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Landowner Adoption of Water Quality Best Management Practices: Motivations and Barriers

Abstract

To assist Extension professionals working in Texas's Little River Watershed with efforts to educate landowners about reducing amounts of bacteria there, we assessed motivations for and barriers to landowners' adopting best management practices (BMPs). We surveyed 275 landowners in the watershed. Respondents were at least somewhat familiar with nine of 11 identified BMPs. Additionally, they agreed that 10 of 13 listed factors were motivators for adopting BMPs and that six of 14 listed factors were barriers to adopting BMPs. Extension professionals can help landowners move through the innovation-decision process by targeting educational programming and materials to motivations for and barriers to adoption of such practices.

Keywords: adoption, best management practice, watershed-based plan, watershed management, water quality

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Introduction

Concern for water quality conservation increases as quality water for human use diminishes (Wurbs, 2014). Nonpoint water source pollution resulting from human activities on privately owned land is a leading source of water pollution across the United States (U.S. Environmental Protection Agency, 2016). Such pollution can negatively affect water quality but can be reduced if landowners employ best management practices (BMPs) (e.g., riparian management, use of terraces, and implementation of livestock grazing plans) (U.S. Department of Agriculture Natural Resources Conservation Service, n.d.).

Although BMPs help improve the environment, adoption of BMPs can be limited because adoption is voluntary and landowners face significant barriers that prevent adoption. Consequently, reducing barriers to

implementing BMPs can greatly increase adoption (Roesch-McNally et al., 2018). Factors that influence adoption can include economic factors (Molnar, Bitto, & Brant, 2001), intrinsic factors (De Young, 1986; Kaiser, Kibbe, & Arnold, 2017), and knowledge-related factors (Bossange, Knudson, Shrestha, Harben, & Mitchell, 2016).

Economic factors (e.g., incentive programs) can lead landowners to seek information about adopting BMPs. However, incentive programs often do not offer sufficient funds to cover the total cost of implementing BMPs and, thus, create financial uncertainty (Rodriguez, Molnar, Fazio, Sydnor, & Lowe, 2009). Furthermore, short-term influences are not effective in generating long-term use of conservation practices (Berthold 2014; De Young, 1993). Similarly, landowners concerned with land profitability are less likely to adopt conservation practices (Reimer, Thompson, & Prokopy, 2012) and are possibly more focused on using their land solely to make money (French, 2017).

Intrinsic motivators, such as values and beliefs, can encourage individuals to pursue changes in behavior (Heath & Heath, 2010; R. M. Ryan & Deci, 2000). In studying farmers, R. L. Ryan, Erickson, and De Young (2003) found that intrinsic motivators can be strong influencers for encouraging long-term adoption of conservation practices. As well, Christensen and Norris (1983) noted that farmers are not always driven by profit maximization when considering implementation of BMPs because values, beliefs, social pressures, and traditions can have stronger influences on their attitudes and intentions to adopt practices.

In addition, basic knowledge, familiarity, and concern regarding a topic can influence individuals' willingness to adopt BMPs (Berthold, 2014), and lack of access to information can be a barrier to adoption (Rodriguez et al., 2009). In a 2015 study, Huang and Lamm found that providing Extension education designed to increase individuals' familiarity with water topics (i.e., water policies, water issues, and conservation behaviors) was one way to mitigate knowledge-related barriers. With regard to long-term adoption of targeted practices, Extension educators and watershed professionals can assist landowners in changing their land management behaviors (Seevers & Graham, 2012) by attending to the five stages of Rogers's (2003) innovation-decision process: knowledge, persuasion, decision, implementation, and confirmation.

