

AN AUDIENCE FOCUSED APPROACH TO FRAMING CLIMATE-CHANGE
COMMUNICATION IN AGRICULTURE

by

CASSIE WANDERSEE

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Approved by:

Major Professor
Lauri M. Baker

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Abstract

The purpose of this study was to explore the frames and messages, issue salience, and communication preferences agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to explore the climate-change beliefs and preferred agricultural media sources for climate and climate change information. Specific research objectives to guide the study were RO1: describe the level of issue salience agricultural producers have related to climate change; RO2: investigate frames and messages agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and RO3: identify the agricultural media and information channels agricultural producers use for climate change. Based on findings in previous research, one hypothesis was developed: H1: agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America's (2012) study. An Internet survey was distributed to producers in Kansas, which was open from March 3 to March 14, 2016, with 158 responses to the survey. Agenda-Setting Theory served as the basis for the study including the tenants of issue salience and framing in relation to climate change. The study found that the majority ($n = 158$, 64.92%) of producers believed that climate change was occurring, however, the causes were still contested. The study identified that higher levels of risk perception and education level were linked to belief in anthropogenic climate change (ACC). Primarily, the study found that loss framing was most effective in communicating the impacts of climate change. Terminology and distance framing were less important in message framing. Regional and university publications were cited most frequently by producers as sources of climate and climate-change information and overall use of agricultural media publications was linked to

higher levels of belief in ACC. Users of business reports and TV had the highest mean climate-change belief; non-users had the lowest. Audience segments aligned with cautious and concerned Six America's (2013) audience segment group, which indicated a shift towards accepting climate change among agricultural producers.

Keywords: Climate change, Agenda setting theory, Issue salience, Framing, Climate-change communication

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Chapter 1 - Introduction

The agricultural industry is both vulnerable to climate change and produces a significant amount of greenhouse gasses (IPCC, 2007b). Results of climate change include successive and extreme events like flooding and droughts, increasing average temperatures, and rising water demand and limited water resources (Field et al., 2014). According to the 2014 Intergovernmental Panel on Climate Change (IPCC) report, these results pose a higher risk in rural communities for loss of livelihoods, severe economic losses in agriculture, as well as damage to cultural values and identity (Field et al., 2014). The IPCC was established in 1988 to prepare a comprehensive review of, and recommendations in response to, the possible impacts of climate change based on scientific, technical, and socioeconomic information (IPCC, 2015). Without adaptation, further changes in climate, atmospheric carbon dioxide, and ocean acidity are expected to have a substantial impact on agriculture (Field et al., 2014). World population is projected to reach 8.1 billion in 2025 and 9.6 billion in 2050 (United Nations. Department of Economical and Social Affairs., 2014), which could significantly impact agriculture and water availability in both rural and urban areas (McDonald et al., 2011). Adaptation actions have been implemented in the agricultural sector in response to climate change including adjusted planting dates, crop selection, and irrigation and fertilizer control (Mimura et al., 2014). Policy measures focused on subsidies and specialty support programs were implemented in the United States on national and regional levels to foster sustainable agricultural and forestry practices (Galarraga, Gonzalez-Eguino, & Markandya, 2011).

Minimizing the effects and reducing the acceleration of anthropogenic climate change (ACC) has become a societal priority. ACC is the belief that human actions, especially emissions produced by human activities, have an accelerating impact on the rate of climate change that would otherwise occur naturally (NASA, 2013). Nearly all papers (97.1%, $n = 3,896$) published since 1997 that expressed a position on climate change and global warming agreed that the human population contributes to climate change (Cook et al., 2013). The scientific conclusion that humans are impacting the climate and warming the planet through land clearing and the burning of fossil fuels is accepted by governments globally (Macdonald, 2013). As the consensus over the existence and impacts of ACC continues to grow stronger within scientific communities, the global environmental problem becomes increasingly debated within political and societal arenas (Dunlap & McCright, 2011). Increasing debates in socio-political fields has led to public disbelief of ACC and declining trust in climate scientists (Leiserowitz, Maibach, Roser-Renouf, Smith, & Dawson, 2012).

Before the Reagan administration of the 1980's, support for environmental protection and action within the United States was relatively nonpartisan; Republicans supported the establishment of national parks and forests by Theodore Roosevelt and Democrats backed Franklin Delano Roosevelt when he included conservation as part of the New Deal in the form of the Soil Conservation Service and related programs (Dunlap & McCright, 2008). However, a widening gap in views on climate between Republican and Democratic political elites, party leaders, and political pundits, has occurred (Dunlap & McCright, 2008) beginning with the conservative resurgence against progressive gains of the 1960s and 1970s (Lapham, 2004).

Political debates over climate change have expanded to the terminology state employees are authorized to use. Employees of the Florida State Department of Environmental Protection were given verbal directions not to use the terms “climate change” or “global warming” in any official communications, reports, or emails (Huppke, 2015). In Wisconsin, the Board of Commissioners of Public Lands passed approval of a rule banning state employees from discussing climate change, even in inquiries from the public (Huppke, 2015).

Even with increased coverage of climate change in the mass media, conservatives have become less likely over the last decade to believe that climate change is already occurring, unlike liberals who are more likely to believe it is (Dunlap & McCright, 2008). The decline for public concern over climate change can partially be explained through early agenda-setting research, which found that when mass media considers an issue to be important, the audience receiving the message will also consider the issue to be important (Cohen, 1963; McCombs & Shaw, 1972). Agenda setting can be measured through issue salience, or the importance that the audience attaches to an issue (Niemi & Bartels, 1985). Declining interest and belief in climate change is partially explained through the creation of doubt portrayed in mass media by political and vested interests, which often challenge the existence of scientific consensus on climate change (Lewandowsky, Gignac, & Vaughan, 2012). Weber and Stern (2011) found the issue of climate change and global warming to be highly contested in the United States, with various actors in private industry and politics seeking to frame the issue and public response in a way that favors their interests.

Since the U.S. economy is closely linked to fossil fuel and their derivative industries, those industries are motivated to present information to the public that climate change is not a serious issue. The fossil fuel industry often depicts the scientific consensus that climate change is occurring as controversial and theoretical. The industry presents the idea that government regulations designed to mitigate climate change would only result in economic restrictions that would hurt the U.S. economy (Dispensa & Brulle, 2003). This process, in communication, is known as framing. Framing focuses on how issues or other objects are depicted within the media and how an issue can be viewed through a variety of perspectives (Weaver, 2007), and the process by which individuals develop a particular conceptualization of an issue or reconceptualize their way of thinking about an issue (Chong & Druckman, 2007). Framing also takes into consideration that an issue can be portrayed as having multiple implications for multiple values or considerations (Weaver, 2007). Frames are important in communication; they can and do affect the attitudes and behaviors of audiences (Chong & Druckman, 2007). However, frames are only effective if the audience's preexisting interpretations are considered (Nisbet, 2009), as an issue can be viewed from a variety of perspectives and designed to resonate with multiple values or considerations of the audience (Chong & Druckman, 2007).

A series of audience segmentation studies by the Yale Project on Climate Change and the George Mason University Center for Climate Change Communication, known as Global Warming's Six America's, has identified six cohesive groups that share similar beliefs, attitudes, and behavior in relation to climate change (Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2013). Six unique audience groups with varying beliefs and attitudes towards climate change and efforts to reduce greenhouse gas emissions were identified within the Six America's

audience segmentation analysis of the American public (Maibach, Roser-Renouf, & Leiserowitz, 2009). The six groups have varying levels of issue salience ranging from the alarmed, who are positive climate change is happening and very concerned about the risk, to the dismissive, who believe climate change is a hoax (Leiserowitz et al., 2013). Agricultural producers have expressed varying degrees of belief in climate change in a similar manner to the authors of the Six America's study (Arbuckle, et al., 2013).

In the face of an American public that is largely divided in its beliefs about climate change (Leiserowitz et al., 2011), President Barack Obama announced a pledge in 2009, that by 2020 the United States would reduce greenhouse gas (GHG) emissions to 17% below 2005 levels (Executive Office of the President, 2013). The plan was announced with the stipulation that all other major economies must also agree to limit GHG (Executive Office of the President, 2013). In June of 2013, President Obama presented a Climate Action Plan consisting of executive actions based on three key areas: cutting carbon pollution in America, preparing the U.S. for the impacts of climate change, and leading international efforts to combat global climate change (Executive Office of the President, 2013). Maintaining agricultural sustainability is one area of focus within the Climate Action Plan. Seven regional climate hubs were established by the Climate Action Plan to deliver science-based knowledge to farmers, ranchers, and forest landowners (Executive Office of the President, 2013). The Southern Plains Regional Climate Hub (SPRCH) was established as one of the seven regional climate hubs to address climate-related agricultural challenges in Kansas, Oklahoma, and Texas through collaboration with federal and state agencies, Native American tribes, private agencies, cooperatives, and conservation groups (USDA Climate Hubs, 2015). Understanding how agricultural producers

currently view climate change and prefer to receive messages, will assist SPRCH employees in delivering science-based agricultural and land management tools and strategies for responding to impacts of climate change.

Statement of the Problem

Although there is a scientific majority that agrees climate change is happening (Cook et al., 2013), and is caused by anthropogenic actions (USGCRP, 2009), there is still a significant amount of the agricultural population that does not believe, acknowledge, or understand climate change and how it is happening (Arbuckle, Morton, & Hobbs, 2013a; Barnes & Toma, 2012; Haden, Niles, Lubell, Perlman, & Jackson, 2012; Hamilton, Hamilton, Duncan, & Colocousis, 2007). Research has found that in order for agricultural producers to remain sustainable and profitable, adaptive and mitigating actions must be taken and implemented (Aalst et al., 2014). SPRCH was established in Kansas, Oklahoma, and Texas as a collaborative effort to deliver science-based information to agricultural producers on the issue of climate change (USDA Climate Hubs, 2015).

Delivery of science-based information on climate change will pose challenges to those individuals and organizations tasked with doing so. Public perceptions about climate change are still widely varied and in the Midwest, where individuals tend to be conservative and doubt climate change communication will be even more challenging (Dunlap & McCright, 2008; Hamilton et al., 2007; Nisbet & Myers, 2007). The dismissive demographic profiles of audience segmentation analysis identified in the Six Americas and other audience studies (Arbuckle et al., 2013a; Leiserowitz et al., 2013; Maibach et al., 2009; Rolfe-Redding, Maibach, Feldman, & Leiserowitz, 2012) follows the same demographic characteristics identified by the USDA Census

of Agriculture as the majority of farm owners within the United States (Vilsack & Clark, 2012). The demographic identified by the Six Americas study and aligning with the USDA Census of Agriculture identifies the dismissive group as white males, between the ages of 45 to 64, with typically politically conservative ideals, as being less likely to believe in ACC than other audience segments (Vilsack & Clark, 2012). The identified demographic group also owns roughly 95% of all U.S. farms (Vilsack & Clark, 2012).

Farmers, ranchers, and forestry landowners now face an urgent pressure to adjust their agricultural practices to make them more resistant to the impacts of climate change, variable weather, and to reduce production of greenhouse gases (Howden et al., 2007). Potential adaptation options are available at the management level on farming operations, which are often variations of existing climate-risk management (Howden et al., 2007). However, if farmers do not believe climate change is occurring or do not perceive it as a threat to their livelihoods, it is not likely they will embrace adaptive or mitigating actions; likewise, those farmers that believe climate change is occurring and perceive higher risk of negative impacts are more likely to endorse adaptive action (Arbuckle, Morton, & Hobbs, 2013b; Howden et al., 2007). Many producers have implemented adaptive measures in their operations (Campbell Hibbs et al., 2014) but are still hesitant to accept climate change as happening or understand the cause of the perceived risks involved (Arbuckle et al., 2013a).

The goal of audience segmentation is to identify and segment the general public into relatively homogeneous, mutually exclusive subgroupings, often based on similar demographics and perceived product needs (Hine et al., 2014). In this study, audience segmentation will be used to

examine agricultural producers based on their relative issue salience relating to climate change and their belief in climate change. Audience segmentation has been utilized in health and political fields with growing interest and research in climate-change communication (Hine et al., 2014). Research suggests that in order for an audience segment to fully understand information about climate change, the information must be actively communicated using appropriate language, metaphor, and analogy (Shome et al., 2009). Arbuckle et al. (2013) identified that agricultural producers were largely supportive of adaptive actions to prepare for extreme weather events, suggesting that terminology used to discuss climate change impacts may play an important role in adaptation.

Trust in media source also has implications in one's belief in climate change and willingness to implement adaptive and mitigating actions (Arbuckle et al., 2013). Farmers that expressed trust in organizations that are environmentally oriented were also more likely to believe in climate change, whereas those who reported trust in agricultural interests were less likely to believe in climate change (Arbuckle et al., 2013). The connection between higher levels of trust in agricultural organizations and non-belief in climate change supports the "denial machine" concept outlined by Dunlap and McCright (2011) which works to manufacture uncertainty and shape the public's perception of climate change. It also suggests that agricultural communicators may have the opportunity to engage producers through agricultural interests to adapt to climate change (Arbuckle et al., 2013).

Purpose of Study and Research Objectives

The acceptance of ACC is influenced by many factors including political identity, demographic profiles, education level, and use of media and agricultural press sources. While improving acceptance and beliefs about climate change is still necessary, encouraging producers to embrace adaptive measures through framing and risk perception has become an important goal of the federal administration and is needed to maintain agriculture within the United States (Executive Office of the President, 2013). It has been suggested in previous research that audience segmentation is one way to reach agricultural producers to encourage adaptive and mitigative actions (Arbuckle et al., 2013; Hine et al., 2014; Maibach et al., 2009).

Although there has been some research conducted investigating agricultural producers' beliefs in the existence of climate change, the causes, and needed responses, the topic has received very little attention regarding agricultural audience specific climate-change communication.

Understanding the audience of agricultural producers will assist in identifying appropriate frames, messages, and messengers with the greatest impact (Moser & Dilling, 2011). Reaching audiences as an individual audience segment using terminology they accept and understand is one aspect of the needed climate-change communication (Shome et al., 2009). Arbuckle (2013) identified six classes of risk, efficacy, and support for action perspectives on climate change held by farmers in the Midwest.

The purpose of this study was to investigate the frames and messages agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to identify their preferred agricultural media

sources for climate and climate-change information, as well as the relation of issue salience to their belief in climate change.

Specific research objectives to guide the study are:

- RO1: Describe the level of issue salience agricultural producers have related to climate-change belief;
- RO2: Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and
- RO3: Identify the agricultural media and information channels agricultural producers use for climate change.

Based on findings in previous research, one hypothesis was developed:

- H1: Agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America's (2012) study.

Assumptions

The most significant assumption in this study is that agricultural producers are at least superficially aware of changes in the climate and potential impact of climate change on their production and sustained profitability. Further assumptions exist regarding the desire of producers to adapt their productions to changing climates to maintain or increase profitability.

Definition of Key Terms

- *Adaption* – A response to perceived vulnerability to the impacts of climate change with the intent to reduce risks to the farm operation (Arbuckle et al., 2013).

- *Agenda Setting* – Agenda setting describes the phenomena by which prominent aspects of public affairs in the news become prominent in the minds of the public (McCombs & Shaw, 1972).
- *Agricultural Producer* – An individual that is actively engaged in producing agricultural products or goods (O’Donoghue, Hoppe, Banker, & Korb, 2009).
- *Anthropogenic Climate Change (ACC)* – “Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities” (NASA, 2013).
- *Climate Change* – “Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer.” (U.S. Environmental Protection Agency, 2013).
- *Extreme Weather Events* – Non-typical or rare weather events such as drought, flooding, tornadoes and hurricanes, that often lead to financial loss, property damage or loss of life (NOAA, n.d.).
- *Framing* – The way issues or other objects are presented in the media (Weaver, 2007).
- *Great Plains* – A 12-state geographic area including Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming (Rathge, Olson, Danielson, & Clemenson, 2001).
- *Issue Salience* – Issue salience describes the importance individuals place on an issue or subject (Niemi & Bartels, 1985).

- *Mitigation* – Government action through policy and regulation in greenhouse gas emissions to reduce emissions, tax emission, and market-based cap and trade (Arbuckle et al., 2013).
- *Southern Great Plains* – A region in the Great Plains that includes Kansas, Oklahoma, and Texas (USDA Climate Hubs, 2015).
- *Southern Plains Regional Climate Hub (SPRCH)* – one of the seven regional climate hubs to address climate-related agricultural challenges in Kansas, Oklahoma, and Texas through collaboration with federal and state agencies, Native American tribes, private agencies, cooperatives, and conservation groups (USDA Climate Hubs, 2015).
- *Weather Patterns* – The definition and use of the term weather pattern varies widely. For this study it is defined as a pattern of weather that occurs over a short period of time, typically from year-to-year (NOAA, 2011).
- *Weather Variability* – For this study, weather variability refers to increased daily variations and changes in weather (Arbuckle et al., 2013).

Summary

Results of climate change, such as successive and extreme events like flooding and droughts, combined with increasing average temperatures and rising water demand, pose a higher risk in rural communities for loss of rural livelihoods, severe economic losses in agriculture, as well as damage to cultural values and identity (Aalst et al., 2014). Many producers have implemented adaptive measures in their operations (Campbell Hibbs et al., 2014), but are still hesitant to accept climate change as happening or understand the cause of the perceived risks involved (Arbuckle et al., 2013). Iowa farmers stated beliefs of the causes of climate change – whether

natural, caused by human activity, a combination of the both, or simply not happening – seem to be less important as a predictor of support for adaptation than expressed concern for impacts (Arbuckle et al., 2013a). Researchers are unsure why this occurs, but speculate that it could be because a farmer’s decision to adapt, or not adapt, does not require the farmer to understand the underlying causes or sources of risk (Gordon et al., 2013).

The purpose of this study was to investigate the frames and messages agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to identify their preferred agricultural media sources for climate and climate-change information, as well as the relation of issue salience to their belief in climate change. Agricultural producers are treated as an audience segment; audience segments are helpful when addressing the American public because of the widely varied beliefs and responses to ACC (Maibach et al., 2009). It was of additional interest to investigate the relationship between preferred frames, political identity, and preference and use of information sources. Specific research objectives to guide the study are RO1: describe the level of issue salience agricultural producers have related to climate change; RO2: investigate the frames and messages agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and RO3: identify the agricultural media and information channels agricultural producers use for climate change. Based on findings in previous research, one hypothesis was developed: H1: agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America’s (2012) study.

Chapter 2 - Review of Literature

The purpose of this study was to investigate the frames and messages agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. The focus is on understanding how agenda setting can impact attitudes and beliefs agricultural producers have towards the issue of climate change and how communicators can best frame audience-segmented, climate-change material to encourage adaptation and mitigation on farm-level management strategies. In order to better understand framing and audience segmentation in climate change, an extensive literature review was conducted by gathering literature from a wide breadth of communication disciplines. To build a theoretical base for the study, the literature review includes the history and application of agenda-setting theory in communication research and risk perception. History pertaining to the study of climate change and representations in media were also explored.

Climate Change Science

The connection to atmospheric concentrations of gases and the understanding that Earth's climate is subject to those concentrations, creating a greenhouse effect, has been studied and acknowledged for over a century (Treut et al., 2007). High accuracy measurements of atmospheric carbon dioxide (CO₂), beginning in 1958 by Charles David Keeling, form the master time basis documenting the changing composition of the atmosphere (Keeling, 1961). The data set collected by Keeling (1961) provides empirical evidence of the effects human activity has had on the chemical composition of Earth's atmosphere (Treut et al., 2007). Later studies of parallel trends in atmospheric levels of ¹³CO₂ isotope identified by tree rings (Francey & Farquhar, 1982) and molecular oxygen (O₂) (Bender, Ellis, & Tans, 1996; Keeling & Shertz,

1992) solidly identified the rise in atmospheric CO₂ as an effect of the burning of fossil fuels. Historic data was gathered from analysis of captured CO₂ bubbles in ice cores from Greenland and Antarctica, which indicated significantly lower levels during the last ice age (Barnola, Raynaud, Korotkevich, & Lorius, 1987; Delmas, Ascencio, & Legrand, 1980).

ACC studies first appeared in the public agenda in the mid-to-late 1980's (Moser, 2010). Studies show that average global temperature has risen by 1.3°F to 1.9°F since 1895, with the highest increase occurring since 1970, with projected rises in temperature of another 2°F to 4°F over the next few decades (Melillo, Richmond, & Yohe, 2014). Climate changes are expected to have an impact across many sectors of the Earth including increased occurrence of extreme weather events, damage to vulnerable populations, human health and wellbeing, infrastructure, water quality and supply, and disruptions and changes to agricultural and traditional cropping systems (Melillo et al., 2014).

Agricultural Impact on Climate Change

On a global scale, agricultural GHG emissions contribute approximately 12% of the total anthropogenic GHG emissions (IPCC, 2007a). Agricultural operations produce 60% of the global nitrous oxide (N₂O) and 50% of global methane (CH₄) emissions (IPCC, 2007a). N₂O is a more potent GHG with a radiative forcing potential that is 12 times larger than CH₄. Wheat, maize, and other upland crops are the primary sources of N₂O emissions, with the majority of emissions coming from the application of nitrogen (N) in the form of fertilizer (Van Groenigen, Velthof, Oenema, Van Groenigen, & Van Kessel, 2010). Adaption and mitigation opportunities

exist within cropping systems to reduce GHG emissions while improving yields (Linguist, Groenigen, Adviento-Borbe, Pittelkow, & Kessel, 2012).

Climate Change Science and Agriculture in the Southern Plains

Negative impacts of climate change are expected and have been observed in the Southern Plains; however, crop production in high-latitude regions has been positively impacted (Porter et al., 2014). A shift in production area occurred in response to more favorable climactic conditions in North Dakota and South Dakota. Maize and soybean production has increased in both areas based on acreage dedicated to production (Hatfield, 2013). The expansion in production is due largely to the increase in summer precipitation and no-till cropping practices, which has increased the soil water availability to the crop, although there has not been a significant change in temperature in northern regions of the Great Plains (Hatfield, 2013). Winter wheat regions of Oregon and Washington may also benefit from increased rainfall and less snowfall during the winter growing season (Lettenmaier, Major, Poff, & Running, 2008).

In addition to changes in precipitation and temperature, CO₂ concentrations have, and are expected to continue to increase in the coming years (Hatfield, 2013). Higher concentrations of CO₂ may have a positive impact on plant growth through increases in water use efficiency resulting in greater biomass and yields (Hatfield et al., 2011). Although increased levels of CO₂ may positively impact crops and crop yields, the positive impacts may not fully mitigate the negative losses caused by heat stress, increases in evaporative demand, and/or decreases in water availability in some regions (Hatfield et al., 2011).

Climate change is expected to negatively impact crop yields in wheat and corn production for many regions (Porter et al., 2014). In the Great Plains and Southern Plains of the United States, the impacts of climate change on agricultural production are already being experienced. Warming winters and alterations in the timing and magnitude of rainfall have changed crop growth cycles (Shafer et al., 2014). Warmer overnight temperatures, specifically during the reproductive stages, will reduce fruit and grain production because the increased rate of development and increased respiration rates. Increased temperatures reduce grain yields and produce serious consequences in terms of the stability of grain production (Hatfield et al., 2011).

Several climate and weather hazards exist in the Southern Plains including floods, droughts, severe storms, tornadoes, hurricanes, and winter storms, with projections for more intense droughts, rainfall, and heat waves (Shafer et al., 2014). Expected impacts of climate change in the Southern Plains include a higher frequency of days over 100°F and nights with minimum temperatures higher than 80°F (Kunkel et al., 2013). Surface water loss, heat stress on animals and crops, and overwintering insect populations as a result of increasing annual temperatures and significant heat waves will have a significant negative impact on agriculture (Kunkel et al., 2013). Increases in extreme heat will have far more negative impact on agriculture in the Southern Plains than benefits. Summer drying is expected in large parts of Texas and Oklahoma projected to experience longer dry spells and periods of drought (Kunkel et al., 2013).

Declines in precipitation and increases in evaporation due to higher temperatures have increased irrigation demand and exacerbate current stress on the Ogallala Aquifer and the High Plains Aquifer, accelerating the depletion of the aquifers and limiting irrigation (Konikow, 2011;

Scanlon, Gates, Reedy, Jackson, & Bordovsky, 2010). Holding other factors of climate change impacts constant, the shift from irrigated crop production to dryland production would reduce yields by a factor of two (Colaizzi, Gowda, Marek, & Porter, 2009).

Increases in high temperatures and heat waves will also negatively affect livestock and concentrated feeding operations (Hahn, Gaughan, Mader, & Eigenberg, 2009; Mader, Frank, Harrington, Hahn, & Nienaber, 2009). The droughts of 2011 and 2012 caused many ranchers to liquidate their herds due to a lack of available forage sources and water (Shafer et al., 2014). Increased precipitation in some regions may positively impact rangeland and pasture growth, although the increased variability of rainfall in other regions in conjunction with warming trends may lead to regional drought (Wang, 2005). Rising annual temperatures should accelerate plant metabolism and developmental processes, cause an earlier spring greening, and ultimately increase the length of pasture season; however, these responses will vary among grassland species (Badeck et al., 2004). Increased ambient air and soil temperatures may enhance plant productivity, but negative effects are expected in existing hot and dry regions (Izaurrealde, Thomson, Morgan, Fay, & Polley, 2011).

Warmer winters pose challenges for agriculture with some pests and invasive weeds surviving through winter months (Hu, Weiss, Feng, & Baenziger, 2005). An expanded range of pests and insects will further exaggerate the stress on crops (Hatfield et al., 2011). Winter crops that leave dormancy earlier are more susceptible to spring freezes (NOAA & USDA, 2008) and shortened winters will also result in lessened periods of dormancy for winter wheat grazing for livestock (Hu et al., 2005).

Agenda Setting

Political scientist, Bernard Cohen (1963), summarized in his research of press and foreign policy that the media fails to tell audiences what to think, but rather what to think about. Cohen's exploration of press and foreign policy would serve as the foundation for future agenda-setting research. Agenda setting describes the phenomena by which prominent aspects of public affairs in the news become prominent in the minds of the public (McCombs & Shaw, 1972). McCombs and Shaw (1972), in their seminal study, examined agenda-setting theory in the realm of the political agenda during the 1968 United States presidential campaign. Agenda-setting effects were studied across undecided voter groups of Democrats, Republicans, and Independents, with between group comparisons to discover individual differences often lost in examining voter groups as a whole (McCombs & Shaw, 1972). Comparisons between voter groups revealed agenda-setting functions for a variety of issues and media channels with minimal differences between groups. The discovery of the correlational relationship with minimal differences between groups supported the position of agenda-setting theory; the public learns about an issue and attaches importance to it through its prevalence in mass media positing that the media has the ability to set the agenda through editorial choices (McCombs & Shaw, 1972).

Agenda setting is identified as occurring on two levels. The first, or initial, level of agenda setting focuses on relative salience, or perceived importance, of objects (McCombs, 2005). The term object is used in agenda-setting research to designate about what an individual has an opinion or attitude (McCombs, 2005). Each object also has a set of attributes, characteristics, and traits that describe the object. In this study the object would be defined as climate change. When the media and individuals discuss and think about an object, some attributes are emphasized,

while others are rarely mentioned. The second level of agenda setting examines the relative salience of attributes of issues (McCombs, 2005). Second-level agenda setting has also been described as framing in communications research. McCombs (1997) suggests that the second level of agenda setting is the selection of a restricted number of related attributes when discussing an issue in the media agenda.

Issue Salience

McCombs and Shaw (1972) state that agenda setting should be measured in terms of issue salience, which describes the importance individuals place on an issue or subject (Niemi & Bartels, 1985). There is an important distinction to make between issue salience and issue position. Issue salience describes the perceived importance of the issue, whereas issue position describes the relative approval of a policy (Erbring, Goldenberg, & Miller, 1980). When agenda setting occurs, the media influences the importance that the public attached to an issue, patterning the public agenda on the media agenda (McCombs, 2004). Issues must become salient with individuals before they can truly become subjects of attitudes (Erbring et al., 1980).

Issue salience and agenda setting are not deliberate influences planned by the media, but rather a result of the necessity for media outlets to select and report on a few topics as the most salient at the time (McCombs, 1997). McCombs (2004) found individual salience of issues rises and falls with shifting attention of the public and mass media on a specific issue. The number of media channels have increased over time, increasing the amount of issues covered and competition for public attention, resulting in a higher rate of issue turnover (McCombs & Zhu, 1995). The

shifting focus on an issue is caused in part by the ability of society to only focus on a few issues at a time; typically no more than five to seven (McCombs, 2004).

