Climate Variability Adaptive Capacity: Perceptions of Alabama Farmers

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
December 12, 2020

Key Words: adaptive capacity, agricultural and extension education, climate change, climate variability, climate-smart agriculture, place and occupational attachment

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Abstract

The purpose of this study was to describe the adaptive capacity perceptions of Alabama farmers to climate variability. Adaptive capacity is the ability to successfully respond to climate variability threats. Climate change and variability threats to agricultural producers include regional weather variability, extreme weather events, and long-term changes to the climate. Adaptation and mitigation to climate variability threats help producers adapt and transform their practices to more sustainable methods. Climate-smart agriculture (CSA) programs are an integrated approach to climate variability adaptation by increasing productivity, reducing greenhouse gas emissions, and enhancing resiliency. CSA programs can help producers successfully respond to climate variability threats. The willingness of producers to adopt CSA programs could be measured through their perceptions of their adaptive capacity. Five dimensions were used to measure adaptive capacity; (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy. Participants were found to have somewhat strong adaptive capacity overall. Place and occupational attachment was also measured and found to be a statistically significant predictor of adaptive capacity. Participants who had previous climate variability education showed stronger adaptive capacity. Further research is needed to better understand place and occupational attachment implications on adaptive capacity. It is also recommended to implement CSA programs by first targeting producers with previous climate variability education with higher adaptive capacity.

Acknowledgments

Earning a PhD has been a lifelong dream of mine and so many individuals have supported and encouraged me along the way. My graduate committee has been at the forefront of supporting me over the three years of this program. Thank you to Dr. James Lindner, Dr. Christopher Clemons, Dr. Jason McKibben, and Dr. James Witte for serving on my committee and guiding me through this process. I would also like to acknowledge all the other professors in the department and at Auburn University that have lent their support through my coursework, research, and dissertation.

I would also like to thank the Alabama Farmers Federation and Carla Hornady for their support and patients. This research would not have been possible without their involvement in the data collection process and I am forever grateful for Mrs. Hornady's support, assistance, and responsiveness.

I would also like to acknowledge the graduate student cohort in the department of AgriScience Education for their encouragement and motivation throughout this process. The support of peers and colleagues enables a conducive work environment that positively impacts one's success.

I would also like to thank my family and friends that have stood by me and always offered supportive and encouraging words of advice. Thank you to my mother and father, I would not be where I am today without their continual belief in my dreams and goals. Thank you to my husband for making my dreams his priority as well. And thank you to my daughters for showing me I can accomplish more than I could have ever imagined.

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List of Abbreviations

AAAE	The American Association for Agricultural Education
ALFA	Alabama Farmers Federation
CSA	Climate-smart agriculture
FAO	Food and Agriculture Organization of the United Nations
IPCC	Intergovernmental Panel on Climate Change

CHAPTER I

INTRODUCTION

The projected impacts of climate change are undeniable. The agricultural sector is fundamentally linked to natural resources and therefore will undoubtedly experience these impacts. Agricultural producers in the United States have been slow to accept the inevitability of these changes and slow to implement adaptation and mitigation practices. Adaptation and mitigation strategies may help lessen the economic and livelihood impacts of climate change. Climate-smart agriculture is an integrated adaptation approach aimed at enhancing resiliency. Climate-smart agriculture programs must be individually developed to consider local production, resource availability, and cultural contexts. The question of farmer acceptance and participation in climate-smart agriculture programs must first be answered to enable program success. This study described the receptiveness and adaptive capacity of Alabama agricultural producers. Understanding Alabama agricultural producers' adaptive capacity may contribute to successful climate-smart agriculture programing.

Background

Climate change is the biggest global issue with the most unprecedented consequences worldwide (United Nations, 2020). Impacts of climate change are already being felt and future impacts will only be more difficult and costly if adaptation and mitigation measures are not implemented today (Shaftel, 2020). Climate change refers to the current and predicted changes in weather patterns, temperatures, rainfall quantity and distribution, and other ecological impacts from the continual increase in greenhouse gas emissions (World Meteorological Organization, 2020). Greenhouse gases naturally occur to a certain extent and are vital for keeping the earth warm enough to be inhabitable (Shaftel, 2020). Greenhouse gases trap some of the sun's rays in the earth's atmosphere while the rest are reflected into space. Since the industrial revolution, the levels of greenhouse gases have risen to record breaking concentrations (United Nations, 2020). More greenhouse gases mean more of the sun's rays are trapped in the earth's atmosphere and global temperatures increase. It has been well established that climate change is real, and the main cause is human related activities (Stocker et al., 2013). The projected outcomes and impacts of climate change are no doubt life altering and life threatening (United Nations, 2020). Climate change will impact every sector from technology to transportation to agriculture.

