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Meaningful Messages: The Process of Communicating Best Management Practices (BMPs)

Abstract

Best Management Practices (BMPs) are evidence-based strategies designed to help agricultural producers optimize productivity while minimizing environmental impact. Despite their scientific foundation and policy support, BMP adoption remains inconsistent across regions and stakeholder groups. This applied qualitative study investigates how BMP communicators (Extension agents, specialists, and government agency employees) perceive and navigate the rhetorical, semiotic, and messaging challenges inherent in BMP communication. Guided by a conceptual framework integrating Communication Accommodation Theory (CAT), Audience Design Theory, and Semiotics, the study explores how language, audience perception, and symbolic meaning shape the reception and implementation of BMPs. Using a phenomenological approach, researchers conducted two focus groups and four interviews with 18 regional communicators. Participants also completed a card-sorting activity evaluating 41 BMP-related terms. Data were analyzed using constant comparative methods and descriptive statistics. Four themes emerged involving (1) conflicting meanings depending on context; (2) adapting language to align with stakeholder expectations; (3) confusion about terms undermine trust; and (4) scientific authority and jargon complicate accessibility. The card-sorting activity supported these findings, with 97.56% of terms identified as problematic by at least one participant. Terms such as "digital agriculture," "proximal sensing," and "sequestering agents" were frequently flagged, while only "scouting" was consistently understood. Findings suggest effective BMP communication requires more than accuracy, it demands audience awareness and intentional language design. Implications include developing plain-language resources, training in adaptive communication strategies, and creating stakeholder-friendly glossaries to improve comprehension and support BMP adoption.

Keywords

Best management practices, qualitative, rhetoric, communication accommodation, audience design, semiotics

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Introduction

The protection of precious water sources at the federal level in the United States started in the mid 1930s during the Dust Bowl era (Ice, 2004). Years later, the Federal Water Pollution Control Act was passed, eventually reorganizing and expanding as the Clean Water Act in the 1970s (Environmental Protection Agency, 2024; Ice, 2004). Since then, both state- and federal-level Best Management Practices (BMPs) have been introduced to reduce the effects of water pollution from point sources (Ice, 2004). BMPs exist across a multitude of agricultural commodities and natural resource industries, like invasive species management, forestry, and livestock production.

While Best Management Practices (BMPs) have long played a vital role in U.S. agriculture, these were developed to safeguard natural resources and support producers in implementing safe, sustainable practices (Ice, 2004; USDA, 2012). The Florida Department of Agriculture and Consumer Services (FDACS) (2025) defines a BMP as "a means, a practice or combination of practices determined by the coordinating agencies, based on research, field testing and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural and urban discharges" (para 1). Broadly, BMPs are evidence-based strategies designed to help farmers and ranchers optimize productivity while minimizing environmental impact (Olexa et al., 2021; UF/IFAS, 2024). These practices are established through rigorous research, field validation, and expert consensus, and are promoted by coordinating agencies as the most practical and effective solutions available (FDACS, 2025). Coordinating agencies include Extension and government agencies like state offices of water policy, local water management districts, and local Natural Resources Conservation Service (NRCS) agents.

Despite the intended benefits, BMP adoption and compliance vary significantly among producers (Kinney, 2011). The dissonance between intent and implementation has often been attributed to BMPs' complexity, making credible, relevant information difficult to access to interpret (Hill et al., 2006; Ice, 2004; King et al., 2017). Access to information, quality of information, financial capacity, and having a local connection have been found to positively influence the adoption and implementation of BMPs, though focusing communication strategies on social aspects like farmer attitudes and environmental awareness could be assistive (Baumgart-Getz et al., 2012). While economic and logistical challenges can hinder implementation, these communication barriers also play a critical role. Previous studies have investigated how producers process and implement BMPs (Henning & Cardona, 2000; King & Baker, 2018; Kinney, 2011), but these studies have traditionally focused on a specific crop, how a certain BMP practice is implemented, or an evaluation component of the BMP in a larger research context (Henning & Cardona, 2000; Hill et al., 2006; Ice, 2004; King et al., 2017; Kinney, 2011). Understanding the components and implementation of BMPs is important, but a need remains to understand BMPs on a broad level to focus on the message transmission instead of just on the reception and implementation.

Effectively conveying BMPs involves more than disseminating technical information; it requires rhetorical sensitivity. Producers may be reluctant to engage with topics that intersect with their livelihoods (Krings, 2025). Moreover, agricultural commodity groups have faced

criticism for public relations strategies that obscure or downplay environmental concerns, sometimes training advocates to deflect scrutiny rather than promote transparency (Fassler, 2023). This applied study evolved from conversations with scientists who indicated they were struggling to effectively communicate BMPs and to interpret the words they used so producers could easily understand them. Thus, this study sought to understand how perceptions of BMPs are shaped by rhetoric, semiotics, and messaging. By examining these communicative dimensions, the research aims to identify strategies that resonate with diverse audiences and ultimately foster more successful BMP implementation.

