the variance in the dependent variable. The independent variable, intention had a standardized beta coefficient (β = .735) with a significant t-value and made the greatest contribution to the explanation of the dependent variable, past behavior.

The *Watering in lawn fertilizer, rain event* bivariate correlations between the independent variables, attitude, perceived norm and perceived control, and the dependent variable, intention, resulted in attitude (r = .55) and perceived norm (r = .54) having a substantial association with the dependent variable, intention. Perceived control had a moderate association (r = .49) with the dependent variable. The coefficient of determination for the explanation of intention from attitude, perceived norm, and perceived control accounted for 64.4% of the variance in the dependent variable, intention. The independent variables, attitude, perceived norm and perceived control all had standardized beta coefficients with significant t-values, and perceived control made the greatest contribution (β = .303) to the explanation of the dependent variable, intention.

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service design a segment of the Louisiana Yards and Neighborhoods (LYN) education program to change homeowners' *Watering in lawn fertilizer, rain event* perceived control, as this construct was the strongest determinant of intention, and intention was the strongest determinant of past behavior. Homeowners' mean response to the perceived control construct was interpreted as having *to a large extent* control over correctly watering in lawn fertilizer when rain is expected. Fishbein and Ajzen (2010) recommend that when there is high perceived control, but low actual control that an intervention should be designed to provide the population with skills that can enhance actual control. Further, the intention construct had a mean of 4.83 with a scale interpretation of *maybe do*, and the past behavior construct had a mean of 4.29 with a scale interpretation of *irregularly* for the *Watering in lawn fertilizer, rain event* practice, which indicated that homeowners' have been experiencing uncertainty about intending to use or performing this practice. These findings are positive because it supports that homeowners are indecisive about the use of this practice and can be persuaded to change their behavior through an educational intervention (Fishbein & Ajzen, 2010). This segment of the LYN education program can educate homeowners on the recommended method of using controlled irrigation to water in lawn fertilizer correctly (LSU AgCenter, 2007).

To decrease homeowners' perceived control about the *Watering in lawn fertilizer, rain event* practice the researcher recommends teaching homeowners how this practice has low actual control, is imprecise, and can cause fertilizer to leach and runoff. A strategic message that frames the use of irrigation as a gain can be used to change homeowners' perceived control of the *Watering in lawn fertilizer, rain event* management practice (Warner et al., 2015). An example of a gain framed message that can be used in the LYN education program would be, "By lightly irrigating the lawn following the application of fertilizer instead of using rainfall you can reduce potential leaching and runoff of fertilizer from the soil". A message such as this could be posted on the LSU AgCenter's LYN education program's webpage, as well as in publications discussing home lawn and landscape fertilizer best management practices.

Further, a workshop should be used to teach homeowners how to enhance their actual control by watering in lawn fertilizer using irrigation, such as a permanent sprinkler system or a sprinkler attachment for a garden hose, where the amount of water applied can be better controlled. The LSU AgCenter's (2007) Louisiana-friendly landscaping guide contains a detailed description of the method for calibrating irrigation systems and watering in lawn fertilizer correctly that can be used as a resource for the workshop and accompanying informational materials. Lastly, trained Master Gardeners should demonstrate the *Watering in lawn fertilizer* practice at a field day event in communities with established demonstration sites and an interest in learning about irrigation practices to properly water in lawn fertilizer. The field day event would provide a hands-on learning experience regarding how to calibrate different types of irrigation systems to apply the recommended amount of moisture to water in fertilizer to a residential lawn.

Conclusion Five

Homeowners believe that excess fertilizer runoff has the potential to cause environmental issues, but homeowners' only slightly believe that fertilizer runoff will result from the *Runoff from fertilizer spills* practice.

Behavioral belief consists of the belief that the performance of a behavior will result in a positive or a negative outcome (outcome evaluation) and the strength of the belief that the behavior will produce that outcome (behavioral belief strength) (Ajzen, 1991; Fishbein & Ajzen, 2010).Therefore, this conclusion was based on the 260 homeowners' responses regarding their outcome evaluation and behavioral belief strength for the fertilizer management practices *Excess fertilizer runoff* and *Runoff from fertilizer spills*.

The mean outcome evaluation for *Excess fertilizer runoff* was 2.23, which was classified as *quite bad* using the interpretative scale established in this study for the item, "Excess fertilizer runoff that contributes to environmental issues, particularly in water is". The mean behavioral belief strength for *Excess fertilizer runoff* was 5.62, which was classified as *quite likely* using the interpretative scale established in this study for the item, "Over application of fertilizer to the lawn or landscape will result in excess fertilizer runoff that contributes to environmental issues, particularly in water".

In this study, the mean outcome evaluation result for the *Runoff from fertilizer spills* practice was 1.98 with a scale interpretation of *quite bad* for the item, "Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is" indicating that homeowners had a fairly negative evaluation of the outcome of this practice. The mean behavioral belief strength for *Runoff from fertilizer spills* was 5.19, with a scale interpretation of *slightly likely*, for the item, “Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water”. This finding indicated that the strength of homeowners’ belief that the *Runoff from fertilizer spills* practice will produce a negative outcome can be increased in a behavioral intervention program (Fishbein & Ajzen, 2010).

It is important for homeowners to have a strong belief that the application of fertilizer to areas other than the lawn or landscape will result in fertilizer runoff, as research supports that the accumulation of fertilizer product on sidewalks, roads, and lawns can result in runoff that contributes to environmental issues in water (U.S. EPA, 2005). The U.S. EPA (2005) reviewed how in residential lawn care improper maintenance of lawn equipment or improper storage of fertilizer product can result in fertilizer spills. Further, if such spilled fertilizer product is not cleaned up properly it can run off into storm drains entering water resources and impacting water quality (U.S. EPA, 2005). The recommendation is that fertilizer granules spilt onto impervious surfaces be swept up to reduce excess product from running off (LSU AgCenter, 2007). Further, if fertilizer is spilled onto pervious surfaces, such as grass, it is recommended that as much fertilizer as possible be collected and that it not be watered in as such excess fertilizer can leach from the soil (FFL, 2015).

Based on this conclusion, the findings of this study and the literature that is cited the researcher recommends that the Louisiana Cooperative Extension Service design a segment of the Louisiana Yards and Neighborhoods (LYN) educational program that targets the strength of homeowners’ behavioral belief about *Runoff from fertilizer spills* practice. Specifically, the segment of the LYN education program should be used to strengthen homeowners’ belief that applying fertilizer to areas other than the lawn and/or landscape will produce a negative outcome.

Israel et al. (1999) recommended the use of seminars/workshops with accompanying publications to enhance adoption of recommended management practice. Therefore, the researcher recommends that the LYN education program, include a workshop to examine how fertilizer spills can result in fertilizer runoff and water quality issues, methods for reducing spills, and methods for proper cleanup of fertilizer spills. The LSU AgCenter's (2007) guide to Louisiana-friendly landscaping should be distributed as a supplementary publication to this workshop as it provides information on how to reduce runoff from fertilizer spills and how to properly clean up fertilizer spills.

Lastly, the researcher recommends future study of the cleanup of fertilizer spills, as an extension of the *Runoff from fertilizer spills* practice. Studying Louisiana urban and suburban homeowners' beliefs, intentions, and past behaviors regarding the cleanup of fertilizer spills would provide information about how this population manages the application of fertilizer to unintended areas of the lawn and landscape. This research may also provide insight into why the homeowners of this study did not have as strong of a behavioral belief in the outcome of fertilizer running off and entering waterways, as they may have practiced cleanup of fertilizer spills to reduce runoff. The literature recommends that when fertilizer is spilled onto impervious surfaces like pavement that the product be collected or swept up to decrease fertilizer granules from ending up in waterways (FFL, 2015; LSU AgCenter, 2007). Therefore, the researcher recommends that data be collected on the cleanup of fertilizer spills practice used by the population of Louisiana urban and suburban residents, and that the data be collected from a random sample to enhance generalizability to this population.

Conclusion Six

The homeowners of this study had inconsistent past performance of a number of recommended fertilizer management practices.

This conclusion is based on the relatively low past behavior mean responses reported for four of the 12 fertilizer management practices examined in this study. The practices were *Calculating the area of lawn*, *Fertilizer application, annual schedule*, *Fertilizer best management practices*, and *Precision fertilizer application*.

The fertilizer management practice *Calculating the area of lawn* had a past behavior mean of 4.23, which was classified as *irregularly* using the interpretative scale established in this study for the item "I have calculated the area of lawn to determine how much fertilizer to apply". The *Fertilizer application, annual schedule* past behavior mean was 4.57 with a scale interpretation of *occasionally* for the item "I have followed an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire". The *Fertilizer best management practice* had a past behavior mean of 4.79 with a scale interpretation of *occasionally* for the item "I have selected fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results". Lastly, the *Precision fertilizer application* practice had a past behavior mean of 4.81 with a scale interpretation of *occasionally* for the item "I have used a fertilizer spreader to determine how much fertilizer is being applied to the lawn".

