Green Industry Experts' Consensus about Wildlife-Friendly Landscape Maintenance: Delphi-Informed Implications for Agricultural and Extension Educators

Abstract

This study was designed to understand the current state of wildlife-friendly landscape maintenance practices and the associated barriers and motivations among Florida green industry professionals. A Delphi technique to achieve consensus, along with descriptive survey questions, was used to facilitate feedback from Florida-based green industry professionals and Extension professionals. The expert panel identified 55 wildlife-friendly landscape activities, 25 barrier items, and 25 motivator items. Descriptive findings showed that green industry professionals believe, on average, Florida residents request wildlife-friendly maintenance services less frequently than wildlife-friendly landscape services are offered by Florida green industry professionals. Consensus findings demonstrated the barriers with the greatest agreement were a lack of public awareness about wildlife-friendly landscaping, its ecological and environmental benefits, professional focus on profit, homeowner association (HOA) regulations, and demand for formal landscape aesthetics. Consensus findings also revealed Florida green industry's major motivators were clients' demand for native, Florida-Friendly plants and wildlife-supporting landscapes, the desire to promote the company as wildlife-friendly, and public interest in native and Florida-Friendly Landscaping. Extension professionals, along with policymakers, educators, and program planners should reduce the identified barriers and expand on the motivators to encourage green industry professionals to engage in landscape maintenance activities that support wildlife.

Keywords: barriers; green industry; landscape; motivators; wildlife-friendly

Introduction

The green industry, a key clientele group served by Extension, comprises a wide range of enterprises, including the production and distribution of ornamental plants, landscape design, and maintenance, and the provisioning of garden supplies (Coastal Research and Extension Center, 2022; Hall et al., 2020; Hodges et al., 2015). The green industry has long been an expanding sector of the United States (U.S.) economy and remains a significant economic contributor (Hall et al., 2017; Hall et al., 2020). In 2018, the green industry's direct economic contribution nationally was 159.57 billion dollars, while providing employment to 1,599,662 individuals in the United States (Hall et al., 2020). Similarly, Florida's green industry in 2021 produced a record 31.4 billion dollars in economic output and created job opportunities for more than 266,000 workers (Novakovic, 2022). The design, management, and maintenance of green spaces in residential, commercial, and public landscapes are some of the key activities of this industry.

As part of its mission to translate and disseminate evidence-based information for specialized groups (National Institute of Food and Agriculture, n.d.), Extension supports the overall growth of the green industry by offering crucial trainings for green industry employee development (Bitsch & Harsh, 2004; Johnson & Christensen, 1995). For instance, the University of Florida's Green Industry Best Management Practices Extension program delivers education to build capacity among people who engage in lawn care and landscape maintenance. This program alone has engaged over 250 instructors and has certified over 59,000 professionals to date (UF/IFAS Extension, n.d.). Extension also plays a

crucial role in overcoming the language and cultural barriers for green industries workforces, thereby contributing to the enhancement of productivity, efficiency, and safety by developing training and other educational programs in dominant (e.g., Spanish) languages among the workforce (Martinez-Espinoza et al., 2003). Extension professionals also aid in the dissemination of innovations like water treatment technologies to protect water resources (Lamm et al., 2019) and automated nursery technologies that can increase production efficiency (Warner et al., 2022).

Landscaped green spaces are often created or maintained to enhance the quality of human life by positively influencing one's social, physical, psychological, cognitive, spiritual, and environmental well-being (Hall & Dickson, 2011). Private landscapes comprise the greatest amount of green space in most cities, presenting the tremendous potential for expanding wildlife-friendly habitats, improving the quality of ecosystem services, and providing residents with opportunities to reconnect with nature (van Heezik et al., 2012). In addition to the capacity to directly benefit human beings, landscaping practices that create or enhance green spaces play a key role in promoting the health of pollinators such as bees, butterflies, and other insects, and wildlife, which are indispensable to maintaining agricultural productivity, as well as the functionality and overall health of ecosystems (Allen-Perkins et al., 2022; Hopwood et al., 2015; Jordan et al., 2021; McIntyre, 2014; Richard, 2001; Steffan-Dewenter et al., 2005). With support from Extension professionals and other service providers, green industry professionals involved in landscape planning, installation, and maintenance could play a central role in protecting wildlife.

The types of plants included in green spaces can impact the degree to which urban areas support pollinators (Johnson & Swan, 2014), and green industry professionals are actively involved in plant selection decisions. Turfgrass lawns are the primary component of many green spaces (Helfand et al., 2006) and are commonly linked to decreased biodiversity, high water usage, high pesticide and fertilizer input, and other negative environmental impacts (Bormann et al.,1993; Larson et al., 2017; Templeton et al., 1999). On the other hand, yards designed with native plants have been shown to support biodiversity, require fewer external inputs, and provide more environmental benefits (Bormann et al., 1993; Burghardt et al., 2009; Butler et al., 2012; Diekelmann & Schuster, 2002). Relatedly, the concept of *right plant, right place* – a research-based concept promoted by Extension – outlines the importance of matching appropriate plants to microclimates by considering available sunlight, soil, and water, which leads to thriving plant communities and supportive habitat for wildlife (Beck et al., 2013; Link, 2017; Yarrow, 2009). Further, evidence demonstrates that the rate of land protection is less than the rate of land development, emphasizing the importance that new development approaches consider residential landscape design and maintenance to support wildlife (Hostetler & Reed, 2014).

Urban green spaces have been broadly ignored in wildlife conservation efforts, but these residential, commercial and public spaces have the capacity to support diverse plant species, habitats, and pollinators (Apfelbeck et al., 2020; Baldock, 2020; Lowenstein et al., 2015; McCleery et al., 2014; Van Helden et al., 2020), indicating a space where Extension and green industry professionals can collaborate to support wildlife. Despite recommendations that wildlife should be considered in park, open space, and backyard management (Adams, 2014), some traditional landscape maintenance practices continue to be employed that are detrimental to, rather than supportive of, wildlife. For example, studies have shown more frequent mowing results in low abundance and richness of bees, decreased plant species richness, and decreased flower- pollinator interactions (Phillips et al., 2019; Wastian et al., 2016; Yang et al., 2019). These practices, in addition to habitat loss, herbicide/pesticide application, the spread of disease, and many other urban landscape-related factors, have led to pollinator decline (Baldock, 2020; Hopwood et al., 2015).