Literature Review

Communicating Best Management Practices

Extension agents play a critical role in disseminating BMP information, from researchers and policy makers to farmers (Bossange et al., 2016; Seevers & Graham, 2012). Taylor et al. (2024) found that Extension agents need to emphasize the repercussions of not using BMPs on their operation when communicating about BMPs. Additionally, Extension needs to clearly define different BMPs, communicate how these practices are relevant to farmers' operations, and ask farmers to reflect on their past experiences (King & Baker, 2018). Recommended visual BMP education and communication methods suggested in previous studies include science-based demonstrations, videos, social media, email newsletters, and information guides (Stearns et al., 2024; Wang et al., 2020; King & Baker, 2018). Communication should also be localized to ensure accurate information is being shared with farmers (King & Baker, 2018).

Policy makers, Extension agents, and researchers have been frustrated by the lack of BMP adoptions (Pannell et al., 2006), as these groups see the value in implementing BMPs but have trouble getting producers to understand the feasibility and importance of adoption. Previous studies have investigated farmers' reasons for not adopting various BMPs, including producers' lack of knowledge about BMPs (Gillespie et al., 2007), producers' lack of relevance (Gillespie et al., 2007), and disengagement with agencies like Cooperative Extension (Henning & Cardona, 2000). These communication gaps raise broader questions about how science recommendations and practices are shared.

Science Communication

Science communication aims to enhance a group of people's scientific awareness, understanding, literacy, and culture (Burns et al., 2003). This can be achieved by increasing someone's awareness, enjoyment, interest, ability to form an opinion, and understand the science in reference to a specific topic (Burns et al., 2003). In essence, science communication can empower an individual or group to be interested in science, gain the confidence to discuss it, and improve their willingness to engage with it (Burns et al., 2003). Yet, communicating contentious scientific issues effectively for audience understanding is a challenge faced across many scholarly disciplines (National Academies of Sciences, Engineering, and Medicine, 2017).

When communicating the science of BMPs to audiences, barriers exist in part due to the lack of knowledge, awareness, or understanding of the impact human actions have on the

environment (Hill et. al, 2006). Additionally, producers who view themselves as stewards of the land could be unintentionally harming their surrounding environment because of their actions (Hill et al., 2006). Agricultural communication scholars have indicated that shifts in perception about contentious topics must include strategies to frame messages to include scientific evidence as vital (Koswatta et. al, 2022), though scientific evidence has been found to be only one of many factors to influence adoption behaviors (Baumgart-Getz et al., 2012). Previous studies have indicated the need for additional agricultural communication research to explore information processing of BMPs (King et al., 2017) and investigate information sources farmers use to gain BMP information (Taylor et al., 2024). Effective science communication depends on more than facts; it also considers style, persuasion, and framing of the message.

Rhetoric

Rhetoric, as the art of effective communication, is concerned with modes of persuasion (Aristotle, 350 B.C.E./1924). In Aristotle's thesis, rhetorical persuasion encompasses a triadic relationship between the message transmitter, receiver, and the subject itself. Ethos examines the credibility of the speaker, while pathos engages the emotional appeal of the audience, and logos focuses on the logic and correctness of the message itself (Braet, 1992). When there is an urgent need for a persuasive message, such as a problem needing to be addressed, the triadic rhetorical situation is created to deliver the message (Bitzer, 1992). For a message to be considered persuasive, the rhetorical triad must be adapted to fit different audiences, repackaging the creditability, emotional appeal, and logic to resonate best with the current audience (Higgins & Walker, 2012).

BMPs serve as a persuasive message to encourage message receivers to adopt the actions (Ice, 2004). Yet, the rhetorical engagement of the message from both the message transmitter and receiver begins an evolving process of identification, in which the two entities decide how much their interests are joined and if they identify with the other (Burke, 1969). As these BMPs are not always implemented, it is important to understand the rhetoric behind the issue and where in the triad the message is lost, from facts, values, policies, or something else (Heath, 2009), which often occurs outside of the message itself.

Heuristics

Heuristic rules allow people to make decisions not based on morals or values, but rather on probabilities of incomplete data available (Sunstein, 2007). Because the data available are often incomplete, heuristics allow decisions to be made with a margin of risk and error (Tversky & Kahneman, 1974). Decisions based on heuristics are not always rational, because they rely on snap judgments (Gigerenzer et al., 1999). One example is the representative heuristic, in which a person will estimate the likelihood of an event or outcome based on their prior experiences (Cherry, 2023; Tversky & Kahneman, 1974). Farmers, for example, perceive a level of risk before adopting BMPs (Liu et al., 2018), and they may find someone who does not look or dress like them discussing the need for BMPs as risky, believing that they do not fully understand the complexities of operating their farm. The availability heuristic, on the other hand, moves toward decision-making based on the frequency of something occurring (Tverskey & Kahneman, 1974). Emphasizing cost savings in BMP messaging across multiple media can act as an availability

heuristic, increasing farmers' exposure to these benefits and reinforcing the belief that BMP adoption leads to real cost savings (Chowdhury, 2023). Heuristics point toward the role of clarity and intentional language in BMP communication.

Comprehensibility

Finally, comprehensibility refers to the ability of a listener to understand and make sense of a message once it has been received, which happens through a process of reconstructing the message received into a method that makes sense to the receiver (Pommee et al., 2022). Plain language summaries are one method to enhance comprehensibility for non-expert audiences to understand research (Stoll et al., 2022). These summaries can both improve a message receiver's comprehension of the message and enhance their perceived clarity of the subject (Stoll et al., 2022). The implementation of jargon and the complexity of language lead to poor readability and comprehensibility (Lang et al., 2025). Therefore, appropriate communication of technical science, from which BMPs stem, should integrate principles for more comprehensibility to encourage implementation.

