Journal of Agricultural Education, 59(2), 343-369
https://doi.org/10.5032/jae.2018.02343

Communicating to Landowners in the Texas Little River Watershed: A Descriptive Analysis of Their Communication Preferences for Receiving Water-Related Information

Stacey Dewald[1], Holli R. Leggette[2], Theresa Pesl Murphrey[3], Allen Berthold[4] & Kevin Wagner[5]

Abstract

Elevated levels of bacteria impact the use of the Little River watershed in Texas. The amount of bacteria entering the waterway could be reduced if landowners within the watershed received water-related information and adopted best management practices. However, landowners' access to water-related information is limited, perhaps, because the information is not targeted to them and their preferences. Therefore, to identify landowners' communication preferences for receiving water-related information, we assessed 275 landowners in the Texas Little River watershed using a paper questionnaire. Respondents preferred water-related information delivered via websites monthly and direct mailings quarterly, twice annually, and annually and least preferred social media platforms as a communication medium. Yet, we found no statistically significant differences between respondents' demographics and their preferred communication mediums. Furthermore, respondents identified Texas A&M AgriLife Extension as the most trustworthy source of water-related information. Water resource experts, therefore, should disseminate information using websites and direct mailings in partnership with Texas A&M AgriLife Extension. Further research should be conducted using observations, focus groups, and interviews during the watershed-based planning process to understand reasons for landowners' communication preferences.

Keywords: Communication; education; watershed-based plans; water quality; agriculture

Authors' Note: This research was supported by Texas Water Resource Institute and Texas Commission on Environmental Quality under the Clean Water Act Section 319(h) Nonpoint Source (NPS) Grant Program, Grant No. 131527 SRS M1502190.

[1] Stacey Dewald is a graduate student in the Department of Agricultural Leadership, Education, & Communications, Texas A&M University, Agriculture and Life Sciences Building, 600 John Kimbrough Blvd., College Station, TX 77843-2116, sdewald@tamu.edu.

[2] Holli R. Leggette is an Assistant Professor in the Department of Agricultural Leadership, Education, & Communications, Texas A&M University, Agriculture and Life Sciences Building, 600 John Kimbrough Blvd., College Station, TX 77843-2116, hollileggette@tamu.edu.

[3] Theresa Pesl Murphrey is an Associate Professor in the Department of Agricultural Leadership, Education, & Communications, Texas A&M University, Agriculture and Life Sciences Building, 600 John Kimbrough Blvd., College Station, TX 77843-2116, t-murphrey@tamu.edu.

[4] Allen Berthold is a Research Scientist at the Texas A&M AgriLife, Texas Water Resource Institute, Texas A&M University, 578 John Kimbrough Blvd., 2260 TAMU, College Station, TX 77843, taberthold@ag.tamu.edu.

[5] Kevin Wagner is the Director of the Oklahoma Water Resources Institute, Oklahoma State University, 139 Ag Hall, Stillwater, OK 74078, kevin.wagner@okstate.edu.

Introduction

Water is a complex and interdisciplinary problem (Andenoro, Baker, Stedman, & Weeks, 2016). Across the United States, bacteria are entering waterways and affecting water quality, and such is the case in the Little River watershed (TCEQ, 2014a, 2014b). One way to improve the environment and decrease the amount of bacteria entering waterways is for private landowners to adopt and implement best management practices (BMPs; e.g., buffer strips, prescribed grazing, critical area plantings, etc.; USDA, n.d.). However, adopting BMPs is voluntary, and successful adoption depends on the availability of quality information. Therefore, agricultural educators and communicators must seek ways to address water quality issues and deliver water quality information that meets landowners' needs as addressed in the American Association for Agricultural Education 2016–2020 National Research Agenda.

Water-related information, especially information related to watershed-based plans, should inform and persuade landowners to adopt BMPs. Landowners' access to information is directly related to their adoption of BMPs (Baumgart-Getz, Prokopy, & Floress, 2012) because, without information, they cannot be knowledgeable about the impacts of BMPs. There are a variety of communication mediums (e.g., television, newspaper, direct mailings, newsletters, magazines, radio, email, websites, and social media) landowners can use to gain information about BMPs. However, lack of familiarity with and access to such communication mediums (Molnar, Bitto, & Brant, 2001) could negatively impact if and how they adopt and implement BMPs.

Thus, landowners need to receive water-related information according to their communication preferences. Landowners across four watersheds in Michigan preferred to receive information about water conservation practices through newsletters, printed bulletins, and fact sheets (Howell & Habron, 2004). Boellstorff, McFarland, and Boleman (2010) found that 45% of Texas farmers and ranchers previously received water quality information from newspapers and magazines. Similarly, Rosenberg and Margerum (2008) found farmers and ranchers highly preferred print sources (e.g., newsletters) because they are a "quick, convenient, and non-invasive method of getting information" (p. 488).

Yet, in the last 12 to 15 years, information delivery has changed drastically. For example, Caumont (2013) found that 50% of Americans obtained national and international news and information using the internet. Of that 50%, 60% reported using television to obtain news and information. In 2000, Thysen noted that email was important to the future of agricultural Extension services and the agricultural network because it provides landowners the opportunity to gain access to educational information and make real-time decisions on their farms (Thysen, 2000). Cline (2011) found that 93% of study respondents, predominately Caucasians who "have worked or lived on a farm or worked for an agricultural business" (p. 81), used social media to access agricultural information and participate in digital conversations. Additionally, White, Meyers, Doerfert, and Irlbeck (2014) found that individuals involved in agri-marketing use social media to communicate about current agricultural issues (e.g., water quality) and to educate the agricultural community. Agricultural organizations use social media to diffuse information to and connect with landowners; therefore, social media could be an efficient method for information delivery.

In addition to accessible information, landowners choose to absorb messages based on their perception of the sources' trustworthiness. For example, research by Mase, Babin, Prokopy, and Genskow (2015) suggested landowners across 19 watersheds in the Midwest trusted local cooperative Extension, county soil and water conservation districts, and Natural Resources Conservation Service more than they trusted environmental organizations and lawn care businesses. These sources of information may be perceived as transparent in and accountable for

the information they provide to the public, which Giupponi and Sgobbi (2008) suggested as factors in trustworthiness. However, Rosenberg and Margerum (2008) found that landowners considered friends, family, neighbors, and local Extension agents more trustworthy than environmental or government agencies. The relationship between landowners and friends, family, neighbors, and/or Extension agents could be attributed to their interpersonal communication, which is an important factor in trustworthiness related to adoption (Rogers, 2003).

Additionally, targeted information is important in innovation adoption and behavioral change (Rogers, 2003). Lamm, Lamm, and Carter (2015) found a knowledge gap between opinion leaders in the food, agriculture, and natural resource sciences and the public related to water issues. For example, opinion leaders were more familiar with terms and initiatives than the public was (Lamm et al., 2015), and lack of familiarity with terms and language is problematic when disseminating information to landowners. Furthermore, "education and outreach approaches centered only on the environmental dimensions of conservation projects may be insufficient to motivate changes in conservation behavior" (Jackson-Smith & McEvoy, 2011, p. 341). Environmental dimensions can include general facts about water, current water quality levels (e.g., nutrients, salinity, etc.), or impacts of agricultural commodity production on water quality.