The literature supports the regular performance of the *Calculating the area of lawn*; *Fertilizer application, annual schedule*; *Fertilizer best management practices*; and *Precision fertilizer application* fertilizer management practice in home lawn and landscape maintenance. The LSU AgCenter's (2007) publication *A guide to Louisiana friendly landscaping* advocates for the use of the *Calculating the area of the lawn* fertilizer management practice, as the performance of this practice reduces the likelihood of applying excessive amounts of fertilizer to the lawn and reduces the potential for fertilizer runoff. Carey et al. (2012a) additionally recommended that prior to fertilizer application the appropriate rate of fertilizer be determined based on the type of fertilizer product being used to reduce the potential for fertilizer runoff. The use of the *Fertilizer application, annual schedule* practice was supported by the LSU AgCenter's (2008) publication *Louisiana Lawns Best Management Practices (BMPs)* that detailed the annual fertilization schedule for several of the commonly grown turfgrass species of the region. The fertilization schedule is specific to each turfgrass species, as it is based on the plants' period of optimal growth and uptake of nutrients (LSU AgCenter, 2008). The study by Carey et al. (2012a) found that when fertilizer was applied to turfgrasses at times of reduced growth that this practice can increase nutrient runoff. The study by Carey et al. (2012a) additionally supported the use of *Fertilizer best management practices* developed by the state's land grant university, as such practices are based on the types of turfgrass species grown and the cultural practices specific to that region (Carey et al., 2012a). Lastly, the use of the *Precision fertilizer application* practice was supported by the LSU AgCenter's (2008) publication on lawn care BMPs recommended the use of a drop or broadcast fertilizer spreader to more accurately apply fertilizer to lawns and reduce the likelihood of over fertilization as well as under fertilization. The LSU AgCenter's (2007) landscaping guide also supported the use of a spreader to precisely apply fertilizer to the lawn and reduce over application.

The research by Fishbein and Ajzen (2010) on changing behavior recommended that the strongest determinant of past behavior be examined to determine which construct to target in an educational intervention program. Therefore the bivariate correlations and regression analyses for the independent variables, intention and perceived control with the dependent variable, past behavior were examined for the following fertilizer management practices: *Calculating the area of lawn*; *Fertilizer application; annual schedule*; *Fertilizer best management practices*; and *Precision fertilizer application*.

For the *Calculating the area of lawn* bivariate correlations, the independent variable intention had a significant, very strong association (r = .77) with the dependent variable, past behavior, and perceived control had a significant, but low association (r = .29) with past behavior. When the regression analysis was examined, the coefficient of determination for the explanation of past behavior from intention and perceived control accounted for 77.0% of the variance in the dependent variable. The independent variable, intention, had a standardized beta coefficient (β = .767) with a significant t-value and made the greatest contribution to the explanation of past behavior for the practice *Calculating the area of lawn*. The intention mean was 4.86 and had a scale interpretation of *maybe do* for the item "I intend to calculate the area of lawn to determine how much fertilizer to apply", indicating the potential to change intention to perform this practice.

As intention was the strongest determinant of past behavior to perform the *Calculating the area of lawn* fertilizer management practice, the intention construct mean, bivariate correlations, and regression analysis were reviewed to further identify the construct to target in a behavioral intervention program (Fishbein & Ajzen, 2010). The *Calculating the area of lawn* bivariate correlations for the independent variables, attitude, perceived norm and perceived control, with the dependent variable, intention resulted in all three independent variables having significant correlations with intention. The variables perceived norm (r = .40), perceived control (r = .37), and attitude (r = .34) had moderate associations with intention. When the regression analysis was examined, the coefficient of determination for the explanation of intention from attitude, perceived norm and perceived control accounted for 45.9% of the variance in intention. The independent variables perceived norm and perceived control had standardized beta coefficients with significant t-values, and the variable attitude had a non-significant t-value. Perceived norm made the greatest contribution (β = .259) to the explanation of intention to perform the practice *Calculating the area of lawn*.

The *Fertilizer application, annual schedule* bivariate correlations were examined for the independent variables, intention and perceived control, with the dependent variable, past behavior. The independent variable intention had a significant, very strong association (r = .80) with the dependent variable, past behavior. The independent variable, perceived control, had a significant, moderate association (r = .31) with past behavior. When the regression analysis was examined, the coefficient of determination for the explanation of past behavior from intention and perceived control accounted for 79.8% of the variance in past behavior. The independent variable, intention had a standardized beta coefficient (β = .807) with a significant t-value, and made the greatest contribution to the explanation of past behavior for the practice *Fertilizer application, annual schedule*. The intention mean for *Fertilizer application, annual schedule* was 5.07 and had a scale interpretation of *maybe do* for the item “I intend to follow an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire” indicating the potential to change intention to perform this practice.

As intention was the strongest determinant of past behavior to perform the *Fertilizer application, annual schedule*, the intention construct mean, bivariate correlations, and regression analyses were reviewed to further identify the construct to target in a behavioral intervention program (Fishbein & Ajzen, 2010). The *Fertilizer application, annual schedule* bivariate correlations examined for the independent variables, attitude, perceived norm and perceived control, with the dependent variable, intention resulted in all three independent variables having significant correlations with intention. The variables attitude (r = .48), perceived norm (r = .43), and perceived control (r = .41) had moderate associations with intention. When the regression analysis was examined, the coefficient of determination for the explanation of intention from attitude, perceived norm and perceived control accounted for 52.0% of the variance in intention. The three independent variables had standardized beta coefficients with significant t-values. Attitude made the greatest contribution (β = .252) to the explanation of intention to perform the *Fertilizer application, annual schedule* practice.

The *Fertilizer best management practices* bivariate correlations were examined for the independent variables, intention and perceived control, with the dependent variable, past behavior. The independent variable intention had a significant correlation and a very strong association (r = .78) with the dependent variable, past behavior. The independent variable, perceived control, had a significant correlation and a moderate association (r = .37) with past behavior. When the regression analysis was examined, the coefficient of determination for the explanation of past behavior from intention and perceived control accounted for 78.1% of the variance in the dependent variable. The independent variable, intention had a standardized beta coefficient (β = .757) with a significant t-value and made the greatest contribution to the explanation of past behavior for the practice *Fertilizer best management practices*. The intention mean was 5.32 and had a scale interpretation of *maybe do* for the item "I intend to select fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results" indicating the potential to change intention to perform this practice.

As intention was the strongest determinant of past behavior to perform the *Fertilizer best management practices*, the intention construct mean, bivariate correlations, and regression analysis were reviewed to further identify the construct to target in a behavioral intervention program (Fishbein & Ajzen, 2010). The *Fertilizer best management practices* bivariate correlations examined for the independent variables, attitude, perceived norm and perceived control, with the dependent variable, intention resulted in all three independent variables having significant correlations with the dependent variable, intention. Perceived norm had a substantial association with intention (r = .58). Attitude (r = .46) and perceived norm (r = .42) had moderate associations with the dependent variable. When the regression analysis was examined, the coefficient of determination for the explanation of intention from attitude, perceived norm and perceived control accounted for 60.7% of the variance in intention. Perceived norm and perceived control had standardized beta coefficients with significant t-values, and perceived norm made the greatest contribution (β = .458) to the explanation of intention to perform *Fertilizer best management practices*.

Lastly, the *Precision fertilizer application* bivariate correlations were examined for the independent variables, intention and perceived control, with the dependent variable, past behavior. The independent variable, intention, had a significant, very strong association (r = .80) with the dependent variable, past behavior. Further, the independent variable, perceived control, had a significant, moderate association (r = .31) with past behavior. When the regression analysis was examined the coefficient of determination for the explanation of past behavior from intention and perceived control accounted for 80.0% of the variance in past behavior. The independent variable, intention had a standardized beta coefficient (β = .830) with a significant t-value and made the greatest contribution to the explanation of past behavior for the *Precision* *fertilizer application* practice. The *Precision fertilizer application* intention mean was 5.28 and had a scale interpretation of "maybe do" for the item "I intend to use a fertilizer spreader to determine how much fertilizer is being applied to the lawn", indicating the potential to change intention to perform this practice.

As intention was the strongest determinant of past behavior to perform the *Precision fertilizer application* fertilizer management practice, the intention construct mean, bivariate correlations, and regression analysis were reviewed to further identify the construct to target in a behavioral intervention program (Fishbein & Ajzen, 2010). The *Precision fertilizer application* bivariate correlations examined for the independent variables, attitude, perceived norm and perceived control, with the dependent variable, intention resulted in all three independent variables having significant correlations with the dependent variable, intention. The variables perceived norm (r = .57) and attitude (r = .54) had substantial associations with intention, and perceived control (r = .46) had a moderate association. When the regression analysis was examined, the coefficient of determination for the explanation of intention from attitude, perceived norm and perceived control accounted for 64.2% of the variance in intention. Perceived norm made the greatest contribution (β = .332) to the explanation of intention to perform the *Precision fertilizer application* practice.