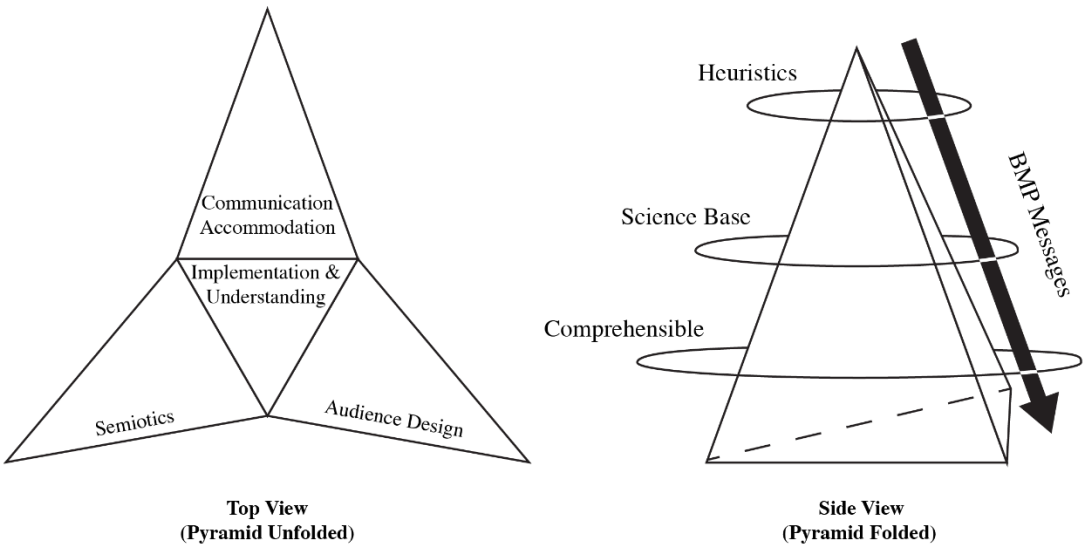
Conceptual Framework

This study was informed by a conceptual framework encompassing communication accommodation theory (CAT), audience design theory, and semiotics. CAT posits an explanation for adjusting the style of communicating (e.g., vernacular, gestures, speech speed, tone, etc.) to better connect with a message receiver in a social interaction (Giles & Ogay, 2007). Audience design theory suggests a message transmitter may adjust their communication style based on their perception of the audience they know is listening and the audience they think might be listening (Bell, 1984). Finally, semiotics provides a framework of understanding the world by relating images and words to meanings associated with interpreted symbolic meaning (Barthes, 1977). Each of these is further explained in the following sections.

As indicated in Figure 1, BMPs have several barriers to successful understanding and implementation. The model illustrates a BMP message traveling toward the base of a tetrahedron, where successful implementation and understanding occur. However, the BMP message must integrate components from each side of the tetrahedron, accommodating changes in language based on the intended audience (i.e., communication accommodation), the possible audience (i.e., audience design), and signs and symbols (i.e., semiotics). However, as the message travels toward the base, there are three additional challenges, and each plane the message passes through provides an opportunity for the BMP message to become lost. To be successful, the message must be defensible from the message receivers' heuristics and biases, it must have evidence of a scientific base, and the message must be clear and comprehensible for its intended audience.

Figure 1

Conceptual Framework of Successful Reception of BMP Messages



Communication Accommodation Theory

In its origination, CAT was a sociopsychological model focused mainly on changes in one's accent during social interactions (Giles, 1973). However, it has evolved to predict and explain patterns of speech people use, spanning linguistic, symbolic, and nonverbal cues. CAT goes beyond personal identities influencing our message transmissions (e.g., laying a gentle hand on a person while delivering somber news because experience tells you the physical contact might be more empathetic), but it also explores a person's changes in communication based on larger groups they represent (e.g., a scientist might tamp down personal feelings when communicating their science because they represent the larger scientific community and want to remain objective; Giles & Ogay, 2007).

CAT posits that those in a social interaction participate in a constant process of accommodation through convergence, in which they try to be more like the other person, and divergence, in which a person tries to become more different throughout the interaction (Giles, 1973). Patterns for convergence and divergence can emerge from several influences, such as the other's language competence, external pressures compelling a speaker to act a specific way, or power dynamics within the group (Simard et al., 1976). Within this framework, accommodation behaviors also shape relational outcomes such as trust, which is particularly important in contexts where audiences must evaluate the credibility and applicability of information. For example, producers were often more likely to implement actions and behaviors if it came from trusted sources, which were recognized as people who seemed like themselves (e.g., from the same region, grew the same commodity, etc.; King et al., 2017). The baseline for where a message transmitter and receiver enter the interaction can also be influenced by several

historical, social, or cultural influences, including a person's or group's stereotypes (Cohen & Cooper, 1986).