Purpose and Research Questions

Our purpose with the study described here was to identify motivations for and barriers to adoption of BMPs by landowners in Texas's Little River Watershed. We achieved this purpose by addressing three research questions:

1. How aware are landowners of BMPs?

2. What BMPs are landowners familiar with and currently implementing?

3. What are motivations for and barriers to landowners' adopting BMPs?

Method

The quantitative study addressed herein was part of a larger project we undertook to identify preferences for receiving water-related information among landowners in the Little River Watershed. Therefore, the research methods and participant demographics we present here are similar to those identified in material published

elsewhere (Dewald, Leggette, Murphrey, Berthold, & Wagner, 2018).

We chose to focus on the Little River Watershed because the Texas Commission on Environmental Quality (2014) had identified it on the Texas Water Quality Inventory 202(d) list as failing to meet recreational use standards due to bacteria (Foust, 2010). We determined the population in the watershed by using geographic information system data and coordinates associated with the watershed boundaries, resulting in a population of 7,592. Using simple random sampling (Bryman, 2012), we identified a total sample of 1,881 (95% confidence level, 1.96 confidence interval). Although 462 individual questionnaires were returned, only 275 were complete. Therefore, we achieved a 15% response rate, which is common for this type of research in Texas (Berthold, 2014).

About two thirds of the respondents reported that they owned land in one of the three counties in the watershed and produced agricultural commodities on that land (39.9%) or owned land in one of the three counties and did not produce agricultural commodities on that land (30.3%). Of the 275 respondents, 50.0% raised livestock, 38.8% produced hay, 22.5% managed wildlife, and 20.4% raised row crops. Almost half (48.7%) did not earn an annual household income from production of agricultural commodities. Respondents' demographics are listed in Table 1.

Table 1.
Demographic Characteristics of Study Respondents in the Little River Watershed (n = 275)

Characteristic	***f***	**%**
Age		
54 or younger	52	20.2
55 to 64	78	30.2
65 to 74	73	28.3
75 or older	55	21.3
Gender		
Male	185	69.8
Female	80	30.2
Race/ethnicity		
American Indian	1	0.4
Asian	1	0.4
Black or African American	19	7.5
Native Hawaiian or Pacific Islander	0	0.0
Spanish, Hispanic, Latino	3	1.2
White or Caucasian	230	90.6

Highest level of education		
Less than high school	6	2.3
High school diploma/GED	47	17.9
Some college	46	17.5
2-year degree	30	11.4
Bachelor's degree	66	25.1
Graduate degree	58	22.1
Other	10	3.8

We designed and administered our survey instrument according to Dillman's tailored design method (Dillman, Smyth, & Christian, 2014). We sent each member of the sample (a) an initial postcard, (b) a questionnaire, (c) a reminder postcard, and (d) a final questionnaire. If an individual responded at any point in the study, we sent that person a thank-you email and did not correspond with him or her again. We did not offer any incentive to encourage participation.

We created the questionnaire content on the basis of previous literature, interviews with Texas Extension agents in three counties in the watershed, and information from the Social Indicators Data Management and Analysis Tool website (Genskow & Prokopy, 2011). The questionnaire included the definition of the term *best management practices* or *BMPs* and comprised 24 3-, 4-, and 5-point Likert-type scaled questions (scales are identified in the "Results" section). We established question validity by engaging experts from Texas Water Resources Institute who specialize in water resources and planning and Texas A&M AgriLife Extension Service agents from the three counties.

Of the initial postcards we sent, 122 were returned as undeliverable due to mailing complications (e.g., addressee not at address, addressee temporarily away, vacant address, closed PO box). Because we received most of the returned postcards at the end of the study and were not aware of the mailing complications before sending subsequent mailings, we continued to send study-related documents (e.g., questionnaire, follow-up postcard) to the recipients. Unlike the initial postcards, the subsequent documents were not returned. Thus, we could not determine whether the intended recipients had received other study-related documents, indicating that we needed to include the 122 recipients as part of the sample. We analyzed the data using SPSS Version 22 and obtained descriptive statistics (i.e., means, standard deviations, and frequencies) (Bryman, 2012; Field, 2013). Furthermore, we found no statistical differences between early and late respondents (Lindner, Murphy, & Briers, 2001).