The current and projected impacts of climate change on agriculture are mounting (Stocker et al., 2013). Changes in temperatures and precipitation will affect agricultural productivity around the globe (Shaftel, 2020). Agricultural production is inherently linked to natural resources and therefore directly impacted by climate change and climate variability including extreme weather events like drought or flooding (International Research Institute for Climate and Society, n.d.). The frequency and intensity of droughts, floods, and storm damage are expected to increase (Shukla et al., 2019). Worsening soil conditions, desertification, pest outbreaks, and long-term water shortages are among the expected agricultural impacts of climate change (Kurukulasuriya & Rosenthal, 2003). Agriculture is the biggest user of freshwater globally and consequently is highly vulnerable to changes in water supply due to climate change (Calzadilla et al., 2013). Rainfed and irrigated agriculture will both be impacted by climate change and irrigated production in the United States is likely to decline (Calzadilla et al., 2013). These changes will undoubtedly impact the local, regional, and global food production and distribution systems. The tropical regions are expected to bare the hardest agricultural impacts of climate change (IPCC, 2001). Experts predict agricultural production will shift away from these areas towards the temperate and polar regions (IPCC, 2001). The linkage of the agricultural sector with poverty gives rise to concern that rural poverty will be exacerbated by the impacts of climate change on agriculture. The impacts will be most severe in developing countries due to the high dependency on agriculture for livelihoods and food security.

Climate change impacts in North America are overall expected to benefit production in the short-term, however regional areas will suffer significant losses (Kurukulasuriya & Rosenthal, 2003). Rainfall quantity and distribution patterns, crop yields, and a shift in production area are all projected impacts of climate change in North America (United States Global Change Research Program, 2018). The main risk of climate change on agriculture in some regions in North America will be primarily from increased variability. Variability of precipitation and temperature will result in lower yields (Cohen & Miller, 2001). Climate variability refers to the short-term variations in regional climate patterns such as changes in seasonal rainfall quantity and distribution amounts or changes in seasonal temperatures (International Research Institute for Climate and Society, n.d.). A change in land use is expected in North America as temperatures increase and growing seasons lengthen, some regions will benefit from warmer temperatures however adverse effects are likely to be seen where summer temperatures will stress and limit irrigation. Warmer climates will alter the relationship between crops, weeds, and pests significantly (Cohen & Miller, 2001). Warmer winters could reduce the kill-off of insects and extreme weather events could reduce the efficacy of pesticide applications (Cohen & Miller, 2001). The United States' agricultural industry will be impacted directly and indirectly by the influences of climate change. Changes in world markets and commodity availability and prices will impact agricultural producers in the United States. Direct impacts of climate change will be felt by producers across the United States with some regions impacted more heavily than others. Some regions such as the northern great plains are predicted to see conditions conducive to expanded productivity (United States Global Change Research Program, 2018). Overall yields in the United States are predicted to decline due to increased temperatures, changes in water availability, soil erosion, and disease outbreaks (United States Global Change Research Program, 2018). Model studies show losses in crop production in the southeast region (Smith et al., 2014). Climate change could lengthen the growing season which would be seen as a positive impact, however warmer temperatures could also shorten crop lifecycles by speeding decomposition (Smith et al., 2014). Crop productivity, livestock health, and rural economies are all at risk due to the numerous challenges presented by climate change.

Both adaptation and mitigation are responses to climate change and climate variability. Mitigation involves reducing greenhouse gas levels to mitigate the impacts of climate change. Adaptation refers more to adjustments in system responses to climate change and variability. Ecological, social, and economic systems all can adapt to the projected impacts of climate change and variability. Both climate change and variability impact agricultural production and both need adaptation strategies. Adaptation to short-term concerns of climate variability are just as crucial as the adaptation to the long-term concerns of climate change. Some adaptations address short-term concerns mostly focusing on the weather effects of climate variability. Long-term adaptations include implementing changes in production times, products, and even production locations. There are several different adaptation areas including the micro level, market responses, institutional changes, and technological developments (Kurukulasuriya & Rosenthal, 2003). Micro level adaptations are done on the farm and include adjustments to production such as diversification or intensification, changes in land use and irrigation methods, and altering the timing of operations. The micro level focuses on the producer and their farming operation and what is in their control. Market responses is an area of adaptation measures that includes the development of crop and flood insurance, credit schemes, innovative investment opportunities, and income diversification opportunities. Another area of adaptation covers institutional changes. Most of these changes require government action such as policy adjustments to subsidies and trade, agricultural support and insurance programs, and agricultural market improvements. Technological development is another area of adaptation. The development of new crop varieties and the promotion of water management techniques like conservation tillage are examples of technological development adaptation measures.