While some urban landscapes are managed solely by the resident or homeowner, green industry professionals play significant roles in decision-making pertaining to home landscapes with environmental and conservation implications (Cook et al., 2012). For instance, the industry can educate consumers about landscape maintenance choices that support wildlife, including insect pollinators. Through their activities, green industry professionals also have an enormous opportunity to protect pollinators and wildlife with improved landscape and green space management activities such as adding flowering plants, improving or preserving existing natural vegetation, providing nesting opportunities and habitat connectivity, reducing pesticide use, increasing plant diversity, and decreasing the frequency of mowing (Baldock, 2020; Klein et al., 2007; Van Helden et al., 2020). While barriers exist, such as consumers' disinterest in purchasing native plants due to a lack of knowledge (Zadegan et al., 2008), opportunities, such as people's willingness to pay more for well-designed yards with ecological characteristics, have also been identified (Helfand et al., 2006).

In response to the need for residential green spaces to better support wildlife, some Extension initiatives from different land-grant university systems provide educational resources related to native plant species, invasive plant species, landscape practices that support wildlife, and other relevant topics (Feather, 2015; Pierce et al., 2016; Stacey & Dale, 2020). For example, in the state of Florida, the Florida-Friendly Landscaping Program™ program incorporates nine principles that include using the *right plant, right place* principle to reduce requirements for additional water, fertilizer, and pesticides (Momol et al., 2019). Extension's engagement with green industry professionals and residential end-users may be an avenue to significantly improve decision-making and adoption of practices that promote wildlife-friendly landscape practices.

Successful Extension programs rely on sound needs assessments to develop tailored education and programming for target audiences. Needs assessments aim to determine and address gaps between the present and the desired state of some phenomena by dissecting the causes of major needs and prioritizing solutions and opportunities to address issues (Witkin & Altschuld, 1995). Since needs vary even among similar populations, it is essential to perform need assessments to obtain information and perceptions of values to guide policymaking and program decisions (Witkin & Altschuld, 1995). Needs assessments can also help identify areas that will benefit the greatest number of individuals over time (Donaldson & Franck, 2016). Designed as a needs assessment exercise, this study aimed to document the present state of wildlife-friendly landscape maintenance, and specifically to understand the current practices, barriers, and motivations among Florida's green industry professionals regarding landscape maintenance that support wildlife. Perceived barriers and motivators of engaging in wildlife-friendly landscape maintenance were gathered to assess the factors green industry professionals might consider when engaging in such landscape services (Hastings & Saren, 2003).

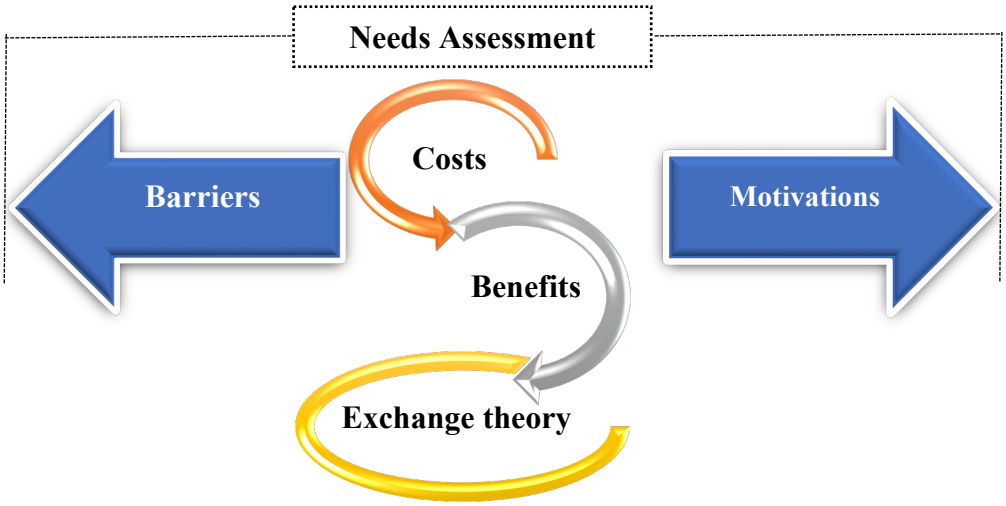
Theoretical Framework

This study used exchange theory as a basis to understand green industry professionals' perceived benefits and costs regarding the adoption of wildlife-friendly landscaping maintenance practices (see Figure 1). According to Peterson (2013), exchange theory focuses on exchanges in relationships and interactions. Exchange theory can be used to understand people's adoption or rejection of particular behaviors, framing exchanges as driven by people's desire to satisfy their own needs (Houston & Gassenheimer, 1987). Maibach (1993) stated that if perceived benefits outweigh the perceived costs of engaging in a behavior, then voluntary adoption is likely. In this study, motivators are conceptualized as aspects of behaviors that increase benefits among green industry professionals. Similarly, barriers are considered aspects associated with greater perceived costs. Like a commercial transaction – in which a consumer might buy some product they perceive to offer adequate value for

the cost – an individual may adopt a practice when they believe the costs associated with the behavior change are justified by the benefits to be received (Lee & Kotler, 2011). Extension professionals can use this theory to drive change by offering benefits to their audience values while reducing barriers to adoption (Grier & Bryant, 2005).

Figure 1

Understanding Landscape Professionals' Barriers and Motivators to Wildlife-Friendly Landscapes Based on Exchange Theory



Accordingly, Extension professionals who work with the green industry will be best positioned to encourage maintenance practices that support wildlife when they understand their target audience's perceptions, including their motivators and barriers pertaining to wildlife-friendly landscape maintenance. For example, a study conducted in the United Kingdom (U.K.) found that landscape professionals preferred more natural landscapes because of "concern for nature/wildlife conservation, environmental education, public benefits, community participation and sustainability whereas their preference for formal landscape was because of public demand, appropriateness of formal design in the urban environment, and experience in formal design" (Özgüner et al., 2007, p. 41-42). Hastings and Saren (2003) suggested that customer willingness to change would increase if they were provided with something beneficial in exchange. In this context, exchange theory could be used to promote wildlife-friendly landscaping if barriers are reduced, and motivators are amplified. A thorough literature review found very little regarding green industry professionals' influences on wildlife-friendly landscaping and no research on the current practices or perceived benefits and barriers to engaging in this type of landscape maintenance in Florida. Much of the related work has focused on residents' perceptions and engagement in landscaping to support pollinators and wildlife and, to a lesser extent, growers' participation in providing appropriate plant material. Overall, connections between green industry professional landscape maintenance practices and wildlife-friendly landscaping have been inadequately explored from a social science perspective.