Expansion of Agenda-Setting Theory

Since the research of McCombs and Shaw (1972), several studies have been conducted to further explore individual characteristics in agenda setting. Political partisanship in agenda setting was studied by McLeod, Becker, and Byrnes (1974) by examining two local newspapers in Madison, Wisconsin, one conservative and the other liberal, for the influence of press opinion on rank-ordering of political issues by the readerships. Although researchers found an influence between press opinion and the opinions of readership, they disagreed with the methods previously used to study agenda setting (McCombs, 2004). McLeod et al. (1974) proposed controlling for perceived issues saliences of users of a specific medium by testing users of another medium who were as similar as possible to the target audience in regard to socioeconomic and political attributes. Benton and Frazier (1976) found that similar issues were emphasized by Minneapolis, Minnesota, newspapers. Surveys were administered to test respondents on three specific information levels. Information levels included awareness of issues, awareness of proposed solutions to issues, and specific knowledge about the proposals (Benton & Frazier, 1976). Early studies focused exclusively on election campaigns in what is described as a mirror-image hypothesis about media effects in agenda-setting (Erbring et al., 1980). Mirror-image research attempted to make connections between the relative frequency of media coverage of a set of issues and the relative salience among the audience of the same set of issues (McCombs & Shaw, 1972; McLeod et al., 1974).

Erbring et al. (1980) argued that mirror-image studies of agenda setting in media were not an adequate measure of issue salience because individuals gain issue concerns from sources other than the media – often from personal experiences, community perspectives, and real-world conditions. Individual factors will vary across the audience as well as within issues and over time (Erbring et al., 1980). With consideration for individual differences and varying sources of issue concern, Erbring et al. (1980) matched each survey respondent with content information from newspapers each individual had read. Survey data was then paired with contextual data on local unemployment and crime rates for joint analysis of the survey, media content, and contextual variables allowing for deeper analysis of agenda-setting beyond presence (Erbring et al., 1980). Results indicated that informal communication about politics with peers was a stronger indicator of issue salience than that of specific media or real-world context, leading to the proposal of a model of audience effects, which assumes that media interacts with the audience's pre-existing sensitivities (Erbring et al., 1980).

Other contingent conditions have been examined in the context of agenda setting, including the concept of need for orientation (McCombs & Shaw, 1993). Orientation describes the need for individuals to be familiar with their surroundings, both within a physical and cognitive environment (McCombs & Weaver, 1973). The psychological basis for orientation comes from Tolman (1932) and the concept of cognitive mapping; individuals will strive to map the world around themselves, gathering enough detail to become oriented and navigate intellectually through society. McCombs (1967) found different levels of need for orientation accounted for varying levels of effectiveness in newspaper editorial endorsements in select California political

campaigns. The need for individual orientation to navigate political issues through the use of media, opens individuals to the effects of agenda setting (McCombs & Weaver, 1973).

Navigation of media outlets has changed greatly for the general public since agenda-setting was first studied. The evolution of media over time, and the ever changing mediums employed by the distribution channels, have expanded the realm of agenda setting to include online editions of newspapers, thus causing the research focus of agenda setting to include that medium (McCombs, 2005). Baker and Irani (2014) expanded the realm of agenda-setting research by including new media, specifically the blogosphere, online newspapers, and online public opinion. Political scientists have also applied agenda-setting theory to political actors, determining, in part, how the actions they take, the issues they give attention to, and how they determine their stance on an issue, are all influenced by mass media (Baker & Irani, 2014; Cook et al., 1983; Dursun-Ozkanca, 2011).

Agenda-setting research has also explored the interaction of media, public, and decision makers' agendas suggesting that the flow of information is not one way from the media to the public (Baker & Irani, 2014; Brosius & Weimann, 1996). Instead, the flow of agenda setting is two-way in nature (McCombs & Shaw, 1972; McCombs, 2004). Interpersonal communication can enhance agenda-setting effects when issues receive extensive coverage in the media, but it may also interfere with salience of issues that receive less attention (McCombs & Shaw, 1972; McCombs, 2004). Brosius and Weimann (1996) explored four models of information flow, finding that influential individuals can influence the effects of media agenda setting. Interpersonal communication can also act as a mediator of mass media campaign effects

(McCombs & Shaw, 1972; McCombs, 2004). Agenda-setting effects can also work in reverse, with the public setting the agenda for the mass media and political actors. Baker and Irani (2014) found that the blogosphere, online newspapers, and online public opinion shaped the policy agenda.

Framing

Framing theory, also considered to be second-level agenda setting, is based on the premise that an issue can be viewed from a variety of perspectives and can be constructed to have implications for multiple values or considerations (Chong & Druckman, 2007). The process by which individuals develop a particular conceptualization of an issue or reorient the way they think about an issue, is known as framing (Chong & Druckman, 2007). Goffman (1974) was one of the first researchers to develop the concept of framing. The theoretical basis for framing comes from several disciplines, with the origin of frames in communication based in sociology. Frames help individuals organize and understand things they see in everyday life (Goffman, 1974). Frames are also defined as devices that help journalists and communicators package information effectively for their audience (Gitling, 1980).

Communication framing can influence the way individuals process information and their subsequent decision-making processes. Kahnem and Tversky (1979) studied loss aversion in communication frames finding that individuals tended to dislike losses more than equal gains and were more likely to take risks when information highlighted the possibility of losses as opposed to gains. Empirical evidence supporting the stronger influence of loss frames is inconsistent, and it appears that gain and loss framing success is dependent on other factors

including the behavior in question and the relationship each individual has with that behavior (Maheswaran & Meyers-Levy, 1990; Rothman, Bartels, Wlasching, & Salovey, 2006). Loss frames have been found to be more effective when the behavior of the issue is considered to be risky, and gain frames are more effective when the behavior is considered to be safe (Banks et al., 1995; Edwards, Elwyn, Covey, Matthews, & Pill, 2001). Framing a message requires a mode or presentation that resonates with the existing mindset of the audience (Shoemaker & Reese, 1996). Focusing a message on a specific consideration is known as an emphasis approach to framing and can influence audience members to focus on those particular issues (Druckman, 2001).

Agenda Setting in Climate Change and Agriculture

Agriculture is within a consumer society where consumers and consumption are dependent upon socio-cultural and economic life (Dagevos, 2005). The public has increasingly become more concerned with the impact of agriculture on the well-being of society, leading to increased rules and regulations by governments in industrialized countries (Blandford & Fulponi, 1999). Public opinion helped shape the regulation of organic food labeling and increased consumer demand for organic and local-food options (Adams & Salois, 2010). Media attention for agricultural based issues are driven by event based occurrences, this is unlike environmental issues, which are often covered in cycles (Shih, Wijaya, & Brossard, 2008). While most experts agree that carbon dioxide emissions and other greenhouse gases are causing ACC, public concern for the issue has been declining (Lewandowsky et al., 2012).

The media and the public are influenced by the current political agenda of those in office. Historically, support for environmental protection within the United States has been relatively nonpartisan; however, a widening gap in views on climate change between Republican and Democratic political elites, party leaders, and political pundits, has occurred (Dunlap & McCright, 2008). Even with increased coverage of climate change in the mass media, Republicans have become less likely over the last decade to believe climate change is already occurring, unlike Democrats who are more likely to believe (Dunlap & McCright, 2008).

Organized Climate Change Denial

Declining interest and belief in climate change is partially explained through the creation of doubt by political and vested interests, which often challenge the existence of scientific consensus in climate change (Lewandowsky et al., 2012). Weber and Stern (2011) found that the issue of climate change and global warming is highly contested in the United States, with various actors in private industry and politics seeking to frame the issue and public response in a way that favors their interests. The fossil fuel industry often depicts the scientific consensus that climate change is occurring as controversial and theoretical. This industry continually presents ideas that proposals for government regulations to mitigate climate change would only result in economic restrictions that would hurt the U.S. economy (Dispensa & Brulle, 2003). Variations in media focus on environmental and health issues change with political climate and concurrent issues (Shih et al., 2008).

Brechin and Freeman (2004) partially attribute the inability of the public to focus on environmental issues due to the supremacy of media coverage to other specific political issues.

For example, the terrorist attack in the United States on September 11, 2001, and the following sustained military engagement abroad, dominated news coverage in American media throughout all mediums (Brechtin & Freeman, 2004; Shih et al., 2008). It has also been suggested that the corporate influence, ownership, and interests in the American media influence the amount of coverage given to news stories covering climate change and global warming (Dispensa & Brulle, 2003). Media owners and leaders in the United States have ties to industries, such as the fossil fuel industry, that rely on the lack of regulations in their industries to profit and therefore present information to the public that undermines the scientific consensus that climate change is occurring because of human causes (Dispensa & Brulle, 2003).

Climate Change Issue Salience

The general public of the United States does not fully understand the causes and impacts of climate change (Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; Maibach et al., 2009; Weber & Stern, 2011). Perceptions of scientific agreement that climate change is happening also widely varied in the Six Americas study. Over 40% of respondents from the Global Warming's Six Americas (Leiserowitz et al., 2013) stated that they believed scientists did not agree whether or not global warming was happening, or that most scientists think global warming is not happening, this is contrary to the 97% of scientific research papers that agree climate change is occurring (Cook et al., 2013).

The decline for public concern over climate change can partially be explained through early agenda-setting research, which found that when mass media considers an issue to be important, the audience receiving the message will also consider the issue to be important (Cohen, 1963;

McCombs & Shaw, 1972). According to Soroka (2002) environmental issues are more open to media influence because individuals do not experience the impacts of environmental issues on a daily basis.

Campbell Hibbs et al. (2014) found that many producers are already making changes within their farming practice in response to current weather conditions. Farmers in Iowa also expressed support for adaptive action that focuses on preparing for more extreme weather events (Arbuckle et al., 2013). Iowa farmers stated beliefs of the causes of climate change – whether natural, caused by human activity, a combination of the both, or simply not happening – seem to be less important as a predictor of support for adaptation than expressed concern for impacts (Arbuckle et al., 2013a). Researchers are unsure why this occurs, but speculate that it could be because the farmer decision to adapt, or not adapt, does not require the farmer to understand the underlying causes or sources of risk (Gordon et al., 2013). The findings of Gordon et al. (2013) contradicts the position that an issue must be salient before it can become a subject of attitudes (Erbring et al., 1980).

Framing of Climate Change Related Messages

The way in which communications about climate change are framed has a considerable impact on the way the messages are received (Spence & Pidgeon, 2010). Communication frames are increasingly being used to influence and encourage sustainable behavior in regards to climate change (Spence & Pidgeon, 2010). Communication and framing of risk to influence behavior change has been thoroughly studied in relation to personal health, policy, and other academic fields. There is a lack of empirical evidence about the most effective strategies for

communicating and presenting climate change risks and adaptation and mitigation options, and whether or not theories developed in other risk domains are transferrable to climate change issues (Pelletier & Sharp, 2008).

Individuals have many perceptions about the dangers and risks associated with climate change, and each individual has varying judgements about the complex science, potential future impacts, and values used to establish whether a particular outcome is acceptable or not (Lorenzoni, Pidgeon, & O'Connor, 2005). Varying perceptions of risk and danger associated with climate change make it impossible to present information without some amount of context (Hulme, 2009). Framing can be used to understand the way such information can be presented and assists in understanding a range of environmental issues and problems including climate change (Miller, 2000).

Gain and loss framing has been found to be effective in influencing climate change behaviors. Like health and behavior research, gain framed messages are more effective than loss frames in promoting positive attitudes towards climate change mitigation and were found to result in judgement of climate change impacts that were more severe (Spence & Pidgeon, 2010). Scannell and Gifford (2013) found that individuals that had been exposed to motivational-orientated frames were more likely to report competence and climate change engagement than those exposed to sacrifice-oriented frames. Additionally, the perceived severity of climate change can be increased by focusing on the future impacts of climate change and the benefits of mitigation (Spence & Pidgeon, 2010). Uncertainty about the impacts of climate change also play a role in the effectiveness of framing. When climate change impacts are framed positively, by focusing on

the possibility that losses as a result of climate change may not occur, uncertainty produces significantly stronger intentions to act than certainty (Morton, Rabinovich, Marshall, & Bretschneider, 2011). Focusing on frames of social impacts of climate change mitigation increased positive attitudes individuals have towards the acts of mitigation (Spence & Pidgeon, 2010).

Agricultural producers who expressed higher levels of trust in agricultural interests and publications were less likely to believe in or accept climate change, especially in the case of anthropogenic causes (Arbuckle et al., 2013b). Since farmers indicated trust in agricultural sources and agricultural press, improving understanding and acceptance of climate change research and policy should be conducted through those avenues (Arbuckle et al., 2013b).

Risk Perception in Climate Change

Perception of risk matters in predicting behavior and behavioral attention, and the perceptions held by the public vary greatly in regards to climate change (O'Connor, Bord, & Fisher, 1999). Understanding how individuals perceive risk will allow communicators to frame messages. Knowledge and understanding of climate change is a powerful predictor of behavior that is independent from beliefs that climate change will happen and have negative impacts (O'Connor et al., 1999). Americans tend to believe the impacts of climate change will have moderate severity and most likely impact people in geographically different regions and at other times (Leiserowitz, 2005).

Risk perception literature on environmental risk began to emerge in the late 1960s. A prominent assumption within the body of literature is that individuals that perceive a relatively high likelihood of negative events are more likely to take personal mitigation actions and support government initiatives to do the same (O'Connor et al., 1999). Risk perceptions specific to climate change are predictors of behavioral intent for voluntary actions in adaptive and mitigative actions (O'Connor et al., 1999). Risk perceptions are socially constructed, with varying communities predisposed to fear and social amplification of some risks, while ignoring, discounting, or attenuating other risk (Leiserowitz, 2005).

Risk Perceptions in Climate Change Among Agricultural Producers

Recent studies conducted with farmers in Iowa indicate perceptions of climate risk are central to attitudes toward adaptation of farming practices and acceptance of mitigation practices (Arbuckle, et al., 2013a). Crop and livestock producers recruited through K-State Research and Extension agents in Kansas, expressed concerns related to climate changes, even if they did not believe in ACC (Campbell Hibbs et al., 2014). Concerns expressed were often linked to future productivity, profitability of farming, and government regulation of agricultural practices related to climate change (Campbell Hibbs et al., 2014). Overall, farmers were less supportive of government initiated greenhouse gas reduction efforts (Arbuckle et al., 2013b).

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human activity, a combination of both, or simply not happening, seemed to be less important as a predictor of support for adaptation than expressed concern for impacts (Arbuckle et al., 2013a). Researchers are unsure why this occurred, but speculate it could be because the farmer decision to adapt, or not adapt, does not require the farmer to understand the underlying causes or sources of risk (Arbuckle et al., 2013). This finding contradicted previous risk perception research which found that when individuals perceive a higher level of risk they are more likely to take personal actions to adapt to or mitigate the risk (O'Connor et al., 1999).

Perception of risk is closely linked to willingness to implement adaptation measures in agriculture (Arbuckle et al., 2013b). Farmers, ranchers, and forestry landowners face an urgent pressure to adjust agricultural practices to make them more resistant to impacts of climate change, variable weather, and to reduce production of greenhouse gases (Howden et al., 2007). Potential adaptation options are available at the management level on farming operations, which are often variations of existing climate-risk management strategies (Howden et al., 2007).

Agricultural producers distinguished between observable variations in an environment that is constantly changing and the concept of climate change (Campbell Hibbs et al., 2014) and have made changes in farming and livestock production to adapt to changing weather and weather variability (Arbuckle et al., 2013a, 2013b; Hibbs et al., 2014). However, the willingness to adapt is self-identified as a means to maintain profitability and not necessarily an indicator of producer understanding or acknowledgement of the underlying causes or sources of the risk associated with climate change (Arbuckle et al., 2013a). Since perceived risk plays a large role in producer willingness to implement and accept adaptation and mitigation practices in relationship to climate

change, (Arbuckle et al., 2013a) it is important to understand the perception and preconceived ideas individuals have for specific words involved (Aldrich, 1980). Information sources also impact trust in messages and acceptance of terminology including understanding (Arbuckle et al., 2013b).

Audience Segmentation

Market segmentation was introduced in the mid-1950s by Wendell R. Smith (1956) who encouraged the development of products for subgroups of consumer who had similar needs, interests, and desires. The purpose of marketing segmentation is to create relatively homogenous, mutually exclusive subgroupings, typically based on demographic information and perceived product needs (Hine et al., 2014). After identifying market segments, marketers were able to craft messages and select specific communicators, delivering the messages through media channels that were best suited to each segment. The primary goal of this type of market segmentation was to reshape purchasing behavior (Hine et al., 2014).

Audience segmentation tactics have also been widely used in public health communication as a way to design engagement and behavior change programs for a variety of health related issues from sexually transmitted diseases (Rimal et al., 2009) to reducing alcohol consumption in adolescents (Mathijssen, Janssen, van Bon-Martens, & van de Goor, 2012). Targeted and tailored print health messages achieve significantly greater change in behavior than non-tailored, general messages (Noar, Benac, & Harris, 2007). The type of audience segmentation used in influencing health behavior is known as social marketing (Kotler & Zaltman, 1971). As Kotler and Zaltman (1971) defined it, social marketing is designed to promote social change through design,

implementation, and control of a program that is created to influence the acceptance of social ideas. Market segmentation and social marketing both utilize product planning, pricing, communication, distribution and marketing research (Kotler & Zaltman, 1971). Unlike market segmentation, which focuses on increasing profits, social marketing focuses on changing behaviors that are beneficial to the target audience and society as a whole.

Audience Segmentation and Climate Change

Communicators and researchers have growing interests in apply audience segmentation and social marketing to climate change communication (Hine et al., 2014). Over 25 climate change studies utilizing audience segmentation were identified by Hine et al. (2014). Researchers identified most climate change segmentation studies utilized surveys and large national samples with the intent of identifying audience segments with similar beliefs, attitudes, and behaviors related to climate change.

Variations in perception of climate change have been noted throughout geographical regions of the United States (Hamilton et al., 2007; Hamilton & Keim, 2009). Regional variations can be partially explained in the experience of individuals in each area. Those living in ski country and tourist areas that depend on winter snowfall for income, perceived the effects of climate change and global warming more with the lessening snowfall (Hamilton et al., 2007).

The Six Americas

The report series, *Global Warming's Six Americas*, used audience segmentation analysis to examine American's beliefs, attitudes, policy preferences, and climate-relevant behaviors

(Leiserowitz et al., 2013). Starting in 2008, the longitudinal study collected nationally representative data, identifying six distinct audiences within the American public. The six audience segments identified in Maibach et al. (2009) included the alarmed, concerned, cautious, disengaged, doubtful, and dismissive.

In the 2012 survey (Leiserowitz et al., 2013), the largest audience segment (29%) was identified as being the concerned. The concerned are moderately sure that climate change is occurring, harmful, and caused by human action. Climate change is viewed by the concerned as a threat to foreign nations and future generations, but is not considered an immediate threat to the individual or their community. Individuals identified as concerned support societal action on climate change, however, it is unlikely they have engaged in political activism.

The cautious make up the second largest (25%) audience segment (Leiserowitz et al., 2013). Individuals within the cautious audience segment potentially believe climate change is occurring, but are unsure if it is and many are unsure about the cause. The cautious are unlikely to have strongly held opinions about what, if anything, should be done in regards to climate change and have given the issue little thought.

Individuals alarmed about climate change make up the third largest group (16%) (Leiserowitz et al., 2013) and are very certain that climate change is happening. They are more likely to discuss, seek information, and act as opinion leaders on the issue than any other audience segment. The alarmed support societal actions to reduce the threat of climate change and are most likely to be political activists, although only about a quarter of the segment has taken political action. The

alarmed are often liberal to moderate Democrats who are active in their communities, more likely to be female, middle-aged, college educated, and favor government intervention to assure the basic needs of all people (Maibach et al., 2009).

The fourth largest group (13%), the doubtful, are uncertain if climate change is occurring or not (Leiserowitz et al., 2013). Those that believe it is happening do not believe it is caused by human activities. Individuals that are doubtful tend to be politically conservative and hold traditional religious views.

Individuals that have given climate change little to no thought are identified as disengaged. The disengaged (9%) have no strongly held beliefs about climate change, have little knowledge about it, and do not see it as a personally relevant issue (Leiserowitz et al., 2013). The disengaged tend to have the lowest education and income levels of all audience segments.

The dismissive make up the smallest (8%) audience segment (Leiserowitz et al., 2013).

Dismissive individuals are very certain climate change is not occurring. They tend to regard climate change as a hoax and strongly oppose any action to reduce the threat. Approximately 11% of the segment has contacted an elected representative to argue against action on climate change. Individuals in the dismissive segment have been found to be predominantly white, male, Republican, politically conservative, pro-hierarchism, and anti-egalitarian world views, anti-environmental attitudes, distrustful of most institutions, highly religious, and rely on radio for the main source of news (Leiserowitz, Maibach, Roser-Renourf, & Smith, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Maibach et al., 2009).

Since the initial survey, researchers have tracked changes in beliefs, attitudes, policy preference, and behaviors, finding a decline in public engagement from the fall of 2008 to January of 2010, followed by a gradual rebound in June 2010. The most recent study, conducted in September of 2012, indicated a continued rebound of public engagement; the alarmed, concerned, and cautious audience segments again comprise 70 percent of the American public.

Audience Segmentation of Agricultural Producers

While the diversity of farm owners and operators increased between the 2007 and 2012 USDA census of agriculture, the majority of farms, approximately 96%, are operated by white farmers (Vilsack & Clark, 2012). Along with the majority of farm operators in the U.S. being white, approximately 86% are also male (Vilsack & Clark, 2012). Initial stages of the Community and Environment in Rural America (CERA) survey found that Midwesterners tend to be the most homogenous in church attendance with 43% reporting they attend once a week (Hamilton et al., 2007). The CERA report also found that the residents of the Midwest were predominately Republican with large majorities voting for George Bush in 2004 (Hamilton et al., 2007). Various demographic studies and census data support the research on beliefs of “naysayer” groups and also align with the identifying demographics of farmers in the Midwest and Plains States. Public perceptions about climate change are largely reflected by political beliefs. In the Midwest where individuals tend to be conservative, there is also a tendency to have doubts about climate change (Dunlap & McCright, 2008; Hamilton et al., 2007; Nisbet & Myers, 2007).

Terminology and Understanding in Climate Change Communication

Language plays a significant role in communicating climate change and cannot be avoided by communicators. Ereaut and Segnit (2007, 2006) in their seminal studies, utilized discourse analysis and semiotics to identify a number of linguistic repertoires defined as loosely coherent lines of talking and thinking about climate change. The variation of meaning and favorability of words associated with climate change, the acknowledged risks, and acceptance of adaptation and mitigation practices, can be partially explained by the differences in experiences, backgrounds, and communications using words in climate change as well as different frames individuals have developed over time (Hertog & Mcleod, 2001). Favorable or unfavorable reception of messages have also been influenced by “previous experience, business or corporate involvement, history, mental images, lack of support, and media or advertising language” (Goodwin, Chiarelli, & Irani, 2011, p. 29).

Respondents to a survey in the South of England demonstrated widely different recognition of the terms climate change and global warming (Whitmarsh, 2009). Global warming was more often believed to be caused by human impacts and associated with greenhouse gases, ozone depletion, and impacts related to temperature increases; climate change was more likely to be associated with natural causes and a wider range of impacts (Whitmarsh, 2009). The desire for government action to control global warming was considerably higher than government involvement in mitigation of climate change (Whitmarsh, 2009).

Context of the words presented will also impact perception (Aldrich, 1980). Framing of words presented is also important to interpretation (Rumble, Holt, & Irani, 2014). Single words may

have a generally positive association, but when left for an audience to interpret, negative associations may arise (Rumble et al., 2014). Salience of words, or the lack of and multiple understood meanings, may confuse individuals and therefore lead to mistrust of the applied use of the terminology (Croney, 2010; Rumble et al., 2014). Gifford and Comeau (2011) found that verbs presented as competence terms impacted respondents intentions to make behavioral changes with respect to climate change. Causative verbs, verbs that link the cause and effect, like “shrink” and “break” were more effective and powerful in making behavior change messages more effective.

Summary

Agriculture is a part of a consumer society where consumers and consumption are dependent upon socio-cultural and economic life (Dagevos, 2005). The public is becoming more concerned with the impact agriculture has on society, leading to increased rules and regulations (Blandford & Fulponi, 1999). Climate change impacts, adaptation, and mitigation in agriculture are now under the focus of public concern.

Climate change science is still debated in mass media realms with the influence of climate change deniers swaying public opinion. Audience segment analysis identified segments of the American public that have varying beliefs about climate change. Studies conducted with agricultural producers indicated that many are still skeptical about the causes and impacts of climate change, but are currently adapting their operations to variable weather within growing seasons. The perception of risk associated with climate change also greatly varies among agricultural producers and the general public.

Framing has been suggested as a way to target specific audiences to relay messages intended to influence behavior in response to climate change impacts. Consideration for risk perception, language repertoires, issue salience, use of sources for information, and existing attitudes should impact the creation of messages. The literature review identified gaps in the knowledge surrounding the framing of climate change based messages to agricultural producers. Large scale audience segmentation studies have also neglected to consider individuals in agriculture as an audience segment.

Chapter 3 - Methods

Climate change is expected to have a substantial impact on agriculture (Field et al., 2014) by threatening food security and rising food demands (Beek, Meerburg, Schils, Verhagen, & Kuikman, 2010) as global population continues to increase (United Nations. Department of Economical and Social Affairs, 2014). Understanding the applications of issue salience and framing can assist communicators in creating specific messages for segmented audiences. The purpose of this study was to explore the frames and messages, issue salience, and communication preferences agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to explore the climate-change beliefs and preferred agricultural media sources for climate and climate change information.

Data for the study was collected through an online survey from participants in the Southern Plains region. The study design was based on a randomized experimental design, which employs various treatments applied randomly to experimental units with a control group (Shadish, Cook, & Campbell, 2002). The data for this study was gathered through Qualtrics survey software, Version 2016 of Qualtrics, Provo, Utah, USA. Qualtrics design was utilized to randomize the assignment of three survey versions to survey respondents. Each survey version consisted of 38 items. Survey version one contained gain framed messages, survey version two contained loss framed messages, and survey version three consisted of neutral frames to create a control group (Appendix A).

The following research objectives guided this study:

- RO1: Describe the level of issue salience agricultural producers have related to climate change;
- RO2: Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and
- RO3: Identify the specific agricultural media and information channels agricultural producers use for climate change information.

Based on findings in previous research, one hypothesis was developed:

- H1: Agricultural producers in the Southern Plains Regional Climate Hub will fall in the audience segment groups of the concerned and the cautious as identified in the Six America's (2012) study.

Design of the Study

The study focused on farmers, ranchers, and forestry landowners in Kansas, Oklahoma, and Texas. These three states were selected because of the geographical association with the SPRCH area. Internet surveys were used to gather the opinions of respondents in each state. Internet surveys are a type of quantitative research method. Quantitative methods are used when the researcher primarily uses post-positivist claims for developing knowledge, utilize methods of inquiry such as experiments or surveys, and collect data on a predetermined instrument that yields statistical data (Creswell, 2007). Surveys can be effective in gathering large amounts of data from populations that are unreasonable to reach through focus groups or interviews (Dillman, 2000). Web survey implementation procedures suggested by Dillman, Rossing, and Christian (2009) were followed to the best of the researchers' ability.

Surveys were distributed through the Kansas Association of Wheat Growers and the Texas Wheat Producers Association. The Oklahoma Wheat Growers Association was also contacted; however, they were unable to participate in the survey due to the lack of a director and the disbursement date of their quarterly newsletter was after the final closing date of the survey. The first invitation to participate in the Internet survey was emailed to members of wheat associations in Kansas (Appendix B) and Texas.

The Kansas Association of Wheat Growers and Texas Wheat Producers Association also posted a link to the survey on the organization's social-media accounts including Facebook and Twitter. A unique survey link was created for each organization and delivery medium. The goal of the unique link was to compare the differences, if any existed, between email and social media respondents. Although two unique links were provided, the Kansas Association of Wheat Growers only used a single, so responses between email respondents and social-media responses were not possible.

