The Journal of Extension

Volume 60 | Number 1 Article 16

3-11-2022

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Audrey McCrary
Mississippi State University, audrey.mccrary@usda.gov

Leslie M. Burger
Mississippi State University, leslie.burger@msstate.edu

Laura Downey
Mississippi State University, laura.downey@mssstate.edu

Beth H. Baker
Mississippi State University, beth.baker@msstate.edu

Recommended Citation

McCrary, A., Burger, L. M., Downey, L., & Baker, B. H. (2022). Water Conservation: Extension Agents' Perceptions of Issue Importance, Professional Abilities, and Landowner Needs. *The Journal of Extension, 60*(1), Article 16. https://doi.org/10.34068/joe.60.01.17

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Cover Page Footnote

This project was supported by funds from the Mississippi Agriculture and Forestry Experiment Station and the Mississippi Department of Environmental Quality.

JOURNAL OF Extension

Feature Article

Volume 60, Issue 1, 2022

Water Conservation: Extension Agents' Perceptions of Issue Importance, Professional Abilities, and Landowner Needs

Audrey McCrary[1], Leslie M. Burger[1], Laura Downey[1], and Beth H. Baker[1]

AUTHORS: [1]Mississippi State University.

Abstract. The Extension Service is one of many agencies charged with increasing awareness and knowledge of research-based agricultural conservation practices. A regional survey of Extension agents with agriculture and natural resources responsibilities was conducted to assess the need for in-service training on 11 water resource conservation topics. The highest priority training needs were for topics related to complex interactions and drivers of agricultural water pollution. This article highlights the implications of these results and offers broader perspective on bringing the Borich model of needs assessment into the agricultural and natural resources realm of subject matter expertise.

INTRODUCTION

Water quality impairment in surface water streams and rivers in the southeastern United States is a major concern for federal and state natural resource agencies (U.S. Environmental Protection Agency [USEPA], 2019; United States Geological Survey [USGS], 2010). A variety of contaminants can impair stream function, but the three leading pollutants of concern in U.S. rivers and streams are sediment, nutrients, and pathogens (USEPA, 2019). Excessive pollutants degrade ecosystem resources and threaten the health of human and wildlife populations (Hooda et al., 2000; Jordan et al., 2016). These pollutants are common byproducts of agricultural activities on the landscape that enter surface waters through runoff after rain events or irrigation.

Broad scale awareness of water quality issues and implementation of water conservation practices are needed to effectively address regional water quality impairments caused by agricultural activities. Baumgart-Getz et al. (2012) found that awareness and knowledge of conservation practices and programs, rather than the general environmental effects of agriculture, are significant factors in determining conservation practice adoption by farmers. Some studies have recommended that Extension increase efforts to provide accurate and relevant research-based information to agriculture and natural resources (ANR) agents to increase the capacity of the organization and impact water conservation (Baumgart-Getz et al., 2012; Harder et al., 2010; Prokopy et al., 2015; Scheer et al., 2011; Smith et al., 2011).

Extension education is considered a valuable and trustworthy source of agricultural information by farmers (Prokopy et al., 2015; Samy et al., 2003). However, a survey of landowners found that Extension was used infrequently, especially in comparison to other private consulting resources (Prokopy et al., 2015). This discrepancy may be caused by a gap in Extension's perception of stakeholder needs and actual information needs (Prokopy et al., 2015; Wright & Shindler, 2001). One method of narrowing the gap between perceived and actual needs of stakeholders is to perform needs assessments of the educators, or ANR agents, and the clientele, or agricultural producers (Fraenkel & Wallen, 2009).

Competency can be defined as individual or organizational capability developed by increasing awareness, knowledge, and skills, thereby increasing the quality of performance of job duties (Athey & Orth, 1999; Harder, 2015; Harder et al., 2010). Previous studies have proposed prioritized lists of state Extension units' core competencies (Benge et al., 2011; Harder, 2015; Layfield & Dobbins, 2002; Scheer et al., 2011). Extension agents with ANR responsibilities must develop competency in relevant ANR subject areas and have access to up-to-date information from Extension specialists to best meet stakeholder needs (Prokopy et al., 2015). However, Extension agent competencies may vary with clientele demand, training choices, and regional priorities, thus necessitating intermittent needs assessments of both agents and stakeholders to ensure effective communication of relevant topics with clientele (Bailey et al., 2014).