Furthermore, the elements of information diffusion (Quarles, Jeffres, Sanchez-Ilundain, & Neuwirth, 1983) are important to developing targeted information. The three elements include leveling, sharpening, and assimilating (Quarles et al., 1983). Leveling, or shortening the message, allows consumers to understand information without becoming overwhelmed. Sharpening, or emphasizing key details, provides consumers the most important information first, which is important for immediate mass media purposes. The third element is assimilation of, or distorting of, messages to fit preexisting stereotypes, attitudes, or expectations, allowing the media to provide relatable messages to a specific population (Quarles et al., 1983). When communicating messages, conforming to specific audiences' attitudes can assist in delivering a more influential message. Tucker and Napier (2002) described "doubt[s] in the value of broad-based or 'shotgun' approaches for delivering agricultural information" (p. ab). Such approaches entail very broad and general information delivered across many audiences that is not specific or applicable to a given audience. Thus, to effectively diffuse information to landowners and achieve successful adoption of practices, those who deliver information must understand their target audience.

Theoretical Framework

One way to understand a target audience is through audience segmentation (Slater, 1996), which we used to guide this study. Slater (1996) suggested that a key piece of audience segmentation is using demographic characteristics (e.g., age, gender, ethnicity, and education level) to deliver information effectively. Audience segmentation is instrumental in communicating with adopters in all stages of Rogers (2003) diffusion of innovations model.

The first step to any communications activity is understanding the target audience. Communicators use audience segmentation to do just that. They can sort or group individuals by characteristics in an effort to define specific methods of delivery and message content (Stone, Singletary, & Richmond, 1999), which enhances information delivery and influences assimilation between message and audience (Slater, 1996). Specifically, generational segmentation—grouping by generations or age—can be a powerful way to effectively deliver information (Lee & Kotler, 2011). Warner, Chaudhary, Rumble, Lamm, and Momol (2017) found audience segmentation to be effective when targeting specific audiences for markets of and participation in Extension programs. Additionally, if the information source's vision is similar to the receiver's vision, "the more likely the receiver is to respond favorably to the source and the source's message" (Stone et

al., 1999, p. 87). One could argue Extension agents and landowners are congruent in their thinking and, therefore, are similar to each other, substantiating Rosenberg and Margerum's (2008) findings that Extension agents are trusted sources of information.

Audience segmentation is critical to understanding landowners' communication preferences, perceived source trustworthiness, and information needs because, without audience segmentation, one cannot tailor information to a targeted audience. Therefore, before communicators and educators can develop effective messaging and programming, they must first understand who is receiving the information. Because the Texas A&M AgriLife's Texas Water Resource Institute (TWRI) was not familiar with the audience in the Little River watershed, TWRI scientists sought to develop targeted messaging. Therefore, we chose to use audience segmentation to develop a descriptive analysis of landowners' communication preferences for receiving water-related information.

Purpose and Research Questions

The purpose of this study was to identify how landowners in the Texas Little River watershed preferred to receive water-related information and who they perceived as trustworthy sources of information based on their demographics. We achieved this purpose using three research questions.

1. What are the differences among landowners' age, gender, ethnicity, and educational level in relationship to their communication medium preferences for receiving water-related information?
2. What are the differences among landowners' age, gender, ethnicity, and educational level in relationship to their perceived source of trustworthiness for water-related information?
3. What are the differences among landowners' age, gender, ethnicity, and educational level in relationship to the types of water-related messages they prefer to receive?

Method

This descriptive quantitative study was part of a larger research study to identify Little River watershed landowners' motivations for and barriers to adopting BMPs related to watershed-based plans. Additionally, the findings included in this study were part of a formal report written for and submitted to the funding agency.

This study used a questionnaire to assess landowners' communication preferences and source trustworthiness for receiving water-related information. Bryman (2016) described survey methodology as a sufficient way to establish facts, describe a population, and generalize information beyond the sample. This type of study has been used in similar studies and states to identify landowners' communication preferences (Rosenberg & Margerum, 2008).

Sample

We sought to survey landowners within the Little River watershed, Big Elm Creek and San Gabriel River in three Texas counties—Bell, Milam, and Falls because those waterways were not meeting water quality standards due to bacteria pollution at the time of the study. We were interested in this particular population because TWRI wanted to communicate with them about managing watersheds.

Therefore, using Geographic Information System (GIS), we identified landowners (N = 7,592) living outside of city limits and along the three waterways. Of those, we drew a simple random sample of 1,881 (95% confidence level, 1.96 confidence interval), yielding 1,880 deliverable responses. A total of 462 landowners (25%) returned the questionnaire, resulting in 275 (15%) usable responses. Of the 275 usable responses, 30.2% were 55 to 64 years of age (n = 78), 69.8% were males (n = 185), 90.6% were Caucasian (n = 230), and 25.1% had at a bachelor's degree (n = 66; Table 1).

Table 1

Demographic Characteristics of the Little River Watershed Study Respondents (N= 275)

Characteristic	*n*	*%*
Age (n = 258)		
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 (n = 265)		
Male	185	69.8
Female	80	30.2
Ethnicity (n = 254)		
American Indian	1	0.4
Asian	1	0.4
Black or African American	19	7.5
Spanish, Hispanic, Latino	3	1.2
White or Caucasian	230	90.6
Highest level of education (n = 263)		
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

Procedures

We designed the paper questionnaire based on interviews with Texas A&M AgriLife Extension agents in Bell, Milam, and Falls counties; a review of relevant literature; and the Social Indicators Data Management and Analysis (SIDMA) tool website (Genskow & Prokopy, 2011). We believed that, because the Extension agents were close in proximity to the landowners of interest, they could help us develop context-specific questions and provide valuable input into the target audience. Furthermore, SIDMA has been used for water-related studies both locally (Berthold, 2014) and nationally. The questionnaire had 24 close-ended questions (i.e., dichotomous and Likert-type scales) related to communication preferences, source trustworthiness, BMPs use, and demographics. Because the project was federally funded, the needs of the funding agency and TWRI were important in determining the types of questions we asked the landowners. The TWRI scientists were especially interested in how communication preferences and source trustworthiness differed based on demographics.

We created a dichotomous scale (i.e., yes or no) to determine how landowners received water-related information from nine communication mediums (i.e., television, newspaper, direct mailings, email, magazines, radio, books, websites, and social media). However, we were not only interested in how they currently received information but also how they preferred to receive information. Therefore, using a modified five-point, Likert-type scale (i.e., *least preferred, slightly not preferred, no preference, slightly preferred,* and *most preferred*), we gathered information about landowners' preferred communication mediums (i.e., television, newspaper, direct mailings, email, magazines, radio, books, websites, and social media) for receiving water-related information. We were also interested in how frequently they preferred to receive water-related information through each of the identified communication mediums noted above, which we determined using a modified four-point, Likert-type scale (i.e., *monthly, quarterly, twice annually,* and *never*). In retrospect, it would have been helpful had we also included a question related to how frequently they currently receive information using the nine communication mediums.

Additionally, we used a dichotomous scale (i.e., yes or no) to identify landowners' current sources of information. While designing the questionnaire, we identified nine potential sources of information (i.e., government agencies, industry groups, friends and neighbors, Texas A&M AgriLife Extension Service, Texas Parks and Wildlife, environmental groups, agricultural service providers, trade shows/fairs, and county health departments). We recognize landowners might obtain information from additional sources other than those included, but we, based on prior studies, identified these nine sources as most prominent. Furthermore, we considered government agencies as entities such as Natural Resource Conservation Service, Farm Services Agency, and soil and water conservation districts; industry groups as entities such as Texas Farm Bureau, Cattle Raisers Association, and Cotton Growers Association; agricultural service providers as entities such as chemical company representatives and crop insurance agents; and environmental groups as entities such as Sierra Club and wildlife societies.

