

# RESEARCH

## Communicating Climate Change: A Qualitative Study Exploring how Communicators and Educators are Approaching Climate-Change Discussions

Katie Rohling, Cassie Wandersee, Lauri M. Baker, and Peter Tomlinson

### ABSTRACT

*The scientific community has come to the conclusion that the climate is changing, but the existence of climate change continues to be rejected or doubted, creating communication challenges for professionals. The purpose of this study was to determine how education and communication professionals involved in climate-change communication are framing the discussions about climate change with agricultural producers. Semi-structured phone interviews were conducted to address terminology usage, challenges encountered, overcoming challenges, and utilization of social media when educating and communicating about climate change. Responses from professionals indicated: 1) they do not avoid using the term “climate change” but are concerned about jargon in materials; 2) the majority agreed the public believes climate change is happening; 3) not addressing the root causes of climate change; 4) framing messages; 5) addressing adaptation options using local data; and 6) climate organizations are promoting materials on social media. This study recommends practitioners frame conversations depending on the audience and avoid using terminology that is not accepted by the target audience. Future research should investigate the effectiveness and uses of social media to engage desired audiences.*

*This research was funded by the United States Department of Agriculture’s Southern Plains Regional Climate Hub.*

### KEY WORDS

Climate Change, Communication, Educational Materials, Social Media, Terminology

### INTRODUCTION

Scientists and governments around the world largely accept the scientific conclusion that the climate is changing and that climate change has been accelerated through the burning of fossil fuels and land clearing (Macdonald, 2013; Melillo, Richmond, & Yohe, 2014). The vast majority of papers (97%) published during the last quarter century support that conclusion (Cook et al., 2013). However, what is considered scientific fact has come under debate and question by the general public (Weber & Stern, 2011). The current United States administration, under the guidance of President Obama, announced plans to reduce net emissions of carbon by over 120 million metric tons by 2025 (Obama, 2013). Agricultural producers have been tasked with limiting contributions to greenhouse gas emissions and adapting to a changing climate through voluntary and incentive-based actions (United States Department of Agriculture, 2015). The agricultural industry has already experienced the impact of climate change in both positive and negative ways. Warming trends in global climate result in longer growing seasons as well as expanded plant hardiness zones (Melillo et

al., 2014). Negative impacts and disruptions are occurring within the agricultural industry in the form of drought, extreme heat, disease, insects, and heavy downpours (Aalst et al., 2014), which impact crop yields and livestock health. Even with short-term benefits, long-term impacts of climate change are expected to have negative impacts on livestock and crop yields (Field et al., 2014). An increasing world population that is projected to reach two billion by 2050 (United Nations, 2014) will rapidly increase global demand for agricultural products, including food (Beek, Meerburg, Schils, Verhagen, & Kuikman, 2010). As global agricultural production increases to match food demand, an increase in greenhouse gas emissions is projected to occur simultaneously as a result of agricultural practice (Beek et al., 2010). To meet growing food demand and mitigate the impacts of agricultural production, adaptation in agricultural practices must be made at the farm-management level (Howden et al., 2007) and within governments (Vergé, De Kimpe, & Desjardins, 2007).

## REVIEW OF LITERATURE

### Public Perception of Climate Change

While the vast majority of scientists agree that climate change is occurring and has been accelerated by human activity (Cook et al., 2013), a significant portion of the American public doubt that climate change is occurring (Leiserowitz & Maibach, 2011). Public perception of climate change is reflected in political views (Hamilton, Hamilton, Duncan, & Colocousis, 2007). Strongly held conservative views are typically associated with doubts about climate change (Nisbet & Myers, 2007). Conservative politicians have been proponents of climate-change denial since its onset, as accepting climate change impacts would impede upon their belief in progress created by the free market and the increased possibility of government regulations (Dunlap & McCright, 2011). Manufactured doubt, also known as organized climate change denial, is partially responsible for the decline of public concern over climate change (Lewandowsky, Gignac, & Vaughan, 2013). However, individuals have been more willing to attribute long-term climate shifts to human causes after they had been informed of the scientific consensus of anthropogenic climate change (Lewandowsky et al., 2013).