Determining the training needs of ANR agents is a critical step in understanding existing gaps in conservation outreach programs. The Borich model is utilized frequently by state Extension administrations and other researchers to identify professional development needs for Extension agents and agricultural educators (Harder & Wingenbach, 2008; Layfield & Dobbins, 2002; Waters & Haskell, 1989). McClure et al. (2012) used this approach to compare competency levels and training needs of 4-H and ANR Extension agents in Georgia. Our goal for this study was to identify and prioritize training needs of southeastern U.S. Extension agents in topics related to water resource conservation through a Borich model needs assessment. The topics presented in the survey of agents were modified to reflect common land management issues affecting water resources on agricultural lands. The objectives of this study were to:

1. Assess competencies of southeastern ANR Extension agents in topics related to water resource conservation.
2. Determine training needs of southeastern ANR Extension agents based upon self-reported competencies in water resource conservation.

METHODS

The target population for our study was all county Extension agents with ANR responsibilities in the southeastern U.S., delineated by member states in the Association of Southern Region Extension Directors (ASRED): Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. We selected these states for their regional continuity, similarity in agricultural backgrounds and water resource concerns, and access through ASRED.

We designed a 14-item, web-based survey to assess ANR agents' water resources conservation competencies and training needs (see appendix). Three additional questions (Q9, Q13, and Q14) were presented when appropriate. Potential competency areas were derived from Alibaygi et al. (2008) and cross-referenced with current water-related land management concerns outlined by the U.S. Department of Agriculture Natural Resource Conservation Service (NRCS, 2019). The list of land management competency topics was reviewed and approved by agricultural water resources specialists to establish face validity.

Survey questions regarding agents' areas of responsibility were used to remove respondents without substantive ANR assignments and to determine individuals' geographic scope of influence. Agents were also asked to provide information on their educational background, age, experience level, and gender. Additional Likert-type questions were included to determine the perceived frequency of landowner requests for each land management topic and to contribute to the interpretation of the agent competency assessment via the Borich needs assessment model framework.

The survey instrument was revised for distribution to the target population after incorporating feedback from a pilot study of ANR agents (n = 10). Agents who completed the pilot survey were excluded from the final survey dataset. We followed Tailored Design Method guidelines, including the use of incentives (a gift card drawing) and distribution by authoritative figures (state Extension directors sent out the survey internally) to maximize response rates (Dillman et al., 2014). The completed survey protocol was distributed online through Qualtrics. Data collection closed after four weeks. No reminders to complete the survey were issued to limit the burden of distribution for state Extension directors.

Cronbach's alpha coefficients were calculated for the Borich's model questions pertaining to land management topic importance and ability (Alibaygi & Zarafshani, 2008; Harder & Wingenbach, 2008). Resulting scores for topic importance and ability questions were 0.87 and 0.88, respectively. Scores closer to 1 indicate strong reliability (Taber, 2018). Therefore, we interpreted these scores to indicate satisfactory survey reliability and delineation of land management topics.

We used SPSS 26.0 and Program R to analyze the final dataset. Descriptive statistics were used to determine mean topic importance and agent teaching ability ratings for each land management competency topic. The Borich (1980) formula for mean weighted discrepancy scores (MWDS) was used to calculate and subsequently rank overall training needs for the 11 land management topics (Alibaygi & Zarafshani, 2008; Borich, 1980; Harder & Wingenbach, 2008). Borich (1980) MWDS values can be negative or positive and are based on the ratio of perceived importance to perceived ability: a higher, positive MWDS value indicates greater training need because perceived importance ratings exceed self-reported ability ratings, whereas a negative score indicates "overtraining" or that the overall ability ratings exceed the perceived importance of the topic.

RESULTS

A total of 246 agents from seven states participated in the survey: Alabama (n = 23), Arkansas (n = 75), Kentucky (n = 38), Mississippi (n = 29), Oklahoma (n = 27), South Carolina, (n = 43) and Virginia (n = 9). Data from two participants were removed for not meeting ANR agent criteria (>10% ANR related responsibilities), resulting in 244 respondents. State Extension administrations who distributed the surveys did not disclose the number of agents given access to the survey; therefore, a survey response rate cannot be determined.