Purpose and Objectives

The dual purpose of this study was to identify the most common landscape maintenance activities that support wildlife and employ Delphi techniques to achieve consensus regarding barriers and motivators pertaining to wildlife-friendly landscape maintenance. The following three research objectives guided this study:

1. Identify the frequency with which landscape maintenance activities pertaining to wildlife corridors are offered and requested.
2. Achieve consensus on the barriers to landscape maintenance activities that support wildlife-friendly landscaping.
3. Achieve consensus on the motivators for landscape maintenance activities that support wildlife-friendly landscaping.

Methods

Study Design

To meet our first study objective, we developed a survey designed to assess the frequency of common wildlife-friendly maintenance practices. To meet objectives two and three, which required the more interpretive opinions and perspectives of our participants, we used a three- round Delphi technique to achieve consensus on barriers and motivators related to wildlife-friendly landscape maintenance among green industry professionals. The frequency questions were embedded in the Delphi round one and two instruments but were not included in the consensus-building process because understanding common practices does not involve opinion or perspective. The Delphi technique assists in facilitating the prioritization of needs as well as the identification of an audience's current situations, motivations, and barriers (Brodeur et al., 2011; Campos-Climent et al., 2012). The Delphi approach assumes expert opinion can best address some issues or research questions, compared to empirical inquiry (Gordon, 1994). Policy formulation, decision-making, program planning, forecasting, and inquiry of knowledge are some areas where Delphi has been most used (Linstone & Turoff, 2002). Particularly, in Extension and non-formal education contexts, the Delphi technique had been used to identify target competencies for Extension professionals, horticultural educators, and international agricultural development professionals, and inform curricula and training development (Basinger et al., 2009; Callahan et al., 2010; Campos-Climent et al., 2012; Conner et al., 2013; Harder et al., 2010; Lamm et al., 2021). Furthermore, Warner (2014) suggested Delphi can be tailored for Extension contexts to determine programmatic priorities and objectives, identify strengths and weaknesses of local industry stakeholder engagements, evaluate programs, and measure barriers and motivators of a target audience to a particular behavior. Given its demonstrated utility in this area, we used the Delphi technique as a needs assessment tool to gather current information to inform future education, and priority targeting Florida's green industry professionals in relation to wildlife-friendly landscaping (Cuiccio & Husby-Slater, 2018).

Population and Sample

We formed an expert panel (Linstone & Turoff, 2002) comprised of green industry professionals working in Florida and allied practitioners (e.g., Extension and research professionals working in the horticulture field). Since the study required specific expertise related to the green industry, we adopted purposive sampling to seek out and connect with individuals aligned with pre-established criteria (Myers & Thompson, 2009; Plowright, 2011; Warner et al., 2016). First, we sent emails to key leaders who we identified as being well connected within and highly knowledgeable about Florida's green industry and the study context. Our internal team included individuals who work in the study context and therefore had access to some of these target key leaders. We internally screened

those potential key leaders and requested nominations based on a provided list with the following specific criteria needed on the expert panel to engage individuals actively engaged in Florida's green industry: well-respected by green industry professionals, familiar with (i.e., expertise in) landscape management and maintenance practices, and conducting landscape maintenance, overseeing landscape maintenance, or supporting the industry in another way, such as through education or research. We assessed the qualifications of nominated individuals by examining their formal professional positions in the green industry, current industry involvement, and formal group memberships. Based on the responses and recommendations, we sent a recruitment email to qualified prospective participants to invite them to join the expert panel. Out of 49 nominees, 29 agreed to participate in the Delphi study, which was greater than the threshold of 13 panelists required to ensure acceptable reliability (Dalkey, 1969).

Instrumentation and Data analysis

Qualtrics^{XM} was used to design a sequence of online questionnaires to collect data from expert panel members. Multiple rounds of anonymous feedback are used to achieve group consensus in Delphi studies (Geist, 2010). Our Delphi data collection and consensus-focused analysis were conducted over three rounds. The data related to frequency of offering and demand were collected in the first two rounds. The number of rounds may depend on the researcher's decisions and design, but many successful Delphi studies have included three rounds (Barry et al., 2021; Custer et al., 1999; Linstone & Turoff, 2002; Ludwig, 1997; Warner et al., 2016). For each round, two weeks were allocated to respond to questions (open-ended questions in round one and close-ended Likert-type questions in rounds two and three), and a reminder email was sent after the first seven days of a survey's distribution. A second reminder was sent a day before the final deadline. There were 37 days between the completion of the first round of data collection and the start of round two and seven days between the closing of the second and the beginning of the third round. In total, data collection lasted 86 days. All data analyses were conducted using Statistical Package for Social Sciences (SPSS; version 27.0.0.0, IBM Corp., Armonk, NY).

Round 1

Generally, the Delphi study begins with open-ended questions (Linstone & Turoff, 2002; Terry & Osborne, 2015). In round one, we asked the expert panel three different open-ended questions (see Table 1) to identify landscape maintenance practices that support native and Florida-Friendly plants and wildlife that uses them and to identify the barriers and motivators pertaining to wildlife-friendly landscaping. Across all three open-ended questions, the expert panel provided 206 wildlife-friendly landscaping maintenance practice statements, 121 motivating factor statements, and 110 barrier statements. Thematic analysis was used to analyze the open-ended responses obtained in the first round of Delphi to generate codes and themes based on commonalities and contrasts across open-ended responses (Braun & Clarke, 2006; Terry et al., 2017). In this process of analyses, raw data were first broken down into individual statements, and then they were reworded into individual behaviors. Duplicate items were consolidated and removed where appropriate. Moreover, qualitative responses were systematically identified, analyzed, and patterns of meaning or theme were interpreted in the thematic analysis (Clarke & Braun, 2017; Guest et al., 2011; Terry et al., 2017). This process generated a consolidated list of 55 unique wildlife-friendly landscape maintenance practices, 25 motivators, and 25 barriers which were then compared to the initial responses to ensure no deviation in meaning. In round one, all members of the expert panel (n = 29) participated with a 100% response rate.