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service design segments of the Louisiana Yards and Neighborhoods (LYN) education program to address homeowners' perceived norm regarding the *Calculating the area of lawn*, *Fertilizer best management practices*, and the *Precision fertilizer application* recommended practices. By targeting homeowners' perceived norms and bolstering communal support for the performance of these three recommended practices the LYN education program can increase homeowners' intention to perform these practices (Fishbein & Ajzen, 2010).

The finding of perceived norm as the strongest determinant of intention to perform these practices confirmed the strong social component of these three practices (Fishbein & Ajzen, 2010). Therefore, using a communal or public space to teach residents the value of performing recommended practices can lead to these practices being accepted as social norms of the community (Israel & Hague, 2002). Carey et al., (2012a) and Robbins and Sharp, (2003b) found that individuals are more likely to adopt fertilization practices if their neighbors are also implementing that practice. To increase communal support for the performance of the *Calculating the area of lawn, Fertilizer best management practices,* and the *Precision fertilizer application* fertilizer management practices, the researcher recommends that County Extension Agents or Advanced Master Gardeners with nutrient management training establish demonstration sites in a public/communal space located in residential areas to conduct field day events. Field day events should include demonstrations on how to perform the recommended practices, as the communal performance of the *Calculating the area of lawn, Fertilizer best management practices*, and the *Precision fertilizer application* practices may increase social acceptance and social obligation to use these fertilizer management practices (Robbins et al., 2001).

Further, based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service design a segment the LYN education program that targets homeowners' attitude about the *Fertilizer application, annual schedule* practice. Attitude was the most important determinant of intention and if targeted in a behavioral intervention program can increase homeowners' intention to perform the recommended practice (Fishbein & Ajzen, 2010). The attitude homeowners have towards this practice was established from homeowners' beliefs about the behavior (Ajzen, 1991). Therefore, the segment of the LYN education program should focus on improving homeowners' positive assessment that utilizing an annual fertilizer application schedule will result in outcomes that they desire and increase the strength of homeowners' belief that using an annual schedule will produce positive outcomes (Ajzen, 1991).

The researcher recommends that the LYN education program include a seminar that outlines the positive outcomes of using the *Fertilizer application, annual schedule* practice and how likely the outcomes are if homeowners follow the annual fertilizer schedule. The LSU AgCenter' (2008) annual fertilizer application schedule for turfgrass should be used as a supporting document to accompany the seminar and provide information on fertilization of the commonly grown turfgrass species in Louisiana. Additionally, the research by Warner et al. (2015) found that messages that framed the performance of irrigation conservation practices as a gain had an impact on respondents' attitude towards the practices. Therefore, the researcher further recommends the development of a strategic gain framed message to improve homeowners' attitude about the performance of an annual fertilizer application schedule that can be presented in the seminar as well as posted on the LYN program webpage. An example of such a strategic message would be, "By using an annual application schedule to determine when to apply fertilizer to your lawn and/or landscape you will improve plant growth and use less costly fertilizer".

Conclusion Seven

There is a relationship between homeowners' past behaviors and their behavioral beliefs about fertilizer management practices.

This conclusion was based on the significant correlations between behavioral belief and the past behavior constructs for 11 of the 12 practices. However, of those 11 management practices only three were selected for discussion in this conclusion based on the behavioral belief mean score. The *Fertilizer application, no schedule, Watering in lawn fertilizer, rain event*, and *Runoff from fertilizer spills* had the three lowest behavioral belief mean scores indicating the greatest likelihood for behavioral change (Fishbein & Ajzen, 2010). Behavioral belief was a product of the 260 homeowners' responses to the items for the constructs, outcome evaluation and behavioral belief strength for each of the 12 fertilizer management practices examined in this study.

The behavioral belief result for *Fertilizer application, no schedule* had a mean response of 31.12 or a *slightly positive* belief. This finding indicated that homeowners slightly believed that the application of fertilizer to the home lawn with no set schedule would result in desired lawn growth. Homeowners should have a strong negative belief in the *Fertilizer application, no schedule* practice, as fertilizer should be applied to the lawn at the appropriate time of year when plants are actively growing and can best uptake and make use of the product, reducing the possibility of fertilizer runoff (Carey et al., 2012a; LSU AgCenter, 2008; LSU AgCenter 2007; UF IFAS Extension, 2004). The *Fertilizer application, no schedule* behavioral belief was correlated with the past behavior mean response for this practice. A substantial correlation (r = .54) was found between behavioral belief and past behavior for the *Fertilizer application, no schedule* practice.

The behavioral belief result for *Watering in lawn fertilizer, rain event* had a mean response of 16.28 or a *slightly negative* belief. This finding indicated that homeowners only slightly believed that coordinating the application of fertilizer to the lawn when rain is expected would fail to water in the product correctly. Homeowners should have a strong negative belief that the use of the *Watering in lawn fertilizer, rain event* practice would not water in the product correctly, as the use of a rain event to water in fertilizer product is imprecise and has the potential to cause harmful runoff (Carey et al., 2012a; FFL, 2015; LSU AgCenter, 2007). The *Watering in lawn fertilizer, rain event* behavioral belief was correlated with the past behavior mean response for this practice. A moderate correlation (r = .47) was found between behavioral belief and past behavior for the *Watering in lawn fertilizer, rain event* practice.

The behavioral belief result for *Runoff from fertilizer spills* had a mean response of 31.47 or a *slightly positive* belief. This result indicated that homeowners only slightly believed that when fertilizer is applied to areas other than the lawn or landscape it can lead to runoff that causes environmental issues, particularly in water. Homeowners should have a strong, positive belief about the *Runoff from fertilizer spills* practice, as research has shown that fertilizer spills can result in runoff and that precise application of fertilizer to the lawn and/or landscape will reduce the chance of the product running off into water resources (LSU AgCenter, 2007; U.S. EPA, 2005). The *Runoff from fertilizer spills* behavioral belief was correlated with the past behavior mean response for this practice. There was a moderate correlation (r = .43) between behavioral belief and past behavior for this practice.

The substantial correlation between behavioral belief and the past behavior construct for the *Fertilizer application, no schedule* indicated that changing homeowners behavioral beliefs about this practices will likely result in changes in behavior (Fishbein & Ajzen, 2010). The moderate correlations found for the *Runoff from fertilizer spills* and *Watering in lawn fertilizer, rain event* fertilizer management practices indicated that changing homeowners' behavioral beliefs about these practice may result in changes in behavior (Fishbein & Ajzen, 2010). The outcome evaluation and behavioral belief strength constructs that comprise behavioral belief were further examined for the *Runoff from fertilizer spills*, *Fertilizer application, no schedule*, and the *Watering in lawn fertilizer, rain event* management practices, to determine what dimension of the belief to target in a behavioral intervention program to either increase or decrease the likelihood of the performance of these practices (Fishbein & Ajzen, 2010).

The *Fertilizer application, no schedule* outcome evaluation mean response was 6.37 or *quite good* for the item "Producing the lawn growth I desire is". This outcome evaluation mean indicated there was not as much potential to use a behavioral intervention to further increase homeowners' positive assessment that producing the lawn growth they desire was good (Fishbein & Ajzen, 2010). The behavioral belief strength mean was 3.14 or *slightly unlikely* for the reverse coded item "Applying fertilizer to the lawn with NO set schedule will produce the lawn growth I desire". This slight behavioral belief strength mean indicated the potential to use a behavioral intervention to further strengthen homeowners' belief that utilizing the *Fertilizer application, no schedule* management practice will not produce desired lawn growth (Fishbein & Ajzen, 2010).

The *Watering in lawn fertilizer, rain event* outcome evaluation mean response was 6.39 or *quite good* for the item "Watering in lawn fertilizer correctly is". The result of the outcome evaluation indicated that there was not as much potential to use a behavioral intervention program to increase homeowners' assessment that watering in lawn fertilizer correctly will produce a more positive outcome (Fishbein & Ajzen, 2010). The behavioral belief strength mean was 5.40 or *slightly likely* for the reverse coded item “Coordinating the application of lawn fertilizer when rain is expected will water in the product correctly”. This slight behavioral belief strength mean indicated the potential to use a behavioral intervention to decrease the strength of homeowners’ belief that applying fertilizer when rain is expected will water in the product correctly (Fishbein & Ajzen, 2010).

The *Runoff from fertilizer spills* outcome evaluation mean response was 1.98 or *quite bad* for the reverse coded item “Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is”. The result of the outcome evaluation indicated that there was not as much potential to use a behavioral intervention program to increase homeowners’ assessment that fertilizer spills will produce a more negative outcome than they previously believed (Fishbein & Ajzen, 2010). The behavioral belief strength mean was 5.19 or *slightly likely* for the item “Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water”. The slightly likely behavioral belief strength mean indicated the potential to use an educational program to increase the strength of homeowners’ belief that applying fertilizer to areas other than the lawn or landscape will produce runoff than was previously believed (Fishbein & Ajzen, 2010).