Most respondents were male (68.4%), had more than 10 years of Extension experience (51.4%), and reported a

master's degree as their highest formal education level (66%). Age of respondents was nearly evenly distributed among the categories of 25–34 years (22.6%), 35–44 years (26.5%), 45–54 years (27.4%), and 55–64 years (18.3%) old. The majority (76.6%) of respondents described themselves as responsible for Extension activities at the county level. Demographic results categorized by state are presented in Table 1.

Ratings of agents' mean perceived importance and teaching ability for each land management competency topic is presented in Table 2. Topics rated as most important to agents were "fertilizer application" (M = 4.3, SD = 0.67), "nutrient management" (M = 4.2, SD = 0.68), "water quality in streams or ponds" (M = 4.1, SD = 0.87), "water conservation" (M = 4.1, SD = 0.87), and "soil erosion" (M = 4.2, SD = 0.78). The land management topic "reducing the use of fertilizer" was given the lowest importance rating. Agents rated their abilities highest for explaining "fertilizer application" (M = 3.9, SD = 0.97) and "nutrient management" (M = 3.5, SD = 0.90). The lowest ability ratings were given to "pathogen pollution in waterways" (M = 2.5, SD = 1.08), "water quality in streams or ponds" (M = 3.0, SD = 1.06), and "soil loss in agricultural fields" (M = 3.1, SD = 1.04).

Landowner expressed needs (LEN) within the 11 land management topic areas are also presented in Table 2. The LEN score is a mean value reflecting the frequency of landowner requests for information within each competency topic, as perceived by the surveyed ANR agents. Agents reported that landowners seek information most often about "fertilizer

Table 1. Demographic Characteristics of Survey Respondents by State

	AL		AR		KY		MS		OK		SC		VA	
Attribute	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Male	60.9	(14)	77.3	(58)	63.2	(24)	69.0	(20)	70.4	(19)	62.8	(27)	55.6	(5)
Female	34.8	(8)	17.3	(13)	28.9	(11)	20.7	(6)	25.9	(7)	34.9	(15)	44.4	(4)
No answer	4.3	(1)	5.3	(4)	7.9	(3)	10.3	(3)	3.7	(1)	2.3	(1)	0.0	(0)
Age (years)														
<25	0.0	(0)	0.0	(0)	0.0	(0)	8.3	(2)	0.0	(0)	4.8	(2)	0.0	(0)
25–34	15.0	(3)	21.6	(16)	28.6	(10)	8.3	(2)	19.2	(5)	33.3	(14)	22.2	(2)
35–44	30.0	(6)	24.3	(18)	20.0	(7)	45.8	(11)	15.4	(4)	28.6	(12)	33.3	(3)
45–54	25.0	(5)	32.4	(24)	25.7	(9)	25.0	(6)	30.8	(8)	16.7	(7)	44.4	(4)
55–64	25.0	(5)	18.9	(14)	22.9	(8)	12.5	(3)	26.9	(7)	11.9	(5)	0.0	(0)
≥65	5.0	(1)	2.7	(2)	2.9	(1)	0.0	(0)	7.7	(2)	4.8	(2)	0.0	(0)
Time in Extension (years)														
<1	0.0	(0)	8.0	(6)	0.0	(0)	3.6	(1)	7.4	(2)	11.6	(5)	0.0	(0)
1–2	4.3	(1)	9.3	(7)	5.3	(2)	3.6	(1)	11.1	(3)	9.3	(4)	0.0	(0)
3–4	26.1	(6)	17.3	(13)	10.5	(4)	7.1	(2)	11.1	(3)	16.3	(7)	22.2	(2)
5–6	17.4	(4)	4.0	(3)	18.4	(7)	17.9	(5)	14.8	(4)	9.3	(4)	11.2	(1)
7–8	0.0	(0)	5.3	(4)	5.3	(2)	3.6	(1)	3.7	(1)	11.6	(5)	22.2	(2)
9–10	4.3	(1)	2.7	(2)	5.3	(2)	0.0	(0)	3.7	(1)	2.3	(1)	22.2	(2)
>10	47.8	(1)	53.3	(4)	55.3	(21)	64.3	(18)	51.9	(14)	39.5	(17)	44.4	(4)
Highest educational attainment														
BS	0.0	(0)	14.7	(11)	10.5	(4)	3.4	(1)	22.2	(6)	30.2	(13)	0.0	(0)
Some graduate study	4.3	(1)	16.0	(12)	13.2	(5)	13.8	(4)	11.1	(3)	4.7	(2)	11.1	(1)
MS	65.2	(15)	66.7	(50)	73.7	(28)	62.1	(18)	66.7	(18)	55.8	(24)	88.9	(8)
PhD	21.7	(5)	1.3	(1)	0.0	(0)	17.2	(5)	0.0	(0)	9.3	(4)	0.0	(0)
Other	8.7	(2)	1.3	(1)	2.6	(1)	3.4	(1)	0.0	(0)	0.0	(0)	0.0	(0)
Geographic scope of responsibility														
County	26.1	(6)	96.0	(72)	100.0	(38)	96.6	(28)	74.1	(20)	39.5	(17)	66.7	(6)
Regional	52.2	(12)	1.3	(1)	0.0	(0)	3.4	(1)	25.9	(7)	37.2	(16)	33.3	(3)
Statewide	21.7	(5)	2.7	(2)	0.0	(0)	0.0	(0)	0.0	(0)	23.3	(10)	0.0	(0)

