Relating Knowledge and Perception of Sustainable Landscape Practices to the Adoption Intention of Environmentally Friendly Landscapes

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Abstract: The influence of traditional residential landscapes on humans and the environment has provoked a discussion on maintaining landscapes in a sustainable way and conserving water resources. Traditional American landscapes require water-intensive management. Previous research has discussed potential negative impacts on the environment from prevalent improper landscaping maintenance techniques. To mitigate long-term consequences, sustainable landscape management programs aim at protecting the environment from harmful inputs and conserving water. Among alternative practices, converting fully turfgrass lawns to sustainable landscapes is recommended. The Florida Friendly Landscaping (FFLTM) initiative is one such program designed to minimize negative impacts while maintaining and improving landscapes’ aesthetic characteristics. Although technological advancements in lawn care services have rapidly developed in the past few decades (e.g., smart irrigation systems), the level of homeowners’ knowledge and perceptions regarding sustainable practices are still at the forefront of potential factors that influence the widespread adoption of sustainable lawn management. Relatively few studies have investigated how homeowners’ knowledge and perceptions of landscape conservation practices affect adoption decisions. This study adapted Ajzen’s theory of planned behavior as a framework to examine how individuals’ knowledge and perceptions of sustainable landscapes influence their adoption intention, and to predict their pro-environmental behavior. We found that homeowners’ knowledge about lawns and landscapes (more knowledgeable) is positively correlated with their sustainable landscape adoption intention. Additionally, homeowners’ perceptions of landscape conservation practices (more agreeable with sustainable landscape practices) are positively correlated with sustainable landscape adoption intentions. The implications for policymakers and water conservation programs are discussed.

Keywords: knowledge; perception; sustainable landscape; ordered logit model; adoption intention

1. Introduction

Over the past two decades, urban areas in the US have increased considerably (12.1% between 2000 and 2010) [1]. Consequently, the area devoted to maintained residential landscapes has also increased substantially [2]. Traditional residential landscapes are dominated by turfgrass covered with relatively small, infrequently irrigated spaces composed of trees, shrubs, and other plants. However, poor landscape management, such as over-irrigation, fertilizer run-off, water pollution, eutrophication, or algae blooms, etc. (see also [3,4]), often causes adverse environmental consequences [5].

The benefits and consequences of traditional residential landscapes on humans and the environment have provoked debates on how to maintain landscapes in a sustainable way.
manner and conserve limited water resources while maintaining their aesthetic characteristics. Previous research has labeled the maintenance of residential and commercial lawns a growing societal and ecological concern [5–9]. Encouraging the adoption of sustainable residential landscapes and practices establishes a framework in which minimizing potential environmental consequences are possible while maintaining lawn characteristics that support essential lifestyle qualities.

Consequently, state and local governments and water management districts are promoting resource-efficient sustainable landscapes that are more environmentally friendly alternatives to traditional lawns. The sustainable residential landscapes are composed of partial turfgrass and partial non-turfgrass areas (with micro-irrigation systems) designed to conserve water resources [10,11]. In addition to environmental conservation (i.e., reduce non-point pollution through reduced chemical applications), sustainable landscapes should strive to maintain the aesthetic and functional features and also cost less to maintain [3,12].

As suggested by Hostetler [12], the research priorities for sustainable landscapes should focus on the links between homeowners’ landscape preferences and landscape features. Investigation of homeowners’ preferences for sustainable landscapes will provide useful information to stakeholders interested in water conservation and the landscape services industry. Policies and programs designed by regulatory agencies and relevant stakeholders could be more efficient and effective if public preferences and perceptions are incorporated into the decision-making process. Previous residential landscape preference studies have investigated plant materials selection, visual quality, maintenance, and environmental benefits [10,11,13–16]. Landscape preferences have been linked with perceptions of value added aspects of sustainable landscapes [15,17–22].

In addition, homeowners’ preferences for sustainable landscapes and related attributes have been greatly explored, e.g., landscape design, maintenance requirement, irrigation, as well as how incentive policy tools could affect households’ preferences and intentions to adopt sustainable residential landscapes (e.g., studies by [23] for New Mexico and Helfand et al. [13] for southeast Michigan). More recently, Zhang and Khachatryan [4,24] have evaluated homeowners’ preferences for Florida Friendly Landscaping (FFL™) and investigated the effects of monetary incentives and environmental concerns on the preferences of sustainable landscapes.