The micro level which focuses on farm level responses to climate change and variability is one of the most important adaptation areas to climate change and can have the most direct influence. Changes at the farm level include diversification of crops and livestock, changes in timing and intensity of production, and altering the use of fertilizer and pesticides, among various others. The capacity of adaptation at the farm level however is blocked by numerous constraints. Short-term adaptations are costly and traditions can be difficult to change. Long-term adaptations are viewed as more of a plan for long-term gradual changes to production practices. Examples of long-term adaptation strategies include changing crop type and production location, the development of new technologies, improving long-term water management practices, and permanent migration of labor. Short-term and long-term strategies will complement each other in some cases however in many cases they will not. Policies and adaptation strategies aimed at reducing short-term vulnerabilities will not reduce long-term vulnerabilities. Adaptation plans for long-term climate change impacts will not alleviate short-term vulnerabilities.

Climate-smart agriculture (CSA) is an integrated approach to climate change adaptation that transforms agricultural systems while ensuring food security (Food and Agriculture Organization of the United Nations, 2020; The World Bank, 2020; Consultative Group on

International Agricultural Research, 2014). The term was coined by the Food and Agriculture Organization of the United Nations (FAO) in preparation for the 2010 Hague Conference on Food Security, Agriculture, and Climate Change (Consultative Group on International Agricultural Research, 2014). CSA aims to simultaneously achieve increased productivity, enhanced resiliency, and reduced emissions (Food and Agriculture Organization of the United Nations, 2020; The World Bank, 2020; Consultative Group on International Agricultural Research, 2020). Increased productivity aims at increasing food and nutrition security and local incomes. Enhanced resiliency aims at reducing vulnerability to shocks and stressors such as drought and disease outbreaks. Enhanced resilience also intends to enhance long-term adaptive capacity in the face of shortened seasons or unpredictable weather patterns. Reduced emissions seeks to avoid deforestation from agriculture production and decrease the amount of emissions emitted per unit of agricultural product produced and distributed. CSA is intertwined with sustainable agriculture as it combines various sustainable methods intended to combat climate change specific threats (Rainforest Alliance, 2020). More attention is given to approaches that actively take climate change into account and plan for adaptive transitions. CSA is one of FAO's strategic objectives and aims to provide the means to help identify agricultural approaches suitable to local conditions (Food and Agriculture Organization of the United Nations, 2020). Assessing the local climate challenges is one of the first steps when implementing a CSA program. Each geographical area will experience different impacts of climate change. Climate risk and landscape vulnerability are dependent on the local ecosystem and specific crops being produced.

Adaptation to climate variability is a practical response strategy and a crucial step in strengthening capacity to unexpected climatic conditions (Smith, 1997). The impacts of climate change and variability are expected to be gradual (Food and Agriculture Organization of the United Nations, 2013). This provides the opportunity for the adaptation of practices and strengthening of infrastructure. Producers must take the threats of climate change and variability seriously to preserve their operations and livelihoods. Gradual changes should not give way to complacency. The fact that the climate is changing gradually gives us the chance to adapt to it. If adaptions are not started now the irreversible impacts of climate change will devastate agricultural producers. Adaptation has the potential to significantly decrease the impacts of climate change. Adaptation to climate variability is the response to current or projected adverse effects to reduce one's vulnerability (Smit et al., 1999). Adaptive capacity is therefore defined as "the potential or capability of a system to adapt to (to alter to better suit) climatic stimuli or their effects or impacts" (Smit & Pilifosova, 2001, p. 894). Strengthening the adaptive capacity of agricultural producers will reduce their vulnerability to climate change (Kurukulasuriya & Rosenthal, 2003). The broad scope of expected impacts of climate change and variability requires a wide range of collaborative adaptation strategies. Adaptative strategies are needed at the local individual level, private industrial level, and the national governmental level. Modifying inputs, production changes, adjusting management strategies, adopting new technologies are all examples of micro level adaptation strategies (United States Global Change Research Program, 2018). The extent of adaptation to climate variability depends on the access to knowledge and technology and the affordability of proposed strategies (Fraisse et al., 2009). Adaptive capacity of agricultural producers measures their capability to adopt proposed strategies.