Audience Design

Audience design has several similarities to CAT, especially as it relates to tailoring messages to better fit an intended audience. However, audience design recognizes that all audiences are not equally important (Bell, 1984). One specific tenet splits an audience into different groups, from the most primary to the most tertiary: speaker, addressee, auditor, overhearer, and eavesdropper. If a person, as the speaker, is the focal point, as we move past audiences, we first pass the addressee, for whom the message was intended. This person has been approved by the speaker as the appropriate and planned audience. Past the addressee is the auditor, a third person or party who might be part of the interaction. The speaker would still approve of this group receiving the message, but they may not tailor every word or nonverbal to align with the auditor. The next audience is comprised of overhearers, who are people the speaker knows are around, but are not intended to be part of the interaction. Finally, the most tertiary audience is eavesdroppers, which includes people the speaker does not know are present, but still may receive the message (Bell, 1984).

Semiotics

Unlike the previous two theories, semiotics focuses more on the message and how the audience engages with the message, rather than tailoring messaging to fit the audience. Semiotics is concerned with developing meaning for communication and messages through signs, interpretations, and symbols (Barthes, 1977). Words convey meaning more than a general denotation, and those meanings are developed based on a person's life experiences (Barthes, 1977). For example, red is not simply a word to define a color; it can also be associated with feelings of anger or a general direction to "stop" an action. Throughout life experience, a person might learn to associate different connotations and symbolic meanings to "red" beyond the color. Semiotics provides a framework to investigate messages across different contexts to highlight symbolic meaning and signs associated with language, which may be attuned to a person's heuristics and experiences (Eco, 1979).

Purpose

The purpose of this study was to understand how BMP communicators' (Extension agents, specialists, and government agency employees) perceptions of BMPs are shaped by rhetoric, semiotics, and messaging. Specifically, the following research questions guided the study:

1. How do BMP communicators describe their experiences when communicating BMPs to stakeholders?
2. How do communicators perceive the clarity or difficulty of terms commonly used in BMP communication?

Methods

Phenomenology is a qualitative method of inquiry used to allow participants to inform the researcher of a lived experience to make sense of a specific phenomenon (Moustakas, 1994). This study examined BMP communicators' (Extension agents, specialists, and government agency employees) experiences with BMP rhetoric to understand challenges and solutions surrounding messages. To accomplish this, multiple methods of data collection were used, including focus groups, interviews, and a card sorting activity. The descriptive qualitative research design allowed focus group participants the opportunity to provide their opinions and experiences, as well as provide an environment in which participants can take part in rich discussion and receive feedback from others (Morgan, 1998). Interview methods supplemented the focus groups by providing participants a chance to share their thoughts if scheduling or other reasons did not allow a participant to take part in a focus group. Interviews, as a form of data collection, allow researchers to fully explore experiences, descriptions, and opinions provided by the participant with minimal to no interference from a third party (Kvale, 1983). Card sorting emerged from personal construct theory (Kelly, 1955), recognizing people categorize the world with similarities and differences that allow us to understand meaning among a group while recognizing individuality, but card sorting, in its essence, is a categorization task (Fincher & Tenenberg, 2005). Participants were given a semantic card sort activity (Fincher & Tenenberg, 2005), in which they saw words associated with BMPs, and categorized these into sections of meaning based on their associations with the word's complexity for stakeholders.

Prior to data collection, approval was received from the Institutional Review Board (IRB), ensuring the study protocol was ethical and all study participants consented to the data collection and publication of results.

Participants

Initially, researchers used snowball sampling (Creswell & Creswell, 2018), selecting participants for two separate focus groups based on county Extension agents who attended the Florida Extension Agent conference on April 8, 2024. Through the focus groups, several additional participants were recommended to the research team for inclusion in the study. Therefore, four virtual interviews were conducted in the spring and summer of 2024 with internal and external Extension stakeholder participants, identified as a result of snowball sampling (Creswell & Creswell, 2018). This sampling method enabled researchers to access a broader network of BMP experts across the region in various occupations, leading to the inclusion of five additional participants: one Florida Extension state specialist, one Florida Extension agent, and three Florida regional or state government employees. However, the research team was less interested in participants who held specific occupational titles, instead focusing on those with adequate experience communicating BMPs, to discuss the benefits and challenges with the process. Combining both focus group and interview methods enabled researchers to gather diverse and well-informed responses from recommended experts across the state on BMPs. Researchers facilitated data collection from April 8, 2024, to June 3, 2024.

Participants were comprised of 10 males and 8 females. All participants were actively involved in discussions regarding BMPs with various constituencies, including clientele,

legislators, and stakeholders in their respective disciplines. Participants were categorized into six distinct groups. Focus Group 1 included general statewide Extension experts, specifically three County Extension Directors, three regional agents, and four county agents. Focus Group 2 included Extension experts from the Panhandle region of Florida, one was a regional agent, and two were county agents, all affiliated with the University of Florida. The focus groups were approximately 50 minutes, while the interviews lasted between 35 and 45 minutes. Interview 1 consisted of one employee from a regional water agency, serving as a liaison between farmers and the government agency. Interview 2 was a Georgia Extension specialist, a BMP expert recommended by multiple focus group participants. Interview 3 was with a regional Extension agent from the Panhandle of Florida. Lastly, Interview 4 included two state government employees who provided researchers with valuable insights regarding broader legislative perspectives on communicating BMPs.

The protocol for each group was similar, with one trained researcher serving as the primary moderator, utilizing a standard moderator's guide and two assistant moderators supporting the process. The guide was developed based on the study's research questions and supporting theories.