Homeowners’ behavior toward the environment may also be influenced by what they feel and think about the environment and pro-environmental actions [25]. Convincing homeowners to swap almost full turfgrass lawns with more sustainable residential landscape alternatives is not a trivial task due to homeowners’ existing landscape knowledge and perceptions, environmental attitudes, consideration of future consequences, and normative behaviors [26].

In addition to homeowners’ preference for sustainable landscapes, homeowners’ skills, knowledge, perceptions, value orientations, environmental beliefs, considerations of social norms, and a range of economic considerations may all contribute to restraining the adoption of sustainable landscapes [27]. One popular behavior theory explaining pro-environmental behavioral changes is the theory of planned behavior (TPB), developed by Ajzen [28]. As an extension of the theory of reasoned action [29], the TPB theory is a self-interest- and rational-choice-based behavioral theory that can improve the understanding of environment-related intentions and behavior. According to the TPB model, behavioral intentions are predicted by attitudes (the positive or negative appraisal of a behavioral option, subjective norm (the social pressure from reference group members to enact the behavior), and perceived behavioral control (the perceived ease or difficulty of performing the behavior) [25–29].

The TPB model has been used in environmental studies to analyze individual behavior [25,27,30,31]. As a general rule, individuals who have a high knowledge level and a positive perception/attitude toward environmental actions, perceive support from peers, and believe the ability to take part in, are more likely to engage in pro-environmental behaviors [25]. However, when investigating environmentally friendly landscapes, scant
studies have investigated how homeowners’ knowledge and perception of sustainable landscapes affect their lawn maintenance decisions.

This study follows Ajzen’s theory of planned behavior (TPB) as a framework to model individuals’ decisions regarding sustainable lawn management. As the TPB suggests, an individual’s behavior could be reflected in their attitude, subjective norms, and perceived behavioral control, such as knowledge and perception [28]. Since homeowners’ adoption intentions could directly affect their environmentally friendly behavior and, consequently, alter landscaping practices and water conservation efforts, it is useful to understand the extent to which knowledge and perception motivate their adoption of sustainable landscapes.

The objective of this study is to examine how individuals’ knowledge and perception of sustainable landscapes influence their adoption intentions and to predict their adoption behavior. It is worth mentioning that this study selected the components with homeowner self-interests, excluding values and moral considerations, as suggested by the value–belief–norm (VBN) framework [32]. Incorporating moral, altruistic considerations, such as environmental concerns (ECs), consideration of future consequences (CFCs), and the new environmental paradigm (NEP) is outside of the scope of the present study.

For analysis in this study, data were collected from residents living in the state of Florida. Florida is a state with leading efforts in water conservation and landscape transformation, with a statewide water and landscape conservation program. Research related to homeowners’ knowledge and perceptions of sustainable landscapes so far has been insufficient, given the urgency of urban landscape conservation issues in the state of Florida. Therefore, this study aims at Florida homeowners, specifically relating their knowledge and perception of sustainable landscape practices to their adoption intentions. Additionally, landscape conservation programs often use educational programs as mechanisms to encourage sustainable landscape adoption [33]. Implications from this study can be used to reinforce educational programs for water and landscape conservation, as well as for other stakeholders for informed decisions of water and landscape conservation programs.

Based on the findings from the previous literature and extant research gaps, four hypotheses related to homeowners’ sustainable landscape adoption intentions specifically focusing on their knowledge and perceptions of sustainable landscape practices were tested. Since educational programs could encourage pro-environmental behavior [33], it was hypothesized.

Hypothesis 1 (H1). Homeowners’ awareness of sustainable landscapes, e.g., “have heard of sustainable landscaping,” will be positively correlated with their adoption intentions.

Knowledge of sustainable landscape practices may influence individuals’ pro-environmental practices, it was also hypothesized.

Hypothesis 2 (H2). Higher levels of knowledge about lawns and landscapes will be positively correlated with homeowners’ sustainable landscape adoption intentions.

The third hypothesis was based upon the finding of Suh et al. [27]—namely, that homeowners’ perception of water conservation will influence their pro-environmental behavior (i.e., smart irrigation controller purchase intention).

Hypothesis 3 (H3). Perceptions of landscape conservation practices (i.e., more agreeable with sustainable landscape practices) will be positively correlated with their adoption intentions of sustainable landscapes.

In addition, previous studies also identified factors and household characteristics that affect environmentally friendly behavior [34]. Selected socio-economic variables were also examined, to understand whether heterogeneous homeowner characteristics would affect their landscape adoption intentions. Therefore, the fourth hypothesis is defined.
Hypothesis 4 (H4). **Demographic characteristics will influence adoption intentions.**

The paper is organized into five sections. Following the introduction, the Methods Section starts with the description of the survey instrument and survey sample. Next, the Methods Section discusses the ordered logit (OL) model used for estimation. The last three sections present the empirical results, discussion of the implications, and lastly, conclusions.

