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Cattle Producers and Climate Change Conversations: Assessing Workshop Effectiveness in Preparing Communicators to Discuss a Contentious Scientific Topic

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Climate change and the resulting impacts on agriculture in the United States, specifically cattle production, are of great concern to educators in Extension and other organizations. Extension has used a deficit model of communication to extend research information to audiences with the goal of changing behavior by simply providing information. Dialogic models that utilize two-way communication have proven to be more effective when communicating about contentious scientific issues. This study examined the effectiveness of a one-day workshop, focused on cattle production and climate change, on increasing attendees' level of comfort when talking about climate change with their clientele. Attendees indicated the workshop increased their level of comfort in facilitating the application of research, hosting programs, and delivering presentations that cover the topic of climate change. Sessions that focused on climate data, trending data over time, and manipulations of data were most beneficial. Making workshop content personally relevant to the attendees' professions increased their comfort with material and their ability to share knowledge with cattle producers. Delivery of the material was also a very important factor in preference for the sessions. Future workshops should incorporate dialogue training and role-play, so educators will feel more prepared to discuss climate change with their clientele.

Keywords: climate change, dialogic communication, cattle production, scientific communication

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Introduction and Theoretical Framework

Extension educators have been tasked with the challenge of providing research-based information to a wide variety of audiences, including agricultural producers, on controversial or contentious topics (Smith & Mukhtar, 2015), such as climate change. Climate change is expected to significantly affect food systems, including crop and livestock production (Porter et al., 2014). However, producers think about climate change and the potential risks associated with climate change in different ways, including some who believe that climate change is not happening (Arbuckle et al., 2014) in spite of a 90%-100% scientific consensus that anthropogenic (human-caused) climate change is occurring (Cook et al., 2016). While views of climate change may vary among producers, Diehl et al. (2016) suggested producers might be receptive to messages about climate change when approached with tailored messages that fit the characteristics and beliefs of the audience. Extension educators should understand farmer perspectives and needs regarding developing effective Extension and outreach material for producers (Arbuckle et al., 2014). Additionally, Jones and Lenart (2014) found significant differences in the perception that climate change is anthropogenic among professional research and Extension personnel, landowners, and private companies. This finding suggests a need to further explore the beliefs of Extension personnel concerning climate change and their perceived level of responsibility and comfort to effectively communicate the topic to their clientele.

Traditional models of information exchange between Extension professionals and the producers they serve have followed a largely effective deficit model of communication (Leeuwis, 2004). Deficit models of communication are based on the presumption that by simply providing knowledge and information to the public, deficits in their knowledge can be filled (Brossard & Lewenstein, 2010). Within Cooperative Extension Services, the deficit model has been used to communicate information and technologies, developed by scientists and researchers, to farmers and ranchers by Extension outreach professionals (Leeuwis, 2004). The Extension model of deficit communication assumes that farmers and ranchers are passive recipients of information (Leeuwis, 2004) and has previously been successful in the transfer of profit-based agronomic information and innovation (Ruttan, 1996).

A deficit model of communication is less effective in communicating information on contentious science topics (Gross, 1994), such as climate change, than traditional profit-based information (Ruttan, 1996). It has been suggested that dialogic models, similar to those emerging in the engagement of the general public in climate change dialogue and other contentious issues (National Academies of Sciences, Engineering, and Medicine, 2017), can be effective in involving producers in two-way communication models to address adaptive needs and mitigation strategies with farmers and ranchers (Leeuwis, 2004). James, Estwick, and Bryant (2014) suggested that the most effective way to engage producers is through personal contact with Extension – “agents must possess good communication and interpersonal skills, be persuasive and tactful, and have a keen interest and knowledge of farming and the environment” (p. 4).

Learning theory has shown that people learn facts best when the material is personally relevant (Bransford, Brown, & Cocking, 2000). To engage audiences effectively, Extension educators should consider their audience and adapt their messages accordingly (Morris, Megalos, Vuola, Adams, & Monroe, 2014). An important factor in introducing dialogic communication models into Extension is to deliberately connect individuals with differing beliefs, knowledge, and skills, connected by a common shared interest. By creating collaborative spaces for producers to learn from their peers, scientists, and educators, Extension professionals can effectively engage producers in conversations about climate change (Arbuckle et al., 2014).