In addition to knowing how landowners receive information, we wanted to know the sources of information they considered most trustworthy, the type of information they needed to receive, and the type of information they were interested in receiving. We determined source trustworthiness using a modified four-point, Likert-type scale (i.e., *not trustworthy*, *somewhat trustworthy*, *trustworthy*, and *very trustworthy*) for all nine of the information sources. To determine the types of water-related information landowners need to receive, we included 11 statements related to water quality and water conservation (e.g., "how water quality impacts your operation," "how to install/maintain conservation practices," and "policies related to water"). We determined the types of information landowners need to receive using a four-point, Likert-type

scale (i.e., *not needed*, *somewhat needed*, *needed*, and *very needed*). Furthermore, to determine the types of water-related information landowners were most interested in receiving, we used the same 11 statements noted above. We determined the types of information landowners were interested in receiving using a four-point, Likert-type scale (i.e., *not interested*, *somewhat interested*, *interested*, and *highly interested*).

Furthermore, we were interested in communication preferences and source trustworthiness in relationship to landowners' demographics, especially as they related to age, gender, ethnicity, and educational level. The questionnaire also included demographics questions related to agricultural production (e.g., acres farmed, commodities produced) and best practices questions related to water quality and water conservation at the request of TWRI scientists. However, those questions were beyond the scope of this study and, therefore, are not reported below.

We sought to establish validity using a pilot study and an expert review, but we were unable to use the pilot study data as a point of validity because of a low response rate (5%). Therefore, we established content validity (Bryman, 2016) of the instrument in two ways— a committee of content experts from TWRI who specialize in water resources and watershed-based plans, and Texas A&M AgriLife Extension Service agents from Bell, Milam, and Falls counties. Because our data were not aggregated into indices, there was not a need for us to calculate a Cronbach's alpha to establish reliability of the instrument.

We distributed the questionnaire using Dillman, Smyth, and Christian's (2014) method for survey distribution. We had four points of contact with the landowners—an initial postcard, a questionnaire, a reminder postcard, and a reminder questionnaire—and provided them the opportunity to return the paper questionnaire or complete the questionnaire online. We sent the initial postcard on June 24, 2016, and data collection ended August 12, 2016. The United States Postal Service returned 122 of the initial postcards for various reasons (e.g., addressee not at address, addressee temporarily away, vacant address, closed P.O. Box), and because we could not verify if the 122 landowners received the questionnaire, we did not remove them from the sample. We sent the first questionnaire to the landowners with a cover letter and information sheet that informed the landowners about the scope of the study, confidentiality, and benefits of participating. If the landowners consented to the study, we asked them to return the questionnaire along with the signed information sheet. We sent the reminder post card one week after we sent the initial questionnaire. One week after sending the second reminder, we sent the final questionnaire in an effort to obtain as many responses as possible. We finalized data collection two weeks after we sent the second round of questionnaires.

As noted earlier, 462 landowners (25%) returned the questionnaire, resulting in 275 (15%) usable responses. We recognize this is a low response rate and prevents us from generalizing our results to the population, but it is typical of water-related research in Texas (Berthold, 2014). In an effort to test for non-response error, we compared early and late respondents on three questions and found no significant differences (Lindner, Murphy, & Briers, 2001).

To answer the research questions, we analyzed the data using Version 23 of the Statistical Package for Social Sciences (SPSS). We calculated the mean, standard deviation, and frequency on descriptive variables, including demographics and dichotomous questions. We ran *t*-tests on categorical data to determine association among variables, specifically demographic information (i.e., gender and ethnicity) related to communication medium preferences, current sources of information, and source trustworthiness. We also calculated four ANOVA analyses among respondents' ages and educational levels based on their preferred communication mediums and source trustworthiness. We calculated effect sizes for all *t*-tests and ANOVAs and adjusted them

accordingly with a Bonferroni correction value (α = 0.49; Field, 2013). All calculations were not significant due to the Bonferroni corrected value.

Results

Respondents most frequently received water-related information through direct mailings (*f* = 109, 48.0%) and preferred to receive information through direct mailings (*M* = 3.99, *SD* = 1.16). In opposition, respondents have not frequently received water-related information through social media (*f* = 201, 90.1%) and least preferred to receive information via this method (*M* = 1.29, *SD* = 1.13). However, an independent *t*-test found no significant differences among communication mediums (*t*(221) = .431, *p* = .682; Table 2).

Table 2

Respondents' Current Use of and Preferred Communication Mediums to Receive Water-related Information (N = 275)

	Current Use					*Preferred*		
	Yes		*No*					
Communication Medium	*f*	%	*f*	%	*N*	*M*	*SD*	*n*
Direct mailings	109	48.0	118	52.0	227	3.99	1.16	205
Magazines	94	41.4	133	58.6	227	2.74	1.30	196
Newspaper	92	40.2	137	59.8	229	2.80	1.35	203
Television	89	38.2	144	61.8	233	2.77	1.35	206
Websites	85	37.8	140	62.2	225	3.20	1.43	203
Email	56	24.9	169	75.1	225	3.10	1.55	203
Radio	49	21.8	176	78.2	225	2.36	1.23	191
Books	41	18.3	183	81.7	224	2.49	1.25	192
Social media	22	9.9	201	90.1	223	1.92	1.13	193
Other	3	20.0	12	80.0	15	2.55	1.37	11

Note. *N* = total respondents in the study. *n* = total respondents who answered the question. *f* = number of respondents who reported a usable answer for each medium. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; 4.50 ≤ = most preferred.

Using an independent *t*-test, we found a significant difference between respondents' frequency of receiving direct mailings and all other communication mediums ($t(227) = 36.85$, $p = 0.000$). Respondents most preferred websites for monthly ($f = 59$, 27.4%) delivery of water-related information and direct mailings for quarterly ($f = 69$, 30.3%), twice annual ($f = 33$, 14.5%), and annual ($f = 39$, 17.1%) delivery of water-related information. Additionally, they preferred not to receive water-related information on social media ($f = 153$, 74.6%; Table 3).

Table 3

Frequency Respondents Preferred to Receive Water-related Information (N =275)

Communication Channel	*n*	*Monthly*		*Quarterly*		*Twice annually*		*Annually*		*Never*	
		f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Websites	215	59	27.4	30	14.0	22	10.2	20	09.3	84	39.1
Direct mailings	228	56	24.6	69	30.3	33	14.5	39	17.1	31	13.6
Email	223	52	23.3	42	18.8	20	09.0	17	07.6	92	41.3
Television	219	51	23.3	26	11.9	21	09.6	28	12.8	93	42.5
Newspaper	214	48	22.4	40	18.7	14	06.5	26	12.1	86	40.2
Magazines	212	35	16.5	29	13.7	25	11.8	30	14.2	93	43.9
Radio	208	34	16.3	21	10.1	10	04.8	20	09.6	123	59.1
Social media	205	22	10.7	7	03.4	11	05.4	12	05.9	153	74.6
Books	209	11	5.3	16	07.7	14	06.7	35	16.7	133	48.4
Other	15	1	6.7	0	00.0	2	13.3	2	13.3	10	66.7

Note. N = total respondents in the study. n = total respondents who answered the question. f = number of respondents who reported a usable answer for each medium.