Programming to assess agricultural producers' adaptive capacity and help them implement adaptation measures like CSA programming is little to non-existent in the United

States. Extension programs need to be developed to help agricultural producers adapt to climate variability. Programs aimed at mitigating climate variability risks are effective and efficient (Fraisse et al., 2009). Adaptation and mitigation strategies need to be localized and developed with participatory methods (Doll et al., 2017; Fraisse et al., 2009). The United States Cooperative Extension System and land-grant universities have a critical role to play in conducting and disseminating climate change related research. Existing climate change extension programs focus on developing and disseminating best management practices adapted to local climate variability (Fraisse et al., 2009). Several universities have already implemented climate change extension programing especially those located in regions already experiencing and adapting to climate change. The Cornell Climate Smart Farming Program specifically focuses on developing decision support tools for agricultural producers to better manage climate variability (Cornell Institute for Climate Smart Solutions, 2020). Florida leads the southeast and is currently the only state in the region to implement a climate change extension program (Morris et al., 2014). The southeast region has experienced milder impacts of climate change, smaller changes in temperature and smaller precipitation percent changes (Morris et al., 2014). Experiencing climate variability is more impactful than only hearing about it. Local climate variations may need to occur first before producers will approach extension about adaptation strategies (Morris et al., 2014). Burnett et al. (2014) found extension agents in North Carolina were willing to engage in climate change programming but perceived a lack of interest among agricultural producers. Conflicting information and lack of available applicable information are other barriers to climate change programing. Respondents indicated a need for training to address conflicts and emphasize relevancy for climate change extension programing to be successful (Burnett et al., 2014). Evans et al. (2011) suggest alternative strategies for distributing climate change knowledge in rural communities as studies have shown extension is not where producers get the majority of their information or that producers have shown distrust in government and science research surrounding climate change knowledge. Climate change programing must take into account the local sociocultural, economic, and environmental contexts of the community it's intended to influence (Evans et al., 2011). The first step towards developing extension programs focused on climate change is to understand agricultural producers' current perceptions and attitudes of climate change as well as their adaptive capacity. This initial assessment serves as a starting point in the effort to create adaptation strategies with economic and ecological sustainability goals.

Problem Statement

Adaptation and mitigation strategies like CSA are vital for the future of agricultural production in the face of climate change and variability threats. Farmer's receptiveness to educational programing surrounding climate change and variability must be known before successful CSA programing can be developed. This research may contribute to the literature and better help producers understand how U.S. agricultural producers perceive climate change and variability threats to their operation and their level of adaptive capacity. Research focusing on the Southeast region of the United States may help agricultural producers and the agricultural industry better understand their vulnerabilities to the impacts of climate change. Extension agents, educators, and researchers should be taking an active role in assessing farmer preparedness to better implement CSA style programming. Understanding the ability of agricultural producers to adapt to climate threats is crucial for adaptation education programing to be successful.

Purpose and Objectives

The purpose of this study was to describe the adaptive capacity of Alabama farmers. Adaptive capacity to climate variability threats was measured through five different dimensions of capacity: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy. The research objectives were identified as:

1. Describe participant demographics: (a) sex, (b) age, (c) household size, (d) school aged children, (e) experience, and (f) education level.
2. Describe participant farming characteristics: (a) products produced, (b) acreage, (c) state region, (d) land ownership, (e) income volatility in a good year, and (f) income volatility in a bad year.
3. Describe participants' perceptions of their adaptive capacity using five different cognitive dimensions: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy.
4. Describe participants' perceptions of their place and occupational attachment using three components: (a) value of agriculture, (b) individual-community interdependence, and (c) community commitment.
5. Describe participants' level of urgency related to climate variability.
6. Describe participants' attitudes towards the terms *climate variability* and *climate change*.
7. Describe participants' previous experience with climate variability trainings and gage interest in future participation.

8. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and participant demographics.
9. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and farming characteristics.
10. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and urgency levels.
11. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and attitudes towards *climate variability* and *climate change* terms.
12. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and interest in future climate variability trainings.
13. Determine the influence of place and occupational attachment on adaptive capacity.

This quantitative study was implemented through an online questionnaire delivered through the Qualtrics platform. The population of this study included adult farmers with Alabama Farmers Federation (ALFA). Participants were contacted through an electronic recruitment letter sent to their email including a link to the questionnaire.