Recognizing a need for dialogic communication models in Extension (Gay, Owens, Lamm, & Rumble, 2017; Harder, Lamm, & Strong, 2011) and a perceived lack of adequate training on climate change topics (Becerra, Middendorf, Campbell, & Tomlinson, 2016; Whitefield et al., 2016; Prokopy et al., 2015; Rogers, 2003), day-long workshop trainings were developed as part of the *Animal Agriculture in a Changing Climate* (AACC) project, funded by the United States Department of Agriculture (USDA). The project sought to influence cattle and poultry producers to make decisions that result in reduced greenhouse gas emissions while maintaining or increasing America's production levels of meat, milk, eggs, and other animal products. Dilling and Berggren (2014) suggested that stakeholders need "additional data and research, improved communication and coordination among data and information providers, education of their various publics, and changes to policy and legal frameworks to better manage under a changing climate" (p. 1). The needs expressed were in the context of attempting to access expected impacts, characterize current and future vulnerability, and manage for future change (Dilling & Berggren, 2014). Becerra et al. (2016) suggested that Extension educators lacked experience on climate change topics, especially regarding drought and related management practices. Educators also indicated they wanted additional educational resources, including print and online decision aids (Becerra et al., 2016).

Evaluation of training and programming is an essential aspect of implementing a dialogic communication model in Extension. Evaluation is most effective with Extension personnel when the data are used to assess the needs and interests of stakeholders or for future programmatic planning (Lamm & Israel, 2013). To assess future needs and develop a model of dialogic communication, programming surrounding climate change conversations should be examined.

Purpose and Objectives

The purpose of this study was to examine the effectiveness of the *Cattle and Climate Conversations Workshop* in increasing Extension agents' comfort in communicating with cattle producers about climate change. Determining the current level of comfort and taking steps to increase agent willingness to discuss climate change are the needed first steps in developing a dialogic model of communication on climate change. As identified in the literature, Extension

agents identified a lack of training on climate change topics as a barrier to productive conversations with their audiences about mitigating or adapting to the effects of climate change (Becerra et al., 2016; Prokopy et al., 2015; Rogers, 2003). The workshop included Extension agents and Natural Resources Conservation Service (NRCS) personnel from the top three states in cattle production respectively, including Texas, Nebraska, and Kansas (National Cattlemen's Beef Association, 2017). Agents from New Mexico, Oklahoma, Colorado, Wyoming, and Washington, other top cattle-producing states, were also in attendance at the workshop. The end goal of this workshop was to produce effective agent communication and outreach that promotes practices that are environmentally sound, climatically compatible, and economically viable. To assess the effectiveness of the workshop, two research objectives were developed:

- 1) Determine if the workshop increased attendees' comfort level in communicating climate change materials, and
- 2) Describe which sessions and topics attendees found most beneficial.

Methods

An online survey was distributed to the 35 participants in the *Cattle and Climate Conversations Workshop*, part of the USDA NIFA-funded AACC project. Of the 35 invited, 27 workshop attendees participated in the post-workshop survey for a response rate of 77.1%. Respondents to the survey were not forced to answer items to increase participant comfort while responding to a contentious scientific topic. As a result, not all respondents answered each question throughout the survey. The purposive sample included Cooperative Extension Service agents and NRCS personnel, including research scientists, rangeland managers, soil scientists, air quality engineers, a plant materials center manager, and other federal government positions. Attendees of the workshop served cattle production clients in the Southwest and Mountain West regions of the United States. While the sample size and sampling method are limitations in generalizing the research to a larger population, the findings contribute to the body of research examining climate change education and workshop effectiveness.

The survey instrument was adapted from a previous assessment tool used to evaluate a similar workshop in the AACC project (Bureau of Sociological Research, 2014). A panel of experts reviewed the instrument for face and content validity. The panel included the director of the Public Issues Education Center, an associate dean for Extension and Agriculture Programs at the University of Florida, the principle investigator of the Southwest Region Animals Agriculture and Climate Change Project, the education coordinator of Public Issues Education Center, and a research coordinator of Public Issues Education Center who has a background in climate change communication strategies and programming. Following final approval of the instrument, institutional review board approval was received.

Attendees of the workshop were made aware they would be receiving an email invitation to participate in the post-workshop survey. A response rate of 77.1% was achieved in an invitation,

reminder, and final reminder method suggested by Dillman, Smyth, and Christian (2014) to increase response rates. The first email invitation was sent the evening the workshop concluded, with subsequent email reminders sent two and four weeks after the workshop.