Table 1

Round One Instrument: Open-ended Question Prompts

Question number	Open-ended question prompts
Question 1	Florida's landscape maintenance professionals may engage in a variety of landscape maintenance practices that support native and Florida-Friendly plants and the variety of wildlife that uses them. These practices can take place one-time or regularly and at any time in the life of a landscape or greenspace. Please use the space provided to list specific practices or services the Florida landscape maintenance industry engages in to protect native and Florida-Friendly plants and wildlife that use them. Please list as many as you can think of here.
Question 2	In the previous question, you added to a list of practices Florida's landscape maintenance professionals engage in that support native and Florida-Friendly plants and the variety of wildlife that use them. Many factors could encourage Florida's landscape maintenance professionals to engage in landscape maintenance practices that support native and Florida-Friendly plants and the variety of wildlife that use them. Please list here the primary factors that may motivate Florida's landscape maintenance professionals to engage in maintenance activities that support native and Florida-Friendly plants and wildlife. The next two rounds of this study will be based on the responses received here. Please list as many motivators as you feel are important.
Question 3	Lastly, many factors can prevent or hinder Florida's landscape maintenance professionals from engaging in landscape maintenance practices that support native and Florida-Friendly plants and the variety of wildlife that use them. Please list here the primary barriers that may prevent Florida's landscape maintenance professionals from engaging in maintenance activities that support native and Florida-Friendly plants and wildlife. The next two rounds of this study will be based on the responses received here. Please list as many barriers as you feel are important.

Round 2

In round two, consolidated landscape maintenance activities, barriers, and motivator items from round one were presented alongside Likert scales in survey form. In the first two questions of round two, we asked the expert panel to rate how frequently wildlife-friendly landscape maintenance practices were offered by Florida green industry professionals and requested by Florida residents, respectively. Both frequency scales were constructed with seven points ranging from 1 (*Never*) to 7 (*Always*). Then, as part of the Delphi process, the expert panel was asked to rate their agreement and disagreement regarding barriers and motivators using a Likert scale constructed with seven points ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Like other Delphi studies, we defined consensus *a priori* as two-thirds (~67%) agreement consensus of *agree* or *strongly agree* (Boyd, 2003; Shinn et al., 2009). We calculated means and standard deviations for the wildlife-friendly landscape maintenance practices and descriptive frequencies for the barriers and motivators items. Individual barriers and motivators items that achieved consensus in round two were considered for round three, while other items that did not achieve consensus were excluded. In round two, 26 expert members participated, with a response rate of 89.65%.

Round 3

In round three, landscape maintenance activities were not repeated because our objective for that data was to assess how often such practices are being offered and requested by green industry professionals and residents respectively. The barriers and motivator items that reached the two-thirds consensus threshold were sent to the expert panel members, who were asked to repeat the same process as in round two. Repetition of the process increases the certainty about the obtained results, thus increasing confidence in the accuracy and reducing errors (Chan et al., 2001; Gemenis, 2015). Again, descriptive frequency tables were generated, and items that reached two-thirds consensus were advanced to compose the final set of data. In round three, 20 out of 29 expert members participated, with a response rate of 68.96%.

Trustworthiness and Rigor

Prior to the commencement of the study, the University of Florida Institutional Review Board reviewed the research protocol and approved it. We followed recommended measures to bolster the study's credibility (Lincoln & Guba, 1985). Namely, faculty and graduate student peers from the College of Agricultural and Life Science at the University of Florida participated in a peer review process in which raw data, open coding, and thematic structures were examined and scrutinized. Each team member offered their opinion on how the responses should be organized, and the researcher and peer evaluators consulted to address any differences. The research process was debriefed, and constructive input was offered to improve the study's methodologies and analyses (Lincoln & Guba, 1985). Trustworthiness is further supported through detailed and accurate reporting of our study design and data analysis procedures (Varndell et al., 2021). Our quality-control to form a representative and qualified panel also contributes to the rigor of the study and specifically ensures credibility and confirmability (Lincoln & Guba, 1985). Expert panel members' mean years of green industry experience was 25.38 (SD = 11.54, n = 24) years which further supports the trustworthiness of the research and findings (Hsu & Sandford, 2007). In rounds two and three participants also had opportunities to provide anonymous open-ended feedback such as criticisms, concerns, or ideas, which contributed to member checking and enhanced the study's credibility (Creswell & Miller, 2000; Lincoln & Guba, 1985; Varndell et al., 2021).

Results

Objective One: Identify the frequency with which landscape maintenance activities pertaining to wildlife corridors are offered and requested.

The mean frequency of professionals offering wildlife-friendly landscape practices ranged from 1.83 (interpreted as *rarely*) to 5.71 (interpreted as *usually*) (see Table 2). The use of mulch to suppress weeds and conserve soil moisture had the highest mean, meaning it was ranked as the most frequently offered practice. Landscape activities related to following fertilizer blackout periods (i.e., temporary bans), planting the *right plant in the right place*, avoiding the use of invasive plants, planting fruiting and flowering native and/or Florida-Friendly plants, and using appropriately placed native and/or Florida-Friendly plants are some other landscape practices which were frequently offered. The use of plant growth regulators to reduce pruning needs, leaving hollow stems for bees while pruning, and allowing bare soil for bird bathing were among the least frequently offered services.

Table 2

Frequency With Which Green Industry Professionals Offer Landscape Maintenance Practices That Support Native and Florida-Friendly Plants and the Variety of Wildlife That Uses Them

Landscape Practices	Mean	SD
Use of mulch to suppress weeds and conserve soil moisture (n = 24)	5.71	1.19
Follow fertilizer blackout periods (n = 24)	4.79	1.81
Planting the right plant in the right place (n = 24)	4.75	1.56
Avoiding the use of invasive plants (n = 24)	4.71	1.89
Planting fruiting and flowering native and/or Florida-Friendly plants (n = 24)	4.50	1.61
Use of appropriately placed native and/or Florida-Friendly plants (n = 24)	4.50	1.79
Removal and control of invasive vegetation (n = 24)	4.33	1.81
Appropriate use of fertilizer only when needed (n = 24)	4.29	1.68
Reduce fertilizer runoff (n = 24)	4.29	1.87
Use of IPM for pest identification, pest monitoring, pest control, and judicious use of chemical pesticides (n = 24)	4.21	1.71
Removing weeds before they go to seed (n = 24)	4.04	1.12
Avoiding over pruning (n = 24)	4.04	1.68
Planting species that are known to support wildlife (i.e., butterfly larval host plants) (n = 24)	4.04	1.73
Selection of appropriate pesticide application methods to reduce drift (n = 24)	4.04	1.80
Use of native and/or Florida-Friendly plants in appropriate sites for wildlife use (n = 24)	4.00	1.84
Encourage diversity in native and/or Florida-Friendly plants (n = 24)	4.04	1.94
Spot treating to limit/eliminate the use of chemicals (n = 24)	3.96	1.62
Perform preventative irrigation maintenance often to check for leaks, clogs, etc. (n = 23)	3.96	1.71
Limiting the scope of pesticides application to only portions of the landscape to reduce the use of pesticides (n = 24)	3.92	1.74
Schedule pruning at the correct time of year when plants are not seeding, flowering, and fruiting (n = 24)	3.83	1.52
Reducing pesticide use for pest control (n = 24)	3.79	1.69
Designing landscape to create and restore habitat (n = 24)	3.67	1.81
Help customers appreciate the value of native and/or Florida-Friendly plants and wildlife (n = 24)	3.67	1.88
Use of micro-irrigation to reduce water use (n = 24)	3.54	1.38
Avoiding routine trimming of certain plants (n = 24)	3.54	1.79
Application of less toxic pesticides (n = 24)	3.54	1.79
Reducing use of systemic pesticides to control pests (n = 23)	3.52	1.88
Management of stormwater by preservation and conservation (n = 24)	3.50	1.66
Reducing systemic herbicide usage in mass plantings of plants to control weeds (n = 24)	3.46	1.56
Reduce turfgrass/lawns (n = 24)	3.35	1.82
Pre- and post-planting maintenance such as the application of a pre-emergent granular herbicide to control invasive vegetation (n = 24)	3.33	1.60