The wheat associations were selected because of existing relationships with the university and the Department of Communications and Agricultural Education. Email invitations were sent by the wheat associations through their official email accounts. Sponsorship by a legitimate authority has been shown to increase response rate to surveys (Dillman, 2007) and researchers hoped that the trust of association members had with their associations would increase response rates. Survey participation by members of the Texas Wheat Producers Association was less than one percent. Only responses from those that participated in the survey of the Kansas Association of Wheat Growers were analyzed for the study.

Independent Variables

Independent variables were studied including frames, preferred agricultural media and information sources, perceived risk, experienced hazard, and perceived benefit. Perceived risk, experienced hazard, and perceived benefit were operationalized as variables of issue salience in climate change. Control variables were also included in the survey design. Six demographic variables were used and included ownership/position on the operation, level of education, farm type, political party, age, gender, and ethnicity.

Frames were examined with gain, loss, and neutral messages in conjunction with four terms that were identified in the literature review as often used interchangeably in climate change. Gain, loss, and neutral frames were based on the survey instrument in Spence and Pidgeon (2010) which utilized a five point Likert type scale. This study did not utilize fear appeals to study the impact of framing. Spence and Pidgeon (2010) reported a reliability score of .75. A Cronbach's alpha reliability score of .80 was calculated for framing questions, indicating a strong reliability.

Distance frames were also examined within the study. Impacts of climate change were framed as currently occurring (near) or occurring in the future (distant). Distance frames had a Cronbach's alpha reliability of .93, which is a very high level of reliability. Cronbach (1951) stated that a reliability of .70 was acceptable and over .90 was a high reliability.

The four terms identified in the literature review to be studied were: climate change, extreme weather events, weather patterns, and weather variability. Climate change refers to any

significant change in the long term measurements of climate. Climate change includes major shifts in temperature, precipitation, and wind patterns amongst others, that occur over several decades or longer (U.S. Environmental Protection Agency, 2013). Extreme weather events include heat waves, droughts, and tornadoes, all weather events that impact the survey region (NOAA, n.d.). Weather patterns are the daily variations observed in weather as a result of global patterns in the atmosphere caused by interactions of solar radiation, Earth's ocean, diverse landscapes, and motion in space (NOAA, 2011). Climate variability is defined in short term climate patterns that occur in cycles of months, years, and decades (NOAA, n.d.). Cronbach's alpha was .87, which is a high reliability score according to Cronbach (1951).

Agricultural media and information sources used by agricultural producers were also examined as an independent variable. Arbuckle et al. (2013b) found that trust in agricultural media sources and interests were linked to lower beliefs in climate change, especially climate change from anthropogenic causes. However, producers that expressed trust in environmentally oriented organizations were much more likely to believe climate change is occurring because of human actions. An exhaustive list of agricultural publications and environmental information sources was generated. The survey aimed to identify which sources producers use and how frequently they sought information for climate change information.

Issue salience, the perceived importance of an issue (Niemi & Bartels, 1985), of climate change served as one of the dependent variables for this study. Measures of perceived risk, experienced hazard, and perceived benefit were operationalized as issue salience. Independent variables were based on the work of (Arbuckle et al., 2013b) and Loy et al. (2013), which found that perceived

risk, experienced hazard, and perceived benefits can impact beliefs about climate change.

Perceived risk is one measure that previous literature identifies as a variable that can impact beliefs about climate change. Perceived risk is measure by nine variables utilizing a five point Likert-type scale to determine concern for those risks. Cronbach's alpha was calculated and found to have a reliability of .86, which is a high reliability score based on the suggestions of Cronbach (1951) which states that .80 is a preferred level of reliability. After experiencing a climate-related impact, farmers are more likely to make changes on the management level of a farming operation, which are often variations of existing climate-risk management strategies (Howden et al., 2007). Experienced hazard is measured by five variables. Cronbach's alpha for experienced hazard variables was .78, which is a high reliability rating. Perceived benefit is the final independent variable examined in the study. Perceived benefits or positive experiences can impact beliefs about the causes and existence of climate change. Five variables were used to examine perceived benefits on a five point Likert-type scale. Cronbach's alpha was calculated for perceived benefit variables and found to have high reliability rating at .74.

The perceived benefit scale was created for this study. Previously, studies focused on loss or the potential to avoid loss when communicating climate-change risk with the goal of affecting behavior. Researchers in this study wanted to examine the potential impact of perceived benefits of climate change in agriculture in relation to climate change belief.

Demographic information was also gathered from survey participants, which described the respondent as well as the type of farming operation. Demographic information is an important aspect of applying successful audience segmentation (Hine et al., 2014). Variations in belief

about climate change have been found to exist within demographic groups (Leiserowitz et al., 2013). Demographic information will also be used as control variables.

Experimental Design of Gain and Loss Frames

The study utilized an experimental design to examine gain and loss frames in conjunction with the terminology identified in the literature review. Specifically a 4 (terminology: climate change, extreme weather events, weather patterns, and weather variability) x 3 (frame: gain, loss, and neutral) between subjects incomplete factorial design was used. Factorial design allows for the determination of the effect of two manipulated independent variables on the dependent variables and the interaction among variables (Shadish et al., 2002).

Dependent Variable

A question to examine climate-change belief was adapted from the Six America's surveys (Leiserowitz et al., 2013; Maibach et al., 2009; Maibach, Leiserowitz, Roser-Renouf, & Mertz, 2011) and the examination of farmer perspective of climate change in the Corn Belt (Arbuckle et al., 2014). The climate-change belief question utilized a Likert-type five point scale to examine producer beliefs, about the existence and causes of climate change. Cronbach's alpha was used to calculate the reliability of the scale used to examine climate-change belief. A reliability of 0.82 was found, which indicates a high reliability level based on (Arbuckle et al., 2013a).

Potential Limitations

Response rate to the survey is one potential limitation, since online surveys tend to have lower response rates than traditional mail surveys (Dillman, 2007). Length of the survey may also be a

limitation if participants experience survey fatigue and do not complete the survey in its entirety (Sheehan, 2001). Online surveys may pose a challenge for populations unfamiliar with navigating online survey platforms (Dillman, 2007). Survey responses were not forced within the study design, which resulted in missing data points in the survey. However, forcing responses may cause respondents to drop out of the survey (Dillman, 2007). The specific geographic area of focus may also impact the generalizability and transferability to a larger population of agricultural producers. The survey population was compared to USDA Ag Census Data (USDA, 2012) to examine transferability to a larger population.

Research design accounted for a number of internal and external threats to validity. Internal threats to validity could impact the inferences made from the survey (Shadish et al., 2002). The survey design and treatment of dependent variable to the outcome variables may not be causal, the relationship between variables could potentially exist without treatment (Shadish et al., 2002). Attrition was a concern in the research design, however, pretesting helped to determine the ease and time it took to complete the survey and aided in preventing attrition and fatigue. The threat of instrumentation was a concern in this study because of the multiple devices, Internet browsers, and operating systems on which the online survey could be completed. Question and survey design are compatible with mobile devices through Qualtrics software. The online survey tool was extensively tested to protect against this threat.

Threats to construct validity were also present due to the operationalizing of variables within the study. Construct validity threats were controlled through pretesting, pilot testing, and manipulation checks in the experiment. Mono-operation bias was controlled through the use of

gain and loss frames and the various terms to be tested. External validity threats may limit the generalizability of the findings to populations outside of the study area in the Southern Plains and agricultural producers who experience varying impacts from climate change.

Instrumentation

Online survey methods offer several advantages including the elimination of paper, postage, data entry costs, time required for survey implementation, and reducing the cost per correspondence in sample sizes (Dillman, 2007). Dillman (2007) suggests keeping online survey design simple so it is compatible with a number of web browsers and variable speed of Internet providers.

Survey questions were reviewed by a panel of experts for face and content validity. The panel of experts included one associate professor in agricultural communication, one assistant professor in journalism and mass communications, and one assistant professor in the agronomy department. To improve reliability of the survey, Cronbach' Alpha was used to analyze the data set for internal consistency of items (Cronbach, 1951). The questions from previous instruments already had acceptable levels of reliability at 0.86, indicating a highly acceptable level of internal consistency (Arbuckle et al., 2013). A similar study examining the impacts of gain and loss frames on attitudes towards climate change mitigation achieved a reliability of .83 (Spence & Pidgeon, 2010).

Independent variables studied included frames, preferred agricultural media and information sources, perceived risk, experienced hazard, perceived benefit and demographics of the audience segment. Frames were studied through gain and loss framings with four variations of terms for a

total of eight questions. A neutral frame group was included in the examination of framing to serve as a control. Preferred agricultural media and information sources were examined through questions asking respondents to identify all sources they seek out for climate change information and the frequency in which they do so. Questions examining frames and preferred agricultural media and information sources, were based on a Likert-type style of questions which can be used to determine attitudes (Likert, 1932). Questions that examined perceived risk, experienced hazard, and perceived benefit utilized a Likert-type scale and consisted of 19 questions. Demographic questions utilized closed-ended questions with ordered response categories to describe the respondents of the survey and the farming operations. The dependent variable of issue salience was operationalized on the work of the Six America's (2009, 2012) and Arbuckle et al. (2013). One question examining issue salience aimed to help researchers to gain a better understanding of how agricultural producers differ and/or are similar in terms of their knowledge about climate change.

When accessing the online survey, respondents were greeted with a welcome screen that was motivational, emphasized the ease of responding, and instructed respondents about how to proceed to the next screen (Dillman, 2007). Providing a notice before the survey and a reminder notice to complete the survey can improve response rate in online surveys (Kaplowitz, Hadlock, & Levine, 2004). The wheat associations of each state were utilized since membership in each state can improve response rate through established rapport with the constituents because they have a vested interest and trust in the organization (Dillman, 2000).

Data Collection

Purposive sampling was used to identify the population for the survey from members of state wheat associations in Kansas, Oklahoma, and Texas. State wheat associations in the three state region were identified through the establishment of SPRCH (USDA Climate Hubs, 2015).

Purposive sampling was appropriate because the researcher sought to examine a certain cultural aspect of a group (Tongco, 2007). Randomization of survey type, with respondents either receiving a gain frame, loss frame, or control group, was administered through survey design in Qualtrics. Question order was also randomized for each survey administered. Audience segmentation has been identified as a way to communicate climate change information to various segments of the American public (Hine et al., 2014).

The survey instrument was submitted to the Kansas State University internal review board (IRB) and approval was obtained before the survey was conducted. IRB found the study was exempt based on the Federal Policy for the Protection of Human Subjects under IRB number 8061 (Appendix A). Survey questions were delivered in an online based format through Qualtrics software with adaptation and consideration in question design for survey completion on mobile devices (Qualtrics, 2014). The survey was administered in an invitation-survey-reminder method, with the invitation and reminder delivered via email and the survey provided in an Internet link on both. Providing invitations before the survey is administered and reminders after the survey is opened can improve response rate (Dillman, 2007). Non responders were emailed an additional reminder. A closing date for the survey was given, which has been found to increase survey participation rates (Dillman, 2007).

Nonresponse error is a concern in survey data and occurs when a significant number of people in the survey sample do not respond to the questionnaire and have different characteristics of those who respond to the survey (Dillman, 2007). Acceptable response rates in Internet surveys are 5%-80% (Wimmer & Dominick, 2011). Based on the work of Arbuckle et al. (2014), 26% is an acceptable response rate given that no meaningful differences are found in a test for nonresponse bias. The survey was distributed to 585 email addresses within the Kansas Wheat Association email list. An invitation-survey-reminder method was used to distribute the survey, which was open from March 3 to March 14, 2016. There were 158 respondents to the email survey, resulting in a 27% response rate. Of the 158 responses, 142 were completed to a level that could be used for analysis. The instrument was also distributed to 2,989 followers on Facebook, and 5,444 Kansas Wheat Twitter followers. Separate links were intended for use in the Internet and social media distribution channels, however, only one link was sent from Kansas Wheat.

Nonresponse bias was tested through the comparison of differences between respondents and non-respondents based on variables measuring farm enterprise and farmer characteristics. The comparison was made using the demographic information collected through the survey and USDA census data of farmers in Kansas (USDA, 2012). Within the study, 1.6% of the farms were non-family or corporate farms. This is similar to the USDA (2012) census data of Kansas which found that 3.26% of the farms in Kansas were corporations. The highest percentage (29.7%) of respondents to this study was between the ages of 56 and 60. This is slightly younger than the highest percentage group in the USDA (2012) census data which reported 18.8% of respondents were 65 and over. Females reported that 9.6% were owner/operators in this study, 10.98% of farms were owned by women according to the USDA census (2012). The study found

that 95.3% of respondents were Caucasian and 2.3% were Native American. The remaining 2.3% preferred not to answer. Ethnicity is where the largest discrepancy is within the demographics of the study and the USDA (2012) census data. This study does not represent Hispanic/Latino, African American, and Asian/Pacific Islanders, which all occur in minor percentages in the USDA census data.

Data Analysis

Data from completed surveys were downloaded into SPSS 19 (IBM Corp, Armonk, NY): for analysis. Basic statistics were explored for demographic information of respondents including age, gender, location, type and size of operation, and political affiliation. Initial means and correlations were calculated for perceived risk, experienced hazard, and perceived benefit. Regression analysis was explored within variables to explain the amount of variance that the dependent variable explains within the independent variables. Further exploration was conducted to examine the differences between demographic groups and their climate-change beliefs. ANOVA analysis was conducted to determine if statistically significant differences existed between demographic groups. Additionally, correlation and regression analyses were conducted to examine causal relationships.

Means for issue salience, frames, and media preference were calculated. Initial correlations were conducted to determine if relationships existed between issue salience, preferred frames and messages, and communication sources. MANCOVA analysis was conducted to examine the impact of issue salience on frames and preferred media sources with frame assignment serving as

the covariate. ANOVA analysis was explored to determine significant issue salience variables in the MANCOVA analysis.

Summary

The purpose of this study was to explore the frames and messages, issue salience, and communication preferences agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to explore the climate-change beliefs and preferred agricultural media sources for climate and climate change information. Low survey response rates from Texas Wheat Association members and timing challenges with the Oklahoma Wheat Commission limited the respondent data to Kansas Association of Wheat Growers members. Three independent variables were studied including frames, preferred agricultural media and information sources, and demographics of the audience segment. Frames were examined with gain and loss messages in conjunction with four terms that were identified in the literature review as often used interchangeably in climate change. Issue salience is the dependent variable that was studied in conjunction to the independent variables. An online survey was utilized to reach agricultural producers with consideration for potential limitations and threats to internal and external validity.

Chapter 4 - Results

Recognizing there is pressure for the agricultural industry to adapt to climate change, this study sought to understand the audience of agricultural producers by identification of appropriate frames, messages, and messengers with the greatest impact for climate-change communication (Moser & Dilling, 2011). Reaching audiences as an individual audience segment using terminology they accept and understand is one aspect of the needed climate-change communication (Shome et al., 2009). The purpose of this study was to investigate the frames and messages agricultural producers in Kansas use and accept related to climate change and the impacts of a changing climate.

The opinions, attitudes, and beliefs of respondents to this survey were examined through 38 items in three survey versions. A total of 178 responses were gathered with 145 responses from Kansas producers, which were used to answer the research objectives. Low response rates in Oklahoma and Texas prompted the researcher to exclude responses from those states. Incomplete responses that could not be utilized in analysis were also excluded. The findings of the survey will be presented in order of the following research objectives including a description of the demographics:

- RO1: Describe the level of issue salience agricultural producers have related to climate change;
- RO2: Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and
- RO3: Identify the agricultural media and information channels agricultural producers use for climate change.

Based on findings in previous research, one hypothesis was developed:

- H1: Agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America's (2012) study.

Demographics

Basic statistics were explored for demographic information of respondents including location, education, farm type, political party, age, gender, and ethnicity (Table 4.1). It is important to note that not all respondents completed the demographic section of the survey. The total respondents to the survey were $n = 145$.

Table 4.1
Frequency of Response to Demographic Items

Demographic	n
State	132
County	128
Education	130
Farm type	127
Political party	129
Age	128
Gender	129
Ethnicity	129

Location

Respondents to the survey were asked to provide the location of their operations by state and county. In Kansas, Morton and Rush counties had the highest number of respondents with six from each county. There were 27 counties in Kansas with one respondent each (Table 4.2). Two

respondents were from Oklahoma in Cimarron and Dewey counties, one respondent was from Texas in Childress County. While the data set was limited to respondents from Kansas, three respondents from other states were included in the data set. Although they were included in the data set, they are affiliated with Kansas Wheat Association and were considered to be a part of the Kansas respondents.

Table 4.2

Number of Respondents per County in Kansas

Kansas					
6	5	4	3	2	1
Morton	Pratt	Bourbon	Barber	Barton	Brown
Rush	Rooks	Leavenworth	Doniphan	Elk	Butler
	Trego	Marion	Franklin	Ellsworth	Clay
		Marshall	Harper	Ford	Coffey
		Smith	Johnson	Gove	Decatur
		Wallace	Riley	Labette	Ellis
			Washington	McPherson	Grant
				Montgomery	Greeley
				Pottawatomie	Haskell
				Rice	Hodgeman
				Sedgwick	Kingman
				Thomas	Kiowa
				Wabaunsee	Lincoln
					Mitchell
					Norton
					Phillips
					Rawlins
					Reno
					Republic
					Saline
					Seward

Table 4.2, continued from page 65
Number of Respondents per County in Kansas

Kansas					
6	5	4	3	2	1
					Stanton
					Stevens
					Wilson

Education

Respondents were asked to provide their highest level of education. All respondents to the survey had at least a high school education or equivalent, with the highest level of respondents ($n = 72, 55.4\%$) reporting they had received a bachelor’s degree (Table 4.3). Individuals reporting an associate’s degree or trade/vocational training both had seven respondents (5.4%). The least reported education level was for the respondents with doctoral degrees ($n = 2, 1.5\%$)

Table 4.3
Education Level of Respondents

	n	%
Bachelor's degree	72	55.4
Master's degree	18	13.8
Some college credit	15	11.5
High school graduate or equivalent	9	6.9
Trade/technical/vocational training	7	5.4
Associate degree	7	5.4
Doctoral degree	2	1.5
Total	130	100

Farm Type

Respondents were also asked to report their farm type (Table 4.4). Description of the farm type is based on the 2012 USDA Census of Agriculture (Vilsack & Clark, 2012), which asks producers about their farm income as well as ownership and other reported occupations. Farm types are described in seven different ways in this study:

- *Limited-resource farm*: small farm with sales less than \$100,000, farm assets less than \$150,000, and total operator household income less than \$20,000. Operators may report any major occupation, except hired manager.
- *Retirement farm*: small farms whose operators report they are retired.
- *Residential/lifestyle farm*: small farms whose operators report a major occupation other than farming.
- *Farming-occupation farms*: small farms whose operators report farming as their major occupation.
- *Large family farm*: sales between \$250,000 and \$499,999.
- *Very large family farm*: sales of \$500,000 or more.
- *Non-family farm*: farms organized as nonfamily corporations or cooperatives, as well as farms operated by hired managers.

Large family farms were reported most often ($n = 41$, 32.3%) where farm sales were between \$250,000 and \$499,999. Non-family farms ($n = 2$, 1.6%), or farms organized as corporations or cooperatives, were reported least frequently in the study (Table 4.4).

Table 4.4*Farm Type Based on USDA Census of Agriculture Classification*

	n	%
Large family farm	41	32.3
Very large family farm	39	30.7
Residential/lifestyle farm	17	13.4
Farming-occupation farms	15	11.8
Limited-resource farm	11	8.7
Retirement farm	2	1.6
Non-family farm	2	1.6
Total	127	100.0

Political Party

The majority of respondents ($n = 95$, 73.6%) reported they identify themselves as part of the Republican Party. The fewest reported identifying themselves as Democrats ($n = 7$, 5.4%). One respondent who identified themselves as belonging to another political party specified they were, “a mix of libertarian and tea party.” Another respondent stated they were not active in a political party, but still interested in politics (Table 4.5).

Table 4.5*Political Party Identification*

	n	%
Republican	95	73.6
Independent	19	14.7
Democrat	7	5.4
Other	5	3.9
No party, not interested in politics	3	2.3
Total	129	100.0

Age

Age was reported in four-year intervals starting at age 18 and going to 60 (Table 4.6). Those 61 and above were reported together. Most respondents were between the ages of 56 and 60 ($n = 38$, 29.7%), and the fewest were 61 and above ($n = 3$, 2.3%).

Table 4.6
Age of Respondents

	n	%
18-24	11	8.6
25-30	17	13.3
31-35	15	11.7
36-40	10	7.8
41-45	5	3.9
46-50	7	5.5
51-55	22	17.2
56-60	38	29.7
61 and above	3	2.3

Gender

Respondents were also asked to report their gender (Table 4.7). The majority of respondents reported they were male ($n = 100$, 77.5%). Of the respondents, 25 (19.4%) reported being female. Four (3.1%) preferred not to provide their gender (Table 4.7).

Table 4.7
Gender of Respondents

	n	%
Male	100	77.5
Female	25	19.4
Prefer not to answer	4	3.1
Total	129	100.0

Ethnicity

Respondents to the survey were asked to report their ethnicity (Table 4.8). The majority reported their ethnicity as Caucasian (white) ($n = 123$, 95.3%). Native American ($n = 1$, 0.8%) was reported as the only ethnicity other than Caucasian. Of the “other” ($n = 3$, 1.6%) ethnicity respondents, one individual reported being “European American.” Hispanic/Latino, African American, and Asian/Pacific Islanders ethnicities are not represented in this study. Of the total respondents, three (2.3%) preferred not to answer (Table 4.8).

Table 4.8

Ethnicity of Respondents

	n	%
Caucasian (white)	123	95.3
Other	3	1.6
Prefer not to answer	3	2.3
Native American	1	0.8

Role on Farm and/or Ranch

Researchers in this study wanted to specifically examine farmers and ranchers in the Southern Plains region. A demographic question asking respondents their specific role on the farming and/or ranching operation was included to ensure the desired audience was being reached (Table 4.9). The majority of respondents ($n = 90$, 69.8%) reported they were the owner/operator.

Table 4.9*Respondent Role on Operation*

	n	%
Owner/operator	90	69.8
Manager/operator	11	8.5
Farmhand/laborer	6	4.7
Spouse of owner	6	4.7
Child of owner	6	4.7
Co-owner	4	3.1
Landlord	3	2.3
Tenant	3	2.3
Total	129	100.0

It was of additional interest to the researchers to compare the ownership of the operations to gender. Cross tabulation was used to explore the gender roles in farm ownership (Table 4.10). Males were reported as the highest percentage at 58.27% of owner/operators and females at 9.45% as owner/operators. Two (1.57%) females reported that they were spouses of operation owners. Nine (7.09%) of males reported that they were spouses of owners.

Table 4.10*Respondent Role on Operation by Gender*

	Male		Female		Prefer not to answer	
	n	%	n	%	n	%
Owner/operator	74	58.27	12	9.45	2	1.57
Spouse of owner	9	7.09	2	1.57	-	-
Child of owner	6	4.72	-	-	-	-
Manager/operator	3	2.36	-	-	-	-
Tenant	3	2.36	3	2.36	-	-
Farmhand/laborer	2	1.57	-	-	1	0.79
Landlord	1	0.79	3	2.36	-	-
Co-owner	-	-	5	3.94	1	0.79

RO1: Describe the Level of Issue Salience Agricultural Producers have Related to Climate Change

To examine RO1, “describe the level of issue salience agricultural producers have related to climate change,” researchers included survey items to measure perceived risk, experienced hazard, perceived benefit, and belief in climate change. Perceived risk was measured by nine variables of concern for impacts of climate change; experienced hazard examined five levels of affect from different climate change related events; perceived benefit measured five variables of benefit related to climate change; and belief was measured by a single variable to measure belief in climate change and the causes. It was of additional interest to explore differences in issue salience between demographic groups.

Perceived Risk

Perceived risk was measured by nine variables on a five-point Likert-type scale including concerned (1), slightly concerned (2), somewhat concerned (3), moderately concerned (4), and extremely concerned (5) (Table 4.11). Respondents indicated their highest level of concern was for longer dry periods and drought with a mean of 4.06 ($SD = 1.04$). The lowest level of concern was for increased flooding ($M = 2.24$, $SD = 1.21$). Summative average concern for all nine measures was 3.10 ($SD = 0.78$). Average concern for perceived risks was slightly above the somewhat concerned level (Table 4.11).

Table 4.11*Perceived Risk of Climate Related Events*

	Mean	SD
Longer dry periods and drought	4.06	1.04
Increased weed pressure	3.87	1.12
Increased heat stress on crops	3.52	1.10
Increased soil erosion	3.33	1.18
Increased insect pressure	3.2	1.02
Increased loss of nutrients into waterways	2.87	1.28
More frequent extreme rains	2.58	1.22
Increases in saturated soils and ponded water	2.29	1.25
Increased flooding	2.24	1.21
Perceived risk aggregate	3.10	0.79

Experienced Hazard

Experienced hazard (Table 4.12) was measured by five variables on a Likert-type scale.

Experienced hazard variables asked respondents to describe the level of effect on their operations that various climate related events have had in the past five years. Respondents rated their experienced hazard impact from no impact (1), minor impact (2), moderate impact (3), moderate impact (4), and major impact (5). Experience of significant drought had the highest level of impact ($M = 3.73$, $SD = 0.97$). Significant drought had slightly more than a moderate impact. Stream and/or river flooding had the lowest mean impact of 1.57 ($SD = 0.79$), indicating respondents considered flooding to have no to minor impact on their operations. Overall, the mean for average experienced hazard was 2.22 ($SD = 0.55$) (Table 4.12).

Table 4.12*Experienced Hazard*

	Mean	SD
Significant drought	3.73	0.97
Land farmed has experienced significant erosion	2.21	0.90
Saturated soils or ponding	1.82	0.85
Creeks, streams, rivers, or running through farmland	1.75	0.89
Stream/river flooding	1.57	0.79
Aggregate experienced hazard	2.22	0.58

Perceived Benefits

Five variables were used to determine an aggregate score for perceived benefits of climate-related impacts over the last five years (Table 4.13). Respondents completed a five point Likert-type scale to indicate their perceived level of benefit on each variable from no benefit (1), minor benefit (2), some benefit (3), moderate benefit (4), and major benefit (5). The highest individual perceived benefit was increased options in crop variety ($M = 2.99$, $SD = 1.24$) and the lowest perceived benefit was longer pasture season ($M = 2.19$, $SD = 1.06$). The aggregate perceived benefit of climate related events in the last five years was 2.48 ($SD = 0.84$). All measures for perceived benefits fell in the range of minor benefit to some benefit (Table 4.13).

Table 4.13*Perceived Benefit*

	Mean	SD
Increased options in crop variety	2.99	1.24
Longer growing season	2.63	1.06
Milder, shorter winter	2.35	1.20
Ability to plant double crops	2.3	1.30
Longer pasture season	2.19	1.14
Aggregate perceived benefit	2.43	0.90

Climate-Change Belief

Climate-change belief was measured by one variable in the instrument. Respondents were asked to select the response that reflected their belief about climate change. Responses were assigned a value on a five point Likert-type scale where a one (1) indicated the respondent did not believe that climate change was occurring and a five (5) indicated the respondent believed that climate change was occurring and was caused mostly by human actions. Possible responses to the variable were:

- a. Climate change is not occurring (1).
- b. There is not sufficient evidence to know with certainty whether climate change is occurring or not (2).
- c. Climate change is occurring, and it's caused by mostly natural changes in the environment (3).
- d. Climate change is occurring, and is caused more or less equally by natural changes in the environment and human activities (4).
- e. Climate change is occurring, and is caused mostly by human activities (5).

Respondents indicated a wide variety of beliefs in climate change and the causes (Table 4.14).

The majority of respondents believed in climate change, but had varying views on the causes.

Most respondents ($n = 45$, 33.58%), believed climate change is occurring and is caused more or less equally by natural changes in the environment and human activities. A minority of

respondents indicated they believed climate change was occurring and was caused mainly by

human actions ($n = 11$, 8.21%). A small minority also indicated they believed climate change

was not occurring at all ($n = 6$, 4.48%) (Table 4.14). The mean response for respondents was 3.19

(SD = 1.02). A mean score of 3.19 indicates that most respondents believed the climate was

changing, and was caused by mostly natural changes in the environment.