Process

Each focus group and interview began with introductions and descriptions of each participant and the researchers' roles and experiences with BMPs. Next, the moderator asked participants, in an open question, to share any terminology their stakeholders struggled with when communicating BMPs in formal or non-formal settings. After this initial discussion, the moderator introduced the card sorting activity, to be completed individually, as a way to determine terms that had conflicting meanings or were perceived overly complex. Participants were asked to do this in three steps: (1) review the terms and provided definitions; (2) provide comments, edits, or additions directly on the cards related to others words used for the term or adjustments to how they would define the term; (3) sort the cards into three piles of (a) "Yes, this is confusing for stakeholders," (b) "Maybe, I think stakeholders might have a problem with this term.", or (c) "No, stakeholders do not have a problem with this term."

The 41 terms for the card sorting activity were generated by a panel of experts in academia in soil and water sciences and agronomy in Florida. The experts collaboratively generated a list of terms and definitions for each term. They used their past experience, state and regional agency guides, and academic literature to develop definitions. The researchers in this study used the terms and definitions to create cards for the sorting activity. The cards had the term on one side and its definition on the reverse. As needed, online participants completed a similar sorting activity individually using Zoom and sharing tools.

After participants completed the card sort activity individually, the moderator led the group in a discussion about the terms, focusing on the most challenging words and how people were currently addressing confusion around terminology. After the term-specific discussion, the assistant moderator picked up the cards and kept each set separated by participant and by the participant's categorizations of yes, maybe, and no. Then, the moderator asked a series of questions related to the current resources available and the needs related to new resources for

communicating about BMPs. This led to questions around participants' experience and practices for communicating BMPS with stakeholders. Probes and follow-up questions were asked to dig deeper into experiences and resources that would be helpful in improving communication experiences. Each group and interview concluded with the moderator summarizing the discussion, as a member check for the study (Creswell & Creswell, 2018; Lincoln & Guba, 1985; Tracy, 2010), and asking if participants had anything else to add related to communicating BMPs. Lastly, participants were asked if there was anyone else whom they thought would be important for the research team to include. Snowball sampling (Creswell & Creswell, 2018) led to multiple other interviews, and this process was adapted to an online format using Zoom and sharing tools, like screenshare and shared Word documents for terminology and definition review. As in in-person, the online participants conducted an individual sort using the online tools prior to the discussion, using the interview/focus group question protocol.

Data Analysis

Focus groups and interviews were audio recorded and transcribed verbatim, organized, coded, and analyzed. The research team employed constant-comparative data analysis, analyzing and coding transcripts individually prior to comparing transcripts against one another (Krueger & Casey, 2000; Morgan, 1998). This process allowed for themes to be compared against one another to the point where initial themes may be combined with another or removed for being too similar. Through this, participant recruitment concluded upon reaching data saturation at 18 participants, indicating that additional qualitative data collection no longer yielded novel themes or insights (Krueger & Casey, 2000; Morgan, 1998). The researchers also utilized a qualitative strategy of reviewing field notes collected during data collection. Field notes provide thoughtful contributions, exemplar quotes, and prelude emerging themes (Phillipi & Lauderdale, 2017). Open coding was used to code for emergent themes (Creswell & Creswell, 2018; Lincoln & Guba, 1985). As themes in the data emerged, patterns related to the exploratory conceptual framework were noted, and researchers used language when naming the themes to clarify connections to the conceptual framework.

Data collected through the card sorting activity were analyzed using descriptive statistics in which researchers determined frequencies of participants' selection of "yes, problem," "maybe, possible problem," or "no, not a problem" for each given industry-related term. Three participants in the focus groups co-mingled their cards in the facilitation process and were thus removed from the descriptive analysis. The multiple researchers within the study gathered consensus on findings, and various data collection procedures such as focus groups and card sorting helped reinforce credibility and confirmability in this qualitative study (Lincoln & Guba, 1985; Tracy, 2010).

Researcher Reflexivity and Credibility of Findings

In qualitative work, the perspectives of the researchers are important to note (Creswell & Creswell, 2018; Lincoln & Guba, 1985), as the researcher is the tool used to code and interpret findings. The lead researcher was a faculty member in agricultural communication with a history of exploring BMP communication in multiple states in the U.S. and multiple contexts. Two researchers were graduate students in agricultural communication with an interest in learning

about the methods and processes, but both had limited prior understanding or experience with BMPs. Six researchers on the project were soil and water scientists and agronomists. These scientists helped inform the work and review protocols and provide definitions, terms, and interpretations to ensure the social scientists were interpreting BMPs correctly in the study design, implementation, and write-up. One other researcher was a professor in agricultural communication who provided overall direction for the work and guidance based on experience in social science.

Member checking provided credibility from a participant perspective, and the research team ensured credibility in the data analysis and reporting process (Creswell & Creswell, 2018; Lincoln & Guba, 1985). This was done through the soil and water and agronomy scientists categorizing terminology related to BMPs. Additionally, the lead researcher and one graduate student, who were both present for all interviews and focus groups, debriefed data and emergent themes throughout the data analysis process. They took notes throughout the process and compared notes and quotes in the transcript working files. This served as an audit trail. Coding was a two-step process with one researcher doing initial coding and the other reviewing and discussing and adjusting codes as needed with the primary coder.

Findings

As researchers sought to understand how BMP communicators (e.g., Extension agents, specialists, and government agency employees) perceived how BMPs were shaped by rhetoric, semiotics, and messaging, data were collected using the two guiding research questions. Results are presented in this section by research question.