We calculated an ANOVA to compare communication preferences among respondents' ages (≤ 54 ($n = 48$), 55 to 64 ($n = 70$), 65 to 74 ($n = 66$), and ≥ 75 ($n = 34$)). Respondents' age was not significant in their communication medium preferences (see Table 4).

Table 4

Group Differences for Respondents' Preferred Communication Mediums Based on Age (N= 275)

	≤ 54		*55 – 64*		*65 – 74*		*≥ 75*				
Communication Medium	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(3)	*p*	η^2
Direct mailings	4.04	0.96	4.08	1.19	3.97	1.25	3.77	1.26	0.51	.674	0.01
Websites	3.63	1.25	3.45	1.40	2.87	1.49	2.71	1.42	4.55	.004	0.06
Email	3.43	1.53	3.14	1.55	2.92	1.56	2.87	1.54	1.24	.297	0.02
Television	2.93	1.34	2.54	1.35	2.80	1.39	2.87	1.25	0.95	.420	1.53
Radio	2.91	1.26	2.22	1.21	2.14	1.18	2.21	1.13	4.18	.007	0.06
Newspaper	2.89	1.32	2.54	1.35	2.74	1.31	3.28	1.37	2.33	.076	0.03
Magazines	2.87	1.29	2.66	1.31	2.75	1.32	2.71	1.32	0.23	.875	0.00
Books	2.51	0.91	2.57	1.35	2.36	1.30	2.60	1.40	0.38	.771	0.00
Social media	2.40	1.37	1.82	1.03	1.65	0.95	1.86	1.03	4.21	.007	0.06

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; ≥ 4.50 = most preferred.

We calculated an independent *t*-test and found no significant differences between male and female respondents' preferred communication mediums. However, male (*M* = 3.87; *SD* = 1.13; *n* = 143) and female (*M* = 4.27; *SD* = 1.19; *n* = 60) respondents *slightly preferred* to receive water-related information via direct mailings, and males (*M* = 1.87; *SD* = 1.07; *n* = 135) *least preferred* and females (*M* = 2.04; *SD* = 1.09; *n* = 57) *slightly did not prefer* social media (see Table 5).

Table 5

Group Differences for Respondents' Preferred Communication Mediums Based on Gender (N= 275)

	Male			*Female*						
Communication Medium	*M*	*SD*	*n*	*M*	*SD*	*n*	*df*	*t*	*p*	*Cohen's d*
Direct mailings	3.87	1.13	143	4.27	1.19	60	201.00	-2.22	.027	.34
Websites	3.28	1.39	141	3.00	1.54	61	200.00	1.29	.198	.19
Email	3.17	1.50	141	2.92	1.66	61	200.00	1.06	.289	.16
Magazines	2.87	1.22	140	2.44	1.45	55	085.77	1.97	.052	.32
Newspaper	2.82	1.27	143	2.76	1.55	59	091.61	0.24	.808	.04
Television	2.68	1.28	146	3.00	1.50	58	202.00	-1.54	.125	.23
Books	2.53	1.20	137	2.41	1.38	54	085.98	0.58	.559	.09
Radio	2.41	1.20	134	2.25	1.31	56	188.00	0.82	.414	.13
Social media	1.87	1.07	135	2.04	1.28	57	090.43	-0.83	.406	.14

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; ≥ 4.50 = most preferred.

Additionally, when comparing communication preferences between Caucasian and other ethnicities, an independent *t*-test showed no significant differences between the two groups (see Table 6). Respondents of American Indian, Asian, Black or African American, Spanish, Hispanic, and Latino ethnicities *slightly preferred* to receive information using direct mailings ($M = 4.40$; $SD = .83$; $n = 15$) and television ($M = 3.89$; $SD = 1.08$; $n = 18$), and Caucasian respondents *slightly preferred* to receive information using direct mailings ($M = 3.96$; $SD = 1.17$; $n = 183$).

Table 6

Group Differences for Respondents' Preferred Communication Mediums Based on Ethnicity (N = 275)

	Caucasian			*All Other Ethnicities*						
Communication Medium	*M*	*SD*	*n*	*M*	*SD*	*n*	*df*	*t*	*p*	*Cohen's d*
Direct mailings	3.96	1.17	183	4.40	0.83	15	196.00	1.44	.151	.43
Websites	3.21	1.40	181	2.94	1.81	16	016.63	-0.58	.564	.17
Email	3.07	1.52	180	3.18	1.81	17	195.00	0.28	.780	.07
Magazines	2.75	1.30	176	2.71	1.33	14	188.00	-0.09	.922	.03
Newspaper	2.76	1.33	180	3.29	1.49	17	195.00	1.58	.116	.38
Television	2.65	1.31	180	3.89	1.08	18	196.00	3.87	.000	.20
Books	2.42	1.20	172	2.86	1.46	14	184.00	1.29	.199	.33
Radio	2.30	1.18	171	2.93	1.39	14	183.00	1.89	.060	.49
Social media	1.88	1.09	172	2.13	1.46	15	185.00	0.85	.398	.19

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; ≥ 4.50 = most preferred.

We calculated an ANOVA to compare communication medium preferences among respondents' educational level (less than high school (n = 2), high school diploma/GED (n = 33), some college (n = 38), 2-year degree (n = 22), bachelor's degree (n = 55), and graduate degree (n = 48)). Respondents' education level was not significant in their communication medium preferences (see Table 7).

Table 7

Group Differences for Respondents' Preferred Communication Mediums Based on Educational Level (N= 275)

	Less than high school		*High school diploma/GED*		*Some college*		*Two-year degree*		*Bachelor's degree*		*Graduate degree*				
Communication Medium	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(6)	*p*	η^2
Television	4.50	0.71	2.73	1.38	2.39	1.41	3.32	1.25	2.73	1.41	2.77	1.13	1.70	.122	0.05
Email	4.50	0.71	2.56	1.39	2.76	1.66	3.17	1.56	3.23	1.66	3.51	1.35	2.13	.052	0.06
Direct mailings	4.00	1.41	3.94	1.32	4.00	1.31	3.82	1.30	4.15	1.01	3.92	0.99	0.31	.934	0.01
Newspaper	4.00	0.00	2.88	1.29	2.39	1.38	3.13	1.36	2.98	1.35	2.70	1.33	1.17	.324	0.03
Websites	4.00	0.00	2.72	1.30	2.81	1.58	3.39	1.47	3.40	1.43	3.55	1.23	2.17	.047	0.06
Magazines	3.00	0.00	2.84	1.25	2.53	1.46	2.74	1.10	2.94	1.42	2.71	1.56	0.53	.787	0.02
Radio	3.00	0.00	2.61	1.30	1.94	1.27	2.45	1.22	2.38	1.18	2.48	1.20	1.19	.316	0.04
Books	3.00	0.00	2.52	1.23	2.51	1.40	2.09	0.97	2.57	1.28	2.63	1.23	0.66	.685	0.02
Social media	3.00	0.00	2.16	1.17	1.62	1.02	2.05	1.36	1.74	1.07	2.08	1.11	1.22	.299	0.04

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; ≥ 4.50 = mos preferred.