Table Continued

Designing landscapes that use little to no irrigation for plants after the establishment (n = 24)	3.29	1.78
Use of hand-weeding for selective weeding (n = 24)	3.25	1.84
Allow leaves to remain as a resource for building nests, habitats for insects, and mulch (n = 24)	3.17	1.85
Habitat restoration in residential settings (n = 24)	3.17	2.01
Minimize the use of fertilization by opting for natural, organic alternatives (n = 23)	3.13	1.60
Use of manual or less disruptive maintenance technologies (e.g., hand shears, string trimmers) (n = 24)	3.08	1.58
Less frequent lawn/turf mowing (n = 24)	3.08	1.58
Hand pruning to avoid hedging or other indiscriminate pruning practices (n = 24)	3.04	1.51
Leave ornamental grasses alone after they flower/seed (do not cut back) (n = 24)	3.04	1.92
Use of natural weed control methods rather than chemical herbicide (n = 24)	3.00	1.64
Installing container gardens for pollinators (n = 24)	2.96	1.39
Use of pre-planting herbicide applications if needed (n = 24)	2.96	1.60
Recycle yard waste (e.g., use leaf litter as mulch or compost) (n = 24)	2.87	1.32
Use of soil water holding amendments to reduce water use (n = 24)	2.79	1.41
Pesticide-free landscape maintenance (n = 24)	2.71	1.54
Monitor soil moisture (e.g., with smart technologies) to reduce water use (n = 24)	2.46	1.17
Use of permaculture practices (n = 24)	2.46	1.50
Maintain brush piles or snags for wildlife cover and nesting (n = 24)	2.37	1.52
Reduce use of noise-producing equipment (n = 24)	2.29	1.26
Allowing bare soil for insect activity (n = 24)	2.00	1.31
Trimming grasses completely to ground level to mimic fire (n = 24)	1.96	1.16
Allowing bare soil for bird bathing (n = 24)	1.96	1.45
Leaving hollow stems for bees while pruning (n = 24)	1.92	1.10
Use of plant growth regulators to reduce pruning needs (n = 24)	1.83	0.81

Note. Responses measured on a scale from 1 to 7 where 1 = *Never*, 2 = *Rarely* (less than 10% of the time), 3 = *Occasionally* (about 30% of the time), 4 = *Sometimes* (about 50% of the time), 5 = *Frequently* (about 70% of the time), 6 = *Usually* (about 90% of the time), 7 = *Always*; SD = Standard Deviation; n= number of study participants responded

The mean frequency of consumers requesting wildlife-friendly landscape practices ranged from 1.39 (interpreted as *never*) to 4.74 (interpreted as *frequently*) (see Table 3). The use of mulch to suppress weeds and conserve soil moisture was the most frequently requested wildlife-friendly landscape practice, followed by the use of appropriately placed native and/or Florida-Friendly plants, planting species that are known to support wildlife, planting the right plant in the right place, and others. When we compared the mean frequency of offering versus requesting each wildlife-friendly landscape item, some maintenance activities differed somewhat while some of the practices mirrored one another. The most and least frequently offered and requested wildlife-friendly landscape practices were the same.

Table 3

Frequency With Which Consumers Request Landscape Maintenance Practices That Support Native and Florida-Friendly Plants and the Variety of Wildlife That Uses Them

Landscape Practices	Mean	SD
Use of mulch to suppress weeds and conserve soil moisture (*n* = 23)	4.74	1.45
Use of appropriately placed native and/or Florida-Friendly plants (*n* = 24)	4.54	1.66
Planting species that are known to support wildlife (i.e., butterfly larval host) (*n* = 23)	4.52	1.56
Planting the right plant in the right place (*n* = 24)	4.46	1.56
Planting fruiting and flowering native and/or Florida-Friendly plants (*n* = 24)	4.33	1.57
Removal and control of invasive vegetation (*n* = 24)	4.21	1.64
Encourage diversity in native and/or Florida-Friendly plants (*n* = 23)	4.13	1.63
Avoiding the use of invasive plants (*n* = 24)	4.13	1.96
Use of native and/or Florida-Friendly plants in appropriate sites for wildlife use (*n* = 24)	4.00	1.56
Help customers appreciate the value of native and/or Florida-Friendly plants and wildlife (*n* = 23)	3.96	1.58
Designing landscapes that use little to no irrigation for plants after establishment (*n* = 24)	3.96	1.65
Follow fertilizer blackout periods (*n* = 24)	3.92	1.71
Appropriate use of fertilizer only when needed (*n* = 24)	3.83	1.68
Reduce turfgrass/lawns (*n* = 24)	3.79	1.58
Designing landscape to create and restore habitat (*n* = 23)	3.74	1.63
Perform preventative irrigation maintenance often to check for leaks, clogs, etc., (*n* = 24)	3.71	1.73
Application of less toxic pesticides (*n* = 22)	3.64	1.62
Minimize the use of fertilization by opting for natural, organic alternatives (*n* = 24)	3.58	1.71
Pesticide-free landscape maintenance (*n* = 22)	3.50	1.87
Use of hand-weeding for selective weeding (*n* = 23)	3.43	1.27
Reducing use of systemic pesticides to control pests (*n* = 23)	3.43	1.85
Reduce fertilizer run-off (*n* = 24)	3.33	1.60
Reducing pesticide use for pest control (*n* = 22)	3.32	1.39
Removing weeds before they go to seed (*n* = 23)	3.26	1.63
Installing containers gardens for pollinators (*n* = 22)	3.23	1.30
Use of natural weeds control methods rather than chemical herbicide (*n* = 23)	3.22	1.41
Limiting scope of pesticide application to only portions of landscape to reduce use of pesticides (*n* = 22)	3.18	1.70
Use of micro-irrigation to reduce water use (*n* = 24)	3.13	1.42
Spot treating to limit/eliminate the use of chemicals (*n* = 22)	3.09	1.41
Habitat restoration in residential settings (*n* = 22)	3.05	1.32
Less frequent lawn/turf mowing (*n* = 23)	2.96	1.18
Schedule pruning at the correct time of year when plants are not seeding, flowering, and fruiting (*n* = 23)	2.96	1.29
Avoiding routine trimming of certain plants (*n* = 23)	2.91	1.12
Use of IPM for pest identification, pest monitoring, pest control, and judicious use of chemical pesticides (*n* = 23)	2.91	1.59