RQ1: BMP Communicators' Experiences When Communicating BMPs

Four major themes emerged through data analysis to help answer this question: (a) individual and community semiotics show BMPs carry multiple, sometimes conflicting meanings, (b) BMP communicators actively use CAT to adapt language when communicating about BMPs, (c) need for audience design theory due to misalignment and confusion undermining trust, and (d) need for CAT use more broadly to remove complexity and accessibility issues due to scientific authority and jargon.

Individual & Community Semiotics Show BMPs Carry Multiple, Sometimes Conflicting Meanings

Participants often stated the meaning of BMPs, or the perceived meaning, could vary depending on the clientele to which they were speaking, especially when considering the context of the message and the person's background. For example, one participant said, "If you have BMP in the title of something on an agenda, different people will perceive that very differently as to what that talk's gonna be about…" implying some clientele may expect a presentation on BMPs told through legal jargon, while others might think it might carry a connotation of a farmer doing things incorrectly and needing to fix their practices.

Other participants expressed different words mean something different, depending on the message receiver. This was expressed by one participant as "I think that depending on who you are talking to, [BMPs] could mean different things." Participants expressed that often people were not "on the same page" when discussing BMPs. Others said some people think BMPs mean legislative priorities rather than practical applications. Through the interviews and focus groups, participants consistently brought up BMPs as an area of focus they know well, but believed clientele interpreted messages about BMPs in a variety of ways.

Lastly, one participant articulated challenges they experienced: "I think one of the biggest challenges…is what a BMP actually means to different people." Meaning, BMPs have established definitions, but the participant suggested the term "BMP" may carry a different pathos and connotation for audiences, based on the clientele's experience with BMPs or with BMP messaging.

BMP Communicators Actively Use CAT to Adapt Language When Communicating About BMPs

Participants described tailoring the way they communicate about BMPs to adapt to the purpose of their communication or the audience to which they were communicating. One participant said, "I'd put it in my ROA [Report of Accomplishments], saying that I taught best management practices. When I'm teaching it, I don't use that term." In this case, the participant was acknowledging the encouraged terminology that is important to include for their performance appraisals, but the participant recognized their typical clientele does not respond to BMPs in the same way, so it gets framed differently in their teaching practices. Another participant discussed how they interact with producers: "I'm gonna bring it down to the producer level. To where they understand." This indicated participants often tweak their methods of communication to get past their clientele's heuristics and adapt their communication methods as they engage their audience, depending on the audience reactions.

Participants also mentioned reflecting on their own communication in the process of working with clients. One participant mentioned that they ask themselves, "Is it my clientele... having a hard time understanding this concept or am I having a hard time explaining it?" This self-reflection demonstrates the thought process of adapting communication to their client's needs. This idea was also explained by participants as the core function of their work. To explain the tasks the participants are asked to do, one said, "We take the research and present it at a grassroots level."

Need for Audience Design Theory Due to Misalignment and Confusion Undermining Trust

Participants discussed the detriments of uncommon, complex language or connotation around BMPs. The theme of misalignment and confusion undermining trust reinforced the idea that communication may deteriorate the BMP communicators' relationships with stakeholders if it was not aligned. One participant discussed how they sometimes communicate about BMPs, but they do not feel like they are speaking the same language or about the same subject, stating, "Consistently, I feel like we are talking about different things." Another noted how the communication leads to relationship fallout, "There's…nothing worse than confusing

people…Then they don't trust you later." The communicators recognized the importance of BMPs, but perhaps just as importantly, they recognized the importance of making BMPs digestible and comprehensible to their stakeholders.

Other participants discussed the trust issues with online information sources related to BMPs. One participant explained this as "a lot of information may not be online anymore or may be not as easy to find anymore." Another participant said, "A lot of my clients in rural areas aren't gonna have great [internet] access, and they want hard copies." Not only did participants express concerns about the comprehensibility of the BMP messaging, but the comments about rural locality and internet connection issues reinforced how access to the resources may undermine trust in the BMP communication processes as a whole.

Need for CAT Use More Broadly to Remove Complexity and Accessibility Issues Due to Scientific Authority and Jargon

BMPs are often promoted by government agencies, but stem from scientific evidence through empirical study, field testing, and expert review. Yet, participants noted how the language used by these authorities can complicate the comprehensibility for their stakeholders. Even though government agencies, science, and Extension agents should be working collaboratively, participants noticed how government, policy, and scientific language can alienate or confuse audiences. One said, "I think you also run into an issue when some of these government organizations get involved, which makes sense. The wording becomes more difficult to understand for legal reasons." Another participant indicated BMPs often rely on already-learned knowledge to interpret the BMP language, saying, "It's [BMPs] definitely an alphabet soup of acronyms." One other said, "Verbiage scares people especially," noting how complex language in the BMP can intimidate someone trying to adopt the actions. Participants mentioned that confusion existed across agencies. One participant said, "We don't even necessarily speak the same language when we go across agencies." Whether the participants' experiences were related to jargon, acronyms, or the adoption behaviors implemented by producers, it was clear that BMPs did not have one central interpretation by any one group.