2. Methods

2.1. Survey and Participants Summary

To collect relevant information, an online survey was conducted in Florida using the Qualtrics XM survey software platform in November 2016. As a part of a broad sustainable landscape preferences study, the survey was pre-tested among university students to improve the survey and reduce respondent fatigue. A total of 1220 Floridian households’ responses were collected.

The survey consisted of four sections. The information of three sections was used in this study (excluding the choice experiment section). In the first section of the survey, the participants were screened to ensure they had implemented landscape practices before. The second section of the survey consisted of questions about homeowners’ awareness, knowledge, and general perceptions of sustainable landscapes, as well as homeowners’ landscape maintenance knowledge and perception of sustainable landscaping. Participants were also asked the likelihood they will install a sustainable landscape in the next 5 years. Since the survey was conducted in Florida, we asked specifically about the FFL\textsuperscript{TM} program. The third section included a standard set of socio-demographic questions. Participants’ socio-demographic characteristics are summarized in Table 1. On average, participants spent around 20 minutes completing the questionnaire.

**Table 1.** Summary of sample statistics of socio-demographic characteristics.

| Survey Sample | US Census Group \textsuperscript{b} |
|---------------|----------------------------------|
| Observations  | 1220                             |
| Age           | 51.4                             |
| Female (%)    | 58.9                             |
| Caucasian (%) | 83.0                             |
| African American (%) | 6.5                             |
| Hispanic (%)  | 4.8                              |
| Others (%)    | 5.7                              |
| Education (%) |                                   |
| High school   | 12.2                             |
| College degree (2 years above) | 67.5                             |
| Graduate degree (%) | 17.3                             |
| Employment (%) |                                   |
| Employed full time (%) | 43.2                             |
| Income (%)    |                                   |
| Less than USD 19,999 | 3.0                             |
| USD 20,000–59,999 | 37.9                             |
| USD 60,000–99,999 | 33.0                             |
| USD 100,000 above | 26.1                             |

Note: \textsuperscript{a}, Florida’s mean age reported in the Census includes individuals under 18 years old, whereas the survey sample does not include minors. \textsuperscript{b}, Data from the US Census Bureau [35].

Approximately 59% of participants were female (Table 1). The average age was 51.4 years old. Regarding the ethnic groups, 83% of respondents were Caucasian, 6.5% were African American, 4.8% Hispanic, and 5.7% indicated “other” ethnicities. About 85% of participants completed education above college level, and around 43% were currently full-time employed. Annual household income levels ranged from below USD 19,999 to above USD 100,000, although most participants (38%) were in the income range of USD 20,000–59,999, and 26.1% were in the above USD 100,000 category (Table 1). Although we aimed to collect data from a
random sample from Florida, our sample was slightly different from Florida’s population as reported by the US Census, most likely due to participant screening, which ensured participants lived in a single-family house and maintained their lawn/garden or landscape themselves or used professional landscaping services.

2.2. Ordered Logit Model

The survey used the ordered-response format for participants’ sustainable adoption intentions. The question asked about the likelihood of installation of a Florida Friendly Landscape in the next 5 years using a 7-point Likert scale (1 = extremely unlikely; 7 = extremely likely). This variable is used as the dependent variable in an ordered logit model for estimation of coefficients and deriving marginal effects regarding the knowledge, perception, and selected socio-demographic (explanatory) variables. Since the response variable has an ordinal nature, the ordered logit model was used to explore the influence of factors on homeowners’ likelihood of landscape adoption intention.

The ordered logit model estimates the probability that homeowner \( i \) takes on the value of \( y_i \) when facing the \( j \)th ordered category where \( j = 1, \ldots, m \), and where \( m \) is the number of categories of the ordinal response. The ordered logit model was specified by mapping a latent variable \( y^* \), ranging from \(-\infty\) to \(\infty\), to an observed variable \( y \) as follows:

\[
y_i = m \text{ if } k_{m-1} \leq y_i^* < k_m \text{ for } m = 1 \text{ to } J
\]  

(1)

where \( k \) is the threshold for each \( m \) category. Using the adoption likelihood with 7 categories, it can be shown as

\[
y_i = \begin{cases} 
1 \text{ if } k_0 = -\infty \leq y_i^* < k_1 \\
2 \text{ if } k_1 \leq y_i^* < k_2 \\
\vdots \\
7 \text{ if } k_6 \leq y_i^* < k_7 = \infty 
\end{cases}
\]  