Table Continued

Hand pruning to avoid hedging or other indiscriminate pruning practices (*n* = 23)	2.87	1.14
Recycle yard waste (e.g., use leaf litter as mulch or compost) (*n* = 23)	2.87	1.20
Reduce use of noise-producing equipment (*n* = 23)	2.87	1.35
Avoiding over-pruning (*n* = 23)	2.83	1.15
Reducing systemic herbicide usage in mass plantings of plants to control weeds (*n* = 23)	2.70	1.42
Management of stormwater by preservation and conservation (*n* = 23)	2.52	0.99
Use of manual or less disruptive maintenance technologies (e.g., hand shearing, string trimmers) (*n* = 23)	2.52	1.23
Allow leaves to remain as a resource for building nests, habitats for insects, and mulch (*n* = 23)	2.52	1.31
Monitor soil moisture (e.g., with smart technologies) to reduce water use (*n* = 24)	2.50	1.53
Pre- and post-planting maintenance such as the application of a pre-emergent granular herbicide to control invasive vegetation (*n* = 24)	2.38	1.27
Use of permaculture practices (*n* = 23)	2.35	1.36
Leave ornamental grasses alone after they flower/seed (do not cut back) (*n* = 22)	2.23	0.97
Use of soil water holding amendments to reduce water use (*n* = 24)	2.21	1.25
Selection of appropriate methods to reduce drift (*n* = 22)	2.00	0.92
Use of pre-planting herbicide applications if needed (*n* = 23)	1.96	0.87
Maintain brush piles or snags for wildlife cover and nesting (*n* = 22)	1.82	0.73
Allowing bare soil for insect activity (*n* = 22)	1.73	0.76
Trimming grasses completely to ground level to mimic fire (*n* = 23)	1.70	0.82
Allowing bare soil for bird bathing (*n* = 22)	1.68	0.71
Leaving hollow stems for bees while pruning (*n* = 22)	1.55	0.67
Use of plant growth regulators to reduce pruning needs (*n* = 23)	1.39	0.49

Note. Responses measured on a scale from 1 to 7 where 1 = *Never*, 2 = *Rarely* (less than 10% of the time), 3 = *Occasionally* (about 30% of the time), 4 = *Sometimes* (about 50% of the time), 5 = *Frequently* (about 70% of the time), 6 = *Usually* (about 90% of the time), 7 = *Always*; SD = Standard Deviation; n= number of study participants responded

Objective Two: Achieve consensus on the barriers to landscape maintenance activities that support wildlife-friendly landscaping.

In round two, only five items reached a two-thirds agreement (see Table 4). These items were then moved to round three for a final iteration. As in round two, these five items again achieved consensus in round three (see Table 5).

Table 4

Range of Agreement Achieved in Round Two for Barrier Items

Barrier Items	A+SA
	%
Lack of public awareness of landscape plant and methodology alternatives (*n* = 23)	91.30*
Lack of awareness among clients about such landscape practices and their ecological and environmental effects (*n* = 23)	82.60*

Table Continued

A focus on profit over proper site-specific maintenance (*n* = 23)	73.90*
Clients want a perfectly trimmed, formal garden which is perceived as being incompatible with native and Florida-Friendly landscapes (*n* = 23)	73.80*
HOA regulations (*n* = 23)	69.50*
Lack of ability to properly identify plants and wildlife (*n* = 23)	65.20
Clients have unrealistic expectations about pest damage and management (*n* = 23)	65.20
Lack of willingness to reduce power tool use (*n* = 23)	65.20
Negative perceptions about native and/or Florida-Friendly landscape aesthetics (*n* = 23)	65.20
Lack of incentives for training (*n* = 23)	65.20
Lack of demand from clients for native and/or Florida-Friendly plants and wildlife supporting landscapes compared to traditional landscape (*n* = 23)	60.90
Lack of cohesive statewide policy addressing landscape design and landscape maintenance (*n* = 23)	60.90
Lack of training and educational resources (*n* = 23)	60.80
Feeling unappreciated for the complexity involved in this type of landscape maintenance (*n* = 23)	60.80
Ambiguity about correct practices (*n* = 23)	60.80
Landscape maintenance professionals are uninformed on what makes a plant Florida-Friendly (*n* = 23)	52.20
Lack of alternative control measures for some pests (*n* = 23)	47.80
Lack of mandatory training (*n* = 23)	47.80
Lack of concern about environment among landscape workers (*n* = 23)	47.80
Lack of availability of native and/or Florida-Friendly plants in adequate volume (*n* = 23)	47.80
Lack of desire to provide continued care to plants (*n* = 23)	43.50
Concern over the time it takes to maintain native and/or Florida-Friendly landscapes (*n* = 23)	43.40
Less affordable due to cost in native and/or Florida-Friendly plants and wildlife-supporting landscape (*n* = 23)	39.10
Lack of accessible training options (*n* = 23)	39.10
Extra costs associated with using wildlife-friendly pest management strategies (*n* = 23)	21.70

Note. Responses measured on a scale from 1 to 7 where 1 = *Strongly disagree (SD)*; 2 = *Disagree (D)*; 3 = *Somewhat disagree (SwD)*; 4 = *Neither agree nor disagree (N)*; 5= *Somewhat agree (SwA)*; 6 = *Agree (A)*; 7 = *Strongly agree (SA);* A+SA used to determine consensus. * = items that reached consensus

The level of agreement in round three ranged from 94.70% to 68.40%, whereas in round two, it was 91.30% to 69.50%. The strongest consensus was found on the lack of public awareness of landscape plant and methodology alternatives, followed by a lack of awareness among clients about such landscape practices and their ecological and environmental effects, and a focus on profit over proper site-specific maintenance.