RQ2: Perceived Clarity or Difficulty of Terms Used in BMP Communication

To address this research question, the card sorting activity was used. The participants were given 41 terms associated with BMPs, each on its own card. The participants were tasked with sorting the cards into a pile for (1) "Yes, this is confusing for stakeholders," (2) "Maybe, I think stakeholders might have a problem with this term," or (3) "No, stakeholders do not have a problem with this term." The 15 correctly sorted sets of cards were used in the analysis. Out of the 41 terms listed in Table 1, "scouting" was the only term deemed unanimously unproblematic by the participants. Thus, 97.56% (n = 40) of the 41 terms were classified as at least possibly problematic by at least one BMP communicator. The three most problematic terms were found to be "digital agriculture," "proximal sensing," and "sequestering agents," with all participants noting at least possible issues with stakeholders' understanding of the terms. The card sorting results point to semiotics and individual and shared meaning of the language around BMPs, specifically the challenges of comprehensibility and heuristics around decision making when terms are overly complex.

Table 1

Perception of Confusing Terms When Communicating BMPs to Stakeholders (n = 15)

Term	Yes		Maybe		No	
	f	%	*f*	%	*f*	%
4R Nutrient Stewardship	1	6.67	5	33.33	9	60.00
5R Nutrient Stewardship	3	20.00	5	33.33	7	46.67
Banding	2	13.33	3	20.00	10	66.67
Basin Management Action Plan (BMAP)	4	26.67	2	13.33	9	60.00
Best Management Practice (BMP)	1	6.67	2	13.33	12	80.00
Biosolids	4	26.67	4	26.67	7	46.67
Calcareous Soils	3	20.00	6	40.00	6	40.00
Chelating Agents	8	53.33	6	40.00	1	6.67
Confining Layers	7	46.67	6	40.00	2	13.33
Consolidated	8	53.33	2	13.33	5	33.33
Control Release Fertilizer (CRF)	3	20.00	3	20.00	9	60.00
Cover Crop	2	13.33	0	0	13	86.67
Digital Agriculture (DA)	8	53.33	7	46.67	0	0
Field Capacity	1	6.67	4	26.67	10	66.67
Filter Strips	3	20.00	5	33.33	7	46.67
Highly Permeable/Well Drained Soils	0	0	1	6.67	14	93.33
Karst Topography	6	40.00	2	13.33	7	46.67
Precision Agriculture (PA)	2	13.33	3	20.00	10	66.67
Precision Irrigation	1	6.67	1	6.67	13	86.67
Precision Soil Sampling	2	13.33	5	33.33	8	53.33
Profitability Maps	5	33.33	8	53.33	2	13.33
Proximal Sensing	11	73.33	4	26.67	0	0
Remote Sensing	2	13.33	6	40.00	7	46.67
Scouting	0	0	0	0	15	100.00
Sequestering Agents	10	66.67	5	33.33	0	0
Site-Specific Nutrient Management (SSNM)	6	40.00	6	40.00	3	20.00
Slow-Release Fertilizer (SRF)	4	26.67	1	6.67	10	66.67
Smart Irrigation	3	20.00	3	20.00	9	60.00
Soil Amendments	1	6.67	3	20.00	11	73.33
Soil Electrical Conductivity (EC)	3	20.00	4	26.67	8	53.33
Soil Maps	0	0.00	1	6.67	14	93.33
Spatial Variability	5	33.33	5	33.33	5	33.33
Spoil	8	53.33	6	40.00	1	6.67
Symptoms	1	6.67	1	6.67	13	86.67
Turbidity	4	26.67	1	6.67	10	66.67
Uncoated Sands	5	33.33	5	33.33	5	33.33
Unmanned Aerial Vehicle (UAVs)	2	13.33	4	26.67	9	60.00
Variable Rate Technologies (VRT)	1	6.67	3	20.00	11	73.33
Yield Maps	1	6.67	6	40.00	8	53.33
Yield Monitor	1	6.67	7	46.67	7	46.67

Term	Yes		Maybe		No	
	f	%	*f*	%	*f*	%
Zone Management	3	20.00	4	26.67	8	53.33

Note: Three of the 18 participants did not correctly sort their cards for analysis, so only 15 sets of cards were analyzed.

Conclusions and Discussion

The study's results provide clear direction for improving science communication around BMPs. This study sought to understand how BMP communicators' (Extension agents, specialists, and government agency employees) perceptions of BMPs were shaped by rhetoric, semiotics, and messaging. As the study was guided by a conceptual framework of CAT, audience design theory, and semiotics (see Figure 1), the results are interpreted through this framework.

Conflicting Meanings

This study's findings indicated the words "Best Management Practices," and words associated with BMPs can hold different meanings in different contexts, due to a message receiver's prior experience and the symbols or meaning they have assigned to the words (Barthes, 1977; Eco, 1979). The semiotics in language around BMPs can be problematic for someone to communicate BMP messaging with the confidence that the receiver will interpret the BMP message with accuracy. The semiotics are reinforced by a stakeholder's heuristics, providing mental shortcuts to help them interpret technical language and ideas (Tversky & Kahneman, 1974). BMPs can be context dependent or interpreted differently based on a stakeholder's geographic locality (King & Baker, 2018), so these findings assert the need for shared language with agreed-upon symbolic meanings to better connect the governing agencies that make the BMPs with the stakeholders who should implement the actions.