Campbell Hibbs et al. (2014) noted producers questioned the scientific validity of climate change for numerous reasons including receiving mixed messages and observations that historical variations in precipitation and temperature are naturally occurring climate fluctuation. Producers still expressed profitability and productivity concerns based on uncertain climate conditions, whether or not they believed in climate change (Campbell Hibbs et al., 2014). Barnes and Toma (2012) found only about half of the 590 dairy farmers surveyed in Scotland believed climate change would negatively impact their operations in the future. Adaptive actions focused on preparing for extreme weather events are largely supported by producers; mitigative actions through government action are not (Arbuckle et al., 2014). Campbell Hibbs et al. (2014) discovered that producers who were adapting to climate change considered their actions to be risk-management strategies to maintain productivity.

### Climate-Change Communication

There is an increased urgency to adapt agriculture to climate change with many potential adaptation options available at the farm-management level (Howden et al., 2007). Agricultural communicators and climate professionals have been tasked with the mission of relating climate change information to the general public and agricultural producers so they can increase their climate knowledge and be better equipped to make management decisions (Howden et al., 2007). However, farmer beliefs about climate change and the need for adaptation and mitigation vary with trust and perceived risk of climate change (Arbuckle Jr., Morton, & Hobbs, 2013a).

A values-based approach to climate-change adaptation and vulnerability acknowledges that individuals and cultures have subjective, qualitative reactions to climate change (O'Brien & Wolf, 2010). Different values between groups also means that efforts to satisfy one group's needs through climate policies can create conflict amongst those groups (O'Brien & Wolf). In response to these challenges, audience segmentation has been suggested as a possible strategy to develop effective communications that are targeted to specific groups within the public who share similar values, beliefs, behaviors, and/or policy preferences about climate change (Hine et al., 2014). One strength of audience segmentation and framing is that people respond and pay closer attention to persuasive messages that match attitudes

and behavior (Fujita, Eyal, & Chaiken, 2008). Individuals can be influenced to develop a particular conceptualization of an issue or reorient the way they think about an issue, through the process known as framing (Chong & Druckman, 2007). Communication framing is increasingly being used to influence the way individuals perceive climate change and to encourage sustainable behavior (Spence & Pidgeon, 2010).

Since the 1980s, the term “global warming” has been used to describe the impact of increasing levels of greenhouses gases linked to human activities (Whitmarsh, 2009). Global warming may describe the concept of global risk and capture the attention of the public, but it obscures the complex and potentially devastating range of effects resulting from what scientists refer to as climate change (Houghton, 2009). Awareness, affect, and knowledge largely vary among the public depending on whether the term climate change or global warming is used in communication (Whitmarsh, 2009). Choice of terminology also impacts how the public understands and evaluates the issue (Whitmarsh, 2009).

Terminology used by communications professionals, educators, and agricultural producers has expanded beyond the use of global warming and climate change. Agricultural producers make distinctions between climate variability and anthropogenic climate change (Campbell Hibbs et al., 2014), and discuss climate shifts (Arbuckle, Morton, & Hobbs, 2013b). It is important to realize that individuals perceive climate change in a variety of ways and prioritize different values, making it clear that climate change cannot be responded to in a single way (O’Brien & Wolf, 2010). Efforts to include agricultural producers in voluntary climate-change initiatives should consider framing climate-change impacts and behavioral goals (Haden, Niles, Lubell, Perlman, & Jackson, 2012).