Significance of the Study

This study may help to understand the adaptive capacity of Alabama farmers. It also may help to understand the climate change and variability perceptions of Alabama farmers. Alabama, the United States, and the world need to implement climate change adaptation and mitigation strategies. It is projected the agricultural industry will be hard hit by the future impact of climate change and variability (Kurukulasuriva & Rosenthal, 2003). Programs like CSA need to be more widely developed and implemented to aid agricultural producers in adaptation decision making.

The development of CSA programs is very localized and preliminary information is needed to understand the sociocultural economic context and farmer's receptibility to such programing. This study may contribute to the understanding of Alabama farmer's receptiveness to climate change education and their adaptive capacity to climate variability. This information may be useful to extension professionals and educators interested in developing CSA programming for Alabama farmers. CSA programs cannot be effectively developed without consideration for local conditions. This study provides a starting point for the development of CSA programs localized to Alabama farmer's receptiveness and adaptive capacity. Potential CSA programing using this information could help agricultural producers better adapt to climate change and variability threats and mitigate risks.

Assumptions and Limitations

The assumptions of this study include the assumptions made when using any online questionnaire to gather data. Participants were assumed to respond honestly and to understand the questions. Clear instructions and definitions where necessary were incorporated into the questionnaire. Another assumption was the accuracy of the sample of Alabama farmer participants. The sample was assumed to accurately represent the population of Alabama farmers with ALFA membership.

There are limitations to every study and many factors can influence or limit a study. Possible limitations in this study included non-response error. Participants not completing the questionnaire creates the potential for non-response error. Non-response error could negatively impact the internal validity of the questionnaire. Participants were urged to complete the questionnaire, given ample time to do so, and a reminder correspondence was sent to help address this potential limitation. The contentious nature of this topic could also impact response rates and who ultimately responded to the survey. All participants are Alabama agricultural producers which limits this study's findings to agricultural producers in Alabama. This is a potential limitation when using the findings to only assess farmers' adaptive capacity to climate change and variability as they cannot be generalized to different geographical locations. However, with the intent of using the findings to help develop CSA programing, localization of the finding is incredibly important and imperative to local CSA program success. Participants were contacted through the Alabama Farmers Federation, an organization of over 300,000 farmers operating in the state of Alabama. Contacting participants though this organization could have limited the study by unknowingly excluding a population of Alabama farmers not registered with the Alabama Farmers Federation.

Definition of Terms

1. Climate change: The current and predicted changes in weather patterns, temperatures, rainfall, and other ecological impacts from the continual increase in greenhouse gas emissions (Shaftel, 2020).
2. Climate variability: The short-term variations in regional climate patterns such as changes in seasonal rainfall quantity and distribution amounts or changes in seasonal temperatures (International Research Institute for Climate and Society, n.d.)
3. Adaptive capacity: A system's ability to adapt to the impacts of expected or unexpected changes (Smit & Pilifosova, 2001).
4. Climate-smart agriculture (CSA): An integrated approach to climate change adaptation that transforms agricultural systems while ensuring food security. CSA aims to simultaneously achieve increased productivity, enhanced resiliency, and reduced

emissions (Food and Agriculture Organization of the United Nations, 2020; The World Bank, 2020; Consultative Group on International Agricultural Research, 2014).

Summary

Climate-smart agriculture programing helps agricultural producers respond to climate change and variability threats through the adoption of adaptive production strategies. The adoption of adaptation strategies to climate change is imperative to the survival of agricultural producers. The threats of climate change and variability are looming and must be met with adaptive change. The implementation of climate-smart agriculture programs relies on individual program development with localized contexts. The adaptive capacity of Alabama farmers to climate variability must first be understood before adaptive programing can be developed. Knowing the receptiveness of farmers to climate-smart agriculture programing aids in the development and ultimate success of climate change adaptation strategies.

CHAPTER II

LITERATURE REVIEW

Agricultural Education

Merriam-Webster (2020) defines education as "the knowledge and development resulting from the process of being educated" (Definition of education). This definition does little to clarify education. Learning is defined as the gaining of knowledge, skill, or understanding through instruction or experience (Merriam-Webster, 2020). Combining these two definitions gives a better understanding of what it means to be educated and therefore what is education. Education is the learning of knowledge, skills, and attitudes through instruction and experience. Education can be divided into three types: formal, nonformal, and informal. Formal education is structured and graded. Schools from kindergarten to university classrooms are formal education. Nonformal education can encompass any program outside the school setting where content is intentional and adapted to the needs of the students. Nonformal education is learner centered and has a lower level of structure than formal education. Agricultural education examples of nonformal education are 4-H or FFA and the majority of the Cooperative Extension System. Informal education is even less structured and deals with everyday experiences. These experiences are categorized as incidental learning as they are not planned or organized. A son or daughter helping preform daily operations on the family farm is an example of informal education. The three forms of education are not at odds with each other. Each form has positives and negatives and offers different opportunities to the learner. All three can be found in the three-component model of agricultural education (Etling, 1993).