Based on this conclusion, the findings of this study, and the literature cited the researcher recommends that the Louisiana Cooperative Extension Service (LCES) design segments of the Louisiana Yards and Neighborhood (LYN) education program to strengthen homeowners’ belief that applying fertilizer to the lawn with no set schedule will not produce the desired lawn care results, and that application of fertilizer to areas other than the lawn or landscape will produce fertilizer runoff. The researcher further recommends that the LCES design a segment of the

LYN education program to reduce the strength of homeowners' belief that coordinating the application of lawn fertilizer when rain is expected will water in the product correctly.

Israel et al. (1999) recommended the use of seminars/workshops with accompanying publications to enhance adoption of recommended management practice. Therefore, the researcher recommends that the LYN education program include a seminar to provide homeowners with detailed information on how the application of fertilizer with no set schedule is not the recommended method for optimizing plant growth. The LSU AgCenter's (2008) publication of best management practices for Louisiana lawns should be used as a supporting document to accompany the seminar and provide information on the fertilization schedule of turfgrass species commonly grown in the state. Further, the LYN education program should include a workshop to examine how fertilizer spills result in fertilizer runoff, how to reduce fertilizer spills, and how to properly clean up fertilizer spills. The LSU AgCenter's (2007) guide to Louisiana-friendly landscaping should be distributed as a supplementary publication to the workshop to provide participants information on how to reduce runoff from fertilizer spills and the methods for cleaning up fertilizer spills.

The researcher further recommends that the LYN education program include a workshop to discuss the outcomes of watering in lawn fertilizer with a rain event, to reduce the strength of participants' belief in this practice. The workshop should examine why rainfall is not the recommended method for watering in lawn fertilizer and how the inaccuracy of this practice can lead to fertilizer runoff. The workshop should also include interactive examples of how to use different types of irrigation to precisely apply water to the home lawn to water in fertilizer correctly. The LSU AgCenter's (2007) guide to Louisiana-friendly landscaping should be distributed as a supplementary publication to this workshop to provide information on how to calibrate an irrigation system to apply the recommended amount of moisture to water in lawn fertilizer correctly, whether the irrigation comes from a sprinkler system or a sprinkler attachment on a garden hose. Further, due to the importance of homeowners not using rainfall to water in lawn fertilizer, the researcher recommends that a field day event be held in neighborhoods where County Extension Agents or Advanced Master Gardeners have developed relationships with community members. The event should take place on a residential lawn within the community where a demonstration can be performed for residents on how to calibrate different types of irrigation systems to apply the recommended amount of water to the lawn following fertilizer application.

Conclusion Eight

There are differences in behavioral belief strength between homeowners who had applied fertilizer and those homeowners who had not applied fertilizer to their home lawn and/or landscape.

This conclusion is based on the five fertilizer management practices that had a significant difference in the mean behavioral belief strength construct between the homeowners who had applied fertilizer and the homeowners who had not applied fertilizer. The fertilizer management practices discussed in this conclusion were *Runoff from fertilizer spills, Precision fertilizer application*, *Community fertilizer management practice*, *Fertilizer application, annual schedule*, and *Fertilizer product label*. The significant differences found between the two groups of homeowners identified which beliefs are important determinants of behavior, and which fertilizer management practices' behavioral belief strength needed to be changed for either homeowners that had applied fertilizer or homeowners who had not applied fertilizer (Fishbein & Ajzen, 2010).

The conclusion was supported by a significant difference found for the mean behavioral belief strength construct for the *Runoff from fertilizer spills* management practice between those homeowners that had applied fertilizer and those that had never applied fertilizer. The mean behavioral belief strength for the item "Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water is" between the homeowners that have applied fertilizer and those that have not applied fertilizer. The mean was significantly higher (t_{258} = 2.24, p = .026) for homeowners that had not applied fertilizer (M = 5.65, SD = 1.88, interpretive scale = *quite likely*) than those that had applied fertilizer (M = 5.03, SD = 1.99, interpretive scale = *slightly likely*) to their home lawn and/or landscape with a mean difference of 0.62.

The *Runoff from fertilizer spills* behavioral belief strength construct mean was significantly lower for homeowners that had applied fertilizer than those that had not applied fertilizer to their home lawn and/or landscape. This finding indicated that the homeowners that had applied fertilizer did not believe as strongly that applying fertilizer to areas other than the lawn or landscape would result in runoff that contributes to environmental issues, particularly in water. The literature states that when fertilizer is applied to impervious surfaces, or areas other than the lawn or landscape, the fertilizer product cannot be taken up by the intended plants and such spills can result in fertilizer runoff into waterways (LSU AgCenter, 2007; U.S. EPA, 2005). To reduce the water quality issues associated with fertilizer spills, it is imperative that all homeowners, especially those residents that are applying fertilizer, have a strong belief that fertilizer applied to areas other than the lawn or landscape results in runoff.

The conclusion was further supported by the finding of a significant difference in the mean behavioral belief strength construct for the *Precision fertilizer application* management practice between those homeowners that had applied fertilizer and those that had never applied fertilizer. The mean behavioral belief strength for the item "Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn" was found to have a significantly higher mean ($t_{87.4}$= 2.67, p = .009) for homeowners that had applied fertilizer (M = 6.06, SD = 1.12, interpretive scale = *quite likely*) compared to those that had not applied fertilizer (M = 5.46, SD = 1.75, interpretive scale = *slightly likely*) to their home lawn and/or landscape with a mean difference of 0.60

The stronger behavioral belief strength held by homeowners who had applied fertilizer regarding the *Precision fertilizer application* practice was an important result since the use of a spreader can help to precisely apply the amount of fertilizer plants need for growth and reduce excess fertilizer application (LSU AgCenter, 2008; LSU AgCenter, 2007). However, this finding indicated that the homeowners that had not applied fertilizer only slightly believed that using a fertilizer spreader would help them determine how much fertilizer is being applied to the lawn. Homeowners, whether they have applied fertilizer or may apply fertilizer in the future, should have a strong belief in the use of a fertilizer spreader as this tool allows for the appropriate rate of fertilizer to be applied while reducing the costly waste of excess fertilizer application and the potential for fertilizer runoff (UF IFAS Extension, 2004).

The conclusion was additionally supported by the finding of a significant difference in the mean behavioral belief strength between the two groups of homeowners for the *Community fertilizer best management practices*. The mean behavioral belief strength was significantly higher ($t_{101.3}$ = 2.25, p = .026) for homeowners that had applied fertilizer (M = 5.93, SD = 1.37, interpretive scale = *quite likely*) than those that had not applied fertilizer (M = 5.43, SD = 1.66, interpretive scale = *slightly likely*) with a mean difference of 0.50 for the item, "Selecting fertilizer practices based on the type of grass being grown and the size of my yard will satisfy the standards and preferences of my neighborhood".

The literature has shown that homeowners that select fertilizer management practices based on the standards and preferences of their neighborhood may perform practices that increase the potential for water pollution (Carey et al., 2012a; Nielson & Smith, 2005). In the study by Nielson and Smith (2005) the community aesthetics and the judgment of neighbors were found to influence the types of lawn care practices that were used by residents. Further, Nielson and Smith (2005) found that those practices that were approved by the neighborhood community increased the frequency of fertilizing beyond the recommended amount, due to the social pressure to keep the aesthetic of a green lawn. The study by Carey et al. (2012a) found that residents may perform improper fertilizer management practices because of the social pressure to do so even if they do not have a positive attitude or assessment of that practice. Further, Carey et al. (2012a) recommended that fertilizer management practices that are based on community aesthetics rather than water conservation or enhancement should not be reinforced as they would result in negative environmental outcomes. Therefore, among the homeowners who had applied fertilizer that participated in this study the strength of their belief in selecting fertilizer practices to satisfy the standards and preferences of their neighborhood should be decreased.

The conclusion was further supported by the significant difference of the mean behavioral belief strength construct for the *Fertilizer application, annual schedule* management practice between those homeowners that had applied fertilizer and those that had never applied fertilizer. The mean behavioral belief strength for the item "Following an annual home lawn and landscape fertilizer schedule will achieve the plant growth I desire" was significantly higher

($t_{107.5}$ = 2.34, *p* = .021) for homeowners that had applied fertilizers (*M* = 5.99, *SD* = 1.16) than those that had not applied fertilizer (*M* = 5.57, *SD* = 1.30) with a mean difference of 0.42. Although the two scores fell within the same interpretive category of *quite likely* the test indicated a statistically significant difference between the homeowners who applied fertilizer and the homeowners who had not applied fertilizer for the *Fertilizer application, annual schedule* management practice.