Table 5

Range of Agreement Achieved in Round Three for Barrier Items

Barrier Items	A+SA
	%
Lack of public awareness of landscape plant and methodology alternatives (*n* = 19)	94.70*
Lack of awareness among clients about such landscape practices and their ecological and environmental effects (*n* = 19)	89.50*
A focus on profit over proper site-specific maintenance (*n* = 19)	84.20*
HOA regulations (*n* = 19)	73.70*
Clients want a perfectly trimmed, formal garden which is perceived as being incompatible with native and Florida-Friendly landscapes (*n* = 19)	68.40*

Note. Responses measured on a scale from 1 to 7 where 1 = *Strongly disagree* (SD); 2 = *Disagree* (D); 3 = *Somewhat disagree* (SwD); 4 = *Neither agree nor disagree* (N); 5= *Somewhat agree* (SwA); 6 = *Agree* (A); 7 = *Strongly agree* (SA); A+SA used to determine consensus. * = items that reached consensus

Objective Three: Achieve consensus on the motivators for landscape maintenance activities that support wildlife-friendly landscaping.

In round two, eight out of 25 items reached a two-thirds agreement (see Table 6) and these items were sent to the expert panel in round three following the same process as in round two.

Table 6

Range of Agreement Achieved in Round Two for Motivator Items

Motivator items	A+SA
	%
Interested in high standards in landscape quality (*n* = 23)	86.90*
Supports company vision and mission (*n* = 23)	78.30*
Clients' demand for native and/or Florida-Friendly plants and wildlife supporting landscape practices (*n* = 23)	73.90*
Desire to help clientele enjoy outdoor spaces (*n* = 23)	73.90*
Desire to promote the company as wildlife/environmentally friendly and distinguish with specific skills and services (*n* = 23)	69.60*
Public interest in beneficial wildlife associated with native and Florida-Friendly landscaping (*n* = 23)	69.60*
Willingness of clients to pay for native and/or Florida-Friendly plants and wildlife supporting naturalistic landscape practices (*n* = 23)	69.50*
Increase in income with the use of native and/or Florida-Friendly landscape practices (*n* = 23)	69.50*
Appreciation for aesthetics of native and/or Florida-Friendly plants among clients (*n* = 23)	65.20
Desire to contribute to a healthy ecosystem through yards and green spaces (*n* = 23)	65.20
The desire to enjoy seeing pollinators in the garden (*n* = 23)	65.20
Less irrigation needed over the life cycle of the native and/or Florida-Friendly yard (*n* = 23)	65.20
To promote and protect the natural side of Florida and the community (*n* = 23)	65.20
Ecological benefits to having a native and/or Florida-Friendly landscape yard (*n* = 23)	56.50
Marketing opportunity for clients that need wildlife-friendly landscaping (*n* = 23)	56.50

Table Continued

Certified in a professional trade that is needed to support our pollinators and ecosystem (*n* = 23)	56.50
The desire to know that larvae are using host plants (*n* = 23)	56.50
Clients' appreciation of economic benefits associated with wildlife-friendly landscapes (*n* = 23)	56.50
Knowing the importance of pollinators to human existence (*n* = 23)	52.10
Clients' appreciation of time-saving benefits associated with wildlife-friendly landscapes (*n* = 23)	43.50
The desire to know that wildlife has access to the food they need (*n* = 23)	39.10
The desire to know that insects are finding nectar and pollen (*n* = 23)	34.80
The desire to know that plants are being pollinated (*n* = 23)	34.70
The desire to know that wildlife has vegetative cover from predators (*n* = 23)	30.40
Customer willingness to wait for benefits of native and/or Florida-Friendly landscapes (*n* = 23)	26.10

Note. Responses measured on a scale from 1 to 7 where 1 = *Strongly disagree (SD)*; 2 = *Disagree (D)*; 3 = *Somewhat disagree (SwD)*; 4 = *Neither agree nor disagree (N)*; 5= *Somewhat agree (SwA)*; 6 = *Agree (A)*; 7 = *Strongly agree (SA);* A+SA used to determine consensus. * = items that reached consensus

Only three items reached two-thirds agreement (see Table 7) in round three. Clients' demand for native and/or Florida-Friendly plants and wildlife supporting landscape practices achieved the strongest consensus, followed by a desire to promote the company as wildlife/environmentally friendly and distinguish with specific skills and services, and public interest in beneficial wildlife associated with native and Florida-Friendly landscaping.

Table 7

Range of Agreement Achieved in Round Three for Motivator Items

Motivator Items	A + SA
	%
Clients' demand for native and/or Florida-Friendly plants and wildlife supporting landscape practices (*n* = 20)	75.00*
Desire to promote the company as wildlife/environmentally friendly and distinguish with specific skills and services (*n* = 19)	73.70*
Public interest in beneficial wildlife associated with native and Florida-Friendly landscaping (*n* = 19)	73.70*
Desire to help clientele enjoy outdoor spaces (*n* = 19)	63.20
Increase in income with the use of native and/or Florida-Friendly landscape practices (*n* = 19)	57.90
Willingness of clients to pay for native and/or Florida-Friendly plants and wildlife supporting naturalistic landscape practices (*n* = 19)	52.70
Supports company vision and mission (*n* = 20)	50.00
Interested in high standards in landscape quality (*n* = 20)	45.00

Note. Responses measured on a scale from 1 to 7 where 1 = *Strongly disagree (SD)*; 2 = *Disagree (D)*; 3 = *Somewhat disagree (SwD)*; 4 = *Neither agree nor disagree (N)*; 5= *Somewhat agree (SwA)*; 6 = *Agree (A)*; 7 = *Strongly agree (SA);* A+SA used to determine consensus. * = items that reached consensus

Discussion

The expert panel generated a comprehensive list of wildlife-friendly landscape activities and practices, demonstrating great diversity in the industry's opportunities to support wildlife. Findings showed that the use of mulch to suppress weeds and conserve soil moisture was most frequently offered wildlife-friendly landscape practice by the Florida green industry followed by fertilizer blackout (temporary bans) periods, planting the *right plant* in the *right place*, and avoiding the use of invasive plants, planting fruiting and flowering native and/or Florida-Friendly plants. The most frequently requested wildlife-friendly landscape service from Florida residents was also the use of mulch to suppress weeds and conserve soil moisture. However, the rest of the most frequently requested services did not align with the frequencies of services offered. For example, one of the most requested landscape services was for appropriately placed native and/or Florida-Friendly plants, followed by planting species that are known to support wildlife, and planting in accordance with the *right plant, right place* principle. The discrepancies in frequency could be related to green industry professionals having more knowledge about some maintenance practices (e.g., fertilizer blackout periods), which residents may not have had the awareness to ask about. On both sides, the use of plant growth regulators to reduce pruning needs had the lowest mean frequency.