Table 2. Mean Topic Importance, Agent Ability, and Landowner Expressed Need

Land management topic	MI (SD)		MA(SD)		LEN (SD)	
Soil loss in agricultural fields	3.9	(0.79)	3.1	(1.04)	2.5	(1.06)
No-till or reduced tillage	3.7	(0.79)	3.2	(1.08)	2.9	(1.30)
Cover crops	3.6	(0.89)	3.3	(1.04)	3.0	(0.98)
Fertilizer application	4.3	(0.67)	3.8	(0.97)	4.0	(0.95)
Reducing use of fertilizer	3.5	(0.99)	3.3	(1.02)	3.0	(0.99)
Soil erosion	4.1	(0.78)	3.4	(0.94)	2.9	(0.88)
Nutrient management	4.2	(0.68)	3.5	(0.90)	3.6	(1.08)
Pathogen pollution in waterways	3.6	(1.00)	2.5	(1.08)	2.8	(0.96)
Reducing use of agricultural chemicals	3.6	(0.94)	3.2	(1.01)	2.2	(1.01)
Water quality in streams or ponds	4.1	(0.87)	3.0	(1.06)	2.9	(1.10)
Water conservation	4.4	(0.87)	3.2	(0.99)	3.1	(1.02)

Table 3. Mean Weighted Discrepancy Scores

Land management topic	AL	AR	KY	MS	OK	SC	VA	ALL
Soil loss in agricultural fields	4.2	2.8	2.6	2.4	2.3	**4.9**	-0.4	3.0
No-till or reduced tillage	2.2	0.9	2.3	1.6	1.3	3.5	1.2	1.8
Cover crops	2.7	0.7	0.8	1.2	-0.8	3.1	0.8	1.2
Fertilizer application	3.3	1.1	1.9	2.8	1.8	3.5	1.3	2.1
Reducing use of fertilizer	1.6	0.1	0.7	0.9	-0.2	2.0	0.0	0.7
Soil erosion	3.3	2.5	**2.9**	3.7	**2.9**	3.0	0.0	2.8
Nutrient management	3.1	2.0	2.7	3.0	**3.5**	3.3	**2.7**	2.7
Pathogen pollution in waterways	**6.0**	**3.1**	**3.8**	**4.4**	2.0	**4.3**	1.2	**3.6**
Reducing use of agricultural chemicals	2.4	1.0	1.4	2.0	0.4	2.5	0.0	1.4
Water quality in streams or ponds	**6.6**	**3.8**	**3.7**	**4.8**	**2.9**	**5.1**	**3.3**	**4.2**
Water conservation	**5.3**	**3.3**	2.4	**4.6**	**3.2**	3.9	**1.6**	**3.5**

Note. Numbers in bold indicate the three highest ranked land management topics (i.e., training needs) within each state.

application" (LEN = 4.0) and "nutrient management" (LEN = 3.6), and least often about "reducing the use of agricultural chemicals" (LEN = 2.2). The LEN scores are presented for comparison to agents' perception of topic importance and their self-reported ability to address landowner needs within the topic area.