Agricultural education has indeed existed in some form or another as long as agriculture itself has been practiced. Early agricultural education was simply a parent passing down knowledge to their children and grandchildren. Formal education in agricultural education eventually became the norm and is still widely practiced today. The history of agricultural education shows us how extensive and important agricultural education is in the United States and around the world. Agriculture can generally be defined as any practice related to producing crops or raising livestock. Education is generally defined as the process of learning new knowledge and skills. Agricultural education can therefore be described as the process of learning new knowledge and skills related to the practices of producing crops and raising livestock. This of course includes marketing, communication, journalism, policy, technical fields, and a host of other subjects taught in the context of agriculture. Agricultural education is an incredibly broad subject area.

The National Association of Agricultural Educators (NAAE, 2020) defines agricultural education as the use of the three-component model to teach students about agriculture, food, and natural resources. Ekstrom (1969) wrote extensively on agricultural education and defined agricultural education as “an organized program of instruction in agriculture in elementary schools, secondary schools, colleges and universities” (p. 15). Dailey et al. (2001) stated agricultural education should produce students capable of high-level social skills, who are effective members of society, and developed in content-rich knowledge. Agricultural educators are responsible for this expectation including elementary, secondary, and post-secondary teachers, teacher educators, professionals in state departments, extension agents, and individuals engaged in international agricultural education. All these actors collaboratively make up the agricultural education system.

Intentional agricultural instruction for adult farmers began as early as 1938 in Alabama with vocational agriculture teachers offering evening classes. The Smith-Hughes Act specifically mentions the intent of agricultural education for adults (Stimson & Lathrop, 1942). The importance of adult education in agriculture was realized from the beginning of agricultural education as the need for agricultural education was high for adult farmers and young men no longer in school.

Andragogy comes from the Greek words *aner* meaning “adult” and *agogus* meaning “leading.” The term was coined by European adult educators that felt a need for a parallel label to pedagogy (Knowles, 1980). Pedagogy means “the art and science of teaching children” (Knowles, 1980, p. 40). Adult education is much more complex then teaching children. It is much broader and harder to define then it’s straightforward definition of “the art and science of teaching adults” (Merriam-Webster, 2020, Definition of andragogy). Malcolm S. Knowles (1980) originally defined andragogy as “the art and science of helping adults learn” (p. 43). This subtle difference, from “teaching” to “helping to learn,” points to the big difference between the interpretation of child learners and adult learners.

Adult educators view themselves as responsible for helping adults learn. An adult educator understands the needs of the individual, institution, and society (Knowles, 1980). Maslow’s hierarchy of human needs can help us understand the actual needs of individuals. Maslow’s human needs range from needs of physical safety to emotional needs to the need for self-actualization (Maslow, 1943). Self-actualization is developed through achieving one’s potential. Meeting this need is crucial to healthy adult learners and helps explain how adults prefer to learn. Adult learners need to see the purpose in what they are learning and be able to relate what they are learning directly to their real-life situations. Adult learners struggle to stay engaged if they do not see the ability for immediate application to help with their current problems. Adult learners fall into three sub-groups: the goal-oriented learner, the activityoriented learner, and the learning-oriented learner (Houle, 1988). An adult learner can fall into more than one of these sub-groups and often migrate between them depending on the purpose of their sought-out education.

The models of pedagogy and andragogy are not opposites of each other. Nor are they mutually exclusive of each other. The two methods are more like two ends of a spectrum. There are three assumptions about a learner that can help an educator understand if the learner is more suitable to andragogy methods. The first assumption is their self-concept is more self-directed then dependent, the second assumption is a reservoir of experience, and the third assumption is their readiness to learn (Knowles, 1980). Generally adult learners lean more towards the andragogy end of the spectrum depending on the learner and the topic. An adult learner trying to learn a mechanical operation for the first time might be more dependent on the educator and require more pedagogical methods. A high school student participating in a supervised agricultural experience will be more self-directed and require more andragogical methods.