(2)

The structural model then can be defined as

\[
y_i^* = x_i \beta + \epsilon_i
\]  

(3)

where \( x_i \) is the vector of the explanatory variable for the \( i \)th response, \( \beta \) is the vector of parameters, and \( \epsilon \) is the random error term. Following Khachatryan et al. [36], it is also assumed that in the ordered logit model the parameters \( \beta \) do not vary over different categories, but the cut-off parameters \( k \) vary over \( j = 1, \ldots, m-1 \). This is known as the proportional-odds or parallel-lines assumption, which implies that parameters do not change for different categories. Conventionally, for the ordered logit model, the \( \epsilon \) random error terms are assumed to have a logistic distribution with a mean of zero and a variance of \( \pi^2/3 \). Then, the probability of \( y_i \) given values of \( x \), is shown as

\[
\Pr(y_i = m|x_i) = \Pr(k_{m-1} \leq y_i^* < k_m|x_i) = F(k_m - x_i\beta) - F(k_{m-1} - x_i\beta)
\]  

(4)

where \( \Pr() \) is the probability function, and \( F() \) indicates the cumulative density function of the standard logistic distribution. Then, the likelihood function can be defined as

\[
\ln L(\beta, k|y, x) = \sum_{y_i=m} \sum_{j=1}^I \ln[F(k_m - x_i\beta) - F(k_{m-1} - x_i\beta)]
\]  

(5)

The ordered logit model was estimated to derive the coefficient estimates. The estimated parameters indicate whether the explanatory variable is likely to increase the probability that the respondents belong to a higher or lower adoption intention category. A positive parameter indicates that the explanatory variable is likely to increase the probability of the outcome (adoption intentions), and a negative parameter indicates that the explanatory variable decreases the same likelihood.

Table 2 summarizes explanatory variables used in the ordered logit model, e.g., adoption intentions, and knowledge and perceptions regarding sustainable landscapes and
practices. The average score of the likelihood of installing a sustainable landscape in the next five years is 4.04 out of 7.

Table 2. Explanatory variables estimated with sample means.

| Variables                                             | Description                                                                 | Full Sample (N = 1220) | Mean   | SD    |
|-------------------------------------------------------|------------------------------------------------------------------------------|------------------------|--------|-------|
| Adoption Intention (INTENT)                           | How likely is it that you will purchase/install a Florida Friendly landscape in the next 5 years? (1 = extremely unlikely; 7 = extremely likely). | 4.04                   | 1.63   |       |
| Awareness of FFL lawn/landscape (AWARE)              | Have you heard of the following terms: Florida Friendly Landscaping, Florida Yards and Neighborhoods, Florida Water Star Certification program (1 = Yes, 0 = No) | 0.62                   | 0.49   |       |
| Knowledge about FFL                                  | How knowledgeable are you about each of the following characteristics of your irrigation system and lawn/landscape? (1 = Not at all knowledgeable; 7 = Strongly knowledgeable) |                        |        |       |
| Knowledge of Florida Friendly Landscapes (KNOWFFL)   | Florida Friendly landscapes and principles                                    | 4.21                   | 1.81   |       |
| Knowledge of Turfgrass Care (KNOWCARE)               | Turfgrass/plant care requirements (fertilization, irrigation, etc.)           | 4.31                   | 1.72   |       |
| Knowledge of Soil (KNOWSOIL)                         | Soil information-care and type                                                | 3.79                   | 1.82   |       |
| Knowledge of Regulations (KNOWREGU)                  | Local regulations (irrigation, fertilizer, etc.) related to residential landscapes | 4.30                   | 1.86   |       |
| Knowledge of Water Conservations (KNOWWATER)         | Water conservation practices                                                  | 4.78                   | 1.67   |       |
| Knowledge of Pollinators (KNOWWILD)                  | Landscaping/gardening for wildlife and/or pollinators                        | 4.06                   | 1.82   |       |
| Perception on Sustainable Landscape Practices         | Please indicate your agreement with the following statements. (1 = strongly disagree; 5 = strongly agree) |                        |        |       |
| Appearance (APPEAR)                                  | I am concerned about the appearance of my landscape                           | 4.15                   | 0.95   |       |
| Irrigation Restrictions (RESTRICT) a                 | I am aware of any irrigation restrictions in my area                          | 3.28                   | 1.41   |       |
| Neighbors Over-irrigating (OVERIRRIGATION)           | I often see my neighbors over-irrigating                                     | 3.06                   | 1.23   |       |
| Neighbors have FFL (NEIGHBORFFL)                     | My neighbors have a Florida Friendly Landscape                               | 2.77                   | 0.98   |       |
| Fertilizer Requirements (FERTILIZER) a                | I am aware of fertilizer/nutrient restrictions in my area                     | 2.29                   | 1.23   |       |
| FFL Appearance (FFLLOOK) a                            | I know what a Florida Friendly Landscape looks like                           | 2.82                   | 1.24   |       |

Note: Variable names are in the parentheses. a, variables have inverse statements.