Messages about climate change that are “dramatic, sensational, fearful, shocking” (p. 375) are capable of capturing the public’s attention and creating a general feeling of importance for the topic (O’Neill & Nicholson-Cole, 2009). Framing climate change in this way can also overwhelm individuals causing them to disengage from the topic. Messages on climate change that use scare tactics can create barriers to an individual’s engagement. Messages addressing an individual’s personal beliefs, environment, and experiences are more likely to create engagement (O’Neill & Nicholson-Cole, 2009). Social media has been identified as one way for organizations to interactively communicate and build relationships (Jun, 2011). Climate-change organizations in the United States that promote their social media pages on their websites use Facebook, Twitter, and YouTube, most often (Jun, 2011). Researchers credit failure to identify key publics as the main challenge for climate-change organizations working to relay climate-change information between experts and the public. It is important to note that only one-third of the total organizations connected their social media networking sites to their website (Jun, 2011). Anderson (2009) found that past mass media news coverage has mainly contributed to mitigation rather than adaptation options.

## PURPOSE AND RESEARCH QUESTIONS

Previous literature looked at broad challenges in climate-change communication, but the specific challenges faced by education and communication professionals when communicating climate-change information remains unknown. Another gap in the literature is what specific communication tools, like social media, are being used to promote educational materials by education and communication professionals working in climate change. The purpose of this study was to determine how education and communication professionals involved in climate-change communication are framing the discussion of climate change with agricultural producers. Framing was the theoretical base for this study. It is of additional interest to learn the specific frames used, challenges in effective communication, and communication tools that are most effective. The following research questions guided this study:

RQ 1: What terminology do communication and education professionals use?

RQ2: Do communication and education professionals encounter challenges when discussing climate change?

RQ 3: How are challenges overcome when communicating climate change information?

RQ4: Are organizations utilizing social media to promote climate change education and information?

## METHODS

In order to address the research questions, qualitative, semi-structured phone interviews were conducted with 16 participants who communicate with agricultural producers about climate change across the United States. Phone interviews are the best way to obtain information when researchers do not have direct access to participants (Creswell, 2007). The semi-structured interviews contained 15 questions related to terminology used by participants, challenges encountered, how to overcome these challenges, and if social media is used. Two researchers at Kansas State University, with an understanding of climate-change and communication practices, conducted the semi-structured interviews. To refine the interview questions a panel of experts reviewed the questions. The panel consisted of a Kansas State University assistant professor in agronomy with an Extension appointment and an associate professor in agricultural communications. Extension has extensive background working with climate change adaptation and mitigation methods in agriculture. The associate professor is an agricultural communications professional trained to handle controversial issues surrounding agriculture. Kansas State University institutional review board considered the ethical issues to this study and approved the study prior to participant recruitment. The institutional review board number for this study was 7766.

The purposive sampling frame for this study was communication and/or education professionals who are involved in communicating to, or educating adults about climate change. Participants were found by conducting a Google search for adult climate change curriculum and/or were suggested by the panel of experts. Participants were also asked if they knew of others working in the area. Information obtained from the Google searches included name, title, organization, and contact information. Researchers then used this information to conduct the semi-structured phone interviews from June 2015 to August 2015. Researchers conducted follow-up phone calls for any participants they were initially unable to reach. The participants ranged in occupation from university professors to government agencies. Participants represented the following organizations: land-grant universities, Cooperative Extension Service, non-governmental organization, and government agencies.

Researchers explained the purpose of the study to all participants. After covering consent information, emphasizing confidentiality and no costs or anticipated risks to participate, the participants provided verbal consent for the study to proceed. The average length of the phone interviews were 20 minutes. To address transferability as much description of the participants' responses were provided in the results as possible (Creswell, 2007). All interviews were digitally recorded and transcribed verbatim by the researchers. The audit trail kept by the researchers aided the dependability of the study (Ary, Jacobs, Sorensen, & Walker, 2013).

The data for this study was analyzed using a grounded theory approach, coding and comparing the data (Creswell, 2007). Researchers used open coding to create categories and subcategories of the data. Researchers also kept member checks and low-inference descriptors by using quotes to aid the credibility of the study (Ary et al., 2013). Another step to ensure credibility was participation by both researchers in the coding and identification of six major themes. This technique, stepwise replication, was also used to ensure the dependability of the study (Ary et al.).