The survey adapted for this study contained a total of twenty items. Attendees were asked to rate their level of comfort before and after the workshop on three items for facilitating the application of university research, hosting programs in their respective counties or regions, and delivering presentations on climate change, for a total of six items on comfort. Responses were on a five-point Likert-type scale with 1 = *extremely uncomfortable*, 2 = *somewhat uncomfortable*, 3 = *neither comfortable or uncomfortable*, 4 = *somewhat comfortable*, and 5 = *extremely comfortable*. Comfort variables were averaged into an overall comfort variable for before and after the workshop with Cronbach's alpha scale reliability of .92 and .79, respectively.

Attendees were also asked to rate the level of benefit they found in each workshop session on a sliding, semantic differential scale from 0 = *not beneficial at all* to 4 = *extremely beneficial*. Each of the six sessions was measured as an individual survey item, with an additional item asking about the overall benefit of the workshop. Sessions covered a variety of topics related to climate change, including roles and responsibilities of Cooperative Extension and NRCS, an examination and explanation of historical climate data and future trend data, predicted vulnerabilities of cattle production on U.S. rangelands, climate change adaptation and mitigation strategies, mitigation of climate change in confinement operations, and a facilitated discussion focused on how attendees were currently discussing climate change with clientele. The sessions were intended to equip attendees with the necessary knowledge and experience (Becerra et al., 2016) to have dialogic conversations with their clientele. Additionally, session content encouraged participants to consider ways in which the content could be integrated into dialogic models of communication. Sessions were presented through a variety of methods including presentation, discussion, and hands-on demonstrations. Additionally, the data and information presented focused on the Southwest and Mountain West regions where Extension agents and NRCS personnel resided and worked.

After rating the perceived level of benefit for each of six sessions, attendees were given the opportunity to provide open-ended responses as to why they found the session to be beneficial or not. Attendees were also asked to provide open-ended responses as to what training and materials they thought they still needed to communicate about climate change. Data were analyzed in SPSS 24.

Results

When asked to rate their level of comfort facilitating the application of university research that deals with climate change, nine attendees indicated that before attending the workshop they were extremely or somewhat uncomfortable, and eleven were somewhat or extremely comfortable (Table 1). Thirteen attendees indicated that before attending the workshop, they were extremely

or somewhat uncomfortable hosting programs that deal with climate change, and eight indicated they were somewhat or extremely comfortable. Nine attendees were somewhat or extremely comfortable delivering presentations on climate change, while fourteen indicated they were extremely or somewhat uncomfortable delivering presentations on climate change.

Table 1. Comfort Presenting Climate Change Information Before the Cattle and Climate Conversations Workshop

(n = 27)	Extremely uncomfortable	Somewhat uncomfortable	Neither comfortable nor uncomfortable	Somewhat comfortable	Extremely comfortable
Facilitating	3	6	7	10	1
Hosting	5	8	6	5	3
Delivering	7	7	4	6	3

After considering and rating their level of comfort before attending the workshop, attendees were asked to rate their level of comfort presenting climate change information after going through the workshop. After the workshop, 16 attendees rated themselves as being somewhat or extremely comfortable when facilitating the application of university research on climate change (Table 2). Fifteen attendees indicated that after the workshop they were somewhat or extremely comfortable hosting programs that deal with climate change in their respective county or region. Fifteen attendees said they were somewhat or extremely comfortable delivering presentations that deal with climate change.

Table 2. Comfort Presenting Climate Change Information After the Cattle and Climate Conversations Workshop

	Extremely uncomfortable	Somewhat uncomfortable	Neither comfortable nor uncomfortable	Somewhat comfortable	Extremely comfortable
Facilitating (n = 28)	-	-	12	12	4
Hosting (n = 27)	3	-	9	12	3
Delivering (n = 27)	5	-	7	11	4

Means were calculated for comfort in facilitating, hosting, and delivering climate change information and presentations for before and after the workshop, with increases in mean comfort on each variable. To compare overall changes in comfort with facilitating, hosting, and delivering information and presentations on climate change, variables were combined into “before” and “after” indexes. Like the individual variables, the combined mean level of comfort increased after the workshop. The increase in mean indicates that the workshop was effective in increasing attendees’ level of comfort when working with climate change topics (Table 3).