In total, three sets of explanatory variables were included. The first set is the awareness and knowledge about sustainable landscapes. About 62% of the participants have heard about sustainable landscape programs in Florida, such as the FFL™, Florida Yards and Neighborhoods, and Florida Water Star. Participants reported above-average knowledge levels for the programs. Knowledge about soil care and soil type received the lowest scores (3.79), followed by landscape/gardening for wildlife and pollinators (4.06). Participants were slightly more knowledgeable about the FFL™ principles (4.21), turfgrass/plant care requirements (4.31), local regulations related to residential landscapes (4.30), and water conservation practices (4.78).

Regarding perceptions of sustainable landscape practices (ranging from 1 = strongly disagree to 5 = strongly agree), participants more agreed with the statement “I am concerned about the appearance of my landscape”, followed by “I am aware of any irrigation restrictions in my area”, and by “I often see my neighbors over-irrigating”. Participants were less agreeable with the following statement “I know what a Florida Friendly Landscape looks like”, and “My neighbors have a Florida Friendly Landscape”, and “I am aware of fertilizer/nutrient restrictions in my area”.

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3. Results

The estimated coefficients from the ordered logit model for the explanatory variables are shown in Table 3. The explanatory variables include participants' knowledge levels and perceptions of sustainable landscape practices, as well as several demographic variables (Table 3). The coefficients represent the correlation of those variables with the likelihood of sustainable landscapes adoption intentions.

The first two columns in Table 3 show coefficients (log odds) and standard errors, by assuming these coefficients do not vary over different categories. The rest of the columns represent the marginal effects of the explanatory variables. The marginal effects indicate the change of the likelihood of adoption intention in each category with respect to a change in each explanatory variable. The marginal effects were estimated by using a method that relaxes the assumption that the covariates are fixed, thus allowing for heteroskedasticity and correlation among the observations.

Since the coefficients taken in isolation are less meaningful for empirical interpretation, here we only discuss the marginal effects with regard to the four hypotheses defined in the introduction. In addition, the marginal effects reported in Table 3 are for all 7 categories of the likelihood of adoption intentions. However, focusing on categories 6 and 7 is because it is more meaningful to discuss the effects on the high likelihood of adoption intentions.

3.1. Knowledge on Sustainable Landscape and Adoption Intentions

The results from the ordered logit model support the first two hypotheses. If the participants are informed, i.e., have heard the terms of sustainable landscapes and practices such as the FFL™ or Water Star Program, they are more likely to adopt the sustainable landscape in the next five years, with a significant coefficient of 0.310. In terms of the marginal effect, if participants have heard about the sustainable landscaping-related programs in Florida, they are 1.8% and 1.6% more likely to be in the top two adoption intentions categories (likely and very likely). In general, higher knowledge levels are associated with increased adoption likelihood (Table 3). Respondents' knowledge levels of soil types and gardening for wildlife and pollinators are positively correlated with the adoption likelihood. Specifically, if the participants are more knowledgeable about the soil care and type information, they are 0.8% more likely to select “likely” and “very likely” to adopt sustainable landscapes. Higher knowledge about landscaping for wildlife and pollinators increases the probability of choosing “likely” and “very likely” to install sustainable landscapes by 1.5%.

However, not all knowledge variables show significant results. It was found that knowledge about Florida Friendly Landscaping, turfgrass care, water conservation practices, and local regulations do not positive effects on the likelihood of adoption. It is likely that knowledge about soil types and landscaping for wildlife and pollinators represent participants' objective knowledge, while other knowledge variables, e.g., FFL principles, water conservation, and local regulation, could be more toward subject knowledge. Participants with more objective knowledge about sustainable landscaping could be more likely to adopt sustainable landscapes. Further research is needed to differentiate the objective knowledge level from the subjective knowledge of sustainable landscapes to further examine the correlation between knowledge and the likelihood of adoption.