The finding of homeowners who had applied fertilizer having a significantly stronger belief in the *Fertilizer application, annual schedule* practice was an important result as fertilizer is recommended to be applied on an annual schedule at the time of year when plants are growing to reduce the costly waste of applying fertilizer when the product cannot be utilized by the plant (LSU AgCenter, 2008; LSU AgCenter 2007). Although the homeowners that had not applied fertilizers had a significantly lower *Fertilizer application, annual schedule* behavioral belief strength mean, this group still believed quite strongly that following an annual home lawn and landscape fertilizer schedule will achieve the plant growth desired. These results are encouraging as all homeowners should understand that by applying fertilizer on an annual schedule at the time of the year when plants are actively growing the nutrient content of these products will be more readily taken up by the plant, decreasing the potential for excess fertilizer runoff from the soil (Carey et al., 2012a; UF IFAS Extension, 2004).

Finally, the conclusion was supported by the finding of a significant difference in the mean behavioral belief strength construct for the *Fertilizer product label* between those homeowners that had applied fertilizer and those that had never applied fertilizer. The mean behavioral belief strength was significantly higher ($t_{106.2}$ = 2.06, *p* = .039) for homeowners that had applied fertilizer (*M* = 5.90, *SD* = 1.08) than those that had not applied fertilizer (*M* = 5.54, *SD* = 1.23) to their home lawn and/or landscape with a mean difference of 0.36 for the item "Following the directions specified on the fertilizer product label will produce the lawn care results I desire". Although the two scores fell within the same interpretive category of *quite likely* the test indicated a statistically significant difference between the homeowners who applied fertilizer and the homeowners who had not applied fertilizer for the *Fertilizer product label* management practice.

It was an encouraging result that the group of homeowners who had applied fertilizers believed more strongly in the use of the *Fertilizer product label* practice. Following the directions on the fertilizer product label is the first step in implementing proper fertilizer use/application and can reduce the risk of fertilizer runoff (LSU AgCenter, 2007; U.S. EPA, 2005). Further, the homeowners that had not applied fertilizer, despite the significantly lower behavioral belief strength compared to homeowners that applied fertilizers, still believed quite strongly in the *Fertilizer product label* practice. These results indicated that both groups of homeowners had a strong belief in following the directions specified on the fertilizer product label.

Based on this conclusion, the findings of this study, and the literature that is cited the researcher recommends that the Louisiana Cooperative Extension Service (LCES) design a segment of the Louisiana Yards and Neighborhoods education program to strengthen the belief in the *Precision fertilizer application* practice by homeowners, including those that have not yet applied fertilizer. The researcher further recommends that the LCES design a segment of the Louisiana Yards and Neighborhoods education program to strengthen the belief in the *Runoff from fertilizer spills* practice by homeowners who had applied fertilizer. Further, the researcher recommends that the LCES design a segment of the Louisiana Yards and Neighborhoods education program to decrease the strength of the belief that homeowners who had applied fertilizer have about the *Community fertilizer best management practices*.

The researcher recommends that to strengthen the belief in the *Precision fertilizer application* practice that the Louisiana Yards and Neighborhoods program include a workshop on home lawn and landscaping tools, such as types of irrigation applicators and fertilizer spreaders and discuss the pros and cons of using these types of tools. For precision fertilizer application, the workshop should discuss how fertilizer spreaders accurately apply fertilizer to the home lawn, and discuss the long-term savings benefit of using a spreader, as it limits the amount of fertilizer product applied to only that which is needed for the designated area. The workshop should also present how to use different spreaders, specifically how to fill them with product and how to properly calibrate the spreader. The LSU AgCenter's (2008) Louisiana lawns best management practices should be distributed as a supplementary publication to this workshop to provide information on the different home lawn care tools that can be used.

The researcher further recommends the LYN education program include a workshop to examine how fertilizer spills result in fertilizer runoff, how to reduce fertilizer spills, and how to properly clean up fertilizer spills. The LSU AgCenter's (2007) guide to Louisiana-friendly landscaping should be distributed as a supplementary publication to this workshop to provide information on how to reduce runoff from fertilizer spills and methods for cleaning up fertilizer spills.

Lastly, the researcher recommends that a workshop be included in the LYN education program to examine how lawn and landscape practices based on community norms to achieve community aesthetic standards can lead to the implementation of improper fertilizer management practices. The workshop can discuss how the basis for community aesthetic goals should come from recommended fertilizer management practices that are not harmful to the environment. The workshop can cover the recommended guidelines for home lawn and landscape care in Louisiana to help establish new community norms, as these practices protect and enhance water quality. The LSU AgCenter's (2007) guide to Louisiana-friendly landscaping and the LSU AgCenter's (2008) Louisiana lawns best management practices publications should be distributed as supplementary information to this workshop to provide the detailed information about Louisiana's recommended lawn and landscape practices.

Summary of the Conclusions, Implications, and Recommendations

The researcher applied Ajzen's Theory of Planned Behavior (TPB) to examine 12 fertilizer management practices identified as pertinent to this study's population of urban and suburban homeowners in Louisiana. The results of this study informed the researcher as to which of the 12 practices the homeowners of this study were using and which TPB constructs had the greatest potential to enhance adoption of recommended practices and change undesired behaviors (Fishbein & Ajzen, 2010). The researcher recommended that for the fertilizer management practices that required behavioral change that the TPB constructs with the greatest potential to change behavior be targeted in a behavioral intervention program, as was recommended by Fishbein and Ajzen (2010). The researcher further recommended that the Louisiana Cooperative Extension Service (LCES) be the organization to develop fertilizer management educational intervention programming. The researcher recommended that such programming be delivered through the LCES' Louisiana Yards and Neighborhoods (LYN) education program, to change the improper fertilizer management practices identified in this study. The researcher made further recommendations for practice on how to design the LYN fertilizer management segments using different delivery methods to effectively address the improper management practices and the TPB constructs being targeted.

As urban and suburban residents of Louisiana live within a landscape of impervious surfaces that exacerbate the issue of fertilizer runoff, the researcher recommends that this population be further investigated in future studies. The researcher recommends that Fishbein and Ajzen's (2010) intervention methodology be used to examine a random sample of urban and suburban Louisiana residents' beliefs and direct measures regarding the principal fertilizer management practices identified from this study, to help focus limited time and financial resources. This larger scale investigation is recommended to provide a statewide representation of urban and suburban residents' beliefs about, intentions to perform, and past behaviors of the six fertilizer management practices from this study that demonstrated the greatest need for behavioral change: *Soil testing, Calculating the area of lawn*; *Watering in lawn fertilizer, rain event*; *Precision fertilizer application*; *Fertilizer application, annual schedule*; and *Runoff from fertilizer spills*. The results of such a study can then be used to design statewide fertilizer management programming through the LCES' LYN education program that can be implemented in each of the parishes that include an urban or suburban population.

The researcher further recommends that mixed methodology be used in future studies of the six aforementioned fertilizer management practices. A mixed methodology, as was used in the study by Nielson and Smith (2005), would provide an opportunity to collect, in addition to survey data, direct observations of the fertilizer management practices being implemented by homeowners, and semi-structured interview data from a sample of Louisiana urban and suburban residents to more fully understand how and why the fertilization practices they adopt are being implemented. A mixed method study such as this can also help to determine the extent to which community aesthetics and judgments of neighbors are influencing the types of lawn care practices being used by Louisiana residents (Nielson & Smith, 2005).

Furthermore, the research by Robbins et al. (2001) and Robbins and Sharp (2003a) identified the influence of socioeconomic factors on the use of improper fertilizer management practices in residential areas. In the study by Robbins et al. (2001) the results indicated that residents that use lawn care chemicals or have *high-input lawn chemical systems*, in comparison with residents that do not use such products, are more likely to be affluent, highly educated, and aware of the potential negative impacts the use of lawn chemicals can have on the environment. Further, in the study by Robbins and Sharp (2003a) a profile was generated of the residents that were likely to use lawn chemicals from a national survey of U.S. lawn owners. The results of this profile indicated, "a highly classed phenomenon, with users of chemicals coming from higher-value homes and neighborhoods in urban areas throughout the census regions of the US South and Midwest" (Robbins & Sharp, 2003a, p. 961). Therefore, the researcher recommends that the demographic characteristics of the homeowners of this study that had applied fertilizer and the homeowners that had never applied fertilizer be compared. The researcher further recommends that the relationships that exist between this population's socioeconomic demographic characteristics and the six aforementioned fertilizer management practices also be examined.

Lastly, the researcher recommends that the urban nutrient management plan studied by Hefner et al. (2009) be examined as an alternative behavioral intervention design to address improper fertilization practices used by homeowners in the residential areas of Louisiana. One of the main benefits of developing urban nutrient management plans would be to tailor the plans to meet the needs of the program participants' home lawn care, and provide relevant information about what types of fertilizers are needed, what time of year to apply the amendments, and in what amount to apply the products using a fertilizer spreader (Hefner et al., 2009). A tailored nutrient management plan could be an important resource to homeowners in Louisiana as it can be used as a fertilizer shopping list to assist in purchasing the appropriate fertilizer products for the specific needs of their home lawn (Hefner et al., 2009). Another benefit of such a behavioral intervention program would be having a technician meet directly with homeowners for a consultation session to discuss the details of the plan and educate homeowners about nutrient management and the health of their watershed (Hefner et al., 2009). However, implementing such an intervention program that has individualized urban nutrient management plans based on soil testing results, with homeowners that perform self-service lawn care, would require the availability of trained personnel, as well as funding for a soil testing rebate program.