We found no significant differences between respondents who did or did not currently receive information through identified communication mediums and their preferences for receiving information through that medium. However, based on means and standard deviations, respondents who currently receive information through direct mailings, email, books, newspapers, social media, magazines, television, radio, and websites *preferred* to receive information through those communication mediums more than those who did not currently receive information through the same communication mediums (see Table 8).

Table 8

Group Differences for Preferred Communication Mediums Between Respondents Who Did or Did Not Currently Receive Information Through the Communication Mediums (N = 275)

Communication Medium	*Yes*		*No*					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Direct mailings	4.24	0.94	3.67	1.32	168.51	3.43	.001	0.53
Other	4.00	1.00	2.00	1.10	007.00	2.35	.033	1.78
Email	3.96	1.17	2.85	1.55	119.04	5.34	.000	0.98
Books	3.72	1.00	2.18	1.10	182.00	7.65	.000	1.13
Newspapers	3.62	1.03	2.20	1.24	192.63	8.74	.000	1.26
Social media	3.53	0.87	1.76	1.04	183.00	6.77	.000	1.00
Magazines	3.48	1.09	2.14	1.15	188.00	8.19	.000	1.19
Television	3.47	1.14	2.30	1.27	173.90	6.74	.000	1.02
Radio	3.30	0.97	2.10	1.18	074.59	6.58	.000	1.52
Websites	1.09	0.96	2.57	1.39	190.89	9.01	.000	1.30

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; ≥ 4.50 = most preferred.

At least 30% of respondents received information from industry groups, government agencies, friends and neighbors, and Texas agencies. More than 80% of respondents were *not receiving* information from county health departments, trade shows/fairs, agricultural service providers, and environmental groups. Overall, respondents noted the Texas A&M AgriLife Extension Service (M = 3.16, SD = .82), Texas Parks and Wildlife Department (M = 2.88, SD = .83), industry groups (M = 2.73, SD = .80), and government agencies (M = 2.64, SD = .86) as trustworthy sources of information (see Table 9).

Table 9

Respondents' Current Sources and their Perceived Level of Source Trustworthiness for Receiving Water-related Information (N =275)

	Current Sources of Information					Source Trustworthiness		
	Yes		*No*					
Information Source	*f*	*%*	*f*	*%*	*n*	*M*	*SD*	*n*
Industry groups	84	36.1	149	63.9	233	2.73	0.80	166
Government agencies	84	35.6	152	64.4	236	2.64	0.86	177
Friends and neighbors	81	34.6	153	65.4	234	2.44	0.80	161
Texas A&M AgriLife Extension Service	80	34.3	153	65.7	233	3.16	0.82	169
Texas Parks and Wildlife Department	66	29.2	160	70.8	226	2.88	0.83	156
Environmental groups	41	17.8	189	82.2	230	1.99	0.90	147
Agricultural service providers	38	16.4	194	83.6	232	2.28	0.79	151
Trade shows/fairs	27	11.9	199	88.1	226	2.16	0.77	141
County health departments	25	10.8	206	89.2	231	2.47	0.83	145
Other	5	22.7	17	77.3	22	2.29	1.38	14

Note. N = total study respondents. *n* = total respondents who answered the question. *f* = number of respondents who reported a usable answer for source trustworthiness; ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; 3.50 ≤ = very trustworthy.

We calculated an ANOVA to identify the effects respondents' age (≤ 54 (*n* = 40), 55 to 64 (*n* = 50), 65 to 74 (*n* = 52), and ≥ 75 (*n* = 23)) had on source trustworthiness. We found no significant differences between respondents' age and source trustworthiness (see Table 10).

Table 10

Group Differences for Respondents' Perceived Source Trustworthiness Based on Age (N= 275)

	≤ 54		*55 – 64*		*65 – 74*		*≥ 75*				
Information Source	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(3)	*p*	η^2
Texas A&M AgriLife Extension Service	3.30	0.72	3.20	0.78	3.10	0.89	3.04	0.93	0.67	.571	0.01
Texas Parks and Wildlife	2.94	0.79	2.79	0.80	2.98	0.88	2.75	0.91	0.65	.585	0.01
Government agencies	2.88	0.84	2.67	0.85	2.41	0.83	2.71	0.91	2.51	.060	0.04
Industry groups	2.72	0.79	2.81	0.72	2.67	0.90	2.70	0.80	0.26	.855	0.00
Friends and neighbors	2.58	0.73	2.37	0.74	2.53	0.92	2.21	0.71	1.26	.290	0.02
County health departments	2.44	0.72	2.48	0.78	2.37	0.89	2.80	0.94	1.05	.373	0.02
Agricultural service providers	2.30	0.74	2.30	0.81	2.27	0.79	2.29	0.92	0.18	.997	0.00
Trade shows/fairs	2.27	0.84	2.17	0.68	2.07	0.77	2.13	0.92	0.47	.702	0.01
Environmental groups	2.15	1.02	1.96	0.79	1.88	0.87	2.11	1.02	0.73	.533	0.01

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; ≥ 3.50 = very trustworthy.

We calculated an independent *t*-test to identify perceived source trustworthiness and found no significant differences between male and female respondents. However, male respondents reported Texas A&M AgriLife Extension (*M* = 3.17; *SD* = .80; *n* = 115), Texas Parks and Wildlife (*M* = 2.85; *SD* = .83; *n* = 107), industry groups (*M* = 2.77; *SD* = .74; *n* = 114), and government agencies (*M* = 2.63; *SD* = .85; *n* = 123) as *trustworthy* sources of water-related information. Female respondents reported Texas A&M AgriLife Extension (*M* = 3.16; *SD* = .88; *n* = 51), Texas Parks and Wildlife (*M* = 2.96; *SD* = .84; *n* = 49), industry groups (*M* = 2.65; *SD* = .91; *n* = 51), government agencies (*M* = 2.66; *SD* = .88; *n* = 53), and county health departments (*M* = 2.58; *SD* = .87; *n* = 48; Table 11) as *trustworthy* sources of water-related information.

Table 11

Group Differences for Respondents' Perceived Source Trustworthiness Based on Gender (N = 275)

	Males			*Females*						
Information Source	*M*	*SD*	*n*	*M*	*SD*	*n*	*df*	*t*	*p*	*Cohen's d*
Texas A&M AgriLife Extension Service	3.17	0.80	115	3.16	0.88	51	164.00	0.12	.902	.01
Texas Parks and Wildlife	2.85	0.83	107	2.96	0.84	49	154.00	-0.75	.452	.13
Industry groups	2.77	0.74	114	2.65	0.91	51	080.75	0.86	.396	.14
Government agencies	2.63	0.85	123	2.66	0.88	53	174.00	-0.19	.853	.05
Friends and neighbors	2.47	0.78	109	2.40	0.86	50	157.00	0.50	.621	.09
County health departments	2.41	0.80	97	2.58	0.87	48	143.00	-1.18	.242	.20
Agricultural service providers	2.25	0.70	102	2.35	0.95	49	073.98	-0.61	.547	.12
Trade shows/fairs	2.12	0.71	95	2.24	0.87	46	074.92	-0.83	.408	.15
Environmental groups	1.94	0.88	101	2.11	0.92	46	145.00	-1.06	.293	.19

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; ≥ 3.50 = very trustworthy.