Table 3. Mean Change in Comfort Before and After the Cattle and Climate Conversations Workshop

(n = 27)	Before		After		M Change
	M	SD	M	SD	
Facilitating	3.00	1.11	3.71	0.71	0.71
Hosting	2.74	1.29	3.44	1.09	0.70
Delivering	2.67	1.39	3.33	1.30	0.67
Mean Index	2.80	1.17	3.49	.89	0.69

Note: Comfort variables were measured on a five-point Likert-type scale of 1 = *extremely uncomfortable*, 2 = *somewhat comfortable*, 3 = *neither comfortable nor uncomfortable*, 4 = *somewhat comfortable*, and 5 = *extremely comfortable*.

Paired sample *t*-tests were used to determine if there were statistically significant differences in the mean comfort scores before and after the workshop. There were statistically significant differences at the $p < .001$ level for all variables, including the mean indexes for combined variables (Table 4). To examine the effectiveness of the workshop on increasing comfort levels, *eta squared* was calculated for each set of corresponding variables. The *eta squared* statistic indicated a large effect size, according to the guidelines of Cohen (1988) (Table 4).

Table 4. Paired *t*-Test Results Before and After the Cattle and Climate Conversations Workshop

	<i>t</i>	<i>df</i>	Sig. (2-tailed)	<i>eta squared</i>
Facilitating	-4.208	26	.000	.41
Hosting	-4.716	26	.000	.46
Delivering	-4.416	26	.000	.43
Mean Index	-5.196	26	.000	.51

Note: All *t*-tests were calculated with a 95% confidence interval rating.

Six workshop sessions were conducted throughout the one-day workshop. Attendees were asked to rate their level of perceived benefit for each session on a semantic differential scale with 0 = *no benefit* to 4 = *extremely beneficial*. Mean scores were calculated for the perceived benefit of each session and overall workshop benefit (Table 5). "Historic Climate Trends and Future Projections" was rated as the most beneficial session, with a mean rating of 3.52 ($SD = .80$). The session focused on explaining trending climate data and the manipulation of climate data in visual representations.

Table 5. Mean Perceived Benefit for Each Cattle and Climate Conversations Workshop Session

	<i>n</i>	<i>M</i>	<i>SD</i>
Historic Climate Trends and Future Projections	27	3.52	0.80
How to “Talk Climate” with Cattle Producers	26	3.04	0.82
Facilitated Discussion with Extension Agents and NRCS Personnel	25	2.84	0.94
Vulnerability of Cattle Production to Climate Change on U.S. Rangelands	25	2.52	1.00
Building Blocks for Climate Action and Mitigation	25	2.52	1.00
Differing Roles and Responsibilities for Cooperative Extension and NRCS for Improving Resiliency to Climate Variability	27	2.19	1.11

Note: Benefit was measured on a semantic differential scale with 0 = *no benefit* to 4 = *extremely beneficial*.

Attendees provided open-ended responses as to why they found the “Historic Climate Trends and Future Projections” session to be beneficial or not beneficial. Attendees found the data presented, discussion of scales and trending data, and the engaging manner of the presentation to be most beneficial. One attendee stated he found the session beneficial because it was a “good scientifically based program. I liked that [the presenter] pointed out the way things are delivered can change the perception of the audience.” Another attendee stated that the “entertaining speaker that kept us engaged. He presented facts, figures, and actual observations, not a bunch of modeling.” Another attendee noted, “[The session] made me reevaluate the way I look at graphs and charts, along with giving me ideas on creating them as well.”

Attendees also found “How to ‘Talk Climate’ with Cattle Producers” as beneficial, with a mean perceived benefit of 3.04 (*SD* = .82) (Table 5). The session focused on the practices cattle producers were implementing to adapt to and mitigate the effects of climate change. It also examined how the topic of climate change can be bridged with cattle producers. One attendee stated the session was a “good example of groups communicating and working together.” Another attendee shared that the session was “relevant on how to begin the conversation without the resistance of ‘this does not apply to me as a producer.’” Another attendee said, “[The presenter] showed how farmers worked to get scientific data that has helped them avoid unrealistic regulations. Also, using the data to make recommended changes.”

Workshop attendees also provided feedback on the climate change training and materials they felt they still needed. A theme that emerged was that attendees felt additional training was needed on how to have in-person conversations and training on specific climate change-related data and tools that cattle producers can use. One attendee stated:

A training about how to actually have the conversation. Although the workshop was good, the impression I got from most people was that they were not going to talk about climate change because it is too politically charged and will shut people down, so instead, we talk around the issue.