The mean weighted discrepancy scores (MWDS) for land management topics are presented by state in Table 3. The three highest MWDS values overall were for "water quality in streams or ponds" (MWDS = 4.2), "pathogen pollution in waterways" (MWDS = 3.6), and "water conservation" (MWDS = 3.5). The lowest MWDS value overall was for "reducing use of fertilizer" (MWDS = 0.7). All states had the topic "water quality in streams or ponds" in their top three MWDS values.

DISCUSSION

ANR Extension agents who participated in this study rated their perceived importance of land management topics greater than their perceived ability to educate landowners in these topic areas, which signals an overall need for further professional development. Although all land management topics were related to water resource conservation, specific issues such as soil loss, pathogen pollution, nutrient management, and water conservation were ranked as the highest priority training needs. These topics are also ranked highly in national water resource protection efforts because of their potential to harm environmental and human health (Clary et al., 2016; Hooda et al., 2000; USEPA, 2019; Zaimes et al., 2009).

Agricultural watersheds contribute significantly to water quality impairment issues such as sediment pollution (Evans et al., 2019). Conservation practices such as conservation tillage and cover crops can reduce erosion and runoff from fields, enhance fuel cost savings, reduce fertilizer input, and improve soil structure (Dabney et al., 2001; Kaye & Quemada, 2017; Shipitalo & Edwards, 1998; Snapp et al., 2005). In this study, land management topics related to sediment were split among source-related topics ("soil loss in agricultural fields" and "soil erosion") and conservation practices ("no-till or reduced tillage" and "cover crops"). Surveyed agents indicated training on sources of sedimentation should be a higher priority than training on conservation practices. Given that agents reported landowners expressed nearly equal interest in all four sediment topics, it is unclear from our study whether landowner interest is driving the higher competency in conservation practices.

Fertilizer application, nutrient management, and fertilizer reduction are important components in managing nutrient pollution (Carpenter et al., 1998; USEPA, 2020). However, Extension agents in this survey did not appear to recognize the importance of reducing fertilizer use, and their reported ability ratings were lower in this topic than those related to fertilizer application and nutrient management. This suggests there may be a disconnect in their understanding of the inter-relationship of these three land use practices and water resource conservation. These topics together describe common sources of nutrient pollution in watersheds; therefore, training in each of these topics would be beneficial for outreach regarding nutrient reduction strategies.

Pathogen pollution, a more prevalent issue in watersheds with animal agriculture, is also a significant concern because of its potential health risk to humans, wildlife, and livestock. Associated with nutrient pollution from animal waste, it can be exacerbated by sediment losses in pastures, making it difficult to isolate from these other two pollutants (Ferguson et al., 1996; Fraser et al., 1998; Weidhaas et al., 2018). Pathogen pollution was one of the highest priority training needs for surveyed agents, second only to overall water quality in streams and ponds. The complementary relationship between pathogen, nutrient, and sediment pollution requires integrated pollution management strategies. Prioritizing training efforts on pathogen pollution should not happen in isolation but rather in conjunction with other high priority nutrient and sediment pollution topics, such as nutrient management, soil loss in agricultural fields, and soil erosion.

Bailey et al. (2014) found agents perceive client questions as a main motivation for seeking information on a topic. Topics of fertilizer application and nutrient management both received high ratings of importance and above average ability by agents. When paired with the expressed landowner need, which was also high for these topics, competency ratings by agents may be explained by higher preparedness because of frequently answering landowner questions on these topics. In contrast, importance and ability ratings for nutrient reduction strategies were low while landowners' expressed needs were high. This inverse relationship may indicate a gap between agent perceptions—which may be influenced by subjective preferences—and objective evaluations of landowner needs.

CONCLUSIONS

Time, budgetary limitations, administrative demands, and educational needs are major challenges to Extension agent performance (Bailey et al., 2014; Brian et al., 2009; Harder & Wingenbach, 2008; McCann, 2007; McClure et al., 2012). Therefore, training needs must be prioritized to maintain Extension's capacity in the face of systematic challenges. Needs assessments such as the one we conducted provide a framework for prioritizing training needs to effectively use limited resources. Our findings suggest a path forward for effectively and efficiently developing Extension agent competencies in land management topics relevant to water resource conservation and improving Extension's service to stakeholders in this area (Boellstorff et al., 2013; Harder, 2015).