Disadvantages to phone interviews include the cost of long distance phone calls and the lack of visible, non-verbal communication cues on behalf the participant (Creswell, 2007). Another limitation to this study was the timing of the calls. Due to the large number of university participants in the study, many were away from their office during the summer. To protect participants' confidentiality, pseudonyms were assigned during the analysis of the data. Transcripts of the semi-structured interviews were printed and analyzed by hand for themes in accordance with Glaser's (1965) constant comparative method. This study utilized Glaser's first approach to the analysis of qualitative data, coding participants' responses into categories then analyzing the categories in an effort to answer a research question (Glaser).

## RESULTS

### RQ 1: What Terminology Do Communication and Education Professionals Use?

Participants were asked what terminology they used when speaking about climate change. Data shows the majority of participants are not afraid to use the term climate change, but they also provided other terms that have appeared recently.

**Terminology.** Eight of the participants said they use the term “climate change” and do not “side step” the politics of using the term. Carl outlined the importance of being honest when speaking about controversial topics “I will use climate change, and I know it’s not a popular phrase in this part of the country but to just honestly talk about it and not try to disguise it as something else.” Another participant, Albert, also called for honesty stating “Well I mean you can’t get completely away from the term climate change since the climate is changing.”

Not everyone in the study agreed with this view. Diane suggested the term “changing climate.” She said “Changing climate does not apparently have the political association with anthropogenic climate change that climate change does.” Walter agreed that, “You can present it in such a way that effectively communicating the idea that the risks are changing without using politically charged buzz words.”

Participants were concerned about the use of jargonistic terms in climate-change materials. Terms not seen as favorable by participants included global warming, “climate disruption,” “cycles,” “anthropogenic climate change,” and “greenhouse gases”. Carl in relation to available climate-change material said:

In general a lot of what I’m familiar with out there on the web is more geared towards people who are going to be a meteorology student or there tends to be a lot of jargon in them, so I’m a little hesitant to just throw those out there. The content is fine, but it needs to be in a language that is more understandable sometimes.

### RQ 2: Do Communication and Education Professionals Encounter Challenges When Discussing Climate Change?

Participants were asked how they addressed challenges when relaying climate-change information to the general public. Major themes were participants felt there was a general acceptance of climate change. Although participants identified a general acceptance of climate change, they recommend not addressing the root causes when discussing the topic with audiences.

**General acceptance of climate change.** The majority of participants (14) in the study agreed the public has accepted that climate change is happening. Although there will always be the minority that believe differently, professionals are ready to work with the segment of the population that has accepted climate change. Carl said “We work with the ones who want to have that conversation and there are plenty of requests we get, more than we can handle. Usually we’re calling up our partners trying to say, ‘Can you go to this one?’.”

The public’s views have shifted in recent years and many believe it’s due to the public experiencing the effects of climate change. Bethany believes educators are open to climate change “which is different from what I saw four years ago. Things have changed. First off the public attitude toward climate change has softened. I think people are seeing the heavier rainfalls and stronger events predicted by climatologists.”

Two participants did not believe the general public and agricultural producers are ready to accept climate change. However, they referred to research that contradicted their personal assessment of public acceptance of climate change. Jack and Edward referred to Becerra, Middendorf, Tomlinson, and Hibbs’ (2015) study which shows 67% of Extension educators in Oklahoma and Kansas believe the climate is changing. Edward said “My perception is that there is [a large resistance to climate change], but when I see some of the surveys that come out they aren’t quite as anti-climate change as my perception.” Diane supported this viewpoint stating “I don’t think people are really as denialist as the general perception is.”