Table 4.14*Climate-change belief Frequencies*

	n	%
Climate change is occurring, and is caused more or less equally by natural changes in the environment and human activities.	45	33.58
Climate change is occurring, and it's caused by mostly natural changes in the environment.	42	31.34
There is not sufficient evidence to know with certainty whether climate change is occurring or not	30	22.39
Climate change is occurring, and is caused mostly by human activities.	11	8.21
Climate change is not occurring	6	4.48
Total	134	100

Demographic Differences in Climate-change belief and Issue Salience

Demographic difference in climate-change belief and issue salience was explored within self-identified gender, political party, education level, role on the operation, commodity, and preferred agricultural media source. An ANOVA analysis was conducted for each demographic variable. Descriptive demographic information can be found under the “demographics” section earlier in Chapter Four.

Education Level

ANOVA analysis with post-hoc testing was conducted to explore the difference in political party and climate-change belief. Respondents were divided into seven groups; Group 1 (high school graduate or equivalent), Group 2 (some college credit), Group 3 (trade/technical/vocational training), Group 4 (associate's degree), Group 5 (bachelor's degree), Group 6 (master's degree),

and Group 7 (doctoral degree) (Table 4.15). There was a statistically significant difference at the $p < .01$ level for the six education levels: $F(6, 123) = 3.18, p = .006$. The effect size of .13, using eta squared, was considered to be a medium effect.

Table 4.15

Climate-change belief Means by Education Level

	Mean	SD
Doctoral degree	4.50	0.17
Master's degree	3.39	1.04
Bachelor's degree	3.28	1.00
Some college credit	3.27	0.78
Associate's degree	3.14	0.69
Trade/technical	2.57	0.98
High school	2.11	1.05

Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 ($M = 2.11, SD = 1.05$) was statistically different from Group 5 ($M = 3.28, SD = 1.0$), Group 6 ($M = 3.39, SD = 1.04$), and Group 7 ($M = 4.50, SD = 0.17$). Group 2 ($M = 3.27, SD = 0.78$), Group 3 ($M = 2.57, SD = 0.98$), and Group 4 ($M = 3.14, SD = 0.69$) did not differ significantly from any other group.

Farm Type

ANOVA analysis with post-hoc testing was conducted to explore the difference in farm type and climate-change belief. Respondents were divided into six groups; Group 1 (limited-resource farm): Group 3 (Retirement farm), Group 2 (residential/lifestyle farm), Group 3 (farming-occupation farms), Group 4 (large family farm), Group 5 (very large family farm), and Group 6 (non-family farm). There was no statistically significant difference between farm type groups.

Political Party

ANOVA analysis with post-hoc testing was conducted to explore the difference in political party and climate-change belief. Respondents were divided into five groups; Group 1 (Republican), Group 2 (Democrat), Group 3 (Independent), Group 4 (Other), and Group 5 (no party, not interested in politics). There was a statistically significant difference at the $p < .001$ level for the five political party identifications: $F(4, 124) = 4.98, p = .001$. The effect size of .14, using eta squared, was considered to be a large effect (Table 4.16).

Table 4.16

Climate-change belief by Political Party

	Mean	SD
Democrat	4.14	1.07
Independent	3.47	1.17
Republican	3.13	0.90
Other	2.40	1.14
No party	1.67	0.56

Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 2 ($M = 4.14, SD = 1.07$) was statistically different from Group 4 ($M = 2.40, SD = 1.14$) and Group 5 ($M = 1.67, SD = 0.56$). Group 3 ($M = 3.47, SD = 1.17$) was only significantly different from Group 5. Group 1 was not significantly different from any group.

Age

ANOVA analysis with post-hoc testing was conducted to explore the difference in age group and climate-change belief. Respondents were divided into nine groups; Group 1 (18-24), Group 2 (25-30), Group 3 (31-35), Group 4 (36-40), Group 5 (41-45), Group 6 (46-50), Group 7 (51-55), Group 8 (56-60), and Group 9 (61 and above). There was no statistically significant difference between age groups.

Gender

ANOVA analysis with post-hoc testing was conducted to explore the difference in gender group and climate-change belief. Respondents were divided into three groups; Group 1 (male), Group 2 (female), and Group 3 (prefer not to answer). There was no statistically significant difference between gender groups.

Ethnicity

Because of the homogeneity of respondents in ethnicity, ANOVA analysis could not be conducted to determine if significant differences existed in climate-change belief between groups. An overwhelming majority of respondents indicated they were Caucasian ($n = 123$, 95.3%). Native American ($n = 1$, 0.8%) was reported as the only ethnicity other than Caucasian. Table 4.8 earlier in Chapter Four provides full details of the ethnicity of respondents.

Role on Farm

ANOVA analysis with post-hoc testing was conducted to explore the difference in political party and climate-change belief. Respondents were divided into eight groups; Group 1 (owner/operator), Group 2 (landlord), Group 3 (tenant), Group 4 (manager/operator), Group 5 (farmhand/laborer), Group 6 (spouse of owner), Group 7 (co-owner), and Group 8 (child of owner). There was no statistically significant difference found to exist between the various reported roles of respondents.

Correlations and Regression Analysis

Researchers were interested in examining the relationship between perceived risk, experienced hazard, perceived benefits, and the belief in climate change. Correlation and multiple regression analyses were conducted to explore the relationship between the variables of interest. Initial bivariate correlation analysis was conducted for each of the independent variables and the dependent variable of climate-change belief. The bivariate correlations were examined to eliminate multicollinearity, which is a concern in regression analysis. None of the correlations were considered to be high, with all correlations at r values of .63 or less.

After eliminating multicollinearity, correlations between the dependent variable of climate-change belief and the independent variables were explored. Each of the independent variables was significantly correlated with climate-change belief (Table 4.17). Perceived risk ($r = .42$) was significant at the $p < .01$ level. Experienced hazard ($r = .20$) and perceived benefit ($r = .19$) were significant at the $p < .05$ level.

Table 4.17

Correlation Between Climate-change belief and Independent Variables

	r
Perceived risk	.42**
Experienced hazard	.20*
Perceived benefit	.19*

Note: ** $p < .01$, * $p < .05$

Simple regression analysis was conducted to determine if each independent variable should be included in a full regression model. Perceived risk resulted in the models $R^2 = .17$, $F(1,132) = 27.61$, $p < .0005$. The analysis indicated perceived risk is significant and explains 17% of the

variance in climate-change belief. Experienced hazard produced $R^2 = .04$, $F(1,132) = 5.43$, $p < .05$, indicating experienced hazard is significant and explains 4% of the variance in climate-change belief. Perceived benefit resulted in $R^2 = .04$, $F(1,132) = 4.89$, $p < .05$, which indicates perceived risk is significant and explains 4% of the variance in climate-change belief.

Because all of the independent variables explained some level of variance in the dependent variable of climate-change belief, multiple regression was used to explore the relationship further. Independent variables were entered into the model by R^2 value. The multiple regression model with all independent variables included resulted in $R^2 = .18$, $F(3, 130) = 9.70$, $p < .0005$. The multiple regression model with all three predictors explains 18% of the variance in climate-change belief. Perceived risk had a significant regression weight, after controlling for other variables in the model. Experienced hazard and perceived benefit were not significant in the model and did not contribute to the regression model (Table 4.18).

Table 4.18

Regression Analysis with Climate-change belief and Independent Variables

	b	B
Perceived risk	0.60	0.47**
Experienced hazard	-0.20	-0.12
Perceived benefit	0.08	0.10

Note: ** $p < .0005$

It was of additional interest to researchers to explore the impact of demographic variables on climate-change belief. Bivariate correlations were conducted for all demographic variables. Each of the demographic variables was significantly correlated with climate-change belief (Table

4.19). Gender ($r = -.25$), ethnicity ($r = -.23$), and education ($r = .28$) were all significantly correlated at the $p < .01$ level.

Table 4.19

Correlation Between Climate-change belief and Demographic Variables

	r
Education	.28**
Ethnicity	-.25**
Gender	-.23**

Note: ** $p < .01$

Simple regression analysis was conducted to determine if each demographic variable should be included in a full regression model. Education level resulted in the model $R^2 = .08$, $F(1, 128) = 10.50$, $p < .005$. The analysis indicated education level is significant and explains 8% of the variance in climate-change belief. Gender produced $R^2 = .25$, $F(1, 127) = 8.59$, $p < .005$, indicating gender is significant and explains 25% of the variance in climate-change belief. Ethnicity resulted in $R^2 = .23$, $F(1, 127) = 7.37$, $p < .01$, which indicates ethnicity is significant and explains 23% of the variance in climate-change belief.

Because all of the demographic variables explained some level of variance in the dependent variable of climate-change belief, multiple regression was used to explore the relationship further. The multiple regression model with all independent variables included resulted in $R^2 = .38$, $F(3, 123) = 7.06$, $p < .0005$. The multiple regression model, with all three predictors, explains 38% of the variance in climate-change belief. Education had a significant regression weight, after controlling for other variables in the model. Gender and ethnicity were not significant and did not contribute to the regression model (Table 4.20).

Table 4.20*Regression Analysis with Climate-change belief and Demographic Variables*

	b	B
Education	0.18	0.06*
Gender	-0.30	-0.18
Ethnicity	-0.09	-0.11

Note: * $p < .001$

Seeing the significant, unique effect of education, researchers were interested in the impact of combining the two regressions models exploring the impacts of issue salience and the demographic variables of education, gender, and ethnicity. Because each of the variables explained some amount of the variance in climate-change belief, they were entered into a regression model by the R^2 value. The multiple regression model resulted in $R^2 = .32$, $F(6, 120) = 9.21$, $p < .0005$. The multiple regression model, with all predictors of issue salience and demographic variables, explains 32% of the variance in climate-change belief. Perceived risk and education had significant regression weights after controlling for the other variables. Experienced hazard, perceived benefit, gender, and ethnicity were not significant (Table 4.21).

Table 4.21*Regression Analysis with Climate-change belief, Issue Salience, and Demographic Variables*

	b	B
Perceived risk	0.59	0.46**
Experienced hazard	-0.28	-0.16
Perceived benefit	0.10	0.78
Education	0.17	0.26*
Gender	-0.31	-0.19
Ethnicity	-0.06	-0.07

Note: ** $p < .0005$, * $p < .001$

Correlations between variables in the regression model were examined to describe the relationship between independent variables (Table 4.22). Education and perceived benefits were negatively correlated ($r = -.08$). Perceived benefit was negatively correlated with perceived risk ($r = -.18$), experienced hazard ($r = -.16$) and gender ($r = -.22$). Perceived risk was also negatively correlated with experienced hazard ($r = -.56$) (Table 4.22).

Table 4.22

Correlation Table of Regression Analysis

	Ethnicity	Education	Perceived benefit	Perceived risk	Experienced hazard	Gender
Ethnicity	1.00	.01	.16	-.02	.04	-.66
Education	.01	1.00	-.08	.01	.00	.00
Perceived benefit	.16	-.08	1.00	-.18	-.16	-.22
Perceived risk	-.02	.01	-.18	1.00	-.56	.05
Experienced hazard	.04	.00	-.16	-.56	1.00	.05
Gender	-.66	.00	-.22	.05	.05	1.00

MANOVA

A one-way between groups multivariate analysis of variance (MANOVA) was performed to explore climate-change belief differences in issue salience. Three variables were used in analysis: perceived risk, experienced hazard, and perceived benefit. The grouping variable was climate-change belief, with five unique groups. Climate-change belief group descriptions can be found in under research objective one in the exploration of climate-change beliefs. Preliminary assumption and validity test were conducted to check for normality, linearity, univariate and

multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no violations found.

There was a statistically significant difference in climate-change belief groups on the combined variables, $F(12, 336) = 3.36, p < .0005$; Wilks' Lambda = .74; partial eta squared = .10. The partial eta squared value indicates that 10% of the variance in issue salience is explained by the grouping variable of climate-change belief. When the results for the issue salience variables were considered separately, perceived risk and perceived benefit were statistically significant and experienced hazard was not. Perceived risk was significant at $F(4, 129) = 7.08, p < .0005$, partial eta squared = .18. Perceived benefit was significant at $F(4, 129) = 4.29, p < .01$.

Further inspection of perceived risk and climate-change belief mean scores revealed respondents who believed climate change was occurring and mostly caused by human activities had the highest mean ($M = 3.58, SD = 0.22$) for perceived risk (Table 4.23). A mean score of 3.58 indicated those respondents were somewhat to moderately concerned about the impacts of climate change. Those who believed climate change was occurring and caused by natural and human impacts equally, had the second highest mean score ($M = 3.41, SD = 0.11$) (Table 4.23).

Table 4.23

Perceived Risk Mean Scores by Climate-change belief Group

	Mean	SD
Occurring, mostly caused by human impacts	3.58	0.22
Occurring, natural causes and human impacts equally	3.41	0.11
Occurring, natural causes	2.99	0.11
Not sufficient evidence	2.77	0.13
Not occurring	2.24	0.30

Those who believed climate change was occurring and was caused by both natural and human impacts equally, had the highest mean score for perceived benefit ($M = 2.81$, $SD = 0.12$) (Table 4.24). A mean score of 2.81 indicated that respondents perceived minor to some benefit from climate change on their operation. The lowest mean score was for those who believed climate change was not occurring ($M = 1.90$, $SD = 0.32$) (Table 4.24).

Table 4.24

Perceived Benefit Mean Scores by Climate-change belief Group

	Mean	SD
Occurring, natural causes and human impacts equally	2.81	0.12
Occurring, natural causes	2.38	0.12
Not sufficient evidence	2.25	0.14
Occurring, caused by human impacts	2.09	0.24
Not occurring	1.90	0.32

ANOVA of Significant Issue Salience Variables in MANOVA Analysis

Follow up analyses of the significant issue salience variables in the MANOVA analysis was conducted to identify where significant differences existed within the groups. A one-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of climate-change belief on perceived risks of climate related impacts, as a part of the measurement of issue salience. As described in Chapter 3, respondents were divided into five groups based on their climate-change belief. Within perceived risk, there was a statistically significant difference between the five climate-belief groups: $F(4, 129) = 7.08$, $p < .0005$. The effect size, calculated using eta squared, was .18. This is a large effect size according the guidelines established by Cohen (1988), which indicated the effects of perceived risk, experienced hazard, and perceived benefit, on climate-change belief are a substantive finding.

Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 ($M = 2.24$, $SD = 1.03$) was significantly different from Group 4 ($M = 3.41$, $SD = 0.73$) and Group 5 ($M = 3.58$, $SD = .56$). Group 2 ($M = 2.77$, $SD = 1.3$) was also significantly different from Group 4 and Group 5. Group 3 ($M = 2.99$, $SD = .78$) did not differ significantly from any group. Group 1 and Group 2 did not differ significantly from each other.

ANOVA analysis with post-hoc testing was also conducted on perceived benefit. Within perceived benefit there was a statistically significant difference between the five climate-belief groups: $F(4, 129) = 4.29$, $p < .005$. The effect size, calculated using eta squared, was .12. This was considered to a medium effect (Cohen, 1988). Post-hoc comparisons using the Tukey HSD test indicated that only Group 2 ($M = 2.25$, $SD = 0.71$) and Group 4 ($M = 2.81$, $SD = 0.74$) differed on a statistically significant level.

RO2: Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts;

To gather information related to RO2 “Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts,” a quasi-experimental question design was utilized. Each respondent to the survey was randomly assigned to one of three questions groups with gain, loss, or neutral frames. Within each question group, respondents were asked to respond to eight questions testing four terms and distant and near frame impacts. Responses to framing questions asked respondents to rate how strongly they agreed or disagreed with impacts that occurred on their operations. A five-point Likert-type scale

was used where one (1) was strongly disagree, two (2) somewhat disagree, three (3) neither strongly agreed nor disagreed, four (4) agree, and five (5) strongly agreed.

Outcome Frames (Gain, Loss, and Neutral)

Mean and standard deviations were calculated for the gain, loss, and neutral frame question groups (Table 4.25). Gain frames had the highest mean score ($M = 2.73$, $SD = 0.42$). Loss frames had the second highest mean ($M = 2.84$, $SD = 0.63$), and the neutral or control frame had the lowest ($M = 2.48$, $SD = 0.86$) (Table 4.25).

Table 4.25

Gain, Loss, and Neutral Frame Scores

	Mean	SD
Loss frame, $n = 47$	2.84	0.63
Gain frame, $n = 46$	2.73	0.42
Neutral frame, $n = 45$	2.48	0.86

Distant and Near Frames

Distant and near frames were compared between respondents. Each respondent to the survey responded to four questions framed with future (distant) impacts and four questions framed with currently occurring (near) impacts. Distant frames had a mean of 2.66 ($n = 138$, $SD = 0.68$). Near frames had a mean of 2.76 ($n = 136$, $SD = 0.75$) (Table 4.26).

Table 4.26

Distant and Near Frames

	Mean	SD
Distant frame	2.66	0.68
Near frame	2.76	0.75

Terminology Framing

Each of the four terms used within the framing manipulation were studied individually. The four terms examined in the study were extreme weather, weather pattern, weather variability, and climate change. Means were calculated for each term (Table 4.27). Weather pattern had the highest mean score ($M = 2.81, SD = 0.82$). Extreme weather had the lowest mean score ($M = 2.08, SD = 0.92$) (Table 4.27).

Table 4.27
Framing Terminology

	n	Mean	SD
Weather pattern	138	2.81	0.82
Extreme weather	137	2.08	0.92
Climate change	137	2.33	0.92
Weather variability	135	2.21	0.91

MANCOVA

A one-way between groups multivariate analysis of covariance (MANCOVA) was used to explore the impact of framing manipulation on climate-change belief. Three dependent variables were used: outcome (gain, loss, and neutral), distance (current and future), and terminology (extreme weather, weather pattern, weather variability, and climate change) frames. Outcome frame assignment was used as a covariate. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations found. There was not a statistically significant difference between climate-change belief groups on the combined dependent variables.

ANOVA

A one-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of gain, loss, and neutral frames on perceived impact of climate and weather events on the respondents farming or ranching operation. Respondents were assigned into three groups via random assignment (Group 1: gain frame; Group 2: loss frame; Group 3: neutral frame). The groups were based on the quasi-experimental design of the survey to examine frame treatments.

There was a statistically significant difference at the $p < .05$ level in total score for the three framing treatment groups: $F(2, 135) = 3.57, p = .031$. The effect size, calculated by eta squared, was .07. The effect size was considered to have a medium effect based on the guidelines of Cohen (1988). Post-hoc comparisons, using the Tukey HSD test, were made for mean scores between groups to test for significant differences. The loss frame group ($M = 2.84, SD = 0.42$) differed significantly from the neutral frame ($M = 2.48, SD = 0.86$). There was not a significant difference between the gain and loss frame groups or the gain and neutral frame groups.

An ANOVA analysis was conducted to determine if there was an impact of gain, loss, and neutral frames on climate-change belief. Finding no statistical significance, the conclusion can be made that there is no statistically significant difference between the frame scores. An ANOVA analysis was conducted to determine if there was an impact of terminology on climate-change belief. Finding no statistical significance, the conclusion can be made that there is no statistically significant difference between the two frame scores.

RO3: Identify the agricultural media and information channels agricultural producers use for climate change.

Respondents to the survey were asked to identify which agricultural media sources they used when thinking about climate and climate change. Most producers ($n = 86$, 61%) indicated that they used regional agricultural publications for climate and climate-change information.

Business reports were used the least ($n = 25$, 18%), and eight respondents indicated that they did not use any of the listed agriculture publications for climate and climate change information (Table 4.28).

Table 4.28

Agricultural Publication Use for Climate and Climate Change

	<i>n</i>	%
Regional agricultural publications	86	61
University publications	76	54
Radio broadcasts	72	51
Industry professional magazines	71	50
Research publications	59	42
Commodity specific magazines	55	39
Commodity organization publications	53	37
TV broadcasts	50	35
Ag expos and/or farm shows	42	30
Business reports	25	18
None of the above	8	6

Respondents were then asked to identify which specific publications within each agricultural publication category they used. A list of publications within each category was provided, and respondents were asked to select each publication they used. *Kansas Farmer* ($n = 73$, 85%) and

High Plains Journal ($n = 71$, 83%) were used most by those respondents who indicated they used regional agricultural publications (Table 4.29).

Table 4.29

Regional Agricultural Publications

	n	%
Kansas Farmer	73	85
High Plains Journal	71	83
Kansas Stockman	28	33
Farm Progress Daily Newsletter	14	16
Western Farm Press	12	14
Farm Talk Newspaper	8	9
The Farmer	6	7
Prairie Farmer	5	6
American Agriculturalist	2	2
None	1	1

University publications were the second highest source respondents indicated they used for climate and climate-change information (Table 4.28). Of the provided options, the K-State Research and Extension (KSRE) Bookstore ($n = 45$, 63%) and extension fact sheets ($n = 36$, 50%) were used the most (Table 4.30).

Table 4.30*University Publications*

	n	%
KSRE Bookstore	45	63
Extension Fact Sheets	36	50
Ag Report	19	26
None of the provided university publications	11	15
OSU Ag Communications	4	6
AgMRC	3	4
SUNUPtv	3	4
Agri Leader	3	4
Agri Life Today	2	3

Respondents indicated that radio was the third preferred media source for information about climate and climate change (Table 4.28). Those that indicated they used radio were asked to select which specific sources they used. KFRM 550 AM ($n = 49$, 68%) was used the most, followed by AgriTalk ($n = 30$, 42%) (Table 4.31).

Table 4.31*Agricultural Radio Broadcasts*

	<i>n</i>	%
KFRM 550AM	49	68
AgriTalk	30	42
Successful Farming Radio	16	22
Max Armstrong's Midwest Digest	14	19
None of the provided radio broadcasts	10	14
Farm Progress America	8	11
KLA Radio	4	6
Radio Oklahoma Agricultural Network	2	3
Down on the Farm Radio Network	2	3
WGN Radio Saturday Morning Show	1	1
Texas Ag Radio Network	1	1

Other media sources included industry professional magazines, research publications, commodity specific magazines, commodity organization publications, television broadcasts, agriculture expos and/or farm shows, and business reports. Respondents were asked to report which specific sources they used in each category (Table 4.32).

Table 4.32*Other Agricultural Publications*

Industry professional magazines	<i>n</i>	%
None of the provided industry magazines	50	70
AgProfessional.com	9	13
Feedstuffs	8	11
Bovine Veterinarian	4	6
BEEF Vet	3	4
Research publications		
USDA Agricultural Research Service	30	51
None of the provided research publications	24	41
Agriculture Week	10	17
Journal Of Agricultural Science	6	10
Journal of Agricultural and Food Economics	4	7
Journal of Animal Science and Technology	4	7
Chemical and Biological Technologies in Agriculture	3	5
Journal of Animal Science and Biotechnology	3	5
Agriculture and Food Security	1	2
Journal of Irrigation and Drainage Systems	1	2
Journal of Plant Pathology	1	2
International Journal on Advances in Precision Agriculture	1	2
International Organization for Biological Control	0	0
International Society of Organic Agriculture Research	0	0

Table 4.31

Continued from page 85

Commodity specific magazines

	<i>n</i>	%
Farm Journal	42	76
Corn Soybean Digest	29	53
BEEF	18	33
Drovers Cattle Network	15	27
Beef Producer	14	25
Beef Today	13	24
Drover Cow Calf	10	18
National Cattlemen	10	18
Angus Journal	8	15
Western Farmer Stockman	7	13
None of the provided commodity specific magazines	5	9
National Hog Farmer	2	4
Pork Network	1	2
Calf News	1	2
Feedlot Magazine	1	2
Dairy Herd Management	0	0
The Packer	0	0
Farm Journals Milk	0	0
Dairy Today	0	0

Table 4.31

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	<i>n</i>	%
Commodity organization publications		
Kansas Stockman	21	40
None of the provided commodity organization publications	20	38
Kansas Soybean	16	30
Oklahoma Wheat	1	2
OK Cowman	1	2
Pig Tales	1	2
Television broadcasts		
RFD Tv	21	42
None of the provided TV broadcasts	21	42
This Week in Agribusiness	17	34
Agriculture expos and/or farm shows		
3iShow	21	50
Topeka Farm Show	14	33
Great Bend Farm and Ranch Show	14	33
Husker Harvest Days	14	33
Wichita Farm Ranch Show	11	26
Commodity Classic	9	21
Mid America Farm Show	8	19
Western Farm Show	5	12

Table 4.31

Continued from page 87

	<i>n</i>	%
None of the provided ag expos/farm shows	4	10
Four State Farm Show	2	5
Cattle Raisers Convention Expo	2	5
Fort Worth Stock Show and Rodeo	2	5
Tulsa Farm Show	2	5
Farm Progress Show	2	5
Hay Forage Expo	1	2
Business reports		
Successful Farming	23	92
Farm Futures	18	72
US Farm Report	12	48
Ag Professional	4	16
Farm Progress Data Solutions	4	16
Doane	3	12
Weekly Livestock Reporter	2	8
None of the provided business reports	1	4

Exploration of Climate-change belief Means by Publication Use

Initial means and standard deviations were calculated for climate-change belief based on reported use of agricultural media sources (Table 4.33). Respondents that reported using business reports for information about climate and climate change, had the highest climate-change belief score ($M = 3.68$, $SD = 0.99$). The lowest climate-change belief score ($M = 2.38$, $SD = 0.92$) was for those who reported not using any of the media sources for climate or climate change information (Table 4.33).

Table 4.33

Climate-change belief Mean by Publication Use

	<i>n</i>	Mean	<i>SD</i>
Business reports	25	3.68	0.99
TV broadcasts	50	3.46	0.91
Research publications	59	3.41	1.05
University publications	76	3.37	0.96
Industry professional magazines	71	3.37	0.90
Ag expos and/or farm shows	42	3.36	0.93
Commodity specific magazines	55	3.33	0.96
Radio broadcasts	72	3.25	0.96
Regional ag publications	85	3.25	1.02
Commodity organization publications	53	3.19	1.00
None of the above	8	2.38	0.92

Initial means and standard deviations were also calculated for issue salience variables (Table 4.34). Television broadcast viewers had the highest mean ($M = 3.32$, $SD = 0.77$) for perceived risk of climate-change impacts. Respondents who reported using business reports had the highest mean ($M = 2.34$, $SD = 0.61$) for reported experienced climate-change related hazards. Television viewers also reported the highest mean ($M = 2.62$, $SD = 0.77$) for perceived benefits of climate-change impacts (Table 4.34).

Table 4.34*Issue Saliency Variables by Publication Use*

	Perceived risk		Experienced hazard		Perceived benefit	
	Mean	SD	Mean	SD	Mean	SD
TV broadcasts	3.32	0.77	2.32	0.64	2.62	0.77
Ag expos/farm shows	3.20	0.83	2.32	0.67	2.59	0.87
Radio broadcasts	3.17	0.84	2.30	0.69	2.53	0.85
Business reports	3.16	0.78	2.34	0.61	2.42	0.65
Commodity specific magazines	3.15	0.80	2.27	0.72	2.45	0.84
University publications	3.14	0.75	2.26	0.60	2.47	0.83
Industry profession magazines	3.13	0.76	2.21	0.61	2.44	0.83
Research publications	3.12	0.81	2.27	0.60	2.45	0.81
Regional ag publications	3.11	0.82	2.26	0.63	2.46	0.78
Commodity org. publications	3.09	0.79	2.26	0.68	2.30	0.75
No listed publications	2.51	0.77	1.88	0.28	2.05	0.85

To further explore the mean differences for climate-change belief and issue saliency variables, independent-samples t-tests were conducted to compare the mean scores for those who reported using each media type, and those that did not (Table 4.35). Several significant differences for users and non-users were found throughout the variables. A significant difference existed in climate-change belief for users ($M = 3.41$, $SD = 1.05$) and non-users ($M = 3.01$, $SD = 0.97$) of research publications: $t(132) = -2.25$, $p < .05$. A significant mean difference in climate-change belief also existed for users ($M = 3.37$, $SD = 0.90$) and non-users ($M = 2.98$, $SD = 1.40$) of industry professional magazines: $t(132) = -2.20$, $p < .05$. Climate-change belief means also had a statistically significant difference between users ($M = 3.68$, $SD = 0.99$) and non-users ($M = 3.07$, $SD = 1.0$) of business reports: $t(132) = -2.75$, $p < .01$. Users ($M = 3.37$, $SD = 0.96$) and non-users ($M = 2.95$, $SD = 1.05$) of university publications also differed significantly on climate-change belief: $t(132) = 2.36$, $p < .05$. Users ($M = 3.46$, $SD = 0.91$) and non-users ($M = 3.02$, $SD = 1.05$)

of television broadcasts had statistically significant differences in climate-change belief: $t(132) = 2.44, p < .05$. Significant differences were also found in climate-change belief for overall users ($M = 3.24, SD = 1.0$) and non-users ($M = 2.38, SD = .91$) of provided media source types: $t(132) = 2.36, p < .05$ (Table 4.35).