In summary, Hypotheses 1 and 2 are supported. Homeowners' awareness of sustainable landscapes and their knowledge about sustainable landscaping practices (more knowledgeable) are positively correlated with their sustainable landscape adoption intentions. These results confirm the importance of education programs that create awareness of environmental protection and transfer knowledge about pro-environmental practices, both in water and landscape conservation. As suggested in the previous studies [12,33], landscape conservation programs could use educational programs as a mechanism to establish awareness and transfer relative knowledge for encouraging sustainable landscape adoption.
Table 3. Ordered logit regression coefficient and marginal effect estimates of Florida consumers’ adoption intention of sustainable landscapes.

| Estimated Coefficients | Marginal Effects (on Purchase Likelihood) |
|------------------------|------------------------------------------|
|                        | Coef. | se 1 | se 2 | se 3 | se 4 | se 5 | se 6 | se 7 | se 8 | se 9 | se 10 | se 11 | se 12 | se 13 |
| Knowledge about Sustainable Landscape Practice | | | | | | |
| AWARE                  | 0.310 ** | 0.121 | −0.026 ** | 0.010 | −0.014 ** | 0.006 | −0.008 ** | 0.003 | −0.005 ** | 0.003 | 0.020 ** | 0.008 | 0.018 ** | 0.007 | 0.016 ** | 0.006 |
| KNOWFFL                | 0.057 | 0.055 | −0.005 | 0.005 | −0.003 | 0.003 | −0.002 | 0.001 | −0.001 | 0.001 | 0.004 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| KNOWCARE               | 0.013 | 0.051 | −0.001 | 0.004 | −0.001 | 0.002 | −0.000 | 0.001 | −0.000 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.003 | 0.003 |
| KNOWSOIL               | 0.149 *** | 0.056 | −0.012 ** | 0.005 | −0.007 *** | 0.003 | −0.004 *** | 0.002 | −0.003 ** | 0.001 | 0.010 *** | 0.004 | 0.008 *** | 0.003 | 0.008 *** | 0.003 |
| KNOWREGU               | −0.028 | 0.048 | 0.002 | 0.004 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 | 0.001 | −0.002 | 0.003 | −0.002 | 0.003 | −0.001 | 0.003 |
| KNOWWATER              | 0.021 | 0.0481 | −0.002 | 0.004 | −0.001 | 0.002 | −0.000 | 0.001 | −0.000 | 0.001 | 0.001 | 0.003 | 0.001 | 0.003 | 0.001 | 0.003 |
| KNOWWILD               | 0.268 *** | 0.052 | −0.022 *** | 0.005 | −0.013 *** | 0.003 | −0.007 *** | 0.002 | −0.005 *** | 0.002 | 0.017 *** | 0.003 | 0.015 *** | 0.003 | 0.014 *** | 0.003 |
| Perception on Landscape and Water Conservation Practice | | | | | | |
| APPEAR                 | 0.376 *** | 0.062 | −0.031 *** | 0.005 | −0.018 *** | 0.003 | −0.010 *** | 0.002 | −0.006 *** | 0.002 | 0.024 *** | 0.004 | 0.021 *** | 0.004 | 0.020 *** | 0.004 |
| RESTRICT               | 0.053 | 0.047 | −0.004 | 0.004 | −0.003 | 0.002 | −0.001 | 0.001 | −0.001 | 0.001 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 |
| OVERIRRIGATION         | −0.090 * | 0.050 | −0.007 * | 0.004 | −0.004 * | 0.002 | −0.002 * | 0.001 | −0.002 * | 0.001 | 0.006 * | 0.003 | 0.005 * | 0.003 | 0.005 * | 0.003 |
| NEIGHBORFFL            | 0.378 *** | 0.068 | −0.031 *** | 0.006 | −0.018 *** | 0.004 | −0.010 *** | 0.002 | −0.006 *** | 0.002 | 0.024 *** | 0.005 | 0.022 *** | 0.004 | 0.020 *** | 0.004 |
| FERTILIZER             | −0.099 * | 0.054 | 0.008 * | 0.004 | 0.005 * | 0.003 | 0.003 * | 0.001 | 0.002 | 0.001 | −0.006 * | 0.003 | −0.006 * | 0.003 | −0.005 * | 0.003 |
| FFLLOOK                | 0.290 *** | 0.058 | −0.024 ** | 0.005 | −0.014 ** | 0.003 | −0.008 ** | 0.002 | −0.005 ** | 0.002 | 0.019 *** | 0.004 | 0.017 *** | 0.003 | 0.015 *** | 0.003 |
| Selected Demographics  | | | | | | |
| CHILDREN               | 0.240 *** | 0.052 | −0.020 *** | 0.004 | −0.011 *** | 0.003 | −0.006 *** | 0.002 | −0.004 *** | 0.001 | 0.015 *** | 0.004 | 0.014 *** | 0.003 | 0.013 *** | 0.003 |
| EMPLOY                 | 0.285 ** | 0.114 | −0.023 ** | 0.010 | −0.014 ** | 0.006 | −0.008 ** | 0.003 | −0.005 * | 0.003 | 0.018 ** | 0.007 | 0.016 ** | 0.007 | 0.015 ** | 0.006 |
| EDUCATION              | 0.062 * | 0.037 | −0.005 * | 0.003 | −0.003 * | 0.002 | −0.002 * | 0.001 | −0.001 | 0.001 | 0.004 * | 0.002 | 0.004 * | 0.002 | 0.003 * | 0.002 |
Table 3. Cont.