In the study by Hefner et al. (2009) the adoption of the nutrient management plan by 68% of program participants and their subsequent purchase of the type of fertilizer and the application of the amount of fertilizer designated in the plan supported the ability of such a program to enhance residents' adoption of recommended fertilizer management practices. Therefore, the researcher recommends that an urban nutrient management plan be piloted in a watershed where elevated nutrient levels and water quality issues have been identified. The results of the pilot can be used to determine if Louisiana homeowners' fertilizer management issues begin with them having difficulty knowing what types of fertilizer to buy, what size of bags, and how many are needed (Hefner et al., 2009). The pilot can also be used to determine the extent to which the program can increase homeowners' adoption of recommended fertilizer management practices and whether the investment of time, finances, and human resources should be pursued to develop this behavioral intervention program throughout the state of Louisiana.

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APPENDIX A.
ACTION ON EXEMPTION APPROVAL REQUEST

TO: Natalie Levy
Human Resource Education & Workface Dev.

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: March 20, 2015

RE: **IRB#** E9262

TITLE: A Multiphase Mixed Method Study of Community Association Member's Nutrient Management Beliefs, Intentions, and Behaviors

New Protocol/Modification/Continuation: New Protocol

Review Date: 3/20/2015

Approved_______X_____Disapproved____________

Approval Date: 3/20/2015 **Approval Expiration Date:** 3/19/2018

Exemption Category/Paragraph: 2a, b

Signed Consent Waived?: Yes - for the quantitative phase using Qualtrics. No - for the group interviews done in the first phase, for it appears these will be in-person.

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable) __________

By: Dennis Landin, Chairman ________________________________

APPENDIX B.
PILOT STUDY: RESIDENT ASSOCIATION INTERVIEW HANDOUT

Hello Broadmoor Residents' Association Board Members

You are invited to attend a meeting on Monday April 27th at 7:00pm at the Broadmoor United Methodist Church to discuss the types of fertilizer practices used in your neighborhood. This less than an hour meeting will give you the opportunity to discuss your beliefs about the following five fertilizer practices:

1) Type of fertilizer applied= the type(s) of fertilizer that you believe should be applied to your lawn/landscape (e.g., quick-release, slow-release, organic fertilizer, etc.)

2) Amount of fertilizer applied= the amount of fertilizer you believe should be applied to your area of lawn/landscape

3) Season of fertilizer application= the season of the year you believe fertilizer should be applied to your lawn/landscape (e.g., summer, fall, winter, spring)

4) Method of application= the methods or tools you believe should be used to apply fertilizer to your lawn/landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)

5) Placement of fertilizer= where you believe fertilizer should be placed in your lawn/landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)

As a current or past board member of this association you are an important leader and representative of your community. Your participation in this meeting will help to identify the beliefs that association members have about these fertilizer practices. This information will be used to develop future LSU AgCenter educational programs that will be designed to save homeowners like you valuable time and money on lawn and landscape care.

Please contact me directly if there are any questions or concerns about this information and I look forward to seeing you at the meeting!
Sincerely,
Natalie J. Levy
Phone: (714)317-4840
Email: nlevy3@lsu.edu
Address: 284 Coates Hall, Baton Rouge, LA, 70803

APPENDIX C.
COMMUNITY ASSOCIATION BELIEFS ABOUT FERTILIZER MANAGEMENT PRACTICES: INTERVIEW PROTOCOL

<u>Date</u>→ April 27th, 2015

<u>Interviewer</u>→ Natalie J. Levy (SHREWD Ph.D. Program)

<u>Interviewees</u>→ Association Members

<u>Introduction/Icebreaker</u>→ Thank you for allowing me this opportunity to interview the members of this association. I am conducting this research study in your community to learn about the beliefs association members have about home lawn and landscape fertilizer practices. The results of this study will be used to develop future LSU AgCenter educational programs that will be designed to save homeowners time and money on lawn and landscape care while also improving water quality in the state. Before we begin the formal interview, I would like to ask you to please review the informational handout and verbally confirm that you want to participate in this interview and that you give your consent to allow this session to be recorded or that you decline to participate in this study.

<u>Transition</u>→ I would like to begin the interview by discussing four specific behavioral fertilizer management practices

1) What thoughts come to mind when you think about the **amount** of fertilizer that you apply to your home lawn and landscape?

2) What thoughts come to mind when you think about the **type** of fertilizer you choose to apply to your home lawn and landscape?

3) What thoughts come to mind when you think about the **season** you choose to apply fertilizer to your home lawn and landscape?

4) What thoughts come to mind when you think about the method of **application** of fertilizer to your home lawn and landscape.

5) What thoughts come to mind when you think about the **placement** of fertilizer on your home lawn and landscape.

<u>Transition</u>→ In this next section I would like to discuss some of the factors that may enable or inhibit your ability to utilize the five fertilizer management practices that we just discussed.

1) What factors or circumstances would **make it easy or enable** you to consider the amount of fertilizer applied, the type of fertilizer used, the season of fertilizer application(s), the method of application, and the placement of fertilizer on your lawn/landscape?

2) What factors or circumstances would **make it difficult or prevent** you from considering the amount of fertilizer applied, the type of fertilizer used, the season of fertilizer application(s), the method of application, and the placement of fertilizer on your lawn/landscape?

Transition→ I would like to end the interview with a discussion of the social aspects that affect the lawn and landscape fertilizer practices that you use at your home. When it comes to the fertilizer management practices that you use there may be particular individuals or groups, such as your spouse, family members, friends, neighbors, association members, County Agent, home landscape company, Scotts company etc. who may think you should or should not perform certain fertilizer management practices or behaviors.

1) What individuals or groups do you think would **approve or think you should use** particular home landscape and lawn care fertilizer practices and why?

2) What individuals or groups do you think would **disapprove or think you should not use** particular home landscape and lawn care fertilizer practices and why?

Transition→ When we are not sure which fertilizer management practices we should use we may look to see what others are doing.

3) What individuals' or groups' landscape and lawn fertilizer practices are you **most likely** to use as a model or example for your home?

4) What individuals' or groups' landscape and lawn fertilizer practices are you **least likely** to use as a model/example for your home?

APPENDIX D.
ACTION ON EXEMPTION APPROVAL REQUEST (MODIFICATION)

TO: Natalie Levy
Human Resource Education & Workface Dev.

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: March 14, 2016

RE: **IRB#** E9262

TITLE: A Multiphase Mixed Method Study of Community Association Member's Nutrient Management Beliefs, Intentions, and Behaviors

New Protocol/Modification/Continuation: Modification

Brief Modification Description: Update to the methodology and population that the PI will collect data from using a semantic differential survey

Review Date: 3/14/2016

Approved_______X_____Disapproved____________

Approval Date: 3/14/2016 **Approval Expiration Date:** 3/19/2018

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable) __________

By: Dennis Landin, Chairman ________________________________

APPENDIX E.
LOUISIANA URBAN AND SUBURBAN RESIDENTS' FERTILIZER MANAGEMENT PRACTICES: SEMANTIC DIFFERENTIAL QUESTIONNAIRE

Survey Overview

Thank you for taking the time to complete the following survey. Your anonymous responses will provide valuable information on the fertilizer management practices used by residents in urban and suburban communities. This information will be used to design educational outreach programs that can help save homeowners like you time and money by teaching more effective and efficient home lawn care practices that can also help enhance water quality in your state. Please read each question carefully in the following **five sections** of this survey and answer them to the best of your ability. There are no correct or incorrect responses; we are merely interested in your personal point of view to better serve you.

<u>Section 1</u>: Introductory questions

Do you currently live in the state of Louisiana?
A) Yes
B) No

In what type of community do you currently live?
A) Urban (population greater than 50,000)
B) Suburban (population between 49,999-2,499)
C) Rural (population less than 2,500)

Please select one of the following choices.
Is your house, apartment or mobile home
A) Owned by you or someone in the household with a mortgage or a loan (including home equity loans)?
B) Owned by you or someone in the household free and clear (without a mortgage or loan)?
C) Rented?
D) Occupied without payment of rent?

What type of community association are you a member of?
A) Homeowners Association (HOA)
B) Property owners Association (POA)
C) Civic Association
D) Neighborhood Association
E) Not a member
F) Other (please specify) ___________________________

Have you EVER served as a board member for a community association you were a member of?
A) Yes
B) No

Are there restrictions or regulations in your community association regarding home lawn and/or landscape management?
A) Yes
B) No
C) Unsure

Do you consider yourself to be a community leader that influences the activities or behaviors of your neighborhood?
A) Yes
B) No

Have YOU EVER applied fertilizer to your home lawn and/or landscape at your current or former residence?
A) Yes
B) No

What type(s) of fertilizers have been applied to your home lawn and/or landscape? Select all that apply.
A) slow release
B) quick release
C) organic
D) all-in-one (pest control & fertilizer)
E) weed and feed
F) other (please specify) ___________________________

For a single application of fertilizer to your lawn, how much fertilizer would you consider applying?
a) Apply the amount listed on the product label
b) Apply the entire bag
c) Apply at a rate of (please specify) _______
d) Not sure

Do you currently use a lawn service to apply fertilizer to your lawn?
A) Yes
B) No

Section 2: Fertilizer practices that are used to manage your home lawn and/or landscape

Directions: Please answer each of the following questions by selecting the number that best describes your opinion from the 7 place rating scale. Some of the questions may appear to be similar, but they do address somewhat different issues, so please read each question carefully.