Table 4.35

Climate-Change Belief T-Test for Media Type Users and Non-users

	Users		Non-users		t
	Mean	SD	Mean	SD	
Research publications	3.41	1.05	3.01	0.97	-2.25*
Industry professional magazines	3.37	0.90	2.98	1.40	-2.20*
Business reports	3.68	0.99	3.07	1.00	-2.75*
University publications	3.37	0.96	2.95	1.05	2.36*
Television broadcasts	3.46	0.91	3.02	1.05	-2.44*
Overall use	3.24	1.00	2.38	0.91	2.36*

Note: * $p < .05$

Users ($M = 3.32, SD = 0.77$) and non-users ($M = 2.98, SD = 0.79$) of television broadcasts had statistically significant differences on perceived risk: $t(140) = -2.48, p < .05$ (Table 4.36).

Statistically significant differences also existed in means for those who reported they used none of the provided media sources for climate and climate change information, and those that did.

Significant differences were found for users ($M = 3.13, SD = 0.78$) and non-users ($M = 2.51, SD = 0.77$) on perceived risk means: $t(140) = 2.19, p < .05$ (Table 4.36).

Table 4.36

Perceived Risk T-Test for Media Type Users and Non-Users

	Users		Non-users		t
	Mean	SD	Mean	SD	
Television broadcast	3.32	0.77	2.98	0.79	-2.48
Overall use	3.13	0.78	2.51	0.77	2.19

Regression Analysis of Preferred Agricultural Media Source

Analyses of bivariate correlations were conducted for preferred media type and climate-change belief (Table 4.36). Significant correlations were found for research publications ($r = .19$), industry professional magazines ($r = .19$), business reports ($r = .23$), TV broadcasts ($r = .21$) and university publications ($r = .21$), all at the $p < .05$ level. A significant negative correlation was found to exist between climate-change belief and the non-use of provided media sources (Table 4.37).

Table 4.37

Correlation Between Publications and Climate-Change Belief

	r
Business reports	.23*
TV broadcasts	.21*
University publications	.21*
No listed publications	-.20*
Research publications	.19*
Industry professional magazines	.19*

*Note: significant at the $p < .05$ level

Publications with significant bivariate correlations were entered into a multiple regression model (Table 4.38). The regression model with the independent variables of research publications, industry professional magazines, business reports, television broadcast, university publications, and no listed publications resulted in $R^2 = .39$, $F(6, 133) = 3.72$, $p < .005$. The regression model explains 39% of the variation in climate-change belief. Television broadcasts were the only significant variable in the regression model (Table 4.38).

Table 4.38*Regression Analysis with Preferred Media Source and Climate-Change Belief*

	B	Beta
TV broadcasts	.41	.20*
Business reports	.40	.15
University publications	.21	.10
Research publications	.21	.10
Industry professional magazines	.20	.10
No listed publications	-.28	-.07

Note: *significant at the $p < .05$ level

H1: Agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America’s (2012) study.

One question was used to investigate which audience segment respondents fit into within the Six America’s spectrum. It was hypothesized that the majority of the respondents would be located within two segment groups, the concerned and the cautious. Based upon the climate-change belief question, the majority of respondents fell into the segment groups of the concerned ($n = 45, 33\%$) and cautious ($n = 42, 31.3\%$) (Table 4.38). The comparison of the two groups indicates that the predicted hypothesis was true.

Table 4.39*Climate-Change Belief Frequencies*

	n	%
The concerned: climate change is occurring, and is caused more or less equally by natural changes in the environment and human activities.	45	33.6
The cautious: climate change is occurring, and it's caused by mostly natural changes in the environment.	42	31.3
The doubtful: there is not sufficient evidence to know with certainty whether climate change is occurring or not	30	22.4
The alarmed: climate change is occurring, and is caused mostly by human activities.	11	8.2
The dismissive: climate change is not occurring	6	4.5
Total	134	100

Summary

An Internet survey was used to explore agricultural producers level of issue salience in climate change; the frames and messages agricultural producers in Kansas use and accept related to climate change and the impacts of a changing climate; identify preferred agricultural media sources; and compare agricultural producer audience segments to the segments of the Six America's study (Leiserowitz et al., 2013). The study included a purposive sample of agricultural producers in Kansas who were contacted through the Kansas Association of Wheat Growers. Researchers discovered the impacts of issue salience on climate-change belief, differences between demographic and belief groups, the impact of framing on climate-change belief, and preferred agricultural media sources.

General demographics are described in the beginning of the chapter to provide a profile of the respondents. Respondents were from 58 counties within Kansas. The majority of respondents (n

= 72, 55.4%) had a bachelor's degree. Large family farms ($n = 41$, 32.3%) and very large family farms ($n = 39$, 30.7%) were the most common type of operation. A vast majority of respondents were Republican ($n = 95$, 73.6%), Caucasian ($n = 123$, 95.3%), and male ($n = 100$, 77.5). The largest group of respondents reported their age between 56 and 60 ($n = 38$, 29.7%). Over half ($n = 90$, 69.8%) of respondents indicated they were the owner/operator of their operation.

In addressing RO1, the level of issue salience related to climate-change belief, the chapter provided findings related to perceived risk, experienced hazard, and climate-change belief. In response to concern for risk of climate-related events, respondents indicated their summative average concern for all nine measures of perceived risk was 3.10 ($SD = 0.78$). Average concern for perceived risks was slightly above the somewhat concerned level. Respondent indicated their average experienced hazard was 2.22 ($SD = 0.55$). The aggregate perceived benefit of climate related events in the last five years was 2.48 ($SD = 0.84$). All measures for perceived benefits fell in the range of minor benefit to some benefit. Additionally, the mean response for respondent climate-change belief was 3.19 ($SD = 1.02$). A mean score of 3.19 indicated most respondents believed the climate was changing, and was caused by mostly natural changes in the environment.

Demographic differences were compared against climate-change belief to explore the differences. ANOVA analysis was used to determine if there were statistically significant differences between groups. Statistically significant differences in groups were found for education, political party, gender, and ethnicity.

Each of the independent variables of issue salience was significantly correlated with climate-change belief. Perceived risk ($r = .42$) was significant at the $p < .01$ level. Experienced hazard ($r = .20$) and perceived benefit ($r = .19$) were significant at the $p < .05$ level. The multiple regression model with all independent variables included resulted in $R^2 = .18$, $F(3, 130) = 9.70$, $p < .0005$. The multiple regression model with all three predictors explained 18% of the variance in climate-change belief. Perceived risk had a significant regression weight, after controlling for other variables in the model.

Each of the demographic variables was examined for significant correlations with climate-change belief. Education ($r = .28$), gender ($r = -.23$), and ethnicity ($r = -.25$) all had statistically significant correlations with climate-change belief at the $p < .01$ level. The multiple regression model with all independent variables included resulted in $R^2 = .38$, $F(3, 123) = 7.06$, $p < .0005$. The multiple regression model, with all three predictors, explained 38% of the variance in climate-change belief.

Significantly correlated issue salience and demographic variables were entered into a regression model to explore the impact on climate-change belief. The multiple regression model resulted in $R^2 = .32$, $F(6, 120) = 9.21$, $p < .0005$. The multiple regression model, with all predictors of issue salience and demographic variables, explained 32% of the variance in climate-change belief. Perceived risk and education had significant regression weights after controlling for the other variables. Experienced hazard, perceived benefit, gender, and ethnicity were not significant.

A MANCOVA analysis revealed there was a statistically significant difference in climate-change belief groups on the combined variables, $F(12, 336) = 3.36, p < .0005$; Wilks' Lambda = .74; partial eta squared = .10. The partial eta squared value indicated that 10% of the variance in issue salience was explained by the grouping variable of climate-change belief. When the results for the issue salience variables were considered separately, perceived risk and perceived benefit were statistically significant and experienced hazard was not.

In addressing RO2, the frames agricultural producers prefer in reference to climate change and impacts, MANCOVA analysis revealed there was not a statistically significant difference between climate-belief groups and the three dependent frame manipulations. ANOVA analysis revealed statistically significant differences for climate-change belief between loss and neutral frame groups. There was a statistically significant difference at the $p < .05$ level in total score for the three framing treatment groups: $F(2, 135) = 3.57, p = .031$. The effect size, calculated by eta squared, was .07. The loss frame group ($M = 2.84, SD = 0.42$) differed significantly from the neutral frame ($M = 2.48, SD = 0.86$). There was not a significant difference between the gain and loss frame groups or the gain and neutral frame groups. Further ANOVA analysis revealed no significant differences for distance or terminology framing.

For RO3, preferred agricultural media sources, producers ($n = 86, 61\%$) indicated they used regional agricultural publications for climate and climate-change information. Business reports were used the least ($n = 25, 18\%$). Eight respondents indicated that they did not use any of the listed agricultural publications for climate and climate-change information.

In addressing H1, the prediction that agricultural producers will fall into the segment groups of concerned and cautious, the majority of respondents fell into the segment groups of the concerned ($n = 45, 33\%$) and cautious ($n = 42, 31.3\%$) (Table 4.26). The comparison of the two groups indicated the predicted hypothesis was true. The doubtful ($n = 30, 22.4\%$) were also a group of considerable size in the analysis.

Chapter 5 - Discussion and Conclusions

The agricultural industry is vulnerable to the impacts of climate change, as well as a significant contributor to the amount of greenhouse gasses (IPCC, 2007b) in the atmosphere. Without adaptation to climate change, further impacts are expected to have a substantial impact on agriculture (Field et al., 2014). While there is a scientific majority that agrees climate change is occurring (Cook et al., 2013), a portion of the agricultural population does not believe, acknowledge, or understand climate change and how it is happening (Arbuckle et al., 2013a; Barnes & Toma, 2012; Haden et al., 2012; Hamilton et al., 2007).

Communicators and educators have been tasked with delivering science-based information on climate change. In a collaborative effort to deliver science-based information to agricultural producers, the Southern Plains Regional Climate Hub (SPRCH) was established to serve Kansas, Oklahoma, and Texas (USDA Climate Hubs, 2015). However, agricultural producers in the Midwest and Southern Plains still have widely varied perceptions of climate change and tend to doubt its existence (Dunlap & McCright, 2008; Hamilton et al., 2007; Nisbet & Myers, 2007). Agricultural producers that perceive climate change to be a risk with negative impacts are more likely to embrace adaptive actions (Arbuckle et al., 2013b; Howden et al., 2007). Audience segmentation and trust in media sources, have been suggested to impact agricultural producers perception of climate change and are possible avenues for communication strategy (Arbuckle et al., 2013).

Improving understanding and acceptance of climate change is still necessary, however, the need for agricultural producers to embrace adaptive measures through framing and risk perception has

become an important goal of the current federal administration and is necessary to maintain a productive agricultural system in the United States (Executive Office of the President, 2013).

Little research exists on agricultural audiences specific climate-change communication needs and perceptions. The purpose of this Internet survey was to expand the existing research body related to agricultural audiences communication needs, specifically related to climate-change frames and messages agricultural producers use and accept related to climate change. It was of additional interest to explore the climate-change beliefs and preferred agricultural media sources for climate and climate change information.

Development of the instrument was guided by agenda-setting theory which includes issue salience and framing. Audience segmentation, as a communication strategy, also guided the development of the instrument. The study examined a purposive sample of 142 agricultural producers in Kansas which were recruited for participation through the Kansas Association of Wheat Growers. The instrument was administered through an Internet survey distributed via email to 585 recipients, 2,989 followers on Facebook, and 5,444 Kansas Wheat Twitter followers. An invitation-survey-reminder method was used to distribute the survey, which was open from March 3 to March 14, 2016.

Specific research objectives guided this study:

- RO1: Describe the level of issue salience agricultural producers have related to climate change;
- RO2: Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts; and

- RO3: Identify the agricultural media and information channels agricultural producers use for climate change.

Based on findings in previous research, one hypothesis was developed:

H1: Agricultural producers in the Southern Plains Regional Climate Hub area will be located within the audience segment groups of the concerned and the cautious as identified in the Six America's (2012) study.

Conclusions

An Internet survey was used to explore the level of issue salience in climate change; the frames and messages agricultural producers use and accept related to climate change and the impacts of a changing climate; identify preferred agricultural media sources; and compare agricultural producer audience segments to the segments of the Six America's study (Leiserowitz et al., 2013). The study included a purposive sample of agricultural producers in Kansas who were contacted through the Kansas Association of Wheat Growers. Researchers explored the impacts of issue salience on climate-change belief, differences between demographic and belief groups, the impact of framing on climate-change belief, and preferred agricultural media sources.

General demographics of the study respondents are described in the beginning of Chapter Four. Respondents were from 58 counties within Kansas. Two respondents were from Oklahoma and one was from Texas. It was assumed that the respondents from Oklahoma and Texas were associated with the Kansas Association of Wheat Growers through membership or land ownership. The majority of respondents ($n = 72$, 55.4%) had a bachelor's degree, 18 (13.8%) had a master's degree, 15 (11.5%) had some college credit, 9 (6.9%) graduated high school or had an equivalent completion, 7 (5.4%) had trade, technical or vocational training, 7 (5.4%) had an

associate's degree, and 2 (1.5%) had a doctoral degree. Large family farms ($n = 41$, 32.3%) and very large family farms ($n = 39$, 30.7%) were the most common type of operation. Other types of farming operations included residential or lifestyle farms ($n = 17$, 13.4%), farming-occupation farms ($n = 15$, 11.8%), limited-resource farms ($n = 11$, 8.7%), retirement farms ($n = 2$, 1.6%), and non-family farms ($n = 2$, 1.6%).

A vast majority of respondents identified themselves as being Republican ($n = 95$, 73.6%) in their political identity. Independents comprised the second largest group ($n = 19$, 14.7%). Democrats made up 5.4% of the population ($n = 7$). Five respondents (3.9%) identified with another party not listed. Three (2.3%) respondents did not affiliate themselves with any party and were not interested in politics.

Age of the respondents was also reported. Age was classified in six-year increments. The population was made up of 11 (8.6%) 18-24 year olds, 17 (13.3%) in the age range of 25-30, 15 (11.7%) in the age range of 31-35, 10 (7.8%) in the age range of 36-40, 5 (3.9%) in the age range of 41-45, 7 (5.5%) in the age range of 46-50, 22 (17.2%) in the age range of 51-55. The largest group of respondents reported their age between 56 and 60 ($n = 38$, 29.7%), and three (2.3%) that were 61 and above.

Respondents were asked to identify their gender as part of the demographic information gathered. Males comprised 77.5% ($n = 100$) of the population. Females made up 19.4% ($n = 25$) and 3.1% ($n = 4$) preferred not to answer.

The ethnicity of respondents was also of interest to researchers. A large majority of respondents reported their race as Caucasian ($n = 123$, 95.3%). One respondent (0.8%) indicated they were Native American. Three respondents (2.3%) preferred not to provide their ethnicity. Three respondents (2.3%) identified their ethnicity as being “other.” Of those that identified their ethnicity as “other,” one individual reported being “European American.” Hispanic/Latino, African American, and Asian/Pacific Islanders ethnicities were not represented in this study.

Since the focus of the study was on farmers and ranchers in Kansas, researchers asked respondents to identify their role on the operation. Over half ($n = 90$, 69.8%) of respondents indicated they were the owner/operator of their operation. Managers/operators comprised 8.5% ($n = 11$) of the population. Farmhands/laborers, spouses of owners, and children of owners, each had six respondents, or 4.7% of the population each. Four respondents (3.1%) identified themselves as being co-owners of the operation. Landlords made up 2.3% ($n = 3$) of the population as did tenants ($n = 3$).

In addressing RO1, the level of issue salience related to climate-change belief, the study provided findings related to issue salience, the combination of perceived risk, experienced hazard, perceived benefit, and climate-change belief. In response to concern for perceived risk of climate related events, respondents indicated their summative average concern for all nine measures of perceived risk was 3.10 ($SD = 0.78$) on a five point scale. Average concern for perceived risks was slightly above the somewhat concerned level. The highest level of concern was for longer dry periods and drought ($M = 4.06$, $SD = 1.04$). A mean of 4.06 indicated respondents were slightly more than moderately concerned. The lowest perceived risk was for

increased flooding ($M = 2.24$, $SD = 1.21$), indicating that respondents were slightly concerned. Respondent indicated their average experienced hazard was 2.22 ($SD = 0.55$). Significant drought ($M = 3.73$, $SD = 0.97$) was the experienced hazard with the reported highest impact, with an impact between moderate and major. The aggregate perceived benefit of climate related events in the last five years was 2.48 ($SD = 0.84$). Increased options in crop variety had the highest mean score ($M = 2.99$, $SD = 1.24$). All measures for perceived benefits fell in the range of minor benefit to some benefit.

Additionally, the mean response for respondent climate-change belief was 3.19 ($SD = 1.02$). A mean score of 3.19 indicated most respondents believed the climate was changing, and was caused by mostly natural changes in the environment. Respondents indicated a wide range of climate-change beliefs. Most respondents ($n = 45$, 33.6%) indicated they believed climate change has occurred and was caused more or less equally by natural changes in the environment and human activities. A smaller portion of the population ($n = 42$, 31.3%) believed that climate change has occurred, and is caused mostly by natural changes in the environment. Other respondents ($n = 30$, 22.4%) indicated they believed there is not sufficient evidence to know with certainty whether climate change was occurring or not. A small portion ($n = 11$, 8.2%) believed that climate change was occurring, and was caused mostly by human activities. The smallest section of respondents ($n = 6$, 4.5%) believed climate change was not occurring.

Demographic differences were compared against climate-change belief to explore the differences. ANOVA analysis was used to determine if there were statistically significant differences between groups. Statistically significant differences in groups were found for

education ($p < .01$), political party ($p < .001$), and gender ($p < .005$). Demographics with non-significant differences were farm type, age, and role on farm. No differences were explored by ethnicity because of the homogeneous sample in the study.

ANOVA analysis with post-hoc testing was conducted to explore the difference in educational and climate-change belief. Respondents were divided into seven groups for educational levels; Group 1 (high school graduate or equivalent), Group 2 (some college credit), Group 3 (trade/technical/vocational training), Group 4 (associate's degree), Group 5 (bachelor's degree), Group 6 (master's degree), and Group 7 (doctoral degree). There was a statistically significant difference at the $p < .01$ level for the six education levels: $F(6, 123) = 3.18, p = .006$. The effect size of .13, using eta squared, was considered to be a medium effect. Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 ($M = 2.11, SD = 1.05$) was statistically different from Group 5 ($M = 3.28, SD = 1.0$), Group 6 ($M = 3.39, SD = 1.04$), and Group 7 ($M = 4.50, SD = 0.17$). Group 2 ($M = 3.27, SD = 3.27$), Group 3 ($M = 2.57, SD = 0.98$), and Group 4 ($M = 3.14, SD = 0.69$) did not differ significantly from any other group.

ANOVA analysis with post-hoc testing was conducted to explore the difference in political party and climate-change belief. Respondents were divided into five groups; Group 1 (Republican), Group 2 (Democrat), Group 3 (Independent), Group 4 (Other), and Group 5 (no party, not interested in politics). There was a statistically significant difference at the $p < .001$ level for the five political party identifications: $F(4, 124) = 4.98, p = .001$. The effect size of .14, using eta squared, was considered to be a large effect. Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 2 ($M = 4.14, SD = 1.07$) was statistically different from

Group 4 ($M = 2.40$, $SD = 1.14$) and Group 5 ($M = 1.67$, $SD = 0.56$). Group 3 ($M = 3.47$, $SD = 1.17$) was only significantly different from Group 5. Group 1 was not significantly different from any group.

ANOVA analysis with post-hoc testing was conducted to explore the difference in gender group and climate-change belief. Respondents were divided into three groups; Group 1 (male), Group 2 (female), and Group 3 (prefer not to answer). There was a statistically significant difference at the $p < .005$ level for the three gender groups: $F(2, 226) = 6.13$, $p = .003$. The effect size of .09, using eta square, was considered to be a medium effect. Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 ($M = 3.25$, $SD = 1.02$) was statistically different from Group 4 ($M = 1.50$, $SD = 0.56$). Group 2 ($M = 3.16$, $SD = 0.85$) was also statistically different from Group 2. Group 1 and Group 2 were not statistically different from each other.

Bivariate correlation was used to examine the relationship between issue salience and climate-change belief. Each of the independent variables of issue salience, perceived risk, experienced hazard, and perceived benefit, was significantly correlated with climate-change belief. Perceived risk ($r = .42$) was significant at the $p < .01$ level. Experienced hazard ($r = .20$) and perceived benefit ($r = .19$) were significant at the $p < .05$ level. Finding significant bivariate correlations for each independent variable, a regression model was calculated. The multiple regression model with all independent variables included resulted in $R^2 = .18$, $F(3, 130) = 9.70$, $p < .0005$. The multiple regression model with all three predictors explained 18% of the variance in climate-

change belief. Perceived risk had a significant regression weight ($B = .47$), after controlling for other variables in the model.

Each of the demographic variables was examined for significant correlations with climate-change belief. Education ($r = .28$), gender ($r = -.23$), and ethnicity ($r = -.25$) all had statistically significant correlations with climate-change belief at the $p < .01$ level. Finding significant correlations for the three demographic variables, a regression model was calculated. The multiple regression model with all independent variables included resulted in $R^2 = .38$, $F(3, 123) = 7.06$, $p < .0005$. The multiple regression model, with all three predictors, explained 38% of the variance in climate-change belief. Education had a significant regression weight ($B = .06$, $p < .001$), after controlling for gender and ethnicity.

Seeing the significance of issue salience and demographic variables, researchers were interested in further exploring the relationship. Significantly correlated issue salience and demographic variables were entered into a regression model to explore the impact on climate-change belief. The multiple regression model resulted in $R^2 = .32$, $F(6, 120) = 9.21$, $p < .0005$. The multiple regression model, with all predictors of issue salience and demographic variables, explained 32% of the variance in climate-change belief. Perceived risk ($B = .46$, $p < .0005$) and education ($B = .26$, $p < .0001$) had significant regression weights after controlling for the other variables. Experienced hazard, perceived benefit, gender, and ethnicity were not significant in the regression model.

A one-way between-groups multivariate analysis of variance (MANVOA) was used to explore issue salience differences between the five climate-change belief groups. The MAOVA analysis revealed there was a statistically significant difference in climate-change belief groups on the combined variables, $F(12, 336) = 3.36, p < .0005$; Wilks' Lambda = .74; partial eta squared = .10. The partial eta squared value indicated that 10% of the variance in issue salience was explained by the grouping variable of climate-change belief. The 10% of variance was considered to be a medium effect size. When the results for the issue salience variables were considered separately, perceived risk and perceived benefit were statistically significant and experienced hazard was not. Perceived risk was significant at $F(4, 129) = 7.08, p < .0005$, partial eta squared = .18. Perceived benefit was significant at $F(4, 129) = 4.29, p < .01$.

Overall, the regression model comparing agricultural producers issue salience and climate-change belief indicated issue salience explained 18% of the variance in climate-change belief. Perceived risk had a significant regression weight ($B = .47$), after controlling for other variables, indicating perceived risk had the greatest impact on climate-change belief. When demographic variables are added to the regression model, the variance explained by the model increased to 32%. Perceived risk and education were significant in the regression model, which indicated the variables had the most power in explaining climate-change belief. Significant differences in climate-change belief existed within education, political party, and gender.

In addressing RO2, the frames agricultural producers prefer in reference to climate change and impacts, a quasi-experimental design was used within the survey instrument. Respondents were randomly assigned to one of three question groups with gain, loss, or neutral framed climate and

weather impacts and events that may or may not impact the farming and/or ranching operation. Items in each frame group asked respondents to reply to eight questions testing distant (future) and near (current) frame impacts and four terms. The four terms examined were extreme weather, weather pattern, weather variability, and climate change.

Initial means and standard deviations were calculated for each frame manipulation for basic comparison. Within gain, loss, and neutral frames, loss frames had the highest mean score ($M = 2.73$, $SD = 0.42$). Gain frames had the second highest mean score ($M = 2.73$, $SD = 0.42$). Neutral frames had the lowest mean score ($M = 2.48$, $SD = 0.86$).

Means and standard deviations were also calculated for each term used within the frame manipulations. Weather pattern had the highest mean score ($M = 2.81$, $SD = 0.82$), followed by climate change ($M = 2.33$, $SD = 0.92$). Weather variability had the third lowest mean ($M = 2.21$, $SD = 0.91$). Extreme weather had the lowest mean ($M = 2.08$, $SD = 0.92$).

A one-way between-groups multivariate analysis of covariance (MANCOVA) was used to explore the impact of framing manipulations on climate-change belief. Three dependent variables were used: outcome (gain, loss, and neutral frames), distant (current and future), and terminology (extreme weather, weather pattern, weather variability, and climate change). The outcome frame assignment was used as the covariate. MANCOVA analysis revealed there was not a statistically significant difference between climate-change belief groups and the three dependent frame manipulations.

To explore the impact of gain, loss, and neutral frames on climate-change belief, an ANOVA analysis was used. The ANOVA revealed statistically significant differences for climate-change belief between gain, loss, neutral, and frame groups. There was a statistically significant difference at the $p < .05$ level in total score for the three framing treatment groups: $F(2, 135) = 3.57, p = .031$. The effect size, calculated by eta squared, was .07. The loss frame group ($M = 2.84, SD = 0.42$) differed significantly from the neutral frame ($M = 2.48, SD = 0.86$). There was not a significant difference between the gain and loss frame groups or the gain and neutral frame groups.

ANOVA analysis was conducted to explore the impact of near and distant frames on climate-change belief. The ANOVA did not produce significant differences between the two groups of respondents. Further ANOVA analysis to explore terminology framing and climate change also revealed there were not significant differences for the various terms. Analysis of message framing indicated loss frames differed significantly ($p < .05$) from neutral frames. Significant differences in distance and terminology framing were not found. Results suggest that loss framing had the largest impact on climate-change belief.

For RO3, preferred agricultural media sources, respondents were asked to identify which agricultural based media sources they used when seeking information about climate and climate change. Most producers ($n = 86, 61\%$) indicated they used regional agricultural publications for climate and climate-change information. University publications were used by 54% ($n = 76$) of the respondents. Radio broadcasts were used by 51% ($n = 72$) of respondents. Industry professional magazines were used by 50% ($n = 71$) of respondents. Slightly less than half ($n =$

59, 42%) of respondents used research publications. Commodity specific magazines were used by 39% ($n = 55$) of respondents. Commodity organization publications were used by 37% ($n = 53$) of survey respondents. Television broadcasts were used by 35% ($n = 50$) respondents. Agricultural expos and farm shows were used for climate and climate-change information by 30% ($n = 42$) respondents. Business reports were used the least ($n = 25$, 18%). Eight respondents indicated they did not use any of the listed agricultural publications for climate and climate-change information.

After identifying which media sources respondents preferred for information about climate and climate change, respondents were asked to identifying specific publications within each category. Within regional agricultural publications, *Kansas Farmer* ($n = 73$, 85%) and *High Plains Journal* ($n = 71$, 83%) were the publications the majority of respondents said they used. The K-State Research and Extension Bookstore ($n = 45$, 63%) and Extension fact sheets ($n = 36$, 50%) were the university publications used by the majority of respondents who indicated use of university publications. Radio was the third most preferred agricultural media source with the majority ($n = 49$, 68%) of respondents indicating they used KFRM 550 AM. Respondents indicated that the majority ($n = 50$, 70%), did not used any of the provided industry professional magazines which included: AgProfessionals.com ($n = 9$, 13%), Feedstuffs ($n = 8$, 11%), Bovine Veterinarian ($n = 4$, 6%), and BEEF Vet ($n = 3$, 4%). The most frequently used research publication was the USDA Agricultural Research Service ($n = 30$, 51%). Forty-one percent ($n = 24$) of respondents indicated they did not use any of the provided research publication. All other publications were used by less than ten (17%) respondents. Full results for the remaining media types can be found in Chapter Four.