Experiential Learning

Experiential learning could be called the landmark of agricultural education. Experiential learning teaches transferable skills that provide lifelong learning skills to students (Dailey et al., 2001). The philosophies of Dewey, Knapp, Stimson, and Lancelot combine to ground the experiential learning model which aligns with authentic learning (Knobloch, 2003). Dewey, Knapp, and Stimson all fall into the progressivism educational philosophy realm. Progressivists encourage students to learn by doing, test ideas through active experimentation, and make meaning from their individual experiences. The learner takes an active, not passive, role their education.

John Dewey was an American educational philosopher and is known as the father of experiential education. Dewey's philosophy of experimentalism centered on the human experience. This type of education was progressive at the time and Dewey championed educational reform noting that education and learning should be accomplished though doing. The process of experiential learning is cyclical (concrete to abstract to concrete) and continual (lifelong). Formal, nonformal, and informal education all exist in the continuum (Roberts, 2006). The experience itself is the act of learning and experiences build on one another to create knowledge and understanding. Experience should be both the why in which we educate and the goal of education (Dewey, 1938).

Seaman Knapp was an American educator and founded the Farmers Cooperative Work Division which was later formalized and nationalized through the Smith-Lever Act of 1914. He promoted evidence-based farming practices throughout the Southern United States and helped initiate community demonstration farms and county farm agents (Bailey, 1945). Knapp also helped draft the Hatch Act of 1887 establishing agricultural experiment stations. His work paved the way for today's Cooperative Extension System. His philosophy is most succinctly captured by the quote "what a man hears, he may doubt. What he sees, he may still doubt. But what a man does himself, he cannot doubt" (Dromgoole et al., 2018, para. 4).

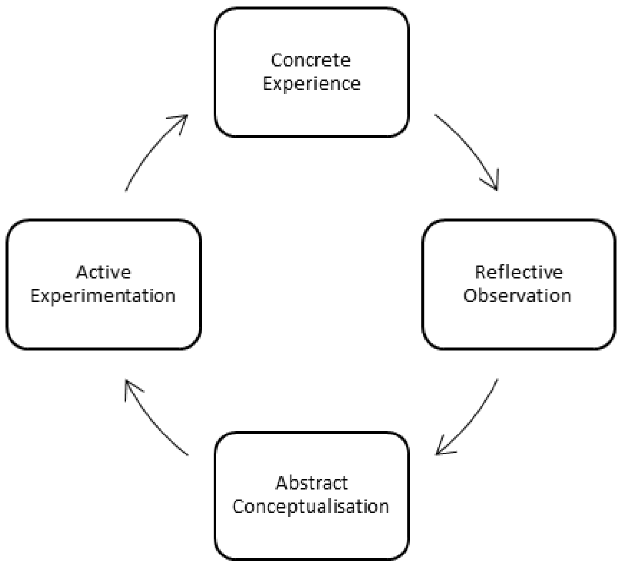
Rufus Stimson is most known for the project method. During his time as an educator, agriculture was taught using classroom lecture and manual labor on the school farm. Stimson did not see these teaching methods as appropriate or effective for agricultural education (Moore, 1988). He pioneered the home project method were students were taught agricultural methods in school and then applied them on their home farms. The project method grew rapidly in popularity and was included as a requirement as part of the Smith-Hughes Act of 1917. The current supervised agricultural experiences piece of agricultural education can be traced back to Stimson. Stimson also had a hand in pioneering adult education in agricultural education as well as not discriminating against female students (Moore, 1988).

William Lancelot developed the interest approach to education that is both effective and widely applicable. Lancelot believed a student's interest in learning the subject matter at hand is critical to their cognitive development. The educator holds the responsibility to engage a student's interest and maintain that high level of interest (Lancelot, 1944). A learner's interest is directly tied to their consumption of new knowledge. Knowledge gained through interested minds sustains knowledge retention as well as application (Benge & Harder, 2018). Lancelot's (1944) instructional methods are centered around developing and maintaining the interest of the students. The interest approach can be achieved through many faucets, experiences being a foundation of such approaches.

David Kolb is an educational theorist influenced by the works of Dewey and Piaget. He developed his experiential learning theory to include a four-stage learning cycle and individual learning styles. Learning is effective when all four stages of the cycle have been applied. Each stage of the cycle is supportive of the next stage. A learner can start the process at any point but must complete all for stages through its sequence to achieve effective learning. Figure 1 demonstrates the four stages of the model and their sequence (Kolb & Fry, 1974). Generally, a learner first has a concrete experience where a new situation is encountered. They then actively reflective on their understanding of the experience. The act of reflection modifies existing concepts and generates new ideas. The learner then applies these new ideas which leads to new experiences and the cycle begins again.