**Avoiding Root Causes.** Participants in the study stressed that the public is not ready to hear about the root causes of climate change. Many professionals stated they intentionally avoid talking about the root causes of climate change or mitigation options. Albert stated, "Our goal is not to get into a political discussion as to what is causing [climate change]." "Human caused," "anthropogenic," and greenhouse gases are all terms participants recommend avoiding when speaking about climate change. Diane supported avoiding these terms stating she didn't see "necessarily an opposition to [climate change] but a lack of belief in it and/or a lack of belief in anthropogenics."

Henry said "I think I'm seeing a little bit more concern among individuals, but not that they know what to do, but at least they want to learn." The public is ready to learn about climate change, but the message they want isn't how to mitigate climate change. Glenn supported this viewpoint saying "It's not an accepted fact of the causes that's a controversial topic."

### **RQ 3: How are Challenges Overcome When Communicating Climate Change Information?**

Participants were asked questions related to how they address opposition of climate change and how they overcome challenges when communicating to resistant audiences. Themes that appeared in the data included that professionals frame conversations to convey messages. Aspects of framing climate-change communication included addressing adaptation options and using local data.

**Framing communication.** Participants recommended using tailored messages and scholarly information to frame communication with agricultural audiences. Diane is working to educate Extension professionals on climate change who in turn provide information to agricultural producers. The information she is gathering are "largely federal reports, but it's sort of vetted government produced or peer reviewed information that is accessible and written for a lay audience." The consensus of the participants was to not push climate-change information on those who are not ready or willing to hear it. Carl pointed out "The bottom line is that it's important that everybody has access to this and learns as much as they care to learn." Robert supported this school of thought saying:

Our philosophy on this is that there is a learning curve and we are more interested in providing education and information to people that are ready to receive it than we are in changing the minds of people that may not be ready for it.

Professionals recommended not lecturing to an audience. Thomas believes professionals need to understand that "a lot of these farmers are pretty sophisticated now, even those that don't have a lot of education." Professionals indicated they use PowerPoint to engage audiences with specifically framed messages. When presenting tailored messages Walter said, "I may get through five slides out of 40 because you know older people are more likely to engage and interact and so forth."

Carl pointed out "[I] use a number of things to illustrate and try to use actual data where I can so it's not just illustrations or schematics." Ralph also heavily relied on tailored presentations saying:

I probably give 50 or 60 of these talks a year. They are all subtle variations of a theme depending on where I'm going and who I'm talking to... And we make a lot of this stuff too, as far as products and pieces of information and different kinds of outreach materials.

Participants cited that they often use local and geographically relevant data for their tailored presentations. Donna said, "You can tell people what climate change is, but when you actually teach it you have to give them a tool or a method and so I've been using maps because you can use local data." Carl uses materials he finds on the Internet, "there are some really good modules that are available and the National Weather Service has a site JetStream that some, it was really well done I think."

**Addressing adaptation options using local data.** When providing the public with information on how to adapt, professionals recommend using data that is local to the area. Adaptation was the main focus of professionals' conversations when communicating about climate change. "How not necessarily to prevent it [climate change], but how

to adapt to it, how to deal with it," said Caleb when explaining what information his constituents look for in regards to climate change. He also pointed out:

Rather than stressing climate change, or the causes of climate change, we've taken a more proactive approach of how to adapt to these changing conditions. You need to focus on what is relevant to them, which is drought. Drought is going to be the biggest one, changes in rainfall.

"That's another point I've learned, is to kind of show them the data and also try to relate it to local situations," said Edward. Henry agreed saying:

What we found in our interview with the ag science teachers, and also the producers throughout the state, is they want local data...The other suggestion that I have, if you're looking specifically at ag producers is target it to the information that is relevant to them.

Edward echoed Henry's viewpoint of needing local data saying:

I tailor it to the audience I expect to have...I try to talk about local information as much as I can as far as changes in rainfall, changes in drought, or less snowfall, so I try to make it as much local and then I'll get into the global, but I think it's more important to show some local relevance.

#### **RQ 4: Are Organizations Utilizing Social Media to Promote Climate Change Education and Material?**

Participants were asked if they promoted any type of climate change information through their personal or organizational social media. Researchers found that the majority of participants provided social media accounts for organizations, and not their personal accounts.