Example:

The Weather in Louisiana is:

bad :____1____:____2____:____3____:____4____:____5____:____6____:____7____: good

If you think the weather in Louisiana is extremely bad, then you would circle the number 1, as follows:

The Weather in Louisiana is:

bad :___1 ___:____2____:____3____:____4____:____5____:____6____:____7____: good

If you think the weather in Louisiana is quite good, then you would circle the number 6, as follows.

The Weather in Louisiana is:

bad :____1____:____2____:____3____:____4____:____5____:___6 ___:____7____: good

1) Fertilizer Product Label= the label found on the fertilizer product that provides information on how to use that product.

Producing the lawn and landscape care results I desire is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Following the directions specified on the fertilizer product label will produce the lawn and landscape care results I desire
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Following the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have followed the directions specified on the fertilizer product label to produce the lawn and landscape care results I desire is completely under my control
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to follow the directions specified on the fertilizer product label to achieve the lawn and landscape care results I desire
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

2) Soil testing= a sample of soil that is taken from the home lawn and/or landscape that is tested to provide information about what specific fertilizer nutrients (e.g. nitrogen, phosphorous, potassium, etc.) should be applied to promote healthy plant growth.

Determining what nutrients the soil needs and in what amount they should be applied is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

A soil test will determine what nutrients the soil needs and in what amount they should be applied
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Using a soil test to determine the nutrients the soil needs and in what amount they should be applied is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me using a soil test to determine what nutrients the soil needs and in what amount
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Using a soil test to determine the nutrients the soil needs and in what amount is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have used a soil test to determine what nutrients the soil needs and in what amount they should be applied
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to use a soil test to determine what nutrients the soil needs and in what amount
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

3) Calculating the area of lawn= measuring the square footage of your lawn to determine how much fertilizer to apply to that area.

Determining how much fertilizer to apply is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Calculating the area of lawn will help to determine how much fertilizer to apply
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Calculating the area of lawn to determine how much fertilizer to apply is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me calculating the area of lawn to determine how much fertilizer to apply is
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Calculating the area of lawn to determine how much fertilizer to apply is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have calculated the area of lawn to determine how much fertilizer to apply
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to calculate the area of lawn to determine how much fertilizer to apply
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

4) Watering in lawn fertilizer= following the application of fertilizer to the lawn, water is applied to the grass to set the fertilizer into the soil.

Keeping the fertilizer product in the soil is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Watering in the fertilizer applied to the lawn will keep the product in the soil
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Watering in the fertilizer applied to the lawn to keep the product in the soil is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me watering in the fertilizer applied to the lawn to keep the product in the soil
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Watering in the fertilizer applied to the lawn to keep the product in the soil is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have watered in the fertilizer applied to the lawn to keep the product in the soil
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost always

I intend to water in the fertilizer applied to my lawn to keep the product in the soil
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

Watering in lawn fertilizer correctly is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Coordinating the application of lawn fertilizer when rain is expected will water in the product correctly
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Coordinating the application of lawn fertilizer when rain is expected, to water in the product correctly is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have coordinated the application of lawn fertilizer when rain is expected, to water in the product correctly
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to coordinate the application of lawn fertilizer when rain is expected, to water in the product correctly
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

5) Precision Fertilizer Application= lawn spreaders are used to provide uniform coverage of lawn care products.

Types of Fertilizer Spreaders
1) hand spreader= this spreader looks like a small container with a handheld trigger that releases small amounts of product.
2) broadcast spreader= walk-behind broadcasters are essentially a bucket, or hopper, mounted on wheels, with a trigger that throws fertilizer in all directions as you push the handle of the device from behind.
3) drop spreader= walk-behind drop spreaders are essentially a bucket, or hopper, mounted on wheels, with a trigger mechanism that drops fertilizer directly downwards onto the lawn as you push the handle of the device from behind.

Which type of fertilizer spreader do you primarily use to apply fertilizer to your home lawn?
a) hand spreader
b) broadcast spreader
c) drop spreader
d) other (please specify)
d) do not use a spreader

Determining how much fertilizer is being applied to the lawn is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Using a fertilizer spreader will help me determine how much fertilizer is being applied to the lawn
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Using a fertilizer spreader to determine how much fertilizer is being applied to the lawn is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me using a fertilizer spreader to determine how much fertilizer is being applied to the lawn
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Using a fertilizer spreader to determine how much fertilizer is being applied to the lawn is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have used a fertilizer spreader to determine how much fertilizer is being applied to the lawn
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to use a fertilizer spreader to determine how much fertilizer is being applied to the lawn
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

6) Fertilizer Application Schedule= the schedule that is used to determine when to apply fertilizer to the home lawn and/or landscape.

Producing the lawn growth I desire is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Appling fertilizer to my lawn with NO set schedule will produce the lawn growth I desire
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Applying fertilizer to my lawn with NO set schedule to produce the lawn growth I desire is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have applied fertilizer to my lawn with NO set schedule to produce the lawn growth I desire
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to apply fertilizer to my lawn with NO set schedule to produce the lawn growth I desire
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

Achieving the plant growth I desire is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Following an annual home lawn and landscape fertilizer schedule will achieve the plant growth I desire
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Following an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have followed an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to follow an annual home lawn and landscape fertilizer schedule to achieve the plant growth I desire
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

7) Excess fertilizer runoff= when a large amount of fertilizer is applied to the lawn or landscape it cannot be taken up by the plants it was applied to and there is a potential for this excess fertilizer to runoff from these areas and enter streams, lakes, estuaries and groundwater.

Excess fertilizer runoff that contributes to environmental issues, particularly in water is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Over application of fertilizer to the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Over application of fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me over applying fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Over applying fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have over applied fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to over apply fertilizer to the lawn or landscape that results in excess fertilizer runoff that contributes to environmental issues, particularly in water
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

8) Runoff from Fertilizer Spills= when fertilizer is applied to areas, such as sidewalks, driveways or drainage ditches, it cannot be taken up by the plants it was intended for and there is a potential for this fertilizer to runoff from these areas and to enter streams, lakes, estuaries and groundwater.

Fertilizer spills that result in runoff that contributes to environmental issues, particularly in water is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Applying fertilizer to areas other than the lawn or landscape will result in runoff that contributes to environmental issues, particularly in water
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Applying fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have applied fertilizer to areas other than the lawn or landscape that resulted in runoff that contributes to environmental issues, particularly in water
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to apply fertilizer to areas other than the lawn or landscape that results in runoff that contributes to environmental issues, particularly in water
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

9) Community Fertilizer Best Management Practices= the types of fertilizer management practices used in your community.

Satisfying the standards and preferences of my neighborhood is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Selecting fertilizer practices based on the type of grass that I grow and the size of my yard will satisfy the standards and preferences of my neighborhood
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood is
Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Selecting fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood is under my control
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have selected fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood
Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to select fertilizer practices based on the type of grass that I grow and the size of my yard to satisfy the standards and preferences of my neighborhood
Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

10) Fertilizer Best Management Practices (BMPs)= the types of fertilizer management practices that have been developed for your state/region that produce effective and efficient lawn and landscape care results

Producing effective and efficient lawn and landscape care results is
Bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Good

Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region will produce effective and efficient lawn and landscape care results
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results is

Harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Beneficial

Most people whose opinion I value would approve of me selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results

Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Selecting fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results is under my control

Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Completely

I have selected fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results

Never : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Almost Always

I intend to select fertilizer practices based on the recommended best management practices that have been developed for my state/region to produce effective and efficient lawn and landscape care results

Definitely do not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely do

Section 3: Fertilizer practices used by people in your community to manage the home lawn and/or landscape

My Neighbors= people that live in proximity to your home or reside within your community.

Most of my neighbors calculate the amount of fertilizer that should be applied to their area of lawn and/or landscape.

Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your neighbors?

Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My neighbors think I should calculate the amount of fertilizer that should be applied to their area of lawn and/or landscape.

Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what the residents of my neighborhood think I should do.

Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Most of my neighbors consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your neighbors?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My neighbors think I should consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what the residents of my neighborhood think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Most of my neighbors consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your neighbors?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My neighbors think I should consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, I want to do what the residents of my neighborhood think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My Friends= anyone you socialize with, including family members, that is NOT your neighbor.