Since researchers were interested in providing the most complete audience segment profile possible, respondents' climate-change belief scores were examined by the grouping variable of reported use of media type. Those who reported using business reports had the highest ($M = 3.68$, $SD = 0.99$) mean score for climate-change belief. Respondents that used television broadcasts for climate and climate-change information had the second highest mean score ($M = 3.46$, $SD = 0.91$). Research publication users had a mean of 3.41 ($SD = 1.05$), university publications ($M = 3.37$, $SD = 0.96$), industry profession magazines ($M = 3.37$, $SD = 0.90$), agricultural expos/farm shows ($M = 3.36$, $SD = 0.93$), commodity specific magazines ($M = 3.33$, $SD = 0.96$), radio broadcasts ($M = 3.25$, $SD = 0.96$), regional agriculture publications ($M = 3.25$, $SD = 1.02$), and commodity organization publications ($M = 3.19$, $SD = 1.00$). Those respondents that reported using none of the provided media types ($M = 2.38$, $SD = 0.92$) for information on climate and climate change had a mean score lower than 3.0.

Initial means and standard deviations were also calculated for issue salience variables. Television broadcast viewers had the highest mean ($M = 3.32$, $SD = 0.77$) for perceived risk of climate-change impacts. Respondents who reported using business reports had the highest mean ($M = 2.34$, $SD = 0.61$) for reported experienced climate-change related hazards. Television viewers also reported the highest mean ($M = 2.62$, $SD = 0.77$) for perceived benefits of climate-change impacts.

To further explore the mean differences for climate-change belief and issue salience variables, independent-samples t-tests were conducted to compare the mean scores for those who reported

using each media type, and those that did not. Several significant differences for users and non-users were found throughout the variables. A significant difference existed in climate-change belief for users ($M = 3.41$, $SD = 1.05$) and non-users ($M = 3.01$, $SD = 0.97$) of research publications: $t(132) = -2.25$, $p < .05$. A significant mean difference in climate-change belief also existed for users ($M = 3.37$, $SD = 0.90$) and non-users ($M = 2.98$, $SD = 1.40$) of industry professional magazines: $t(132) = -2.20$, $p < .05$. Climate-change belief means also had a statistically significant difference between users ($M = 3.68$, $SD = 0.99$) and non-users ($M = 3.07$, $SD = 1.0$) of business reports: $t(132) = -2.75$, $p < .01$. Users ($M = 3.37$, $SD = 0.96$) and non-users ($M = 2.95$, $SD = 1.05$) of university publications also differed significantly on climate-change belief: $t(132) = 2.36$, $p < .05$. Users ($M = 3.46$, $SD = 0.91$) and non-users ($M = 3.02$, $SD = 1.05$) of television broadcasts had statistically significant differences in climate-change belief: $t(132) = 2.44$, $p < .05$. Significant differences were also found in climate-change belief for overall users ($M = 3.24$, $SD = 1.0$) and non-users ($M = 2.38$, $SD = 0.91$) of provided media source types: $t(132) = 2.36$, $p < .05$.

Users ($M = 3.32$, $SD = 0.77$) and non-users ($M = 2.98$, $SD = 0.79$) of television broadcasts had statistically significant differences on perceived risk: $t(140) = -2.48$, $p < .05$. Statistically significant differences also existed in means for those who reported they used none of the provided media sources for climate and climate-change information, and those that did. Significant differences were found for users ($M = 3.13$, $SD = 0.78$) and non-users ($M = 2.51$, $SD = 0.77$) on perceived risk means: $t(140) = 2.19$, $p < .05$.

Analyses of bivariate correlations were conducted for preferred media type and climate-change belief. Significant correlations were found for research publications ($r = .19$), industry professional magazines ($r = .19$), business reports ($r = .23$), TV broadcasts ($r = .21$) and university publications ($r = .21$), all at the $p < .05$ level. A significant negative correlation was found to exist between climate-change belief and the non-use of provided media sources at the $p < .05$ level.

Regional agricultural publications were used by most ($n = 86$, 61%) of respondents when seeking climate and climate-change information. *Kansas Farmer* ($n = 73$, 85%) and *High Plains Journal* ($n = 71$, 83%) were the top two regional agricultural publications used by respondents.

Respondents who used business reports had the highest mean score ($M = 3.68$, $SD = 0.99$) for climate-change belief. Respondents that did not use any type of agricultural media for climate or climate-change information reported the lowest means score ($M = 2.38$, $SD = 0.92$) for climate-change belief.

In addressing H1, the prediction that agricultural producers will fall into the segment groups of the concerned and the cautious, the majority of respondents fell into the segment groups of the concerned ($n = 45$, 33%) and cautious ($n = 42$, 31.3%). The comparison of the two groups indicated the predicted hypothesis was true. The doubtful ($n = 30$, 22.4%) was also a group of considerable size in the analysis.

Discussion

Issue Salience Related and Climate-Change Belief of Respondents

A significant area of exploration in this study was the level of issue salience, or the perceived importance individuals place on an issue or subject (Niemi & Bartels, 1985). Issue salience was operationalized in this study as the combination of perceived risk, experienced hazard, and perceived benefit, in relation to climate and climate related impacts, which impact a farming and/or ranching operation. Individual producer's climate-change beliefs were also of interest to researchers.

Perceived Risk

In response to concern for perceived risk of climate related events, respondents indicated their summative average concern for all nine measures of perceived risk was 3.10 (SD = 0.78). The aggregate mean for perceived risk of 3.10 indicates that respondents have a level of concern slightly above the somewhat concerned level. The highest level of concern for perceived risk factors was for longer dry periods and drought ($M = 4.06$, $SD 1.04$). A mean of 4.06 indicated respondents were slightly more than moderately concerned. Drought and longer dry periods has been a significant issue in the Southern Plains and is expected to occur more frequently in the future (Shafer et al., 2014). Since producers have experienced drought and longer dry periods most frequently, it stands to reason they would report it as the highest level of concerned risk. Expected impacts of climate change in the Southern Plains include a higher frequency of days over 100°F and nights with minimum temperatures higher than 80°F (Kunkel et al., 2013). Surface water loss, heat stress on animals and crops, and overwintering insect populations as a result of increasing annual temperatures and significant heat waves will have a significant

negative impact on agriculture (Kunkel et al., 2013). Increases in extreme heat will have far more negative impact on agriculture in the Southern Plains than benefits, partially explaining why perceived risk is highest for drought and longer dry periods.

The lowest perceived risk was for increased flooding ($M = 2.24$, $SD = 1.21$), indicating that respondents were slightly concerned. More intense rainfall and flooding events are expected for the Southern Plains (Shafer et al., 2014). Low perceived risk for increased flooding suggests that producers have not seen or experienced the negative impacts of flooding on their operations or flooding has had minimal or normal impact. Flooding, unlike drought, may impact isolated aspects of an agricultural operation.

Perceived risk had the highest mean score of all the issue salience variables. Perceived risk plays a large role in producer willingness to implement and accept adaption and mitigation practices in relationship to climate change (Arbuckle et al., 2013a). Leiserowitz (2005) explained risk perceptions are socially constructed, with varying communities predisposed to fear and social amplification of some risks, while ignoring, discounting or attenuating other risk. The variation in perceived risk is evident within the survey population.

Experienced Hazard

Respondents indicated their average experienced hazard was 2.22 ($SD = 0.55$). Experienced hazard was the lowest mean score of issue salience variables, indicating that producers had perceived minor to moderate effect on their productions. Significant drought ($M = 3.73$, $SD = 0.97$) was the experienced hazard with the reported highest impact, with an impact between

moderate and major. Knowing that producers highest level of perceived risk is for drought and longer dry periods ($M = 4.06$, $SD = 1.04$), it was expected for drought to also be their highest level of experienced hazard. The low mean for experienced hazard may be related to the perception of risk held by producers. Previous studies found Americans tend to believe the impacts of climate change will have moderate severity and most likely impact people in geographically different regions and at other times (Leiserowitz, 2005). A similar trend of thought could be present among agricultural producers who perceive climate hazards as an expected occurrence in their operations or who perceive other regions of the United States, or world, as experiencing more hazards through portrayal in the media.

Individuals that perceive a relatively high likelihood of negative events are more likely to take personal mitigation actions and support government initiatives to do the same (O'Connor et al., 1999). Many producers are already making changes within their agricultural production practices in response to current weather conditions (Campbell Hibbs et al., 2014). Producers have made changes in farming and livestock production to adapt to changing weather and weather variability (Arbuckle et al., 2013a, 2013b; Campbell Hibbs et al., 2014). Adaption to current changing weather and weather variability may be lowering producer's level of perceived experienced hazards since they view the hazard as manageable and of lower risk to their operations. The variation in type of hazard and agricultural operations may contribute to low experienced hazard. Three of the hazard ratings involved flooding, saturated soils, or ponding of water. Ranching or feedlot operations may not experience those hazards. Another possible explanation for overall low experienced hazard is the significant drought that occurred within recent years in the study area.

Perceived Benefit

The aggregate perceived benefit of climate related events in the last five years was 2.48 ($SD = 0.84$), indicating producers experienced minor to some benefit. All measures for perceived benefits fell in the range of minor benefit to some benefit. This is a reasonable finding for the study since experienced hazard had the lowest mean score for issue salience variables. Producers may view changes in climate as beneficial, instead of a hazard, explaining the difference in aggregate scores.

Increased options in crop variety had the highest mean score ($M = 2.99$, $SD = 1.24$). While shifts in favorable climatic conditions have been reported in maize and soybean production for the Northern Plains (Hatfield, 2013), it is possible that producers in Kansas are experiencing some of the same opportunities. It is also likely that seed companies are producing a wider variety of hybrid seed options in reaction to drought conditions, allowing producers wider options in crop selection.

Longer pasture season received the lowest mean score ($M = 2.19$, $SD = 1.14$) for perceived benefit in the study. The low mean score could be explained by the significant drought event and the negative effects on native grasses used for cattle grazing in recent years (Raz-Yaseef & Billesbach, 2015). The drought event in the Southern Plains created a shortage of forage for livestock and had negative impacts on feed yards. Negative impacts of drought may explain the low perceived benefit of longer pasture seasons.

Climate-Change Belief

Respondents indicated a wide range of climate-change beliefs. Most respondents ($n = 45$, 33.6%) indicated they believed climate change has occurred and was caused more or less equally by natural changes in the environment and human activities. A smaller portion of the population ($n = 42$, 31.3%) believed that climate change has occurred, and is caused mostly by natural changes in the environment. Other respondents ($n = 30$, 22.4%) indicated they believed there is not sufficient evidence to know with certainty whether climate change is occurring or not. The smallest section of respondents ($n = 6$, 4.5%) believed climate change was not occurring. The mean response for respondent climate-change belief was 3.19 ($SD = 1.02$), indicating that most respondents believed the climate was changing, and was caused by mostly natural changes in the environment.

The variation of climate-change belief in this study marked a shift in belief from previous research. The varied belief in climate change and the causes is a direct contradiction from the scientific majority that agrees climate change is happening (Cook et al., 2013), and is caused by anthropogenic actions (USGCRP, 2009). A small portion of respondents in this survey ($n = 11$, 8.2%) believed climate change was occurring, and was caused mostly by human activities. The variations of climate-change belief and its causes by agricultural producers in this study mirror the beliefs of the general public of the United States, who do not fully understand the causes and impacts of climate change (Ding et al., 2011; Maibach et al., 2009; Weber & Stern, 2011). Variation in perceived risk, experienced hazard, and perceived benefit within the study may partially explain the variation in climate-change belief. If producers did not perceive the impacts of climate change, they may be less likely to believe climate change is occurring.

Agenda setting and organized climate-change denial may also explain the variation in climate-change belief among respondents. Even though most experts agree that carbon dioxide emissions and other greenhouse gases are causing ACC, public concern for the issue has been declining (Lewandowsky et al., 2012). Decline in public concern, and climate-change belief in the study, may be a result of media coverage through agenda setting. Environmental issues are more open to media influence because individuals do not experience the impacts of environmental issues on a daily basis (Soroka, 2002). Furthermore, environmental issues are often covered in cycles (Shih et al., 2008) which may help to explain the increase in climate-change belief. It is possible at the time the survey was sent to producers, the coverage cycle for climate change may have been at a peak, increasing climate-change belief among respondents.

Declining interest and belief in climate change in the study can be partially explained through the creation of doubt by political and vested interests, which often challenge the existence of scientific consensus in climate change (Lewandowsky et al., 2012). Weber and Stern (2011) also found that the issue of climate change and global warming is highly contested in the United States, with various actors in private industry and politics seeking to frame the issue and public response in a way that favors their interests. Vested interests that frame the issue of climate change include the agricultural and fossil fuel industries. The fossil fuel industry often depicts the scientific consensus that climate change is occurring as controversial and theoretical. This industry continually presents ideas that proposals for government regulations to mitigate climate change would only result in economic restrictions that would hurt the U.S. economy (Dispensa & Brulle, 2003). Since financial success of agricultural operations is highly dependent upon the

fossil fuel industry, it stands to reason that producers in the study would be influenced by the agenda setting efforts of the industry.

Agricultural producers in the study were also subject to the overwhelming amount of media coverage on many topics. Brechin and Freeman (2004) partially attribute the inability of the public to focus on environmental issues due to the supremacy of media coverage to other specific political issues. The timing of the survey amongst a presidential election year, increased reporting of terrorism and terrorist attacks, and continued U.S. military involvement in the Middle East may have resulted in a lessening of coverage for environmental and climate-change issues. It has also been suggested that the corporate influence, ownership and interests in the American media influence the amount of coverage given to news stories covering climate change and global warming (Dispensa & Brulle, 2003). Media controllers in the United States have ties to industries, such as the fossil fuel industry, that rely on the lack of regulations in their industries to profit and therefore present information to the public that undermines the scientific consensus that climate change is occurring because of human causes (Dispensa & Brulle, 2003).

Relationship of Issue Salience to Climate-Change Belief

All issue salience variables were correlated to climate-change belief. The regression analysis of issue salience variables together predicted 18% of the variance in climate-change belief and causes. As issue salience increased, belief in climate change and the impact of human actions on the existence of climate change increased. Within the regression model, only perceived risk had a significant regression weight, after controlling for other variables in the model. This indicates that perceived risk is the largest predictor of climate-change belief. A higher level of perceived

risk could be explained by the adaptations that producers are already making in response to weather conditions (Campbell Hibbs et al., 2014). Current actions may be considered a normal part of agricultural production, however, the risk of future impacts is still unknown and prompts producers to support adaptive actions (Arbuckle et al., 2013).

The findings in relationship of issue salience and climate-change belief support previous research by Gordon et al. (2013), which found that agricultural producers do not need to understand the underlying causes or sources of risk, in this study experienced hazards and benefits, to make management decisions in adaptation actions on their operations. Erbring et al. (1980) stated that an issue must be salient before it can become the subject of attitudes. Like the findings of Gordon et al. (2013), the study findings contradict the position that an issue must be salient before it becomes the subject of attitudes.

Variations in perceived risk, experienced hazard, and perceived benefit (issue salience variables) also influence the level of climate-change belief because individuals in the survey experience each in different ways and at different intervals. Soroka (2002) explained that individuals are more open to media influence on environmental issues because they do not experience the impacts on a daily basis. Agricultural operations, and the operators, may experience the impacts of climate change in cyclical patterns that align with patterns in the operations, lessening their belief in climate change.

Audience Segmentation Impacts in Climate-Change Belief and Issue Salience

There is a growing interest in the application of audience segmentation and social marketing within climate-change communication (Hine et al., 2014). Audience segmentation studies have been conducted on the national level to examine difference in climate-change belief and the causes (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Maibach et al., 2009). The interest in studying agricultural producers as an audience segment of the larger United States population has carried over into strategies for promoting adaptation and mitigation.

Demographic information was collected in this study to further describe the impacts of audience segmentation in climate-change communication. Demographic differences were compared against climate-change belief to explore the differences. ANOVA analysis was used to determine if there were statistically significant differences between groups. Statistically significant differences in groups were found for education, political party, and gender. Previous studies have indicated that education, political party, and ethnicity all have impacts on climate-change belief (Dunlap & McCright, 2008; Hamilton et al., 2007; Nisbet & Myers, 2007; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Maibach et al., 2009).

This study found that education level did have significant mean differences for belief in climate and was considered to be a medium (.13) level effect. This is in line with the findings of Maibach et al. (2009) which found that those who were college educated were very certain that climate change was happening. Respondents with a bachelor's, master's, or doctoral degree were most likely to believe that climate change was occurring and impacted by human actions. An increase

in climate-change belief level as education level increased may be a result of exposure to scientific information that supports the acceptance of climate change. Likewise, a lower education level was associated with a lower climate-change belief within the study. Leiserowitz et al. (2013) identified those disengaged with climate change as having given the issue little to no thought and having little knowledge about it. The disengaged also tend to have the lowest education levels (Leiserowitz et al., 2013). The findings of this study support previous research identifying an increased belief in ACC as education level increased.

Self-identified political party was considered to have a large (.14) effect on climate-change belief. The majority ($n = 95, 73.6$) of respondents identified themselves as Republicans. Affiliation with the Republican political party has been linked to lower belief and uncertainty in ACC (Leiserowitz et al., 2013). A widening gap in views on climate change between republican and democratic political elites, party leaders, and political pundits, has occurred (Dunlap & McCright, 2008). Even with increased coverage of climate change in the mass media, republicans have become less likely over the last decade to believe climate change is already occurring, unlike democrats who are more likely to believe (Dunlap & McCright, 2008). This study also found that Democrats were more likely to believe that climate change was occurring and caused by human impacts than Republicans. However, this was a slightly different finding than previous research which found that Democrats were more likely to believe in climate change overall, not a difference in the causes. This finding suggests that agricultural producers are becoming more open to the acceptance that climate change is occurring, but differences in the causes may still exist. Those who identified themselves as having an “other” ($M = 2.40, SD = 1.17$) or not party affiliation ($M = 1.67, SD = 0.56$) had the lowest mean scores for belief,

indicating they believed climate change is not occurring or there is not sufficient evidence to determine with certainty whether climate change is happening or not. By not affiliating with any party or having an interest in politics, those respondents may be removing themselves from the effects of agenda setting completely, and have very low issue salience or knowledge of climate change resulting in lower levels of beliefs.

Gender had a statistically significant medium (.09) effect on climate-change belief. However, the difference between males and females in climate-change belief was not as strong as in other studies. Leiserowitz et al. (2013) found that women were more likely to believe in climate change than men and were also more likely to be Democrats. In this study, women and men have similar beliefs about climate change. This may be a result of considering agricultural producers as the audience segment instead of males and females on a larger scale.

Expanding the Regression Model for Climate-Change Belief

Since demographic variables were found to have significant difference in climate-change belief, a regression model was calculated. The multiple regression model with all independent variables included resulted in $R^2 = .38$, $F(3, 123) = 7.06$, $p < .0005$. The multiple regression model, with all three predictors, explains 38% of the variance in climate-change belief. Education had a significant regression weight ($B = .06$, $p < .001$), after controlling for gender and ethnicity. The findings indicated that education is the most significant factor in predicting climate-change belief and that as education increases, climate-change belief and attribution to human impacts also increases. Education was also significant factor in climate-change belief in the Six Americas audience segmentation study (Leiserowitz et al., 2013) which found that those individuals who

were college educated believed that climate change was occurring and were more likely to believe in anthropogenic causes. In the same study (Leiserowitz et al., 2013), the audience segment that did not believe in climate change or denied its existence held only a high school education. Education may be the strongest predictor of climate-change belief because of the homogeneity of Kansas agricultural producers as an audience segment. Most producers in the survey indicated they are Republican and Caucasian, lessening the statistical significance of these values in the regression model.

Seeing the significance of issue salience and demographic variables, researchers were interested in further exploring the relationship. Significantly correlated issue salience and demographic variables were entered into a regression model to explore the impact on climate-change belief. The multiple regression model, with all predictors of issue salience and demographic variables, explains 32% of the variance in climate-change belief. Perceived risk ($B = .46, p < .0005$) and education ($B = .26, p < .0001$) had significant regression weights after controlling for the other variables. Experienced hazard, perceived benefit, gender, and ethnicity were not significant in the regression model. Perceived risk has the most explanatory power in the model, and has the largest impact on climate-change belief. The results of the model indicate that as perceived risk and education level increase, climate-change belief also increases. The predictive power of perceived risk and education in the expanded regression model support the findings of the previous regression models in the study. Education level likely increases respondents understanding and ability to predict possible risk on their agricultural operations.

Comparing Climate-Change Belief Groups

The mean differences in issue salience between the five climate-change belief segments were compared through MANOVA analysis. Results indicated there were significant differences in issue salience for each group on the combined variables. When the results for the issue salience variables were considered separately, perceived risk and perceived benefit were statistically significant and experienced hazard was not. This indicates that the level of issue salience is related to the climate-change belief group each individual identifies themselves as believing. Climate-change belief groups may report different levels of issue salience based on their personal experience with climate-impacts and perceptions. This study suggests that perceptions of risk and benefit have a significant impact on climate-change belief, while experienced hazards do not.

Correlations between variables in the regression model were examined to describe the relationship between independent variables. Education and perceived benefits were negatively correlated, which indicated that as an individual became more educated, they saw fewer benefits in the impacts of climate change. Higher levels of education were identified a predictor of increased belief in climate change in the regression model. When both variables were considered together, the findings aligned with previous literature which stated that acceptance of climate change increase with higher education levels (Leiserowitz et al., 2013) Perceived benefit was negatively correlated with perceived risk, which indicated producers that held lower perceptions of benefit had higher levels of risk. Perceived risk was also negatively correlated with experienced hazard. This phenomenon likely occurred because producers that had experienced

climate and weather hazards then perceived them as part of the routine aspects of running their operations, lowering their perception of risk.

Preferred Frames in Climate-Change Communication

Spence and Pidgeon (2010) found the way in which communications about climate change are framed has a considerable impact on the way the messages are received. Communication and framing of risk to influence behavior change has been thoroughly studied in relation to personal health, policy, and other academic fields. This study contributes to the exploration of frames agricultural producers prefer in reference to climate change and impacts, a quasi-experimental design was used within the survey instrument. Respondents were randomly assigned to one of three question groups with gain, loss, or neutral framed climate and weather impacts and events that may or may not impact the farming and/or ranching operation. Items in each frame group asked respondents to reply to eight questions testing distant (future) and near (current) frame impacts and four terms.

Within gain, loss, and neutral frames, loss frames had the highest mean score ($M = 2.84$, $SD = 0.63$). Gain frames had the second highest mean score ($M = 2.73$, $SD = 0.42$). Neutral frames had the lowest mean score ($M = 2.48$, $SD = 0.86$). Comparisons of the means for each frame manipulation suggest that respondents agreed to neither agreed or disagreed for loss frames. To explore the differences in means of gain, loss, and neutral frames in relations climate-change belief, an ANOVA analysis was used. The ANOVA revealed statistically significant differences for climate-change belief between gain, loss, and neutral frame groups. There was a statistically significant difference at the $p < .05$ level in total score for the three framing treatment groups:

$F(2, 135) = 3.57, p = .031$. The effect size, calculated by eta squared, was .07. The loss frame group ($M = 2.84, SD = 0.42$) differed significantly from the neutral frame ($M = 2.48, SD = 0.86$). There was not a significant difference between the gain and loss frame groups or the gain and neutral frame groups. The findings of this survey contradict the findings of Spence and Pidgeon (2010) who suggest that gain frames, not loss frames, will be the most effective in promoting positive attitudes towards climate-change adaptation and mitigation. However, the finding that loss frames had the highest mean and were significantly different from neutral framed messages aligns with the finding that perceived risk is the strongest predictor of climate-change belief.

Distant and near frames were compared between respondents. Each respondent to the survey responded to four questions framed with future (distant) impacts and four questions framed with currently occurring (near) impacts. Distant frames had a mean of 2.66 ($n = 138, SD = 0.68$). Near frames had a mean of 2.76 ($n = 136, SD = 0.75$). ANOVA analysis revealed that there were not statistically significant differences between frame groups and their reported belief in climate change. The findings suggest that distance frames do not impact climate-change belief. Distance frames may not impact this audience segment because of the nature of agricultural production focusing on current impacts of climate and weather. Agricultural producers can do little to control weather and climate impacts in the future, so future oriented messages may have little impact on their perceptions.

The four terms examined were extreme weather, weather pattern, weather variability, and climate change. Means and standard deviations were also calculated for each term used within the frame manipulations. Weather pattern had the highest mean score ($M = 2.81, SD = 0.82$),

followed by climate change ($M = 2.33$, $SD = 0.92$). Weather variability had the third lowest mean ($M = 2.21$, $SD = 0.91$). Extreme weather had the lowest mean ($M = 2.08$, $SD = 0.92$). Even though there were differences in the mean score for each term, ANOVA analysis revealed there were no statistically significant differences for each term and climate-change belief.

Previous studies revealed significantly different recognition of the terms climate change and global warming (Whitmarsh, 2009). The variation of meaning and favorability of words associated with climate change, the acknowledged risks, and acceptance of adaptation and mitigation practices, can be partially explained by the differences in experiences, backgrounds, and communications using words in climate change as well as different frames individuals have developed over time (Hertog & Mcleod, 2001). The findings of this study suggest that over time a shift has occurred in the understanding and preference for terms as the public becomes more accepting of climate change. A shift in the perception and acceptance of climate change since the Whitmarsh (2009) study may have occurred, increasing the understanding and perception of climate change. Continued and increased exposure to media messages about climate change may have increased the level of issue salience for agricultural producers related to climate change. The continuation of the presidential agenda to address climate change (The White House, 2013) and continued coverage of impacts may have lessened resistance to terminology. The establishment of the Southern Plains Regional Climate Hub (SPRCH) by the USDA may have also increased the level of issue salience in climate change. SPRCH was established to deliver science-based knowledge and practical information to farmers, ranchers, and forestry landowners to help them adapt to climate change and weather variability in Kansas, Oklahoma, and Texas (USDA Climate Hubs, 2015).

To examine the full impact of framing manipulation on climate-change belief, a MANCOVA was used to explore the impact of framing manipulations on climate change belief. Three dependent variables were used: outcome (gain, loss, and neutral frames), distant (current and future), and terminology (extreme weather, weather pattern, weather variability, and climate change). The outcome frame assignment was used as the covariate. MANCOVA analysis revealed there was not a statistically significant difference between climate-change belief groups and the three dependent frame manipulations.

This study demonstrates that the framing of climate-change messaging may be less important in the formation of climate-change belief attitudes. The lack of statistically significant findings that differ from previous research in framing and communication of risk information may be a result of several variables. As audience segments become more homogenous in their climate-change belief (Leiserowitz et al., 2013), significant variations in framing may become less severe. Significant mean differences in loss and neutral framed information, suggests agricultural producers have the strongest reaction to impacts that can negatively impact their operations. Negative impact framing may have the largest influence on producers because of their dependency on operational success for their livelihoods and continued way of life. The finding in this study that perceived risk has the highest impact on climate-change belief also supports this position.

Preferred Agricultural Media Sources

Respondents were asked to identify which agricultural based media sources they used when seeking information about climate and climate change. Most producers ($n = 86$, 61%) indicated they used regional agriculture publications for climate and climate-change information.

University publications were used by 54% ($n = 76$) of the respondents. Radio broadcasts were used by 51% ($n = 72$) of respondents. This is a shift from the previous research in the Six America's (Leiserowitz et al., 2013), which found that most respondents in the demographic audience segment of the study population would cite radio as their first source for news and information.

The difference in preferred media source between the Leiserowitz et al. (2013) study and this study may be due to a difference in population; specifically, that this study focused solely on agricultural producers in Kansas. Availability of agricultural radio programming as a source of information for climate and climate change related topics may also influence the ability of producers to access radio as a source of information. The findings of this study align with publication usage described by the American Business Media Agri Channel (2012) which found that agricultural magazines or newspapers were used most frequently.

The study provided valuable insights into the specific media sources agricultural producers are using. Within regional agricultural publications, *Kansas Farmer* ($n = 73$, 85%) and *High Plains Journal* ($n = 71$, 83%) were the publications the majority of respondents said they used. This may be a result of the availability of the publication, quality of writing, or the trust level associated with the publications. The K-State Research and Extension Bookstore ($n = 45$, 63%)

and Extension fact sheets ($n = 36$, 50%) were the university publications used by the majority of respondents who indicated use of university publications. Like regional publications, the availability, ease of accessing Extension materials, and trust in the source may contribute to their use. The magnitude of agricultural based materials produced by Extension would encourage use among the audience segment. Radio was the third most preferred agricultural media source with the majority ($n = 49$, 68%) of respondents indicating they used KFRM 550 AM. While radio was not cited as the top media source for agricultural producers seeking information on climate and climate change, it is still a popular resource among producers (American Business Media Agri Channel, 2012).