| Coef. | se 1  | se 2  | se 3  | se 4  | se 5  | se 6  | se 7  |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1     | 3.537 | 0.439 |       |       |       |       |       |
| 2     | 4.461 | 0.445 |       |       |       |       |       |
| 3     | 5.028 | 0.449 |       |       |       |       |       |
| 4     | 6.832 | 0.465 |       |       |       |       |       |
| 5     | 8.354 | 0.487 |       |       |       |       |       |
| 6     | 9.690 | 0.515 |       |       |       |       |       |

Note: *, **, and *** indicate 10%, 5%, and 1% significance levels. Akaike’s Information Criteria (AIC) and Bayesian Information Criteria (BIC) are reported for goodness of fit of the ordered logit model.
3.2. Perception on Sustainable Landscapes and Adoption Intentions

The third hypothesis (H3) that perceptions on landscape conservation practices (more agreeable with the practices) will be positively correlated with intentions to adopt sustainable landscapes is also supported by the estimated results from the ordered logit model. Participants who are more agreeable with sustainable landscaping and water conservation practices are more likely to adopt sustainable landscapes.

Participants with higher perceptions about the appearance of landscapes and who believe their neighbors over-irrigate are more likely to adopt sustainable landscapes. Specifically, for homeowners with more concerns about the appearance of their landscape, the probability of selecting “likely” and “very likely” to adopt sustainable landscapes increases by 2.1%. For participants with a higher perception of neighbors over-irrigating, the probability of selecting “likely” and “very likely” increases by 0.5%.

Regarding the perception of FFL’s, participants who are more agreeable with neighbors having FFLs and know what an FFL looks like have an increased probability of adoption by 2.1% (average) and 1.6% (average), respectively. It seems adoptions are substantially increased for participants who live in areas with existing sustainable landscape sites and have neighborhood norms and peer pressure. This finding further confirms the importance of individuals’ perceptions (in addition to knowledge) for sustainable landscapes adoption. While the level of knowledge about sustainable landscapes has a positive correlation with adoption intentions, positive and concrete perception further increases the likelihood to adopt.

However, participants’ perception of irrigation restrictions has no significant effects on adoption intention. Furthermore, if participants are more agreeable/aware of fertilizer restrictions, they are slightly less likely to adopt sustainable landscapes. Specifically, participants are 0.6% less likely to adopt sustainable landscapes. The result that the perception about fertilizer restriction decreases the adoption likelihood was unexpected. The relationship between restriction perceptions and adoption intentions needs further investigation to ensure this result can be supported. Particularly, it is necessary to replicate this finding in order to avoid any misleading information of restriction-based policies and adoption intentions. Alternatively, this result could be negative because homeowners recognize they are not as knowledgeable as they should be on fertilizer requirements for a sustainable landscape (i.e., Maslow’s hierarchy of conscious competency). This presents an area for educators and industry members to provide simple measures to help participating homeowners know what the policies are regarding fertilizer and how much is required of their landscape. As many studies have addressed, working on environmental attitude/perceptions could substantially encourage homeowners’ environmentally friendly behaviors [25,27,31], including environmentally friendly landscaping practices.

Finally, several socio-demographic variables also influence homeowners’ likelihood of adopting sustainable landscapes. For example, for participants with higher education levels, fully employed, and with more children, the probability to adopt sustainable landscapes by selecting “very likely” increases by 0.4%, 1.6%, and 1.4%, respectively. The socio-demographic characteristics, with less substantial effects, are also relevant for the adoption intentions, which are partially in line with the early study of socio-demographic factors influencing pro-environmental behavior [34].

In summary, Hypotheses 3 and 4 that perceptions regarding landscape and water conservation practices and selected socio-demographics positively affect sustainable landscape adoption intentions were supported.