An advantage of using the Borich model is that it allows agents to objectively measure their own competency levels, rather than using subjective measurements by administrative personnel (Borich, 1980). Although this study addressed agents' perceptions of landowners' expressed needs, there is potential for these observations to be biased. Landowners may seek water resource conservation information from other sources because they perceive Extension to be relevant in only a specific range of topics (Prokopy et al., 2015). Further study of these issues through a landowner needs assessment would greatly enhance the interpretation of our study by providing context for landowner perceptions, conservation adoption motivations, and information needs to balance ANR agent training priorities.

Whereas other elements of Extension such as 4-H and family and consumer sciences commonly have established lists of required agent competencies, in the course of this research it became apparent that few states have created specific competency benchmarks for agents in the ANR field (Harder, 2015; Harder & Wingenbach, 2008). Competency benchmarks created for ANR agents by state Extension administrations could help identify areas where training is needed and serve as indicators for measuring progress in professional development. Specifically, professional development could include holding face-to-face or virtual in-service trainings or field days, moderating periodic webinars on topics of relevance, or hosting a statewide or regional conference that builds the capacity of Extension professionals as related to ANR in general and water resource

conservation specifically. Additionally, these efforts could focus on orienting newly hired Extension professionals to relevant conservation and agricultural production issues and practices.

This study is pointedly different from other Borich model needs assessments of Extension agents in the United States because it addresses a natural resource concern rather than skills and duties that have been defined as soft by administrators. Specific areas where subject matter training can be implemented has been revealed. If addressed, Extension agents will be better prepared to deliver valuable information and guidance to agricultural producers and conservationists—a substantial portion of Extension's clientele. This approach could be adapted for other popular and relevant natural resource topics including pollinator habitat management, wildlife habitat management, protection of endangered species, and control of invasive species. However, a word of caution is necessary regarding these ecological topics, as this study exposed an issue that often confounds efforts in water conservation and natural resources in general: these topics are not easily delineated by state and county lines. In the case of water resources, it may be more appropriate to use watersheds to delineate administratively defined training goals and program evaluations. Similar ecological delineations must be considered if future studies of this nature are pursued in other regions and contexts.

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APPENDIX: WATER RESOURCE CONSERVATION SURVEY

Q1 Consent

We are conducting a research project at Mississippi State University titled "Water Resource Conservation Survey of Extension Agents" (Protocol ID: IRB-19-229). This survey is part of the project and will help us determine competencies and training opportunities for Extension agents on topics relating to water resources on agricultural lands.

We would like to invite you to voluntarily participate in our research project. If you choose to participate, you will be asked to complete a survey that will take approximately 8 minutes of your time.

Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue your participation at any time without penalty or loss of benefits. Answers to the survey are anonymous and no identifiable information is recorded. You are free to exit the survey at any time. If you decide to participate in the survey, your participation includes your consent. Please print this page for your records.

By clicking yes below, you agree that you have read the above information and wish to participate in the following survey. If you click no, the survey will not begin. Click on the arrow in the bottom right corner to submit your answer.

☐ **Yes,** I will participate. (1)

☐ **No,** I do not wish to participate. (2)

Q2 Over the course of a full calendar year, how much time do you dedicate to the following areas of responsibility? Use your best estimate. Please total your choices to 100%.

_____ **Plants** (e.g., crop production, nematology, pest management, plant breeding, plant health) (1)
_____ **Environment** (e.g., ecosystems, invasive pests, climate change) (2)
_____ **Natural Resources** (e.g., air, forests, grasslands, soil, water) (3)
_____ **Farming and Ranching** (e.g., agriculture technology, farmer education, organic agriculture, small/family farms) (4)
_____ **Animals** (e.g., breeding, health, production, aquaculture) (5)
_____ **Food Science** (e.g., food quality, food safety) (6)
_____ **Health** (e.g., nutrition, wellness, obesity) (7)
_____ **4-H and Youth Development** (8)
_____ **Other** (please specify) (9)

Q3 In the last year, how often have you shared information with landowners about the following issues?

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Very Often (5)
Soil loss from agricultural fields (1)	○	○	○	○	○
No-tillage or reduced tillage (2)	○	○	○	○	○
Cover crops (3)	○	○	○	○	○
Fertilizer application (including rate, type, placement, or timing) (4)	○	○	○	○	○
Reducing use of fertilizers (5)	○	○	○	○	○
Soil erosion (6)	○	○	○	○	○
Nutrient management (7)	○	○	○	○	○
Reducing use of agricultural chemicals (8)	○	○	○	○	○
Pathogen pollution (disease/bacteria) in waterways (9)	○	○	○	○	○
Water quality in streams or ponds (10)	○	○	○	○	○
Water conservation (11)	○	○	○	○	○

Q4 In your opinion, how important are the following issues?