**Promoting materials on social media.** "I'm not a big Twitter or Facebook person. I don't do a whole lot of social media, now I know the USDA does," said Albert. Gerald is also seeing this in his organization's promotion of climate change on social media saying:

...one of the problems is the educators we're finding don't use social media for professional purposes. They use it for personal purposes so they go to Twitter for their personal reasons. And that's a challenge for us to figure out where the engagement strategy using digital tools for our target audience is.

Gerald's organization is syndicating educational materials and recently signed a contract with PBS LearningMedia. PBS LearningMedia offers free digital content to preschool through high school educators and promotes the material through their website and social media accounts. Diane also provided social media information for her organization instead of her personal sites saying "Maybe 10 to 20 percent of our posts are things like we posted today, a cool sort of infographic. Like a chart that you can play with what shows the different forgings of climate and the global temperature."

Two participants provided personal Twitter pages where they publish climate information from their job to their personal site. "What they [Climate Change Agriculture and Food Security Research Program] do is they post stuff about climate smart agriculture and climate smart villages and how to adapt to climate change...so then I'll retweet that stuff," said Edward. Overall, participants provided organizational information for eight Facebook sites, eight Twitter pages, one blog, one YouTube channel, and one podcast.

## **CONCLUSION AND DISCUSSION**

The results of this study indicate climate educators and professionals believe in speaking honestly when talking with agricultural producers. Participants did not avoid using the term climate change. However, key findings suggest other terms such as climate disruption, cycles, anthropogenic climate change, global warming, and greenhouse gases should be avoided in climate-change materials and discussions.

The majority (97%) of scientific writing supports the fact that the climate is changing (Cook et al., 2013). The challenge now becomes addressing the causes of climate change, as well as adaptation and mitigation options. Participants in the study indicated the general public is not ready for cause and mitigation discussions. Because these topics can disengage the audience, they should be avoided. O'Neill and Nicholson-Cole (2009) also recommended not providing information that might overwhelm audiences and cause them to disengage from the conversation.

Participants frame messages when communicating about climate change, in consideration of the audience. They also provide local data to audiences. Information related to an individual's personal beliefs, environment, and experiences are more likely to create engagement in climate change communication (O'Neill and Nicholson-Cole, 2009).

This study revealed participants are not promoting climate change through their personal social media accounts. Participants referenced climate-change organizations' social media sites. The top two social media sites provided by participants were Facebook and Twitter. Similar to Jun's (2011) study of climate change organizations, which found Facebook, Twitter, and YouTube are the top three promoted social media sites. This study found social media preferences of climate change education and communication professionals are to promote adaptation options.

### **Recommendations for Practitioners**

Several recommendations for practitioners surfaced from the study. Audience segmentation and framing repetitively appeared as a theme throughout interviews. Communications and education professionals should avoid using terminology that is perceived negatively or not accepted by the target audience. Specifically, respondents said use of climate disruption, cycles, anthropogenic climate change, global warming, and greenhouse gases should be avoided when discussing climate change. Framing should also occur when selecting data and information. Local data and tools were received the best by the target audiences and should be utilized in communication.

Respondents often relied on climate organization's social media for content to share with their constituents.

Communication and education professionals depend on social media material from climate organizations to share with their respective organization's social media presence. A few respondents shared climate information to their personal accounts.

### **Recommendations for Research**

Additional research should investigate the use of social media to relay climate-change information. It would be of additional interest to examine the effectiveness of social media in engaging the desired audience on the subject of climate change. Personal use of social media to share climate change information should also be examined.

Respondents in this survey indicated a wide variety of terminology usage and indicated several motivations for the terms used. Terminology that agricultural producers accept and understand should be further investigated. Sources of trusted information should also be explored since this study focused heavily on professionals involved within the university system.