Most of my friends calculate the amount of fertilizer that should be applied to their area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your friends?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My friends think I should calculate the amount of fertilizer that should be applied to their area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what my friends think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Most of my friends consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your friends?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My friends think I should consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what my friends think I should do.
Agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Disagree

Most of my friends consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your friends?
Very much : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Not at all

My friends think I should consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, I want to do what my friends think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Social media acquaintances= this is someone that you communicate with on social media sites, such as Facebook, Nextdoor, Tumblr, Twitter etc.

Have you ever consulted with a social media acquaintance about the fertilizer practices that you should use for your home lawn and/or landscape?
1) yes

2) no

The social media acquaintance(s) calculate the amount of fertilizer that should be applied to their area of lawn and/or landscape.
Imprrobable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your social media acquaintance(s)?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My social media acquaintance(s) think that I should calculate the amount of fertilizer that should be applied to my area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what the social media acquaintance(s) think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My social media acquaintance(s) consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your social media acquaintance(s)?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My social media acquaintance(s) think I should consider which method(s) should be used to apply fertilizer precisely to my lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what the social media acquaintance(s) I consult think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My social media acquaintance(s) consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your social media acquaintance(s)?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My social media acquaintance(s) think I should consider where fertilizer is placed on my lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement fertilizer, I want to do what my social media acquaintance(s) think I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Home & Garden Store Expert= an employee at a home and garden store that is a knowledgeable expert about home lawn care with many years of experience.

Have you ever consulted with a home & garden store expert about the fertilizer practices that you should or should not use for your home lawn and/or landscape?

1) yes
2) no

My home & garden store expert calculates the amount of fertilizer that should be applied to their area of lawn and/or landscape.

Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your home & garden store expert?
Not at all: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My home & garden store expert thinks that I should calculate the amount of fertilizer that should be applied to my area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what the home & garden store expert thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My home & garden store expert considers which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your home & garden store expert?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My home & garden store expert thinks that I should consider which method(s) should be used to apply fertilizer precisely to my lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what my home & garden store expert thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My home & garden store expert considers where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your home & garden store expert you consult?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My home & garden store expert thinks that I should consider which method(s) should be used to apply fertilizer precisely to my lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, I want to do what my home & garden store expert thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Master Gardener= are part of the volunteer staff of the LSU AgCenter's Louisiana Cooperative Extension Service. They provide unbiased, research-based educational assistance and programs on consumer horticulture issues to the gardening public.

Have you ever consulted with a Master Gardener about the fertilizer practices that you should or should not use for your home lawn and/or landscape?
1) yes
2) no

My Master Gardener calculates the amount of fertilizer that should be applied to their area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your Master Gardener?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Master Gardener thinks that I should calculate the amount of fertilizer that should be applied to my area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what my Master Gardener thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My Master Gardener considers which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your Master Gardener?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Master Gardener thinks that I should consider which method(s) should be used to apply fertilizer precisely to my lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what my Master Gardener thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My Master Gardener considers where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your Master Gardener?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Master Gardener thinks that I should consider where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, I want to do what my Master Gardener thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Extension Agent= distribute knowledge, usually of a technical nature, and are teachers that instruct the residents of the parish they work in on how to use that knowledge. The agent is formally trained for this position and is provided with the technical knowledge and information that they communicate to the members of their parish.

Have you ever consulted with an Extension Agent about the fertilizer practices that you should or should not use for your home lawn and/or landscape?
1) yes
2) no

My Extension Agent calculates the amount of fertilizer that should be applied to their area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, how much do you want to be like your Extension Agent?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Extension Agent thinks that I should calculate the amount of fertilizer that should be applied to my area of lawn and/or landscape.
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to calculating the amount of fertilizer applied, I want to do what my Extension Agent thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My Extension Agent thinks that I should consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, how much do you want to be like your Extension Agent?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Extension Agent thinks that I should consider which method(s) should be used to apply fertilizer precisely to the lawn and/or landscape (e.g. by hand, broadcast spreader, drop spreader, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to methods of applying fertilizer, I want to do what my Extension Agent thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

My Extension Agent considers where fertilizer is placed on the lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, how much do you want to be like your Extension Agent?
Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very much

My Extension Agent thinks that I should consider where fertilizer is placed on my lawn and/or landscape (e.g. incorporated into the soil, side dressed, watered in, etc.)
Improbable : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Probable

When it comes to placement of fertilizer, I want to do what my Extension Agent from my parish thinks I should do.
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Section 4: Factors that may facilitate or impede your performance of fertilizer management practices.

Which of the following factors contribute to you **NOT** applying fertilizer? Please select all that apply.

- I do not have the physical strength to apply fertilizer to my home lawn or landscape

- I do not have the time in my schedule to apply fertilizer to my home lawn or landscape
- I do not have the financial means to apply fertilizer to my home lawn or landscape
- I am not able to find a fertilizer product that also controls pests (i.e. weeds, insects &/or disease)
- I am not able to find an expert in my area to consult with about the recommended fertilizer management practices for my home lawn and/or landscape
- I am not able to get all the fertilizer application supplies that I need from one location (store/company)
- Any application of fertilizer will result in runoff that contributes to environmental issues, particularly in water
- Other, please specify in the space provided

Section 4: Factors that may facilitate or impede your performance of fertilizer management practices.

Physical Strength/Ability = having the strength to perform a physical act

I will have the physical strength necessary to complete my own lawn and landscape fertilizer management practices
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Having physical strength will enable me to walk the yard with a broadcast spreader to apply lawn fertilizer
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Time Requirement

I will have time in my schedule to perform the recommended lawn and landscape fertilizer management practices
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Having time in my schedule will allow me to apply fertilizer to my lawn following a set fertilizer program
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Having time in my schedule will allow me to apply the recommended amount of fertilizer using a fertilizer spreader
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Cost/Expense

I will have the financial means to be able to perform the recommended lawn and landscape fertilizer management practices
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Having the financial means would enable me to purchase a spreader to apply fertilizer to my lawn
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Convenience (fertilizer products)

I will be able to find a fertilizer product that controls pests (weeds, insects &/or disease) to apply to my home lawn and/or landscape
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Having a fertilizer product that also controls pests (weeds, insects &/or disease) would be convenient to use on my home lawn and landscape
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Having a fertilizer product that also controls pests (weeds, insects &/or disease) would save me money
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Convenience (consulting an expert)

In my area, I will be able to find an expert to consult with about the recommended lawn and landscape fertilizer management practices
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

In my area, having an expert to consult with would enable me to determine the recommended lawn and landscape fertilizer management practices
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

Convenience (purchasing fertilizer supplies)
I will be able to get all the fertilizer application supplies that I need from one location (store/company)
Unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Likely

Having one location (store/company) from which I can get all the fertilizer application supplies that I need would be convenient
Disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Agree

<u>Section 5</u>

Demographic Information= questions about yourself, such as age, education, ethnicity, etc.

Directions: Please provide responses to the following demographic questions to the best of your knowledge.

How many people are staying in this house, apartment, or mobile home, as of today's date? (Please specify the number) ______________________

Are there any additional people staying here, as of today's date that you did not include in Question 1? (Please mark all that apply)

- o Children, such as newborn babies or foster children
- o Relatives, such as adult children, cousins, or in-laws
- o Non-relatives, such as roomates or live-in babysitters
- o People staying here temporarily
- o No additional people

What is your sex?
A) Female
B) Male

What is your age, as of today's date? (please specify the number) ___________________

Are you of Hispanic, Latino, or Spanish origin?

- o No, not of Hispanic, Latino, or Spanish origin
- o Yes, Mexican, Mexican Am., Chicano
- o Yes, Puerto Rican
- o Yes, Cuban
- o Yes, another Hispanic, Latino, or Spanish origin (please specify origin) ________________

What is your race? (Please mark all that apply)

- o White or Caucasian
- o Black or African Am.
- o American Indian or Alaska Native (please specify name of enrolled or principal tribe)
- o Asian Indian
- o Chinese
- o Filipino
- o Japanese
- o Korean
- o Vietnamese
- o Other Asian (please specify race)
- o Native Hawaiian
- o Guamanian or Chamorro
- o Samoan

- Other Pacific Islander (please specify race)
- Some other race (please specify race) ____________________

7) What is the **highest level** of education **completed**, as of today's date?

- Grade level (please specify) ___________
- GED
- High School Diploma
- Associates Degree
- Bachelors Degree
- Masters Degree
- Doctoral Degree

8) What is your gross household income, as of today's date? (please specify the numeric dollar amount)_______________

VITA

Natalie Levy was born and raised in Southern California. She then attended the University of California, Berkeley for her undergraduate education in Environmental Science. After graduation she moved to Louisiana to work for the Audubon Nature Institute. She then attended graduate school at Louisiana State University to obtain her masters degree in Agronomy. She then received the Huel D. Perkins fellowship to attend a doctoral program in Agricultural Extension Education and Evaluation at Louisiana State University. Following her anticipated graduation from her PhD program she aspires to work with the Cooperative Extension Service or comparable organizations to educate the public on water quality issues related to fertilizer management and nutrient runoff.