4. Discussion

Limited studies have focused on homeowners’ knowledge and perception of sustainable landscaping practices. Since these factors could directly affect homeowners’ sustainable landscape adoption intentions and related environmentally friendly behaviors, this study aimed to fill the research gap by examining how homeowners’ knowledge and perceptions of sustainable landscapes affect their adoption intentions.
Homeowners’ awareness and knowledge levels on sustainable landscaping practices positively affect their alternative landscape adoption intentions. In general, homeowners with higher knowledge levels have a higher likelihood of adoption. The more that a Florida homeowner knows of the sustainable landscape programs such as Florida Friendly Landscapes and Water Star, the more likely they will participate. These findings provide practical implications for organizations involved in landscape and water conservation such as the Florida Department of Environmental Protection and Water Management Districts, as well as local water conservation programs, extension educators, and local conservation organizations. Information about sustainable landscapes adoption intentions could be incorporated into educational programs to promote sustainable landscapes, to establish the awareness of sustainability as well as to increase public understanding of the environmental and societal benefits associated with alternative landscapes. This result also plainly lays out the relative success that the sustainable landscape programs have thus far sought to achieve—thorough information sharing results in participation. Along with the landscape incentives, as laid out in previous literature, enhancing homeowners’ awareness and knowledge could substantively synergize the effects for convincing homeowners to adopt sustainable landscapes through additional marketing and promotion.

Homeowners’ perceptions regarding sustainable landscaping practices also directly influence their adoption intentions. Participating homeowners who were more agreeable about sustainable landscaping and water conservation practices were significantly more likely to adopt alternative landscapes. Therefore, landscape conservation programs could benefit from improving homeowners’ perceptions of sustainable landscapes and assessing periodically whether the perceptions for sustainable landscapes have changed. Developing concrete and convincing communications with homeowners could significantly improve households’ awareness and perception pertaining to sustainable landscapes. More importantly, it is crucial to communicate and promote sustainable landscapes, but also to make them highly visible to homeowners. Making FFL physically visible and helping homeowners fully aware of how an FFL should look, i.e., developing new neighborhoods or retrofitting existing homes to showcase the FFL principles, can substantially improve homeowners’ perceptions of sustainable landscapes. These practices could positively affect individuals’ preferences for sustainable landscapes and, consequently, affect the adoption decisions. Speaking with developers and contractors for new neighbors as well as presenting the benefits of sustainable landscapes at homeowner association (HOA) meetings could help promote the installment of FFL and could also improve the rate of acceptance. A potential follow-up to this study could include investigating signage signaling of sustainable practices among homeowners to further investigate neighborhood awareness of sustainable landscape practices.

5. Conclusions

To promote the adoption of sustainable residential landscapes, state and local governments, water management districts, and educational outreach organizations are involved in landscape conservation programs. Converting traditional turfgrass lawns with more water-efficient sustainable landscape options is one of the alternatives that relevant stakeholders are interested in learning more about. For landscape conservation program developers, the implications are twofold. First, synergistically incorporating knowledge and environmental benefits information into the educational programs can improve homeowners’ general perception of sustainable landscapes. This could be an important premise to influence homeowners’ preferences, thus increasing the probability of adoption. Landscape conservation programs, such as the FFL™ program, often use educational programs as a mechanism to encourage sustainable landscape adoption. Secondly, measurements of the knowledge level and homeowners’ perception indicators can be combined with the actual adoption rate to reflect the effectiveness of conservation programs. It is expected that findings from this study can be used to reinforce water- and landscape-conservation-related educational programs. Results also provide useful implications for other stakeholders for
informed decision making as it pertains to increasing the adoption of environmentally friendly landscapes and related practices.

This study is not free of limitations. This study focuses mainly on homeowners’ knowledge level and perceptions about sustainable landscapes. In addition to these factors, future research can incorporate the effects of moral considerations (e.g., environmental concerns) among homeowners. Future research can further investigate the effects of factors in terms of homeowners’ moral factors, e.g., environmental attitude, consideration of future consequences, following the VBN framework. Understanding the possible interactive effects could help improve landscape conservation programs that are designed to encourage sustainable residential landscaping practices.

**Author Contributions:** Conceptualization, X.Z. and H.K.; Data curation, X.Z.; Formal analysis, X.Z.; Investigation, H.K.; Methodology, X.Z. and H.K.; Project administration, H.K.; Writing—review & editing, M.K. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was supported by the Center for Landscape Conservation and Ecology at the University of Florida.

**Institutional Review Board Statement:** This study was approved by the Institutional Review Board of University of Florida (IRB201600776 in October 2016).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data and STATA code are available upon request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

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