Results

Respondents' Awareness of BMPs

Before completing the questionnaire, 60.8% of respondents had been unaware of the term *BMPs*, 48.7% were unaware of efforts to control water pollution through BMPs, and 58.1% were unaware of the term *incentive program*. Furthermore, only 8.0% of respondents used the Environmental Quality Incentives Program, and only 7.1% used the Conservation Reserve Program.

Respondents' Familiarity with and Implementation of BMPs

Overall, respondents were somewhat familiar with nine of the 11 BMPs presented on the survey instrument. Of those nine BMPs, they were most familiar with soil testing, use of terraces, and pesticide management. Overall, they were not familiar with variable rate application technology, riparian management, or other BMPs not presented. Implementation rates were somewhat consistent with levels of familiarity. About half of the respondents had implemented pesticide management practices, and most had not implemented riparian management or variable rate application technology. Familiarity levels and implementation rates are shown in Table 2.

Table 2.

Respondents' Familiarity with and Implementation of Best Management Practices (BMPs) (n = 275)

				Implementation				
	Familiarity				Yes		No	
BMP	**#**	***M*[a]**	***SD***	**#**	***f***	**%**	***f***	**%**
Soil testing	250	2.09	.72	234	85	36.3	149	63.7
Terraces	242	2.09	.80	219	67	30.6	152	69.4
Pesticide management	239	2.05	.76	219	109	49.8	110	50.2
Wildlife management program	246	1.88	.70	218	50	22.9	168	77.1
Conservation tillage (no-till, strip-till)	241	1.87	.75	217	52	24.0	165	76.0
Retaining crop residue on soil surface	241	1.78	.79	209	77	36.8	132	63.2
Nutrient management	238	1.77	.96	214	77	36.0	137	64.0
Approved grazing management plan for livestock	243	1.74	.73	212	59	27.8	153	72.2
Fencing around riparian areas for rotational grazing	240	1.73	.75	212	49	23.1	163	76.9
Variable rate application technology	240	1.43	.66	208	22	10.6	186	89.4
Riparian management	236	1.16	.71	205	23	11.2	182	88.8
Other	15	1.27	.59	13	2	15.4	11	84.6

Note. # = total number of respondents who answered questionnaire item.

[a]≤1.50 = not at all familiar, 1.51–2.50 = somewhat familiar, ≥2.51 = very familiar.

Factors Motivating Respondents to Adopt BMPs

Of 13 factors presented, respondents agreed that 10 factors motivated them to adopt BMPs and somewhat agreed that the remaining three factors motivated them to adopt BMPs. Two of the most influential factors motivating respondents to adopt BMPs were economic profitability of a practice and

improvement/maintenance of the environment for future generations. Overall, however, we found no significant differences in the results (see Table 3).

Table 3.

Factors That Motivate Landowners to Adopt Best Management Practices (*n* = 275)

Factor	#	*M*[a]	*SD*
Economic profitability of practice	230	4.19	.94
Improvement/maintenance of environment for future generations	230	4.19	.94
Personal values and connection to the land	232	4.12	1.00
Increased property value	233	4.05	1.02
Improved wildlife/fish habitat	231	4.00	1.02
Pride of conserving land	229	3.96	.98
Improved scenic beauty	231	3.96	1.08
Concern for neighbor's land	233	3.86	.99
Seeing landowners' success implementing practices	224	3.70	.96
Relation of practice to current management situation	224	3.52	.93
Cost-share programs to offset implementation costs	232	3.38	1.1
Personal recognition of implementing practices	266	3.27	1.09
Loans easing implementation costs	230	3.09	1.05
Other	15	3.40	1.55

Note. # = total number of respondents who answered questionnaire item.

[a]≤1.50 = strongly disagree, 1.51–2.49 = disagree, 2.50–3.49 = somewhat agree, 3.50–4.49 = agree, ≥4.50 = strongly agree.