Adaptive Language

The participants were already modifying their message to better align with different audiences and demonstrated convergence in tailoring specific language when meeting with different stakeholders, consistent with both CAT and audience design (Bell, 1984; Giles, 1973). Yet, the motivations for reframing BMP messages went beyond speaking to different groups; participants were also adapting ethos and pathos of the message to allow the logos to be more comprehensible, making a clear connection to semiotics and heuristics of decision making (Braet, 1992). For example, the communicators would often use different terminology to adapt their ethos, finding a way to be perceived as a credible source that should be trusted, modify pathos through language to influence emotional appeal through possible impacts if BMPs were implemented, and adjust logos to turn scientifically complex information or jargon into something easily comprehensible. This application of rhetoric in different contexts brings to light the need for training and support in adaptive communication for BMP communicators.

Confusion Undermines Trust

Comprehensibility was a major challenge perceived by the participants, and it led to issues in trust with stakeholders. Confusion about BMPs reduced the perceived credibility, because the message receiver could not reconstruct the message into something that made sense (Pommee et al., 2022). Barriers already exist in communicating the science of BMPs (Hill et al., 2006), acknowledging that source credibility and homogeneity between the transmitter and receiver influence trust (King et al., 2017), but overly technical messages, abundant acronyms, and complex jargon erode stakeholders' trust in the institutions creating and disseminating the BMPs. This finding indicates that some BMP communicators demonstrate divergence according to CAT. Audience-centered communication could be improved by reducing scientific language and jargon and instead demonstrating convergence. In a rhetorical sense, trust is tied to ethos (Braet, 1992), and if the source is not credible or clear in its messaging, it is difficult to encourage a farmer to adopt the BMP. Building trust requires more than facts; it requires a triadic relationship between the speaker, receiver, and message (Burke, 1969), and issues in the triad (Heath, 2009) or in the symbolic meaning of the messaging (Barthes, 1977) discourage the implementation of the BMP.

Jargon Overcomplicates the Message

Through talking with the participants and the card sort activity, jargon and technical terms emerged as a major challenge for communicating about BMPs. Those working at government agencies developing BMPs likely have different life experiences or worldviews than the stakeholders they want to adopt the BMPs, shaping a nuanced and incongruent understanding of the meaning between the two groups (Barthes, 1977). If the language used is too technical, it also leads to poorer readability, and the likelihood of being persuaded by the message decreases (Lang et al., 2025). While it is important for BMP communicators to help stakeholders synthesize the science, it is difficult to enhance science communication when there is tension between scientific precision and public accessibility of the message. While effective science communication can empower stakeholders to engage science (Burns et al., 2003), ineffective science communication can lead to a distrust or a lack of interest in the science itself.

Essence

Ultimately, this study highlights that communicating BMPs is as much about language, audience, trust, and adaptation as it is about science. By examining the phenomenon through a conceptual model bridging CAT, audience design, semiotics, and comprehensibility, BMP communicators can better align messaging to engage with all stakeholders to maintain trust and develop a better understanding. However, the message will easily be lost if scientific legitimacy is not balanced with comprehensibility. Communicators must embrace the idea of adapting communication to audience needs to improve understanding and implementation of BMPs.

Implications

Several implications exist to improve BMP communication. First, BMP communicators should have increased access to training and resources about audience and communication adaptation. Many participants indicated this was already a skill they employed, but noted that others, particularly state agency communicators, were not adapting communication to audience

needs. It is important to ensure all professionals in the field have communication training, as it can increase self-efficacy when it comes to engaging different clientele.

Secondly, a glossary of terms could be created to help stakeholders understand the 41 terms used in this study. The glossary could help define specific words or phrases so stakeholders can rely on the logos of the message instead of using their own symbolic meaning and heuristics to assume or disengage with the material. The glossary could be available in both a digital format and print media to leave with stakeholders after meetings, adapting to the audience's needs (Bell, 1984). Finally, it is imperative for public messages like BMPs to reduce jargon and acronyms where possible. In places where technical language cannot be reduced, plain language summaries could be developed (Stoll et al., 2022) to reconstruct the technical message in a way that non-expert audiences can understand.

Future Research

This study focused on the strategies and challenges of BMP communicators (Extension agents, specialists, and government agency employees) when communicating about BMPs. However, there is a missing perspective to fully understand the implementation motivations of stakeholders: the stakeholders themselves. Future research should be conducted to better understand the perspectives of these stakeholders, which could be compared to the findings in this study. Additionally, test interventions would be helpful to better examine plain-language summaries that would be more salient or resonant to stakeholder groups. It could also be beneficial to examine BMP language in a specific context through future research, looking at a specific BMP, commodity, or geographic locality. This may include, but is not limited to, reviewing language used online related to BMPs, evaluation of university and government agency websites related to BMPs, and online trends in search behavior regarding BMP terminology. This study focused more broadly on BMPs as a construct, but specific investigation into the persuasive language of BMPs with a narrower focus could yield beneficial results for the field of science communication.

To continue this line of research with BMP communicators, future research should be conducted to evaluate their formal training and competency when it comes to adaptive communication. While many participants discussed using this as a skill, this study did not evaluate their self-efficacy in using adaptive communication strategies, nor how they learned to use the skills. Finally, this study examined BMP communication in one specific state at a moment in time. While BMPs have been around for decades, long-term trust effects of communication clarity, especially related to science communication, would be beneficial to study to better understand where and how communication challenges disrupt trust in science.

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