Turning to the Delphi findings, the expert panel identified barriers and motivators they perceived as coming from two sources: green industry professionals and consumers. Similar to Goddard et al.'s (2013) identification of lack of knowledge and information as a barrier, lack of awareness of landscape plants and practices that support wildlife was the barrier that achieved the highest consensus among Florida green industry professionals. This finding implies a need exists for Extension education about the landscape maintenance practices that support native and Florida-Friendly plants and wildlife that use them. To facilitate such education, research shows that on-site educational programs targeted to the homeowner could improve the sustainability of their yard management (Hostetler et al., 2008). However, resources may limit the ability to conduct on-side educational activities, and thus alternative options such as virtual demonstrations could be considered. Another barrier that achieved consensus was residents' lack of awareness about the ecological and environmental benefits of such landscape practices, which indicates the need for Extension to also educate residents about the benefits of wildlife-friendly landscaping. The two top agreed-upon barriers indicate the need for educational programs related to wildlife-friendly landscaping to introduce residents to plants and practices that could support wildlife as well as associated ecological and environmental benefits. By addressing these barriers, Extension professionals can increase residents' demand for such landscape practices. The third most agreed upon the barrier, focused on industry profit over proper site-specific maintenance, implies that perceptions exist that wildlife-friendly landscaping is more expensive and less profitable. However, promising research suggests people are willing to pay more for a landscape that is ecologically beneficial and supportive of native plants and wildlife (Helfand et al., 2006). There is an opportunity for Extension educators to educate green industry professionals about the willingness of residents to pay more for wildlife-friendly landscaping to potentially increase their engagement in these practices.

HOA regulations were identified as one of the important barriers to landscape maintenance activities that support wildlife, which aligns with previous studies (Carr & Kramer, 2022; Fraser et al., 2013). However, other researchers (Larson et al., 2022; Lerman et al., 2012) have suggested that HOA leaders and norm holders – when convinced of the benefits of residential conservation activities – can play an impactful role in encouraging the mitigation of biodiversity loss and provision of wildlife habitat. This barrier highlights the important opportunity for Extension to educate and collaborate with HOAs to support the development of wildlife-friendly landscape policies.

Client demand for a highly manicured and trimmed landscape aesthetic was the final barrier that reached expert consensus, which aligns with past research (Özgüner et al., 2007). Since education plays an important role in developing people's preference for wildlife-friendly landscaping (Rodriguez et al., 2017), Extension can address this barrier by educating both residents and green industry professionals about the possibilities of adopting wildlife-friendly landscaping maintenance, which in many cases can still include aspects of trimmed and manicured landscapes. On the other hand, clients' demand for native and Florida-Friendly plants and wildlife-supporting landscape practices was the primary motivator among Florida's green industry professionals. These interlinked dynamics demonstrate consumer demand is essential in determining whether green industry professionals engage in wildlife-friendly landscape maintenance practices.

As a motivator, green industry professionals' desire to promote their company as wildlife/environmentally friendly and distinguish themselves with specific skills and services indicated the interest of Florida's green industry in engaging in wildlife-friendly landscaping as a means of standing out as a business in this sector. An Extension intervention to develop a trained workforce for such wildlife-friendly landscaping maintenance practices could be beneficial to promote and implement this type of landscaping. Findings also indicate public interest in beneficial wildlife associated with native and Florida-Friendly landscaping motivates Florida's green industry professionals, implying green industry professionals want to align with the client's interests. To build on this finding, Goddard et al. (2013) reported that moral responsibility to nature and personal well-being is a key motivator for wildlife-friendly gardening. Thus, it would be worth Extension developing strategies to increase the public's appreciation of the perceived well-being and moral responsibility benefits that can be attained from engaging in these practices. It is unclear why items with high consensus in round two (e.g., interested in high standards in landscape quality and supports company vision and mission) did not achieve consensus in round three, although given the less than 100% response rate, some of the participating individuals between the rounds likely changed.

These findings can be viewed through an exchange theory lens. The theory emphasizes that a change is possible only when a person receives a reward that is equal to or greater than the perceived cost to make that change (Singaiah & Laskar, 2015). Interestingly, some motivators and barriers were specific to professionals and others were specific to residents, suggesting the need to engage both audiences. To promote the adoption of wildlife-friendly landscape maintenance activities, Extension professionals and their stakeholder partners should collaborate on strategies to reduce or remove the identified barriers. Lack of awareness among the public about wildlife-friendly landscaping was one of the barriers that achieved consensus, which clearly indicates the need for educational intervention via land-grant universities, the Cooperative Extension System, and other related public and private stakeholders to create awareness about the associated tangible and nontangible benefits of wildlife-friendly landscaping. When communicating with both residents and green industry professionals to encourage the adoption of wildlife-friendly landscaping practices, the most effective rewards described should be immediate, personal, and reflective of individual values (Andreasen, 2006).

The identified motivators should therefore be taken into consideration while planning Extension programs and formulating policies. A comprehensive statewide or national survey of consumers to understand the barriers and motivators related to wildlife-friendly landscape maintenance activities exclusively from the residential audience perspective would be an appropriate next step in research.

This study points to opportunities for additional, future research on the topic. Since the present study showed that lack of awareness and client demand are the barrier and motivator items that achieved the highest consensus, it remains important to research which kinds of Extension educational programs residents are interested in, which are appropriate for them, and how those educational programs could be designed in the most impactful way. It is also important to study which factors influence the adoption of wildlife-friendly landscape activities among both consumers and service providers to better position program priorities and behavior change programs for Extension professionals. There is an immense opportunity to research how each motivator could encourage green industry professionals to engage in wildlife-friendly landscape maintenance activities. There is also an opportunity to further examine and quantify how specific motivators could reduce the perceived cost so green industry practitioners can realize more benefits and rewards.

Finally, we note the frequency that wildlife-friendly landscape maintenance activities are requested by residents was assessed through the expert panel, which may provide a biased outlook. While outside the scope of the present study, surveying Florida residents could provide more accuracy in understanding consumer demand for wildlife-friendly landscape practices. A Delphi study among green industry professionals within a broader geographical region could additionally provide valuable and more generalizable insights into the current state of wildlife-friendly landscape maintenance activities and related barriers and motivators in the profession.

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