This study also contributed to the audience segment profile of media use and climate-change belief. Those respondents who reported using business reports and television broadcasts for their source of information about climate change, had the highest mean score for belief and causes of climate change. The high mean scores indicate these producers believe climate change is occurring, and is caused by mostly natural changes in the environment, but many may also believe, or are starting to believe, that human impacts can impact climate change. Respondents who used business reports are likely to be more concerned about the profit and success of their operations. Seeing the fluctuations in agricultural markets, based on climate change related events, may increase their belief in climate change. Similarly, those who consume or are exposed to more media messages through television broadcasts are more likely to become subject to the effects of agenda setting on climate-change topics and belief.

It is important to note that respondents who indicated using any media source had aggregate mean scores that indicated they believed climate change was occurring. Only those producers who said they did not use any media source for climate and/or climate-change information reported mean scores which indicated they believed there is not sufficient evidence to know with certainty whether or not climate change is occurring. The differences in climate-change belief can be partially explained through agenda-setting theory which states the first, or initial, level of agenda setting focuses on relative salience, or perceived importance, of objects (McCombs, 2005). When the media and individuals discuss and think about an object, in this case climate change, some attributes are emphasized, while others are rarely mentioned, and the object becomes a subject of attitudes. If agricultural producers are not interacting with media sources that discuss climate change, then it is less likely they will place relative importance on the object.

The study further added to the audience segment profile and preferred media source knowledge by exploring the levels of issue salience by reported use of media type. Television broadcast viewers had the highest mean score for perceived risk and perceived benefits of climate-change impacts. This could be a result of the highly polarized nature of television in support, or against climate change. Respondents who reported using business reports had the highest mean for reported experienced climate-change related hazards. It stands to reason that producers who are using business reports in their operation are closely studying the yields and profit of their operations. Experienced hazards that impact their bottom lines are more likely to be observed by this group.

Several significant differences for users and non-users of agricultural media sources were found throughout the variables in the study. A significant difference existed in climate-change belief for users and non-users of research publications, industry professional magazines, business reports, university publications, and television broadcasts. This is likely a result of the reflection of opinions held by the media sources surfacing within the consumers through the process of agenda setting (McCombs, 2004). Those respondents that use media sources are more likely to believe in climate change because they consume media that supports the belief. Within all media types, those that reported using the media had higher mean belief scores in climate change, which also represents a higher belief that the human actions are contributing to the impacts. Significant differences were also found in climate-change belief for overall users and non-users of provided agricultural media source types. Additionally, analyses of bivariate correlations were conducted for preferred media type and climate-change belief. Significant correlations were found for research publications (.19), industry professional magazines (.19), business reports (.23), TV broadcasts (.21) and university publications (.21), all at the $p < .05$ level. This finding indicates that as use of these media sources increases, belief in climate change also increases. Individuals that do not consume any type of media for information on climate and climate change, are probably predisposed to doubt the existence of climate change, and therefore do not seek out information on the topic. This finding supports previous research which stated agricultural producers who expressed higher levels of trust in agricultural interests and publications were less likely to believe in or accept climate change, especially in the case of anthropogenic causes (Arbuckle et al., 2013b).

A significant, negative correlation was found to exist between climate-change belief and the non-use of provided media sources at the $p < .05$ level, indicating that not using media sources decreases climate-change belief. Like use of media sources increased climate-change belief, non-use decreases climate-change belief. Producers who do not believe in climate change are less likely to seek out information about it. Without consuming media with messages related to climate change, the effects of agenda setting do not occur and climate-change belief decreases. Since respondents were asked specifically to identify which media sources they used for climate and climate change information, the question wording may have contributed to the significant results. However, it stands to reason those who did not believe in climate change would not be seeking information on the topic.

Audience Segment Comparison to the Six America's

Through the literature review process it was hypothesized that agricultural producers would fall into the segment group of concerned and cautious, the majority of respondents fall into the segment groups of the concerned ($n = 45, 33\%$) and cautious ($n = 42, 31.3\%$). The comparison of the two groups indicated that the predicted hypothesis was true. The doubtful ($n = 30, 22.4\%$) were also a group of considerable size in the analysis. This aligns with the findings of previous research which analyzed climate-change belief on a national scale (Leiserowitz et al., 2013).

Respondents in the concerned and cautious groups are likely to believe climate change is occurring, but do not attribute the causes to human actions. They are also opposed to mitigation actions and opposed to increased government involvement or regulation. Arbuckle et al. (2013) found similar beliefs in the study of farmers in the Corn Belt. Overall, beliefs and reactions to

adaptation and mitigation strategies are a result of individual combined issue salience and the effects of agenda setting.

Recommendations

Practitioners

The findings in relation to RO1, “describe the level of issue salience agricultural producers have related to climate change,” resulted in several recommendations for practitioners. When discussing climate change impacts and encouraging adaptation, practitioners should focus on messages related to perceived risks. Perceived risks had the highest aggregate mean score and also had statistical significance in the multiple regression model, indicating that it is the largest predictor of climate-change belief.

Variations in climate-change belief and issue salience suggest that a producer’s understanding of the underlying causes of climate change is less important than their perceived risk and adaptation options. Instead of trying to educate producers on the causes of climate change to reach adaptation, communicators should focus adaptation to current risks. However, the regression model indicated that education level was also an indicator of climate-change belief. When addressing audiences with higher education levels, it may be appropriate to focus on underlying causes of climate change and mitigation options, instead of just focusing on adaptation options. Other variations in demographic variables should also be considered when communicating climate-change information. Democratic audiences are more likely to believe in climate change and the impacts humans have on accelerating the effects. Republicans are more likely to attribute climate change to a mixture of natural and human causes. And those that are not interested in

politics are most likely to believe that climate change is not occurring. Ultimately, communicators must be highly aware of the audience they are addressing.

The findings related to RO2, “Investigate frames agricultural producers prefer in reference to the scientifically designated phenomena of climate change and impacts,” resulted in several recommendations for practitioners. Loss frames were found to have the largest impact on climate-change belief. Communicators should focus on the possibility of losses within agricultural production based on the perception of risk. By encouraging adaptation options to prepare for the possibility of loss, communicators are likely to reach producers. Findings in the study indicate that distance and terminology framing were not important in relation to climate-change beliefs. The results suggest that communicators should develop messaging that encompasses both current and future impacts since there were not significant differences between distance frames. Findings in the study also suggest that communicators should not be hesitant to talk about climate change in conjunction with potential impacts and adaptation options. However, communicators should be mindful of the audience they are addressing since climate-change belief and belief in the human impacts on accelerating climate-change belief are still varied among producers in Kansas.

Findings from RO3, “identify the agricultural media and information channels agricultural producers use for climate change,” resulted in several recommendations. When attempting to reach a specific audience segment, it is crucial for communication practitioners to know which media sources that segment is using. This study found that regional agricultural publications, university publications, and radio were the three most frequently reported for use in climate and

climate-change information. Based on this finding, practitioners should continue placing messaging about climate change in these publications to reach their desired audience. They should also utilize university publications, including the K-State Research and Extension Bookstore and fact sheets, to share information with their audiences. Communicators should also utilize these sources for information to use in their own communication efforts.

Communicators should target audiences who reported lowest means for climate-change belief. The two lowest groups include commodity organization publications and those who used none of the listed agricultural publications. Commodity organizations stand to make large contributions to willingness of their constituents to embrace adaptive measures and should utilize their existing communication lines to promote climate-information and adaptation strategies. Additional effort will be required to reach audiences that report not using any type of media for climate and climate-change information.

The findings of the study suggest that practitioners should use agricultural sources and agricultural press to improve understanding and acceptance of climate-change research and policy. Research publications, industry professional magazines, business reports, university publications, and television broadcasts are reported to have the highest level of belief in climate change for users. Other media sources that reported lower levels of belief in climate change should be targeted to improve belief and acceptance of climate change within those audiences.

Research

Findings in issue salience and climate-change belief indicate that issue salience may not be as important in developing attitudes towards objects and subjects (Erbring et al., 1980). Future research should focus on the exploration of issue salience and whether or not it is truly a significant factor in the development of attitudes related to climate change. Additional research should explore whether or not issue salience is needed to form attitudes in other areas of complex scientific information, or only climate change. Research should also explore the impacts of gain and loss, distance, and terminology framing within topics of complex scientific nature. Possible areas of research include producer willingness to adapt genetic science, hybrid science, computer technology, and other complex scientific topics that have potential to impact agricultural production.

The findings of this survey contradict the findings of Spence and Pidgeon (2010) who suggest that gain frames, not loss frames, will be the most effective in promoting positive attitudes towards climate-change adaptation and mitigation. However, the finding that loss frames had the highest mean and were significantly different from neutral framed messages aligns with the finding that perceived risk is the strongest predictor of climate-change belief. Loss aversion theory is also supported in the study, which says that individuals tended to dislike losses more than equal gains and were more likely to take risks when information highlighted the possibility of losses as opposed to gains (Kahnem & Tversky, 1984). Shome et al. (2009) also suggest that people have a tendency to avoid loss, rather than seek a possible gain in regards to climate change. Future research should examine the impact of gain and loss frames in relation to the attitudes agricultural producers have towards adaptive and mitigative actions. Since terminology

was not found to have a significant impact in this study, other terms should be explored in future framing studies. Future studies should also explore the impact of framing on other complex scientific topics in agriculture.

A small portion of respondents indicated they did not use any agricultural media source for information in climate and climate change. Research should be conducted to explore which media source these producers are using. It would be of additional interest to explore the motivations for non-use of agricultural media sources. Future research should explore how to reach audiences that identified themselves as non-users of agricultural media sources for climate and climate-change information. It is possible that this segment of the audience is simply not seeking information on climate change. Respondents also indicated a sizeable portion were using other industry professional magazines other than the ones provided within the survey options. Research should be conducted to identify those sources.

The study further added to the audience segment profile and preferred media source knowledge by exploring the levels of issue salience by reported used of media type. To explore the impact of media source on issue salience, the type and attitude of information presented within each media source should be explored. Specific messages should also be tested in future research based on the findings in this study. This study did not specify whether or not the media source was delivered through traditional or through electronic mediums. Future research should explore the impact of electronic and social-media information on issue salience and climate-change belief.

The study should also be repeated with different segments of agricultural producers. Other regional segments should be explored since this study focused on respondents in Kansas. Type of agricultural production could also be explored within organic production and other types of “natural” agriculture. Results of the study indicated the benefit scale developed to examine the perceived level of benefits in climate change was valid. The Cronbach’s Alpha reliability for the scale was found to have high reliability rating at .74. Future studies should continue to test the validity of the scale and expand it to further examine possible perceived benefits of climate change.

Theory

This study made contributions to theory in several ways. Findings in issue salience and climate-change belief indicate that issue salience may not be as important in developing attitudes towards objects and subjects. Issue salience was stressed as an important aspect of forming attitudes in Erbring et al. (1980).

There is a lack of empirical evidence about the most effective strategies for communicating and presenting climate-change risks and adaptation and mitigation options, and whether or not theories developed in other risk domains are transferrable to climate-change issues (Pelletier & Sharp, 2008). This study contributed to the body of empirical evidence about communication strategies for presenting climate-change information to agricultural producers. The study also indicates that some tactics of the theory of agenda setting did not work with the topic and audience of agricultural producers.

The differences in climate-change belief within the study can be partially explained through agenda-setting theory which states the first, or initial, level of agenda setting focuses on relative salience, or perceived importance, of objects (McCombs, 2005). When the media and individuals discuss and think about an object, some attributes are emphasized, while others are rarely mentioned, and the object becomes a subject of attitudes. If agricultural producers are not interacting with media sources that discuss climate change, then it is less likely that they will place relative importance on the object. This finding supports the ideals of agenda-setting theory and contributes to the existing body of research.

The study also contributed to agenda-setting theory in the media sources that should be used to reach the audience segment. The findings of Arbuckle et al. (2013) indicated trust in agricultural sources and agricultural press could be used to improve understanding and acceptance of climate-change. The findings in this study support previous research and confirm that readership of agricultural media sources for information on climate and climate-change information increase belief in climate change and anthropogenic causes. Findings in the study indicated that the effects of agenda setting do have an effect on climate-change belief with this audience. Those respondents that sought out information and media sources were more likely to be impacted by the messages they consumed.

Summary

Communicators and educators have been tasked with delivering science-based information on climate change to agricultural producers. However, agricultural producers in the Midwest and Southern Plains still have widely varied perceptions of climate change and tend to doubt the existence (Dunlap & McCright, 2008; Hamilton et al., 2007; Nisbet & Myers, 2007).

Agricultural producers that perceive climate change to be a risk with negative impacts are more likely to embrace adaptive actions (Arbuckle et al., 2013b; Howden et al., 2007). Audience segmentation and trust in media sources, have been suggested to impact agricultural producers perception of climate change and are possible avenues for strategic communication (Arbuckle et al., 2013).

A review of communication and scientific literature suggested that communicators could benefit from applying agenda setting theory, framing theory, and audience segmentation as a part of communication strategy. Although other studies have provided insights into the application of agenda setting, framing and audience segmentation, few have combined the tenants of each or focused specifically on agricultural producers in the Southern Plains. The purpose of this study was to explore the frames and messages, issue salience, and communication preferences agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts of a changing climate. It was of additional interest to explore the climate-change beliefs and preferred agricultural media sources for climate and climate-change information.

The study found that perceived risk and education level had significant impacts on climate-change belief. Additionally, mean scores for climate-change belief in the study indicated most respondent believed that climate change was occurring. While respondents indicated they believed climate change was occurring, beliefs about the causes of climate change were still widely varied. This was a significant finding of the study indicating agricultural producers were becoming more accepting of the existence of climate change even if the causes were disputed.

Loss frames were found to have significant differences from neutral framed messages, suggesting that loss frames should be used when communicating motivations to adapt to climate change and its impacts. Terminology framing did not have a significant impact on climate-change belief. Knowing that terminology did not affect climate-change belief in this study, communicators should begin addressing adaptation options, and the issue of climate change, by naming it specifically as climate change.

Regional agricultural publications, university publications, and radio broadcasts, respectively, were the top three used sources of information for climate and climate change topics.

Respondents that used business reports and television as a source for climate and climate change information were most likely to believe in climate change. Those that reported not seeking any type of media for climate and climate change information had the lowest mean belief in climate change. Differences in climate-change belief between media use groups were likely an effect of agenda-setting theory. Respondents that seek out information about climate change were exposed to media about climate change and predisposed to belief, whereas those that did not seek any information were not likely to believe in climate change.

Audience segment groups based on climate-change belief aligned with the audience segments described in the Six America's study (Leiserowitz et al., 2013). Those concerned and cautious about climate change constituted the largest groups in this study. Similar to the findings of Leiserowitz et al. (2013), this suggests a shift in population belief towards accepting climate change.

The study identified specific recommendations for communicators to utilize when discussing climate change with agricultural audiences. Communicators should focus on perceived risk and adaptation when discussing climate change since perceived risk was found to be the most significant predictor of climate-change belief. However, audiences with higher education levels also held higher levels of belief about climate change and should be considered as part of the formation of messaging strategies. Framing was found to have less of an impact than in other studies, although loss frames did have a significant impact in climate-change belief. Distance framing and terminology were not significant in this study. Use of agricultural media sources was also related to higher levels of belief in climate change. Communicators should continue to use those media sources as ways to reach their audience and use them as resources in developing their own communication strategy. Communicators are also tasked with the challenge of reaching audiences identified in this study that are not seeking out information on climate and climate change through identification of their preferred media sources.

Several suggestions for research surfaced from the findings of this study. Future research should explore whether or not issue salience is truly a significant factor in developing attitudes towards complex scientific topics. Additional research should be conducted to explore the impacts of framing to include outcome, distance, and terminology frames. Knowing that a segment of agricultural producers does not seek out agricultural media sources for information on climate and climate change, research should explore the sources they are using and how to reach that audience. This study focused on traditional media sources. Future studies should explore the impact of electronic and social-media information on issue salience and climate-change belief.

This study also made several contributions to communications theory. Findings in the study indicate that issue salience may not be as important in developing attitudes towards climate-change belief as initially thought. Previous research in agenda-setting theory stresses the importance of issue salience in developing attitudes towards objects (Erbring et al., 1980). The study also contributed to the empirical body of research on the effective strategies for communicating and presenting climate change risks and mitigation and adaptation options to agricultural producers in Kansas.

Ultimately, agricultural communicators in Kansas and elsewhere can use the findings in the study to guide the formation of communication strategy in relation to climate-change adaptation messages. Implementation of agenda-setting theory, framing theory, and audience segmentation will allow communicators and organizations to have constructive conversations with their audiences. Implementation must also include evaluation and appropriate adjustments as belief and acceptance of climate change and the causes continue to shift.

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Appendix A - Survey Versions with Quasi-Experimental Design

Perceived Risk

Please indicate how concerned you are about the following issues:

1. How concerned are you about increases in flooding?
 - Not concerned
 - Slightly concerned
 - Somewhat concerned
 - Moderately concerned
 - Extremely concerned

2. How concerned are you about longer dry periods and drought?
 - Not concerned
 - Slightly concerned
 - Somewhat concerned
 - Moderately concerned
 - Extremely concerned

3. How concerned are you about increases in weed pressure?
 - Not concerned
 - Slightly concerned
 - Somewhat concerned
 - Moderately concerned
 - Extremely concerned

4. How concerned are you about increases in insect pressure?
 - Not concerned
 - Slightly concerned
 - Somewhat concerned
 - Moderately concerned
 - Extremely concerned

5. How concerned are you about more frequent extreme rains?

- Not concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned

6. How concerned are you about increases in saturated soils and ponded water?

- Not concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned

7. How concerned are you about increases in heat stress on crops?

- Not concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned

8. How concerned are you about increases in loss of nutrients into waterways?

- Not concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned

9. How concerned are you about increases in soil erosion?

- Not concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned

Experienced Hazard

Please indicated the level of impact the following have had on your farming and/or ranching operation in the last 5 years:

10. Experienced significant drought in the last five years

- No impact
- Minor impact
- Moderate impact
- Major impact
- Extreme impact

11. Problems with saturated soils or ponding in the last five years

- No impact
- Minor impact
- Moderate impact
- Major impact
- Extreme impact

12. Creeks, streams, or rivers running through farmland in the last five years

- No impact
- Minor impact
- Moderate impact
- Major impact
- Extreme impact

13. Experienced stream/river flooding in the last five years

- No impact
- Minor impact
- Moderate impact
- Major impact
- Extreme impact

14. Some land farmed has experienced significant soil erosion in the last five years

- No impact
- Minor impact
- Moderate impact
- Major impact
- Extreme impact

Perceived Benefit

Please indicate the level of benefits you have experienced on your farming and/or ranching operation in the last 5 years:

15. Longer growing seasons in the last five years

- No benefit
- Minor benefit
- Some benefit
- Moderate benefit
- Major benefit

16. Longer pasture seasons in the last five years

- No benefit
- Minor benefit
- Some benefit
- Moderate benefit
- Major benefit

17. Ability to plant double crops in the last five years

- No benefit
- Minor benefit
- Some benefit
- Moderate benefit
- Major benefit

18. Increased options in crop variety in the last five years

- No benefit
- Minor benefit
- Some benefit
- Moderate benefit
- Major benefit

19. Milder, shorter winters in the last five years

- No benefit
- Minor benefit
- Some benefit
- Moderate benefit
- Major benefit

Gain Framed Questions

There is increasing discussion about the profitability and sustainability of production agriculture. Please indicate how strongly you agree or disagree with the following statements:

20. The increasing frequency of extreme weather events will not impact my operation.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

21. Differences in weather patterns will allow for longer growing seasons.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

22. Weather variability will result in positive daily weather for my operation.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

23. Climate change can benefit the profitability of my farming/ranching operation.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

24. Recent increases in extreme weather events have not impacted my operation.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

25. Shifts in weather patterns have allowed for longer growing and pasture season.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

26. Climate Change has resulted in increased profits on my farm/ranch.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

27. Weather variability has not impacted my daily activities on my farming and/or ranching operation.

- Strongly agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

Loss Framed Questions

There is increasing discussion about the profitability and sustainability of production agriculture.

Please indicate how strongly you agree or disagree with the following statements:

20. The increased frequency of extreme weather events will damage my crops and/or pasture.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

21. Changing weather patterns will disrupt the planting and harvest dates of my crops and/or length of grazing season.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

22. Weather variability has potential to alter my daily routine and maintenance of my operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

23. Climate change will reduce the profitability of my farming/ranching operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

24. The increased frequency of extreme weather events has damaged my crops and farmland and/or pasture.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

25. Changing weather patterns have negatively altered the planting and harvest dates of my crops and/or length of grazing season.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

26. Weather variability has disrupted my daily routine and maintenance of my operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

27. Climate change has reduced the profitability of my farming/ranching operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Neutral Framed Questions

There is increasing discussion about the profitability and sustainability of production agriculture. Please indicate how strongly you agree or disagree with the following statements:

20. Increased frequency of extreme weather events can impact my crops and farmland and/or pasture.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

21. Changing weather patterns will change the future planting and harvest dates of my crops and/or length of grazing season.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

22. Weather variability has potential to alter my daily routine and maintenance of my operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

23. Climate change will impact the profitability of my farming/ranching operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

24. The increased frequency of extreme weather events has affected my crops and farmland and/or pasture.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

25. Changing weather patterns have altered the planting and harvest dates of my crops and/or length of grazing season.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

26. Weather variability has affected my daily routine and maintenance of my operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

27. Climate change has impacted my farming/ranching operation.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

28. Thinking about climate and climate change, which of the follow agricultural media sources do you use for information? Select all that apply.

- Research publications
- Industry professional magazines
- Business reports
- Commodity specific magazines
- Regional agricultural publications
- Agricultural expos/farm shows
- Radio broadcasts
- Television broadcasts
- Commodity organization publications
- University publications
- None of the above

29. Please select all research publications you use:

- Agriculture Week
- Journal of Agricultural and Food Economics
- Journal of Agriculture & Food Security
- Journal of the International Organization for Biological Control
- Chemical and Biological Technologies in Agriculture
- Journal of Irrigation and Drainage Systems
- Journal of Animal Science and Biotechnology
- Journal of Animal Science and Technology
- Journal of General Plant Pathology
- International Journal on Advances in Precision Agriculture
- USDA Agricultural Research Service
- The International Society of Organic Agriculture Research
- Journal of Agricultural Science
- None of the above

30. Please select all industry professional magazines you use:

- Bovine Veterinarian
- BEEF VET
- Feedstuffs
- AgProfessional.com
- None of the above

31. Please select all business reports you use:

- Ag Professional
- US Farm Report
- Doane
- Farm Futures

- Farm Progress Data Solutions
- Successful Farming
- Weekly Livestock Reporter
- The Stock Exchange
- None of the above

32. Please select all commodity specific magazines you use:

- Dairy Herd Management
- Drovers Cattle Network
- Pork Network
- Drovers Cow/Calf
- BEEF
- Corn + Soybean Digest
- Beef Producer
- Western Farmer Stockman
- National Hog Farmer
- Farm Journal
- The Packer
- Farm Journal's Milk
- Beef Today
- Angus Journal
- Calf News
- Dairy Today
- Feedlot Magazine
- National Cattleman
- Texas Hereford
- Texas Longhorn Trails
- None of the above

33. Please select all regional agricultural publications you use:

- American Agriculturist
- Farm Progress Daily newsletter
- Kansas Farmer
- Prairie Farmer
- The Farmer
- Western Farm Press
- High Plains Journal
- Farm Talk Newspaper
- Kansas Stockman
- Southern Livestock Standard

- None of the above

34. Please select all agricultural expos/farm shows you attend:

- Topeka Farm Show
- Wichita Farm & Ranch Show
- Mid America Farm Expo
- Great Bend Farm and Ranch Expo
- Four State Farm Show
- 3i Show
- Amarillo Farm & Ranch Show
- Cattle Raisers Convention & Expo
- Commodity Classic
- Fort Worth Stock Show & Rodeo
- South Texas Farm & Ranch Show
- Heart of America Farm Show
- KNID Agrifest
- Oklahoma City Farm Show
- Tulsa Farm Show
- Wichita Falls Ranch & Farm Expo
- Western Farm Show
- Hay & Forage Expo
- Husker Harvest Days
- New York Farm Show
- The Farm Progress Show
- None of the above

35. Please select all radio broadcasts you use:

- Farm Progress America
- Max Armstrong's Midwest Digest
- WGN Radio Saturday Morning Show
- Successful Farming Radio
- KFRM 550 AM
- AgriTalk
- Radio Oklahoma Agricultural Network
- Texas Ag Radio Network
- Down on the Farm Radio Network
- KLA Radio
- None of the above

36. Please select all television broadcasts you use:

- This Week in Agribusiness
- RFD - TV
- None of the above

37. Please select all commodity organization publications you use:

- Kansas Soybean
- Oklahoma Wheat
- Oklahoma Corn Growers Association
- Oklahoma Soybean Board
- Oklahoma Conservation Commission
- Texas Wheat
- Texas Soybeans
- Texas Corn
- Texas Cotton Association
- Texas Cattle Feeders Association
- Oklahoma Cowman
- Oklahoma Pork Council
- Kansas Stockman
- Pig Tales
- Producer Connection, Texas Pork Producers Assn.
- None of the above

38. Please select all university publications you use:

- AgriLife Today
- AgMRC
- Ag Report
- K-State Research and Extension Bookstore
- SUNUP TV
- Extension Fact Sheets
- AgriLeader
- Texas A&M AgriLife Extension Bookstore
- Oklahoma State University Agricultural Communications
- None of the above

39. Please select the statement that best reflects your beliefs about climate change:

- Climate change is occurring, and it's caused by mostly natural changes in the environment
- Climate change is occurring, and is caused mostly by human activities
- Climate change is occurring, and is caused more or less equally by natural changes in the environment and human activities
- Climate change is not occurring
- There is not sufficient evidence to know with certainty whether climate change is occurring or not

40. Please indicate your role on the farming/ranching operation:

- Owner/operator
- Landlord
- Tenant
- Manager/operator
- Farmhand/laborer
- Spouse of owner
- Co-owner
- Child of owner

41. Select each crop and/or livestock type that is raised on your farming and/or ranching operation:

- Corn
- Wheat
- Soybeans
- Oats
- Beef cattle
- Sorghum
- Hay
- Alfalfa
- Hogs/Swine
- Sheep/goats
- Dairy cattle
- Other _____

42. What is the highest degree or level of education you have completed?

28. No schooling completed
29. Kindergarten to 8th grade
30. Some high school, no diploma
31. High school graduate or equivalent (GED)
32. Some college credit
33. Trade/technical/vocational training
34. Associate's degree
35. Bachelor's degree
36. Master's degree
37. Professional degree
38. Doctoral degree

43. Select the farm type that best describes your production:

- Limited-resource farm: small farm with sales less than \$100,000, farm assets less than \$150,000, and total operator household income less than \$20,000. Operators may report any major occupation, except hired manager.
- Retirement farm: small farms whose operators report they are retired.
- Residential/lifestyle farm: small farms whose operators report a major occupation other than farming.
- Farming-occupation farms: small farms whose operators report farming as their major occupation.
- Large family farm: sales between \$250,000 and \$499,999
- Very large family farm: sales of \$500,000 or more
- Non-family Farm: farms organized as non-family corporations or cooperatives, as well as farms operated by hired managers.

44. Which political party do you identify yourself as belonging to?

- Republican
- Democrat
- Independent
- No party, I am not interested in politics
- Other (please specify) _____

45. What is your age?

- 18-24
- 25-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- 61 and above

46. I identify my gender as...

- Male
- Female
- Other
- Prefer not to answer

47. I identify my ethnicity as....

- Caucasian (white)
- Hispanic or Latino
- African American (black)
- Native American
- Asian/Pacific Islander
- Other (please specify) _____
- Prefer not to answer

Appendix B - Kansas Wheat Initial Email



KANSAS STATE

UNIVERSITY

College of Agriculture

A master's student in Kansas State University's College of Agriculture is conducting a study to explore your concerns, experiences, and preferred **communications** channels in regards to weather and climate. She is interested in determining how we can improve **communication** efforts to better serve agricultural producers.

The researcher has requested us to send a link to our members in support of her efforts.

We were hoping all Kansas Wheat members will help her with his study by **completing** an online survey.