Another attendee expressed a similar desire for a program focused more specifically on communicating climate change to cattle producers: “The workshop focused more on communicating climate change in general, rather than communicating climate change with cattle producers. It may have been better to focus a little more heavily on that part.” Another attendee stated, “A plan for visiting with producers [is needed]. Unless told otherwise I will continue to utilize best management practices.” In relation to cattle-specific training, attendees expressed a desire for additional data related to cattle production. One attendee stated he needed “real data that is non-biased and research-based. I still feel that this is too politically charged to discuss in a public forum with county producers.” To accompany data, attendees expressed they wanted training on tools to utilize climate data, as one attendee noted: “Training on tools that a producer can use now to help with seasonal and yearly variability is much more applicable. Drought monitoring, tools for producers to record their weather data, emphasis on seasonal outlooks, etc.” Several attendees mentioned wanting science-based fact sheets, with maps and graphs of localized information.

Discussion and Conclusions

Traditional deficit communication models employed by Extension professionals to provide agricultural producers profit-based information have proven to be ineffective in the communication of contentious scientific topics such, as climate change (Leeuwis, 2004). If Extension is to shift from a deficit to a dialogic model of communication (Leeuwis, 2004), personnel must receive adequate training on the topic and on communication styles (Becerra et al., 2016). Extension agents engage their clientele in effective dialogue when they possess good communication and interpersonal skills paired with interest and knowledge of farming and the environment (James et al., 2014). The *Cattle and Climate Conversations Workshop* had a statistically significant impact on increasing attendees’ comfort levels in facilitating the application of university research, hosting programs in their respective counties or regions, or delivering presentations on climate change information to their cattle production clientele. The finding aligns with Becerra et al. (2016), who suggested agents needed additional training and resources on climate change topics to feel as though they had the proper capacity to address the issue.

Upon closer examination of the workshop content, attendees found the sessions that focused on climate data, trending data over time, and manipulations of data to be most beneficial. This aligns with previous research that found educators and stakeholders needed additional data, research, and understanding of the data and research to feel properly equipped to manage climate

change conversations (Becera et al., 2016; Dilling & Berggren, 2014; Gay et al., 2017). Understanding the science-based information behind the causes of and strategies in reaction to climate change is the first needed step to build the confidence and comfort of public educators in engaging in dialogue and tailored effective communication. In this study, making workshop content personally relevant to the attendees' professions increased their comfort with the material and their ability to share knowledge with cattle producers (Diehl et al., 2016). Presenters who engaged the audience and made the content personally relevant to the workshop attendees received the highest benefit rating levels. Brandsford et al. (2014) also found that audiences learn best when the material is personally relevant. While content was a factor in the success of the programming, it is important to note that delivery of the material was also a very important factor for the sessions.

In the face of a lack of needed communication training or a lack of knowledge on the topic of climate change, workshop attendees indicated that they felt the topic was too politically charged to broach with their clientele or that producers felt the information did not apply to them. When attendees indicated they did not feel comfortable discussing climate change with producers, they utilized best management practices to discuss adaptation strategies. After the workshop, attendees expressed that they wanted workshops and training that focused specifically on communicating with producers and training on climate tools and data.

Recommendations

Based on the findings from this study, future workshops on climate change topics and communication should focus on teaching Extension agents how to implement a dialogic model of communication into their programming and conversations with agricultural producers when addressing climate change or other contentious issues. Recognizing that Extension agents have varying beliefs about the causes of climate change (Jones & Lenart, 2014), workshops should be based on the same premise of dialogic models of communication. Extension agents and NRCS personnel have shown they are receptive to learning new communication skills and have a desire for climate information that is relevant to them in their jobs. As revealed in this study, agents want and are open to conversation training. Workshops that incorporate role-play, the development of conversation starters, and the identification of clientele beliefs about climate change should be created to help increase agent comfort in contentious conversations.

The findings in this study suggest that training should be held on the use of specific climate data tools cattle producers can use in their production. Future workshops should focus more specifically on the workshop topic and prepare attendees to utilize communication strategies and climate data. It is also recommended that workshops and training utilize experts from a variety of backgrounds so collaboration on the topic of climate change can continue (Arbuckle et al., 2014).

Future research should further assess the preferred type and format of climate data that Extension agents and their clientele prefer. Additionally, it is important to examine agent perceptions of cattle producer willingness to engage in conversations about climate change and the adaptation and mitigation strategies that can be implemented in cattle production and other forms of agricultural production. Assessment of the effectiveness of training should be continued as new programs are developed to teach Extension agents on dialogic communication.

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