Additionally, respondents of American Indian, Asian, Black or African American, Spanish, Hispanic, and Latino decent reported all nine sources of information as *trustworthy*. However, Caucasian respondents reported only Texas A&M AgriLife Extension Service ($M = 3.16$; $SD = .80$; $n = 152$), Texas Parks and Wildlife Department ($M = 2.89$; $SD = .83$; $n = 142$), industry groups ($M = 2.73$; $SD = .79$; $n = 150$), and government agencies ($M = 2.61$; $SD = .85$; $n = 159$) as *trustworthy* sources of information. When comparing source trustworthiness between Caucasians ($n = 207$) and other ethnicities ($n = 20$), we found no significant differences using an independent *t*-test (see Table 12).

Table 12

Group Differences for Respondents' Perceived Source Trustworthiness Based on Ethnicity (N = 275)

	Caucasian			*All Other Ethnicities*						
Information Source	*M*	*SD*	*n*	*M*	*SD*	*n*	*df*	*t*	*p*	*Cohen's d*
Texas A&M AgriLife Extension Service	3.16	0.80	152	3.20	0.92	10	160.00	0.14	.893	.04
Texas Parks and Wildlife	2.89	0.83	142	3.00	0.82	10	150.00	0.42	.677	.13
Industry groups	2.73	0.79	150	2.80	0.92	10	158.00	0.28	.777	.08
Government agencies	2.61	0.85	159	3.00	0.78	11	168.00	1.48	.140	.48
Friends and neighbors	2.44	0.78	144	2.55	0.93	11	153.00	0.43	.664	.13
County health departments	2.45	0.81	130	2.80	0.92	10	138.00	1.32	.188	.40
Agricultural service providers	2.26	0.77	136	2.64	0.92	11	145.00	1.51	.132	.45
Trade shows/fairs	2.11	0.74	127	2.67	0.87	9	134.00	2.16	.032	.69
Environmental groups	1.95	0.87	131	2.60	0.97	10	139.00	2.25	.026	.71

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; ≥ 3.50 = very trustworthy.

We calculated an ANOVA to identify the effects respondents' educational level (less than high school (n = 2), high school diploma/GED (n = 27), some college (n = 27), 2-year degree (n = 21), bachelor's degree (n = 48), and graduate degree (n = 43)) had on source trustworthiness. We found no significant differences between respondents' educational level and source trustworthiness (see Table 13).

Table 13

Group Differences for Respondents' Perceived Trustworthiness of Water-related Information Sources Based on Educational Level (N= 275)

	Less than high school		*High school diploma/ GED*		*Some college*		*Two-year degree*		*Bachelor's degree*		*Graduate degree*				
Information Source	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(6)	*p*	η^2
Texas Parks and Wildlife	3.00	1.41	2.70	0.99	2.43	0.79	3.10	0.83	3.18	0.68	2.92	0.75	2.60	.020	0.10
Industry groups	3.00	1.41	2.66	0.72	2.54	1.06	2.50	0.76	2.85	0.79	2.91	0.65	1.13	.345	0.04
Government agencies	3.00	1.41	2.41	0.80	2.41	0.84	2.62	1.07	2.79	0.82	2.81	0.76	1.31	.257	0.04
Agricultural service providers	3.00	1.41	2.38	0.64	2.26	1.10	1.89	0.74	2.31	0.76	2.33	0.69	1.56	.163	0.06
County health departments	3.00	1.41	2.12	0.73	2.05	0.89	1.94	0.57	2.28	0.78	2.19	0.79	0.68	.526	0.05
Environmental groups	3.00	1.41	1.92	0.86	1.74	0.75	2.11	1.15	2.15	0.93	1.92	0.79	1.17	.325	0.04
Texas A&M AgriLife Extension Service	2.67	1.16	3.00	0.86	2.80	0.91	3.29	0.90	3.30	0.64	3.39	0.70	2.17	.049	0.08
Friends and neighbors	2.67	1.56	2.53	0.78	2.38	0.97	2.42	0.77	2.46	0.82	2.46	0.68	0.21	.973	0.01
Trade shows/fairs	2.67	1.16	2.46	0.91	2.14	0.83	2.41	0.76	2.69	0.72	2.56	0.81	1.22	.299	0.04

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; ≥ 3.50 = very trustworthy.

Using an ANOVA, we found no significant differences between respondents who did or did not receive information from identified sources and their reported trustworthiness of the source. However, means and standard deviations revealed that respondents who did receive information from Texas A&M AgriLife Extension Service, industry groups, government agencies, friends and neighbors, and environmental groups perceived the source to be more *trustworthy* than those who did not receive information from the same source (see Table 14).

Table 14

Group Differences for Source Trustworthiness Between Respondents Who Did or Did Not Currently Receive Information from the Source

	Yes		*No*					
Source of Information	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Texas A&M AgriLife Extension Service	3.37	0.63	2.99	0.92	165.00	3.09	.002	0.48
Texas Parks and Wildlife	3.02	0.72	2.81	0.90	146.12	1.60	.111	0.26
Industry groups	2.95	0.68	2.51	0.85	154.64	3.67	.000	0.59
Government agencies	2.90	0.77	2.43	0.88	174.58	3.86	.000	0.58
County health departments	2.82	0.80	2.41	0.86	140.00	2.15	.033	0.36
Agricultural service providers	2.70	0.78	2.13	0.73	147.00	4.05	.128	0.67
Friends and neighbors	2.66	0.71	2.23	0.80	157.00	3.61	.000	0.58
Other	2.50	1.73	2.14	1.35	009.00	0.38	.710	0.25
Trade shows/fairs	2.42	0.72	2.08	0.76	135.00	2.00	.048	0.34
Environmental groups	2.39	1.00	1.87	0.82	055.68	2.91	.005	0.78

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; ≥ 3.50 = very trustworthy.

We found respondents were *interested* in receiving all types of water-related information and *somewhat interested* in receiving other types of information (e.g., invasive wildlife management, impact of prescribed burning on water quality, and well water testing). They reported they *somewhat needed* or *needed* all types of water-related information (see Table 15).

Table 15

Means and Standard Deviations of Respondents' Interest in and Need for Receiving Water-related Information (N = 275)

	Interest			*Need*		
Type of Information	*M*	*SD*	*n*	*M*	*SD*	*n*
Current water quality levels	3.07	0.84	232	2.70	0.98	228
Conservation practices to improve water quality	2.97	0.87	232	2.66	0.98	224
Policies related to water	2.93	0.89	230	2.66	0.99	224
Water conservation practices to improve operations	2.93	0.90	232	2.64	1.00	226
Increase profit or improve practices	2.93	0.94	230	2.67	0.98	227
Conservation practice effectiveness	2.84	0.90	228	2.59	0.96	227
Pesticide/fertilizer application management	2.80	0.94	226	2.56	0.99	222
Install/maintain conservation practices	2.80	0.96	230	2.58	1.00	227
Agricultural production impact on water quality	2.75	0.94	228	2.42	0.97	226
Water quality impact on operation	2.72	0.93	232	2.27	0.98	223
Water conscious fertility application methods	2.69	0.99	222	2.43	0.99	210
Other	2.40	1.51	10	2.81	1.33	16

Note. Interest: ≤ 1.50 = not interested; 1.51 – 2.49 = somewhat interested; 2.50 – 3.49 = interested; ≥ 3.50 = highly interested. Need: ≤ 1.50 = not needed; 1.51 – 2.49 = somewhat needed; 2.50 – 3.49 = needed; ≥ 3.50 = very needed.