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Soil loss from agricultural fields (1)	○	○	○	○	○
No-tillage or reduced tillage (2)	○	○	○	○	○
Cover crops (3)	○	○	○	○	○
Fertilizer application (including rate, type, placement, or timing) (4)	○	○	○	○	○
Reducing use of fertilizers (5)	○	○	○	○	○
Soil erosion (6)	○	○	○	○	○
Nutrient management (7)	○	○	○	○	○
Pathogen (disease/bacteria) pollution in waterways (8)	○	○	○	○	○
Reducing use of agricultural chemicals (9)	○	○	○	○	○
Water quality in streams or ponds (10)	○	○	○	○	○
Water conservation (11)	○	○	○	○	○

Q5 Please rate your ability to educate landowners on the following issues.

	Below average (1)	Slightly below average (2)	Average (3)	Slightly above average (4)	Above average (5)
Soil loss from agricultural fields (1)	○	○	○	○	○
No-tillage or reduced tillage (2)	○	○	○	○	○
Cover crops (3)	○	○	○	○	○
Fertilizer application (including rate, type, placement, or timing) (4)	○	○		○	○
Reducing use of fertilizers (5)	○	○	○	○	○
Soil erosion (6)	○	○	○	○	○
Nutrient management (7)	○	○	○	○	○
Pathogen (disease/bacteria) pollution in waterways (8)	○	○	○	○	○
Reducing use of agricultural chemicals (9)	○	○	○	○	○
Water quality in streams or ponds (10)	○	○	○	○	○
Water conservation (11)	○	○	○	○	○

Q6 Where do you look for supplemental information about land management issues? Please select all that apply.

- ☐ Extension Service resources such as agents, specialists, publications, and/or websites (1)
- ☐ USDA Natural Resource Conservation Service personnel, publications, and/or websites (2)
- ☐ USDA Farm Service Agency personnel, publications, and/or websites (3)
- ☐ USDA Forest Service personnel, publications, and/or websites (4)
- ☐ US Fish and Wildlife Service personnel, publications, and/or websites (5)
- ☐ State natural resource agency personnel, publications, and/or websites (6)
- ☐ Other (Please specify): (7) _____

Q7 In which state do you work for the Extension Service?

_____

Q8 Which option best describes your scope of responsibility for delivering educational programs?

- ☐ County/Parrish (1)
- ☐ Regional (2)
- ☐ Statewide (3)
- ☐ I do not deliver educational programs (4)

Q9 How many counties do you serve?

_____

Q10 How many years have you been an employee of the Cooperative Extension Service?

- ☐ Less than 1 year (1)
- ☐ 1–2 years (2)
- ☐ 3–4 years (3)
- ☐ 5–6 years (4)
- ☐ 7–8 years (5)
- ☐ 9–10 years (6)
- ☐ More than 10 years (7)

Q11 Which category best represents your highest level of education?

- ☐ Bachelor's degree (1)
- ☐ Some graduate education, but no Master's degree (5)
- ☐ Master's degree (2)
- ☐ Doctoral degree (3)
- ☐ Other (Please specify) (4) _____

Q12 What was your major field of study for your bachelor's degree? (For example: forestry, animal science, crop science)

_____

Q13 What were your major fields of study for your degrees? (For example: forestry, animal science, crop science)

- ☐ Bachelor's degree (1) _____
- ☐ Master's degree (2) _____

Q14 What were your major fields of study for your degrees? (For example: forestry, animal science, crop science)

- ☐ Bachelor's degree (1) _____
- ☐ Master's degree (2) _____
- ☐ Doctoral degree (3) _____

Q15 What term best describes you?

- ☐ Male (1)
- ☐ Female (2)
- ☐ I prefer not to answer (3)

Q16 What is your age in years?

_____

Q17 How did this survey reach you?

- ☐ National Association of County Agriculture Agents (1)
- ☐ Association of Natural Resource Extension Professionals (2)
- ☐ My state's Extension administration (3)
- ☐ Other (Please describe) (4) _____