Factors Respondents Considered Barriers to Adopting BMPs

Of 14 factors presented, respondents agreed that six factors were barriers to adopting BMPs and somewhat agreed that seven other factors were barriers to adopting BMPs. One of the most influential factors considered a barrier to adopting BMPs was uncertainty about government regulations and rules associated with implementing practices. Respondents did not consider uncertainty of what neighbors would think as a barrier to adopting BMPs. Overall, we found no significant differences in the results (see Table 4).

Table 4.

Factors Landowners Considered Barriers to Adopting Best Management Practices (*n* = 275)

Factor	#	*M*[a]	*SD*
Uncertainty about government regulations and rules associated with implementing practice	211	3.75	0.99

Lack of information about effectiveness of practice	208	3.67	0.99
Lack of awareness of incentive programs	213	3.66	1.09
Initial cost of implementation of practice	208	3.61	1.03
Lack of opportunities to see demonstrations of practice	207	3.58	0.95
Maintenance costs	209	3.54	0.98
Inadequate incentive (cost-share) levels	198	3.44	1.04
Uncertainty about whether practice will increase or decrease production profits	203	3.41	0.93
Lack of support from agencies/organizations when implementing practice	199	3.36	1.02
Terms of program contract	194	3.25	0.96
Land that does not meet requirements for practice	196	2.94	1.07
Belief that adopting practice will not make a difference	206	2.90	1.05
Unwillingness to change current land management practices	209	2.84	1.09
Uncertainty about what neighbors would think	202	2.39	1.06
Other	11	3.36	1.57

Note. # = total number of respondents who answered questionnaire item.

[a]≤1.50 = strongly disagree, 1.51–2.49 = disagree, 2.50–3.49 = somewhat agree, 3.50–4.49 = agree, ≥4.50 = strongly agree.

Conclusions, Implications, Recommendations

Evaluating survey participants' motivations for and barriers to adopting BMPs can provide Extension professionals with an understanding of landowners' current positioning in the innovation-decision process. In general, we found that respondents in our study had not implemented a majority of the BMPs typically associated with watershed management, a circumstance that could be a result of their lack of knowledge about BMPs, incentive programs, and terms associated with BMPs.

Lack of knowledge about and implementation of BMPs suggest the need to increase communication with landowners about water. According to the innovation-decision process (Rogers, 2003), respondents in our study had not entered the first stage of the process, knowledge, given that 60.8% of them were not aware of BMPs related to water quality. To address this lack of awareness, educators should deliver foundational information about BMPs related to water quality.

Overall, respondents in our study were motivated to adopt BMPs that were economically profitable and increased the property value of their land, but they were not necessarily motivated by loans to implement practices. This discrepancy could be a result of landowners' not wanting to spend money on practices that do not generate income. However, Extension professionals could provide trials and demonstrations (Seevers & Graham, 2012) to increase understanding of BMP impact. Education by Extension professionals in local areas can be an important factor in the adoption of BMPs (Bossange et al., 2016).

Respondents also were motivated to implement practices that could improve or maintain the environment for future generations and practices that aligned with their personal values and connections with the land (Heath

& Heath, 2010; Rosenberg & Margerum, 2008). Landowners care about their land and will adopt BMPs that provide personal benefit; thus, Extension educators should promote the personal benefits and intrinsic motivators of adopting BMPs (R. M. Ryan & Deci, 2000).

As for barriers, respondents were unsure of government regulations and rules associated with BMPs and did not have favorable attitudes toward adopting BMPs because of the initial cost of implementation and maintenance costs. These findings support those of Berthold (2014) and Rodriguez et al. (2009). Extension educators can provide more information about BMPs to reduce uncertainty about government regulations and rules.

For future research, we recommend using qualitative interviews to investigate the motivations and barriers related to landowner adoption of BMPs. Extension professionals will be able to use findings from such research to further guide their development of educational materials that assist landowners through the innovation-decision process.

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