Conclusions

Audience segmentation is useful when delivering important information to a targeted population because the population can assimilate and relate to the messages more effectively when preferred delivery methods are used (Slater, 1996). However, because the response rate for this study was low, we must be cautious with generalizing the findings to the population. The results of this study, however, do provide guidance for delivering water-related information to landowners based on their demographic characteristics.

Overall, respondents preferred water-related information be delivered via websites monthly and direct mailings quarterly, twice annually, and annually, which supports Rosenberg and Margerum (2008) and Howell and Habron (2004) who found landowners preferred newsletters. Direct mailings are an assimilated medium, as suggested by Quarles et al. (1983), in which water-related information can be effectively disseminated to landowners in the Little River watersheds. These mediums provide landowners access to necessary information without requiring the two-way interaction of social media. Even though social media is an important part of a 21st century communication plan, landowners in this study did not prefer to receive information through social media. This contradicts Cline's (2011) finding that 93% of Caucasian individuals who live or work on a farm used social media to access agricultural-related information and engage in conversation. Perhaps, because the majority of landowners in this study were 55 years of age or older and did not use social media as a communication medium, they reported lower preference for social media. The internet is a useful communication medium, but access to the internet in rural areas can be limited, therefore, making it difficult to diffuse water-related information to landowners through internet-based communication mediums.

More specifically, male and female respondents, regardless of educational backgrounds, and Caucasian respondents preferred direct mailings. However, respondents of all other ethnic backgrounds preferred direct mailings and television. Although there were no significant differences, respondents aged 54 and younger preferred to receive information through direct mailings and websites and respondents aged 55 and older preferred to receive water-related information through direct mailings. Additionally, respondents with a graduate degree slightly preferred to receive water-related information through email compared to respondents with all other levels of education who had no preference for receiving water-related information through email.

At least 30% percent of the respondents reported currently receiving information from industry groups, government agencies, friends and neighbors, and the Texas A&M AgriLife Extension Service. However, of those sources, respondents reported Texas A&M AgriLife Extension Service, government agencies, and industry groups as trustworthy sources of information, which substantiates Rosenberg and Margerum's (2008) finding that Extension agents were a trusted source of information. Because respondents considered the Texas A&M AgriLife Extension Service, government agencies, and industry groups trustworthy, water-related information should be disseminated using one of these three sources. Perhaps, respondents consider these three sources trustworthy because landowners often seek like-minded sources (Cline, 2011) and perceive Texas A&M AgriLife Extension as transparent in and accountable for the information they provide to the public, which Giupponi and Sgobbi (2008) suggested as factors of trustworthiness.

Furthermore, audience segmentation in relation to perceived source trustworthiness can impact (Slater, 1996) and assist with source assimilation (Quarles et al., 1983). Therefore, we suggest that communicators use Texas A&M AgriLife Extension Service, Texas Parks and Wildlife Department, industry groups, and government agencies when communicating to male and Caucasian landowners like the respondents in this study. Female respondents reported the same four sources and county health departments as trustworthy. Female respondents might have had more familiarity and knowledge of county health departments than males; thus, they found county health departments as a trustworthy source of information. However, respondents from all other ethnic backgrounds considered all of the identified sources in the study trustworthy. When considering respondents' age in relation to source trustworthiness, water information should be communicated through the Texas A&M AgriLife Extension Service, Texas Parks and Wildlife Department, and industry groups as respondents across all age groups trusted these three sources. Although respondents at all education levels reported the Texas A&M AgriLife Extension Service

as trustworthy, respondents with a bachelor's or graduate degree had a higher trust in the Texas A&M AgriLife Extension Service than the others. Furthermore, respondents with a bachelor's degree reported a higher mean level of trust for the Texas Parks and Wildlife Department than respondents with graduate degrees.

Finally, respondents were interested in receiving and needed water-related information (e.g., water quality levels, specific conservation practices that improve water quality) and environmental-specific information regarding water quality. This finding contradicted what Jackson-Smith and McEvoy (2011) suggested as being unsuccessful in changing behavior. Because respondents in this study were interested in receiving all types of water-related information, communicators and educators should provide them with direct, simple, fundamental water quality information.

Recommendations and Implications

This study not only provides insight in communicating to landowners in the Little River watershed, but it also assists with communicating with similar audiences in similar watersheds. Respondents in this study preferred water-related information delivered to them via websites monthly and direct mailings quarterly, twice annually, and annually. They also preferred to continue receiving water-related information through the communication mediums they currently use and perceived local Extension Service personnel as the most trustworthy source of information. Landowners in similar geographic areas with similar demographics may prefer websites and direct mailings because they are non-invasive forms of communication (Rosenberg & Margerum, 2008). To communicate with such landowners, communicators and educators should use the communication mediums currently used by the target audience and communicate through local Extension Service agents.

The results of this study will directly benefit organizations such as the Texas A&M AgriLife Extension Service and TWRI by informing them about effective delivery of water-related information. The findings of this study have the potential to encourage collaboration between trusted agencies and organizations to deliver information effectively across audiences within the watershed. Additionally, using results of this study, communicators can deliver information to landowners prior to watershed-based planning meetings and provide landowners with updates during the development and planning process.

Further research could assist communicators in identifying the potential use of social media to deliver water-related information. The dramatic changes in information access associated with smart phones and websites offer a cost-effective means of reaching diverse audiences. Social media could be used to communicate short, specific, and assimilated messages to the public and provide quick and effective ways to deliver water-related information to segmented audiences (Quarles et al., 1983; Rogers, 2003; Slater, 1996). Delivery of information via social media allows for two-way conversations between the audience and the source and is more cost effective than direct mailings. Although this study did support delivery of information via websites, it did not support delivery of water-related information via social media. Therefore, further research is warranted due to the innate characteristics of social media (e.g., efficient and widespread).

Surprisingly, respondents in this study did not consider friends and neighbors as trustworthy sources of information—contrary to Rosenberg and Margerum's 2008 findings—but did consider the Extension Service a trustworthy source of information. However, both are sources of information based on interpersonal communication, which Rogers (2003) documented as essential to innovation adoption and behavioral change. One could extend audience segmentation

beyond the landowners' basic demographic characteristics and segment them based on their current level of adoption (Rogers, 2003). Extension agents' interpersonal communication networks can help provide landowners with knowledge and assistance when processing new information and, therefore, target landowners based on their position within Rogers' (2003) diffusion of innovation model.

Because respondents in this study reported the Texas A&M AgriLife Extension Service as a trustworthy source of information, Extension agents in the Little River watershed should be provided additional training on water-related issues to enhance delivery of this information. Collaboration between stakeholders and Extension agents during watershed planning processes will assist in providing informed Extension agents with information on water-related topics. In fact, uncertainty about a new idea or knowledge is best communicated during face-to-face discussion (Rogers, 2003). Therefore, having informed Extension agents will provide landowners more access to water-related information.

Additionally, partnerships between trustworthy sources (see Table 9) could assist in informing landowners about water-related information. It would be beneficial for the Texas A&M AgriLife Extension Service and TWRI to use the communication mediums respondents in this study identified as useful for communicating water-related information as a starting point for communicating about water-related issues. Such partnerships and communication strategy would increase landowners' trust, and thereby, landowners' participation in developing watershed-based plans. Finally, further research is needed to assess the communication preferences of Extension agent opinion leaders (Lamm et al., 2015). To improve the exchange of water-related information, researchers should identify the differences and similarities in landowners' and Extension agents' communication preferences.