## REFERENCES

- Aalst, M. van, Adger, N., Arent, D., Barnett, J., Betts, R., Bilir, E., ... Yoh, G. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Assessment Report 5*.
- Anderson, A. (2009). Media, Politics and Climate Change: Towards a New Research Agenda. *Sociology Compass*, 3(2), 166–182. doi:10.1111/j.1751-9020.2008.00188
- Arbuckle, J.G., Morton, L.W., & Hobbs, J. (2013a). Farmer beliefs and concerns about climate change and attitudes toward adaptation and mitigation: Evidence from Iowa. *Climatic Change*, 118(3-4), 551–563. doi:10.1007/s10584-013-0700-0
- Arbuckle, J.G., Morton, L.W., & Hobbs, J. (2013b). Understanding farmer perspectives on climate change adaptation and mitigation: the roles of trust in sources of climate information, climate change beliefs, and perceived risk. *Environment and Behavior*, 47(2), 1–30. doi:10.1177/0013916513503832
- Arbuckle Jr., J. ., Hobbs, J., Loy, A., Morton, L.W., Prokopy, L.S., & Tyndall, J. (2014). Understanding Corn Belt Farmer Perspectives on Climate Change to Inform Engagement Strategies for Adaptation and Mitigation. *Journal of Soil and Water Conservation*, 69(6), 505–516. doi:10.2489/jswc.69.6.505
- Ary, D., Jacobs, L., Sorensen, C., & Walker, D. (2013). *Introduction to research in education*. Cengage Learning.
- Becerra, T.A., Middendorf, G., Tomlinson, P., & Hibbs, A. (2015). Attitudes of Extension Educators in Kansas and Oklahoma Regarding Climate Change. *Manuscript Accepted with Revisions*.
- Beek, C.L. van, Meerburg, B.G., Schils, R.L.M., Verhagen, J., & Kuikman, P.J. (2010). Feeding the world's increasing population while limiting climate change impacts: Linking N<sub>2</sub>O and CH<sub>4</sub> emissions from agriculture to population growth. *Environmental Science & Policy*, 13(2), 89–96. doi:10.1016/j.envsci.2009.11.001
- Campbell Hibbs, A.C., Kahl, D., PytlíkZillig, L., Chapman, B., Abdel-Monem, T., Steffensmeier, T., ... Hubbard, K. (2014). Agricultural producer perceptions of climate change and climate education needs for the central great plains. *Journal of Extension*, 52(3).
- Cook, J., Nuccitelli, D., Green, S.A., Richardson, M., Winkler, B., Painting, R., ... Skuce, A. (2013a). Quantifying the consensus on anthropogenic global warming in the scientific literature. *Environmental Research Letters*, 8(2), 024024. doi:10.1088/1748-9326/8/2/024024
- Creswell, J.W. (2007). *Qualitative Inquiry & Research Design Choosing Among Five Approaches*. Thousand Oaks, California: Sage publications, Inc.
- Dunlap, R., & McCright, A. (2011). Organized Climate Change Denial. In *Oxford Handbook of Climate Change and Society* (pp. 143–160). doi:10.1093/oxfordhb/9780199566600.003.0010
- Field, C.B., Barros, V.R., Mastrandrea, M.D., Mach, K.J., Abdrabo, M.A.K., Adger, N., ... Davidson, D.G.W. (2014). *Summary for Policymakers , Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Fujita, K., Eyal, T., & Chaiken, S. (2008). Influencing attitudes toward near and distant objects. *Journal of Experimental*, 44(3), 472-562. <http://doi.org/10.1016/j.jesp.2007.10.005>
- Glaser, B.G. (1965). The constant comparative method of qualitative analysis. *Social Problems*, 12(4), 436–445.
- Haden, V., Niles, M., Lubell, M., Perlman, J., & Jackson, L. (2012). Global and local concerns: what attitudes and beliefs motivate farmers to mitigate and adapt to climate change. *PLoS One*.
- Hamilton, L.C., Hamilton, L.R., Duncan, C.M., & Colocousis, C.R. (2007). Place matters challenges and opportunities in four rural Americas place matters. *Report on Rural America*, 1(4), 1 – 32.
- Hine, D.W., Reser, J.P., Morrison, M., Phillips, W.J., Nunn, P., & Cooksey, R. (2014). Audience segmentation and climate change communication: conceptual and methodological considerations. *Wiley Interdisciplinary Reviews: Climate Change*, 5(4), 441–459. doi:10.1002/wcc.279
- Houghton, J. (2009). *Global Warming: The Complete Briefing*. Cambridge University Press.
- Howden, S.M., Soussana, J.F., Tubiello, F.N., Chhetri, N., Dunlop, M., & Meinke, H. (2007). Adapting agriculture to climate change. *Proceedings of the National Academy of Sciences of the United States of America*, 104(50), 19691–6. doi:10.1073/pnas.0701890104
- Jun, J. (2011). How climate change organizations utilize websites for public relations. *Public Relations Review*, 37(3), 245–249. doi:10.1016/j.pubrev.2011.04.001