Follow this link to the survey or copy and paste the URL below into your Internet browser:

https://kstate.qualtrics.com/SE/?SID=SV_cNmPZqCGhD2iaON

She would like to thank you in advance for supporting her study and efforts to help improve weather and climate communication in the interest of promoting agriculture.

If you have questions or problems accessing the survey, please e-mail Cassie Wandersee at wande@ksu.edu.

Appendix C - IRB Approval Letter

KANSAS STATE
UNIVERSITY

University Research Compliance Office

TO: Lauri Baker
Communications
307 Umberger

Proposal Number: 8061

FROM: Rick Scheidt, Chair 
Committee on Research Involving Human Subjects

DATE: 12/22/2015

RE: Proposal Entitled, "An audience focused approach to framing climate-change communication in agriculture"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written - and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.



Committee for Research Involving Human Subjects (IRB) Application for Approval Form

Please send your completed application to comply@k-state.edu

INSTRUCTIONS

Be sure to save the application PDF to your computer before you begin completing the form. You may not be able to save your changes if you edit this form in a web browser.

The KSU IRB is required by law to ensure that all research involving human subjects is adequately reviewed for specific information and is approved prior to inception of any proposed activity. Consequently, it is important that you answer all questions accurately. If you need help or have questions about how to complete this application, please call the Research Compliance Office at 532-3224, or e-mail us at comply@ksu.edu.

Please provide the requested information in the outlined text boxes. The text boxes are designed to accommodate responses within the body of the application. As you type your answers, the text boxes will expand where appropriate and as needed. After completion send your application by e-mail to comply@k-state.edu.

Additional material is requested with this application. Be sure to provide electronic copies of the following documents (if applicable) and submit them to comply@k-state.edu along with your application:

- Consent Form (see *Administrative Information, IX. Informed Consent A.*)
- Sponsor's grant application or contract as submitted to the funding agency. (See *Administrative Information*)
- Surveys, instruments, etc used for data collection (see *V. Design and Procedures C. and X. Project Information P.*)
- Debriefing statement to be utilized (see *IX. Informed Consent E.*)

**FAILURE TO PROVIDE ALL INFORMATION REQUESTED MAY LEAD
TO A DELAY IN PROCESSING YOUR REQUEST.**

**Please proof read and check spelling BEFORE submitting the form.
To use Acrobat spelling check, press F7 or select EDIT, CHECK SPELLING**

**PLEASE CONTINUE TO THE NEXT PAGE
TO BEGIN COMPLETING THE FORM**

ADMINISTRATIVE INFORMATION:

Title of Project/Course:

Type of Application: New / Renewal Revision (to a pending new application)
 (check one box) Modification to an existing approved application #:

Principal Investigator Details: (must be a KSU faculty member):

Name: Degree/Title:

Department: Campus Phone:

Campus Address:

E-mail: Fax #:

Responsible Graduate Student: (Person to contact for questions/problems with the form):

Name: Campus Phone:

E-mail:

Does this project involve any collaborators not part of the faculty/staff at KSU? (projects with non-KSU collaborators may require additional coordination and approvals):

No Yes

Project Classification (Is this project part of one of the following?):

Thesis Dissertation Faculty Research
 Other:

Note: Class Projects should use the short form application for class projects.

Copy of the Consent Form: Copy will be submitted to comply@ksu.edu with this application Consent form not used

Funding Source: Internal External (Identify source. You will also need to provide a copy of the sponsor's grant application or contract as submitted to the funding agency. This should be submitted to comply@ksu.edu with your application.)

Based upon criteria found in 45 CFR 46 – and the overview of projects that may qualify for exemption explained at <http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html>, I believe that my project using human subjects should be determined by the IRB to be exempt from IRB review:

No Yes (If yes, please provide the category of "Exemption" in the space below)

Exempt Projects: 45 CFR 46 identifies six categories of research involving human subjects that may be exempt from IRB review. The categories for exemption are listed here: <http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html#c2> If you believe that your project qualifies for exemption, please indicate which exemption category applies (1-6). Please remember that only the IRB can make the final determination whether a project is exempt from IRB review, or not.

Exemption Category:

MODIFICATION:

Is this a modification of an approved protocol? No Yes If yes, please comply with the following:

If you are requesting a modification or a change to an IRB approved protocol, please provide a concise description of all of the changes that you are proposing in the following block. Additionally, please highlight or bold the proposed changes in the body of the protocol where appropriate, so that it is clearly discernible to the IRB reviewers what and where the proposed changes are. This will greatly help the committee and facilitate the review.

- I. **NON-TECHNICAL SYNOPSIS** (Please provide a brief narrative description of proposal. This should typically be less than 75 words and be easily understood by nonscientists):

An online survey will be dispersed to agricultural producers in Kansas, Oklahoma, and Texas identified by their voluntary membership in commodity organizations. An email invitation will be sent to producers inviting them to participate in the survey. The survey will consist of approximately 40 items investigating the beliefs respondents have about climate change, how they prefer to talk about climate change, and from what agriculture media sources seek information about climate change.

- II. **BACKGROUND** (concise narrative review of the literature and basis for the study):

A majority of papers (97.1%) published since 1997 that expressed a position on climate change and global warming, agreed that the human population is causing global warming (Cook et al., 2013). The scientific conclusion that humans are impacting climate and warming the planet through the burning of fossil fuels and land clearing, has been accepted by governments globally (Macdonald, 2013). The agricultural industry is both vulnerable to climate change and produces a significant amount of greenhouse gases (Gordon Arbuckle, Prokopy, et al., 2013). Results of climate change, such as successive and extreme events like flooding and droughts, combined with increasing average temperatures and rising water demand, pose a higher risk in rural communities for loss of rural livelihoods, severe economic losses in agriculture, as well as damage to cultural values and identity (Aalst et al., 2014). Without adaptation, further changes in climate, atmospheric carbon dioxide, and ocean acidity are expected to have a substantial impact on agriculture including water resources (Aalst et al., 2014). The farmer decision to adapt, or not adapt, does not require the farmer to understand the underlying causes or sources of risk (Gordon et al., 2013). While most experts agree that carbon dioxide emissions and other greenhouse gases are causing anthropogenic climate change, public concern for the issue has been declining (Lewandowsky et al., 2012). The way in which communications about climate change are framed has a considerable impact on the way the messages are received (Spence & Pidgeon, 2010). Communication frames are increasingly being used to influence and encourage sustainable behavior in regards to climate change (Spence & Pidgeon, 2010). Communication and framing of risk to influence behavior change has been thoroughly studied in relation to personal health, policy, and other academic fields. There is a lack of empirical evidence about the most effective strategies for communicating and presenting climate change risks and adaptation and mitigation options, and whether or not theories developed in other risk domains are transferrable to climate change issues (Pelletier & Sharp, 2008).

III. PROJECT/STUDY DESCRIPTION

(Please provide a concise narrative description of the proposed activity in terms that will allow the IRB or other interested parties to clearly understand what it is that you propose to do that involves human subjects. This description must be in enough detail so that IRB members can make an informed decision about the proposal).

The potential participants will be members of corresponding state commodity organizations. Researchers will create an online survey to be distributed to the organization's members through their email contact lists. Respondents to the survey will be introduced to the project through a greeting screen and then provide their consent digitally before moving on to the survey instrument. After completing the survey, respondents will be debriefed. If a low response rate occurs, a paper copy of the survey will be mailed to non-respondents.

IV. OBJECTIVE

(Briefly state the objective of the research – what you hope to learn from the study).

The purpose of this study is to investigate the frames and messages agricultural producers in Kansas, Oklahoma, and Texas use and accept related to climate change and the impacts a changing climate has. In reaching this purpose we hope to discover how agricultural producers want to hear and learn about climate change. Completing this purpose will allow researchers to develop communication guides for use in Kansas, Oklahoma, and Texas.

V. DESIGN AND PROCEDURES (succinctly outline formal plan for study)

- A. List all sites where this research will be conducted:

Kansas State University, Manhattan, Kansas

- B. Variables to be studied: Belief in climate change; experienced hazard; perceived risks; preferred frames; preferred terminology; climate change information sources

- C. Data collection methods: (surveys, instruments, etc - copies must be submitted to comply@k-state.edu).

Online survey, paper version of online survey

- D. List any factors that might lead to a subject dropping out or withdrawing from a study. These might include, but are not limited to emotional or physical stress, pain, inconvenience, etc.

Time to participate

- E. List all biological samples taken: (if any)

none

- F. Debriefing procedures for participants:

After completing the survey or ending the survey before completion, respondents will be directed to a screen thanking them for their participation. The debriefing message will explain that the gathered information will assist researchers in the development of communication guides on the topic of climate change. Provided information will serve as a starting point for the development of those guidelines. The same debriefing message will be included if a hard copy survey is mailed.

VI. RESEARCH SUBJECTS:

- A. Source:

Kansas Wheat, Texas Wheat, Oklahoma Wheat Association, National Association of Wheat Growers, US Wheat Associates

- B. Number: (provide a brief rationale for your sample size)

3,000 - The survey will be distributed to all members of the associations with emails on file

C. Inclusion criteria: (List any unique qualifiers desirable for research subject participation)

Involved in agricultural production

D. Exclusion criteria: (list any unique disqualifiers for research subject participation)

n/a

E. Recruitment procedures:

How will subjects be identified?

Subjects will be identified by their membership in their respective state wheat growers associations

How will subjects be recruited (advertisement, associates, etc.) ?

Subjects will be recruited through email by the associations. No advertisements will be used.

How will subjects be enrolled?

Subjects will be enrolled through an email link to the survey.

Describe any follow-up recruitment procedures: (reminder emails, mailings, etc.)

A follow up email will be sent as a reminder to complete the survey. A hard copy of the survey will be mailed if a low response rate occurs.

VII. RISK - PROTECTION - BENEFITS: The answers for the three questions below are central to human subjects research. You must demonstrate a reasonable balance between anticipated risks to research participants, protection strategies, and anticipated benefits to participants or others.

A. Risk for Subjects: (check all that apply)

- Exposure to infectious diseases
- Use of confidential records
- Exposure to radiation
- Manipulation of psychological or social variables such as sensory deprivation, social isolation, psychological stressors
- Examining for personal or sensitive information in surveys or interviews
- Presentation of materials which subjects might consider sensitive, offensive, threatening, or degrading
- Invasion of privacy of subject or family
- Social or economic risk
- Risk associated with exercise or physical exertion
- Legal risk
- Review of medical records
- Review of criminal records
- HIV/AIDS or other STD's
- Employment/occupational risk
- Others – Please explain below (Indirect risks, risk to individuals who are not the primary subjects):

B. Minimizing Risk: (Describe specific measures used to minimize or protect subjects from anticipated risks.)

The introduction to the survey will explain the purpose of the survey, who is conducting the research, and that their responses will be used in academic research. This will alert participants to the purpose of the survey. They will be assured that their confidentiality will be protected and their identity will not be revealed.

C. Benefits: (Describe any reasonably expected benefits for research participants, a class of participants, or to society as a whole.)

Society will benefit from this research as the answers will develop communication materials to prepare agricultural producers for the impacts of climate change.

D. More than Minimal Risk? In your opinion, does the research involve more than minimal risk to subjects? ("Minimal risk" means that "the risks of harm anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.")

Yes No

VIII. CONFIDENTIALITY: Confidentiality is the formal treatment of information that an individual has disclosed to you in a relationship of trust and with the expectation that it will not be divulged to others without permission in ways that are inconsistent with the understanding of the original disclosure. Consequently, it is your responsibility to protect information that you gather from human research subjects in a way that is consistent with your agreement with the volunteer and with their expectations.

Explain how you are going to protect confidentiality of research subjects and/or data or records. Include plans for maintaining records after completion.

Email and mailing lists will be maintained by the commodity associations, researchers will not have access to personal information of the research subjects. All data produced from the survey will be kept on a University password protected computer. No personal identifying information will be collected in the survey.

IX. INFORMED CONSENT: Informed consent is a critical component of human subjects research - it is your responsibility to make sure that any potential subject knows exactly what the project that you are planning is about, and what his/her potential role is. (There may be projects where some forms of "deception" of the subject is necessary for the execution of the study, but it must be carefully justified to and approved by the IRB). A schematic for determining when a waiver or alteration of informed consent may be considered by the IRB is found at <http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html#c10>

Even if your proposed activity does qualify for a waiver of informed consent, you must still provide potential participants with basic information that informs them of their rights as subjects, i.e. explanation that the project is research and the purpose of the research, length of study, study procedures, debriefing issues to include anticipated benefits, study and administrative contact information, confidentiality strategy, and the fact that participation is entirely voluntary and can be terminated at any time without penalty, etc. Even if your potential subjects are completely anonymous, you are obliged to provide them (and the IRB) with basic information about your project. See informed consent example on the URCO website. It is a federal requirement to maintain informed consent forms for 3 years after the study completion.

Answer the following questions about the informed consent procedures.

- Yes No **A.** Are you using a written informed consent form? If "yes," include a copy with this application. If "no" see B.
- Yes No **B.** In accordance with guidance in 45 CFR 46, I am requesting a waiver or alteration of informed consent elements (see section VIII above). If "yes," provide a basis and/or justification for your request.

- Yes No C. Are you using the online Consent Form Template provided by the URCO? If "no," does your Informed Consent document have all the minimum required elements of informed consent found in the Consent Form Template? (Please explain)
- The informed consent document specific to this project has all the minimum required elements of the consent form template including: research statement, research purpose, expected time to participate, description of survey, explanation that there are no expected risks or benefits, assurance of total confidentiality, and a statement that participation is voluntary and can be ended by the participant at any time. Contact information is also provided for the IRB office and the principle researcher.
- Yes No D. Are your research subjects anonymous? If they are anonymous, you will not have access to any information that will allow you to determine the identity of the research subjects in your study, or to link research data to a specific individual in any way. Anonymity is a powerful protection for potential research subjects. (An anonymous subject is one whose identity is unknown even to the researcher, or the data or information collected cannot be linked in any way to a specific person).
- Yes No E. Are subjects debriefed about the purposes, consequences, and benefits of the research? Debriefing refers to a mechanism for informing the research subjects of the results or conclusions, after the data is collected and analyzed, and the study is over. (If "no" explain why.) Copy of debriefing statement to be utilized should be submitted to comply@k-state.edu with your application.
- Copy attached
- F. Describe the Informed Consent Process:
- Who is obtaining the consent? (i.e. Principle Investigator, Graduate Student, etc.)
- Graduate student through survey consent question
- When and where will consent be obtained?
- Following the greeting message after subjects are informed of the purpose of the study. Subjects must provide consent before they are allowed to participate. Those that choose not to consent will be directed to an exit message. A paper consent form will be included if a hard copy of the survey is mailed.
- If assent (for minors) is required, please describe who will obtain the assent? (Assent means a child's affirmative agreement to participate in research)
- n/a
- If assent (for minors) is required, when and where will assent be obtained?
- n/a
- How will consent be obtained from non-English speaking participants? (a translated written form, orally, identify the name and qualifications of the individual providing the translation)
- The survey will not be offered in a form for non-English speaking participants. Non-English speaking participants are not expected.

Informed Consent Checklist

Items	YES	NO	N/A
Does the title appear at the top of the consent/assent form?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the consent/assent form written toward the subject?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is there a statement that explains that the study is <i>research</i> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is there a statement that explains the <i>purpose</i> of the research?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the procedures to be followed explained clearly and adequately?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the consent document describe <i>risks or discomforts</i> to subjects as a result of participating in the research?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is the consent/assent form written in the <i>native language</i> of the potential subject?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are participants compensated?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
If the subjects' identity is known to the PI, does the form detail how confidentiality of records will be maintained?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Is contact information for both the PI and the URCO/IRB office included?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the consent document indicate to the participant that he/she can withdraw at any time from the project without penalty or loss of benefit?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are there probable circumstances which would require the PI to terminate a subject's participation regardless of his or her consent?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Is the consent document written in lay language (Recommended 8th grade level)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

X. **PROJECT INFORMATION:** (If you answer Yes to any of the questions below, you should explain them in one of the paragraphs above)

- Yes No A. Deception of subjects? If "YES" explain why this is necessary.
-
- Yes No B. Shock or other forms of punishment
- Yes No C. Sexually explicit materials or questions about sexual orientation, sexual experience or sexual abuse
- Yes No D. Handling of money or other valuable commodities
- Yes No E. Extraction or use of blood, other bodily fluids, or tissues (if "yes", you must comply with facility and handling protections detailed in the 5th Edition of the Biosafety in Biomedical Laboratories (BMBL))
- Yes No F. Questions about any kind of illegal or illicit activity
- Yes No G. Questions about protected health information as defined by HIPPA
- Yes No H. Purposeful creation of anxiety
- Yes No I. Any procedure that might be viewed as invasion of privacy
- Yes No J. Physical exercise or stress
- Yes No K. Administration of substances (food, drugs, etc.) to subjects
- Yes No L. Any procedure that might place subjects at risk
- Yes No M. Will there be any use of Radioactive materials and/or use of Radioactive producing machines
- Yes No N. Any form of potential abuse; i.e., psychological, physical, sexual
- Yes No O. Is there potential for the data from this project to be published in a journal, presented at a conference, etc?
- Yes No P. Use of surveys or questionnaires for data collection. **Copies should be submitted to comply@k-state.edu with your application.**

XI. **SUBJECT INFORMATION:** (If you answer yes to any of the questions below, you should explain them in one of the paragraphs above)

- Yes No a. Under 18 years of age (these subjects require parental or guardian consent)
- Yes No b. Over 65 years of age
- Yes No c. Minorities

- Yes No d. Physically or mentally disabled
- Yes No e. Economically or educationally disadvantaged
- Yes No f. Unable to provide their own legal informed consent
- Yes No g. Pregnant females as target population
- Yes No h. Victims
- Yes No i. Subjects in institutions (e.g., prisons, nursing homes, halfway houses)
- Yes No j. Are subjects likely to be vulnerable to coercion or undue influence
- Yes No k. Is this international research? If yes, provide details as to if OHRP regulations apply in or near the area you intend to conduct research or if you have contacted individuals for applicable regulations to human subject research.
- Yes No l. Are research subjects in this activity students recruited from university classes or volunteer pools? If so, do you have a reasonable alternative(s) to participation as a research subject in your project, i.e., another activity such as writing or reading that would serve to protect students from unfair pressure or coercion to participate in this project? If you answered this question "Yes," explain any alternatives options for class credit for potential human subject volunteers in your study. (It is also important to remember that: Students must be free to choose not to participate in research that they have signed up for at any time without penalty. Communication of their decision can be conveyed in any manner, to include simply not showing up for the research.)
- Yes No m. Is audio from the subjects recorded? If yes, how do you plan to protect the recorded information and mitigate any additional risks?
- Yes No n. Are research subjects' images being recorded (video taped, digitally recorded, photographed)? If yes, how do you plan to protect the recorded information and mitigate any additional risks?

XII. FDA ACTIVITIES: Answer the following questions about potential FDA regulated activities:

- Yes No a. Is this a Clinical Trial?
- Yes No b. Are you using an FDA approved drug/device/diagnostic test?
- Yes No c. Does this activity involve the use of FDA-Regulated products? (biological products, color additives, food additives, human drugs, etc.)
- Yes No d. Has the protocol been submitted to the FDA, or are there plans to submit it to the FDA?
- Yes No e. Have you submitted an FDA form 3454 or 3455 (conflict of interest)?

XIII. CONFLICT OF INTEREST: Concerns have been growing that financial interests in research may threaten the safety and rights of human research subjects. Financial interests are not in them selves prohibited and may well be appropriate and legitimate. Not all financial interests cause Conflict of Interest (COI) or harm to human subjects. However, to the extent that financial interests may affect the welfare of human subjects in research, IRB's, institutions, and investigators must consider what actions regarding financial interests may be necessary to protect human subjects. Please answer the following questions:

- Yes No a. Do you or the institution have any proprietary interest in a potential product of this research, including patents, trademarks, copyrights, or licensing agreements?
- Yes No b. Do you have an equity interest in the research sponsor (publicly held or a non-publicly held company)?
- Yes No c. Do you receive significant payments of other sorts, eg., grants, equipment, retainers for consultation and/or honoraria from the sponsor of this research?
- Yes No d. Do you receive payment per participant or incentive payments?
- e. If you answered yes to any of the above questions, please provide adequate explanatory information so the IRB can assess any potential COI indicated above.

The graduate student conducting the research is paid through a grant grant funded by the United States Department of Agriculture to complete this research. The project contract is attached.

XIV. PROJECT COLLABORATORS:

- A. **KSU Collaborators:** List anyone affiliated with KSU who is collecting or analyzing data: (list all collaborators on the project, including co-principal investigators, undergraduate and graduate students).

Name:	Department:	Campus Phone:	Campus E-mail:
Dr. Peter Tomlinson	Assistant Professor, Agronomy	785-532-3198	ptomlin@ksu.edu
Lana Barkman	Project Coordinator, Agronomy	785-532-3198	lanaan@ksu.edu
Katie Rohling	Communications and Agricultural Education	785-532-5804	wande@ksu.edu
Brooke Harshaw	Communications and Agricultural Education	785-532-5804	katie26@ksu.edu
Dr. Wes Wise	Journalism and Mass Communications	785-532-6890	weswise@ksu.edu
Cassie Wandersee	Communications and Agricultural Education	785-532-5804	wande@ksu.edu
<input type="button" value="Add Row"/>		<input type="button" value="Delete Row"/>	

- B. **Non-KSU Collaborators:** List all collaborators on your human subjects research project not affiliated with KSU in the spaces below. KSU has negotiated an Assurance with the Office for Human Research Protections (OHRP), the federal office responsible for oversight of research involving human subjects.

Name:	Organization:	Phone:	Institutional E-mail:
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="button" value="Add Row"/>		<input type="button" value="Delete Row"/>	

- C. Does your non-KSU collaborator's organization have an Assurance with OHRP? (for Federalwide Assurance listings of other institutions, please reference the OHRP website under Assurance Information at: <http://ohrp.cit.nih.gov/search>).

Yes No If yes, Collaborator's FWA #

Is your non-KSU collaborator's IRB reviewing this proposal?
 Yes No If yes, IRB approval #

XV. IRB Training:

- A. The URCO must have a copy of the Unaffiliated Investigator Agreement on file for each non-KSU collaborator who is not covered by their own IRB and assurance with OHRP. When research involving human subjects includes collaborators who are not employees or agents of KSU the activities of those unaffiliated individuals may be covered under the KSU Assurance only in accordance with a formal, written agreement of commitment to relevant human subject protection policies and IRB oversight. The Unaffiliated Investigators Agreement can be found and downloaded at <http://www.k-state.edu/research/comply/irb/forms>

Online Training***TRAINING REQUIREMENTS HAVE RECENTLY CHANGED***

The IRB has mandatory training requirements prior to protocol approval. Training is now offered through the Collaborative Institutional Training Initiative (CITI) Program. Instructions for registration and access to training are on the URCO website <http://www.k-state.edu/research/comply/>.

Use the check boxes below to select the training courses that apply to this application. If you have any questions about training, contact URCO at comply@ksu.edu, or (785) 532-3224.

Mandatory Training**Required for all Principal Investigators, research staff and students**

- Responsible Conduct of Research
 IRB core modules

Required (Provost-mandated) for all full-time K-State employees

- Export Compliance

Required procedure-specific training (check all that apply to this protocol):

- Students in Research (check if students are listed as personnel on this protocol) International Research
 Research in Public Elementary and Secondary Schools Research with Children Research with Prisoners
 Internet Research Vulnerable Subjects - Research Involving Workers/Employees
 Research with Subjects with Physical Disabilities and Impairments Illegal Activities or Undocument Status in Human Research
 Gender and Sexuality Diversity in Human Research Research with human blood, body fluids, or tissues
 Research with Older Adults

All new personnel or personnel with expired training are required to register for CITI and take the new training requirements. If you previously completed online IRB modules, your training status will remain current until it expires. URCO will verify training from the previous system as well as the new system prior to approval of any protocol.

INVESTIGATOR ASSURANCE FOR RESEARCH INVOLVING HUMAN SUBJECTS

(Print this page separately because it requires a signature by the PI)

P.I. Name: Lauri M. Baker

Title of Project: An Audience Focused Approach to Framing Climate Change Communication in Agriculture

XVI. ASSURANCES: As the Principal Investigator on this protocol, I provide assurances for the following:

- A. **Research Involving Human Subjects:** This project will be performed in the manner described in this proposal, and in accordance with the Federalwide Assurance FWA00000865 approved for Kansas State University available at <http://www.hhs.gov/ohrp/assurances/forms/filasurt.html>, applicable laws, regulations, and guidelines. Any proposed deviation or modification from the procedures detailed herein must be submitted to the IRB, and be approved by the Committee for Research Involving Human Subjects (IRB) prior to implementation.
- B. **Training:** I assure that all personnel working with human subjects described in this protocol are technically competent for the role described for them, and have completed the required IRB training accessed via the URCO website at: <http://www.k-state.edu/research/comply/irb/training>. I understand that no proposals will receive final IRB approval until the URCO has documentation of completion of training by all appropriate personnel.
- C. **Extramural Funding:** If funded by an extramural source, I assure that this application accurately reflects all procedures involving human subjects as described in the grant/contract proposal to the funding agency. I also assure that I will notify the IRB/URCO, the KSU PreAward Services, and the funding/contract entity if there are modifications or changes made to the protocol after the initial submission to the funding agency.
- D. **Study Duration:** I understand that it is the responsibility of the Committee for Research Involving Human Subjects (IRB) to perform continuing reviews of human subjects research as necessary. I also understand that as continuing reviews are conducted, it is my responsibility to provide timely and accurate review or update information when requested, to include notification of the IRB/URCO when my study is changed or completed.
- E. **Conflict of Interest:** I assure that I have accurately described (in this application) any potential Conflict of Interest that my collaborators, the University, or I may have in association with this proposed research activity.
- F. **Adverse Event Reporting:** I assure that I will promptly report to the IRB / URCO any unanticipated problems involving risks to subjects or others that involve the protocol as approved. Unanticipated or Adverse Event Form is located on the URCO website at: <http://www.k-state.edu/research/comply/irb/forms>. In the case of a serious event, the Unanticipated or Adverse Events Form may follow a phone call or email contact with the URCO.
- G. **Accuracy:** I assure that the information herein provided to the Committee for Human Subjects Research is to the best of my knowledge complete and accurate.

(Principal Investigator Signature)

(Date)

Appendix D - Kansas Wheat Follow-Up Email



KANSAS STATE

UNIVERSITY

College of Agriculture

Earlier this week a survey link was sent out in our weekly market report seeking your concerns, experiences, and preferred communications channels in regards to weather and climate. Kansas Wheat is assisting the master's student in collecting data for her thesis study.

If you have already completed the Internet survey, please accept our sincere thanks. If not, please complete it at your earliest convenience. We are especially grateful for your help because it is only by asking our producers to share your experiences that we can truly understand your communication needs.

If you have not completed the survey, or need to finish an incomplete survey, please follow the link below to participate:

https://kstate.qualtrics.com/SE/?SID=SV_cNmPZqCGhD2iaON

If you have questions or problems accessing the survey, please e-mail Cassie Wandersee at wande@ksu.edu

Thank you in advance for supporting the study and efforts to help improve weather and climate communication in the interest of promoting agriculture.

She would like to thank you in advance for supporting her study and efforts to help improve weather and climate communication in the interest of promoting agriculture.

If you have questions or problems accessing the survey, please e-mail Cassie Wandersee at wande@ksu.edu.

Appendix E - Kansas Wheat Final Email



KANSAS STATE

UNIVERSITY

College of Agriculture

About a week a survey link was sent to you seeking your concerns, experiences, and preferred communications channels in regards to weather and climate. Kansas Wheat is assisting the master's student in collecting data for her thesis study.

If you have already completed the Internet survey, please accept our sincere thanks. If not, please complete it at your earliest convenience. We are especially grateful for your help because it is only by asking our producers to share your experiences that we can truly understand your communication needs.

The survey is drawing to a close, and this is the last email reminder we will be sending. If you have not completed the survey, or need to finish an incomplete survey, please follow the link below to participate:

https://kstate.qualtrics.com/SE/?SID=SV_cNmPZqCGhD2iaON

If you have questions or problems accessing the survey, please e-mail Cassie Wandersee at wande@ksu.edu

Thank you in advance for supporting the study and efforts to help improve weather and climate communication in the interest of promoting agriculture.

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