We recommend research be conducted to further explore the communication preferences of landowners in this area. After developing and implementing the watershed-based plan, a quantitative follow-up study of the landowners should be conducted. This type of study would provide further understanding of the effectiveness of the information diffusion framework (Quarles et al., 1983) and accuracy of audience segmentation (Slater, 1996) as well as provide program administrators with more accurate communication strategies. Furthermore, qualitative interviews with key stakeholder groups and landowners would provide more justification and understanding of why they prefer water-related information from the Texas A&M AgriLife Extension Service be delivered via websites monthly and direct mailings quarterly, twice annually, and annually. Additionally, interviews with landowners would provide information about designing specific content for water-related communication messages and identify the current level of water-related knowledge, which would enhance the assimilation of communication messages.

Limitations

We believe this study had three limitations: pilot test, low response rate, and undeliverable points of contact. First, because of a lack of response on the pilot test, we were unable to determine the validity of the instrument using participants similar to the target population. Thus, we sought validity using other methods. Second, we recognize the study had a low response rate. However, the response rate of this study was consistent with similar studies conducted in Texas with similar audiences (Berthold, 2014). The low response rate could be linked to topic sensitivity, in which landowners were reluctant to respond to a questionnaire about water. Third, when beginning data collection, the post office returned 122 initial postcards with invalid addresses. This decreased the effectiveness of Dillman's Tailored Design Method (Dillman et al., 2014) because not all individuals in the sample received all intended points of contact.

References

Andenoro, A. C., Baker, M., Stedman, N. L. P., & Weeks, P. P. (2016). Research priority 7: Addressing complex problems. In T. G. Roberts, A. Harder, & M. T., Brashears (Eds), *American Association for Agricultural Education national research agenda: 2016–2020* (pp. 57–66). Gainesville, FL: Department of Agricultural Education and Communication.

Baumgart-Getz, A., Prokopy, L. S., & Floress, K. (2012). Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature. *Journal of Environmental Management*, *96*(1), 17–25. doi: 10.1016/j.jenvman.2011.10.006

Berthold, T. A. (2014). *Addressing water quality mitigation challenges through evaluation* (Unpublished doctoral dissertation). Texas A&M University, College Station, Texas.

Boellstorff, D. E., McFarland, M. L., & Boleman, C. T. (2010). Water issues in Texas: A survey of public perceptions and attitudes about water. *The Southern Region Water Resource Project*, (B-6219).

Bryman, A. (2016). *Social research methods* (5th ed.) New York, NY: Oxford University Press.

Caumont, A. (2013, October 16). 12 trends shaping digital news. Retrieved from http://www.pewresearch.org/fact-tank/2013/10/16/12-trends-shaping-digital-news/

Cline, M. (2011). Expansion of social media in agriculture: A user profile of Twitter's @AgChat, @FollowFarmer, and @TruffleMedia followers (Unpublished master's thesis). Oklahoma State University, Stillwater, OK.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed mode surveys: The tailored design method*. Hoboken, NJ: John Wiley & Sons.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Thousand Oaks, CA: Sage Publications.

Genskow, K., & Prokopy, L. (2011). The social indicator planning and evaluation system (SIPES) for nonpoint source management: A handbook for watershed projects. *Great Lakes Regional Water Program*, (3), p. 1–104.

Giupponi, C., & Sgobbi, A. (2013). Decision support systems for water resources management in developing countries: Learning from experiences in Africa. *Water, 5*(2), 798–818. doi:10.3390/w5020798

Howell, J. L., & Habron, G. B. (2004). Agricultural landowners' lack of preference for internet extension. *Journal of Extension*, *42*(6). Retrieved from https://www.joe.org/joe/2004december/a7.php

Jackson-Smith, D. B., & McEvoy, J. P. (2011). Assessing the long-term impacts of water quality outreach and education efforts on agricultural landowners. *Journal of Agricultural Education and Extension, 17*(4), 341–353. doi: 10.1080/1389224X.2011.576823

Lamm, K. W., Lamm, A. J., & Carter, H. S. (2015). Bridging water issue knowledge gaps between the general public and opinion leaders. *Journal of Agricultural Education, 56*(3), 146–161. doi: 10.5032/jae.2015.03146

Lee, N. R., & Kotler, P. A. (2011). *Social marketing: Influencing behavior for good* (4th ed.). Thousand Oaks, CA: Sage Publications.

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education*, *42*(4), 43–53. doi: 10.1177/1470593107076865

Mase, A. S., Babin, N. L., Prokopy, L. S., & Genskow, K. D. (2015). Trust in sources of soil and water quality information: Implications for environmental outreach and education. *Journal of the American Water Resources Association, 51*(6), 1656–1666. doi: 10.1111/1752-1688.12349

Molnar, J. J., Bitto, A., & Brant, G. (2001). Core conservation practices: Adoption barriers perceived by small and limited resource farmers. Alabama Agricultural Experiment Station, Auburn University. doi: http://hdl.handle.net/11200/4088

Quarles, R., Jeffres, W. L., Sanchez-Ilundain, C., & Neuwirth, K. (1983). Information diffusion. In Stone, G., Singletary, M., & Richmond, V. P. (Eds.), *Clarifying communication theories* (pp. 165–172). Ames, IA: Iowa State University Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: Free Press.

Rosenberg, S., & Margerum, R. D. (2008). Landowner motivations for watershed restoration: Lessons from five watersheds. *Journal of Environmental Planning and Management*, *51*(4), 477–496. doi: 10.1080/09640560802116962

Slater, M. D. (1996). Theory and method in health audience segmentation. *Journal of Health Communication*, *1*(3), 267–284. doi: 10.1080/108107396128059

Stone, G., Singletary, M., & Richmond, V. P. (1999). *Clarifying communication theories*. Ames, IA: Iowa State University Press.

Texas Commission on Environmental Quality (2014a). 2014 Texas integrated report: Assessment results for basin 12—Little River. Retrieved from http://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014_basin12.pdf

Texas Commission on Environmental Quality (2014b). Chapter 307- Texas surface water quality standards: Rule Project No. 207-002-307-OW. Retrieved from https://www.tceq.texas.gov/waterquality/standards/2014standards.html

Thysen, I. (2000). Agriculture in the information society. *Journal of Agricultural Engineering Research*, *76*(3), 297–303. doi: 10.1006/jaer.2000.0580

Tucker, M., & Napier, T. L. (2002). Preferred sources and channels of soil and water conservation information among farmers in three Midwestern U.S. watersheds.

Agriculture, Ecosystems & Environment, *92*(2–3), 297–313. doi: 10.1016/S0167-8809(01)00293-6

United States Department of Agriculture, N. R. C. S. (n.d.). Conservation practices. Retrieved from http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/?cid=nrcs143_026849

Warner, L. A., Chaudhary, A. K., Rumble, J. N., Lamm, A. J., & Momol, E. (2017). Using audience segmentation to tailor residential irrigation water conservation programs. *Journal of Agricultural Education*, *58*(1), 313–333. doi: 10.5032/jae.2017.01313

White, D., Meyers, C., Doerfert, D., & Irlbeck, E. (2014). Exploring agriculturalists' use of social media for agricultural marketing. *Journal of Applied Communications*, *98*(4), 72–86. doi: 10.4148/1051-0834.1094