- Leiserowitz, A., & Maibach, E. (2011). Global warming's six Americas, May 2011. *Yale University and George Mason University*. New Haven, CT: Yale Project on Climate Change Communication.
- Lewandowsky, S., Gignac, G., & Vaughan, S. (2013). The pivotal role of perceived scientific consensus in acceptance of science. *Nature Climate Change*.
- Macdonald, D.E. (2013). Climate Change Strategies 101. *Earth Common Journal*, 3(1).
- Melillo, J.M., Richmond, T.C., & Yohe, G.W. (2014). *Overview of the Climate Change Impacts in the United States: The Third National Climate Assessment*.
- Merriam, S.B., & Brockett, R.G. (2007). *The profession and practice of adult education*. San Francisco, CA: Jossey-Bass.
- Nisbet, M., & Myers, T. (2007). The polls—trends twenty years of public opinion about global warming. *Public Opinion Quarterly*.
- O'Brien, K., & Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate*, 1(2), 232-242. doi:10.1002/wcc.30
- O'Neill, S., & Nicholson-Cole, S. (2009). "Fear Won't Do It" Promoting positive engagement with climate change through visual and iconic representations. *Science Communication*, 30(3), 355–379. doi:10.1177/1075547008329201
- Obama, B. (2013). The president's climate action plan. *White House Executive Office of the President*, Washington, DC.
- Spence, A., & Pidgeon, N. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change*, 20(4), 656–667. doi:10.1016/j.gloenvcha.2010.07.002
- United Nations. (2014). *Concise report on the world population situation 2014*.
- United States Department of Agriculture. (2015). Building blocks for climate smart agriculture and forestry - Fact Sheet. Retrieved from: <http://www.usda.gov/documents/climate-smart-fact-sheet.pdf>
- Vergé, X.P.C., De Kimpe, C., & Desjardins, R.L. (2007). Agricultural production, greenhouse gas emissions and mitigation potential. *Agricultural and Forest Meteorology*, 142(2-4), 255–269. doi:10.1016/j.agrformet.2006.06.011
- Weber, E.U., & Stern, P.C. (2011). Public understanding of climate change in the United States. *The American Psychologist*, 66(4), 315–328. doi:10.1037/a0023253
- Whitmarsh, L. (2009). What's in a name? Commonalities and differences in public understanding of "climate change" and "global warming." *Public Understanding of Science*, 18(4), 401–420.

## ABOUT THE AUTHORS

Katie Rohling is a second year master's student at Kansas State University.

Cassie Wandersee is a second year master's student at Kansas State University.

Lauri M. Baker is an associate professor of agricultural communications at Kansas State University and is the co-creator of The Center for Rural Enterprise Engagement, which focuses on new-media research to improve rural economic viability.

Peter Tomlinson is an assistant professor at Kansas State University and an Extension Specialist for K-State Research and Extension.