Figure 1

Kolb's experiential learning four-stage learning cycle



Experiential learning is the foundation of agricultural education and should be present in each of the three components of the three-component model. It is the instructor's responsibility to provide purposeful and planed support, develop meta-cognitive skills, and incorporate experiential learning into curriculum planning and assessments (Baker et al., 2012).

Land-Grant Institutions

There is a plethora of United States legislation related to agriculture and agricultural education. Of this extensive list (Reid, 2017) the following legislations relate directly to land-grant institutions and the Cooperative Extension System. The Morrill Act of 1862 granted public lands to states to establish colleges for the benefit of agricultural and mechanical education. Vermont Congressman Justin Smith Morrill was the author of the Morrill land-grant act and intended it to serve as a means of a practical and scientific education (True, 1929). Congressman Morrill introduced the first version in 1856, but the bill was denied. The second edition passed by a vote of 90 to 25 and was signed into law by President Lincoln less than two months after he approved the bill that created the United States Department of Agriculture (True, 1929). When the Morrill land-grant act of 1862 was passed, agriculture was almost non-existent in secondary schools. After it passed it was assumed that these new designations and colleges would provide the necessary agricultural education needed. The number of farm children that would actually attend these colleges were very few and supplemental agricultural education in lower schools would be needed if agricultural education were to reach the masses and be supplied in large measure. This awareness not only promoted agricultural education be taught in secondary schools but in elementary schools as well. This was especially important as rural elementary schools were sometimes the only educational institutions attended by farm boys (True, 1929). Agricultural education remains a cornerstone of secondary and post-secondary education across the United States.

Conditions of land-grant colleges and agricultural education the first 25 years after the passage of the Morrill Act were unsatisfactory at best. The body of agricultural knowledge referring to American conditions was lacking and the standards of teaching mostly by textbook alongside the requirement of manual labor did not appeal to students. A meeting in 1871 of representatives of land-grant colleges started the movement that would eventually lead to three very important establishments: the Hatch Act of 1887, the Morrill Act of 1890, and the formation of the Association of American Agricultural Colleges and Experiment Stations in 1887 (True, 1929).

The Hatch Act of 1887 established experiment stations and strengthened agricultural teaching and research. The Hatch Act was important for vocational education in that it provided "the means for conducting research upon which subject matter in agriculture might be based"

(Ekstrom, 1969, p. 44). The Hatch Act helped establish the partnership of agricultural research being directly related to agricultural education. Land-grant institutions continue to lead the United States in agricultural education, research, extension, and leadership development. The Morrill Act of 1890 expanded federal endowment of the land-grant colleges. It allowed former confederate states to create separate land-grant colleges for people of color. Many of the United States' historically black colleges and universities were founded through the Morrill Act of 1890. The Smith-Lever Act of 1914 formalized the relationship between land-grant colleges and the federal extension service. The increase in extension work promoted instruction, practical agricultural field demonstrations, and publications (True, 1929). The Cooperate Extension System continues to be a vital part of agricultural education.

Extension

The first reported formal agriculture education in Alabama was a one-room school at Tuskegee in 1880. Booker T. Washington was gifted 100 acres of farmland for the school for the students to have hands-on learning opportunities. He went on to found Tuskegee Institute in 1881. At the time of the founding, 85% of African Americans in the gulf states depended on agriculture to earn a living (Stimson & Lathrop, 1942). Agricultural education teaching began based on the needs of the farmers. The Department of Agriculture at Tuskegee was organized in 1896 with theoretical courses as well as practical agricultural courses (poultry, dairying, gardening, and beekeeping). In 1906 the movable school was created through the development of a demonstration wagon which was designed and made by Morris K. Jesup of New York who also donated the cost of equipping the wagon for work (Stimson & Lathrop, 1942). After three months of successful operations giving talks and demonstrations to farmers, Washington presented the idea to the federal government. They immediately approved the idea and subsequently appointed him as the first African American extension agent to work with African American communities in the South (Stimson & Lathrop, 1942). This type of agricultural education became a permanent part of the extension service in Alabama after the passage of the Smith-Lever Act in 1914.

Extension remains one of the United States' best kept secrets. The relevancy of the Cooperative Extension System has only grown and will continue to do so with all the projected future challenges in agriculture. Aggressive marketing and advertisement campaigns need to continue to broaden the awareness of the extension service and their programs. The Cooperative Extension System today is the primary outreach organization for land-grant institutions. Research based curriculum remains at the core of the extension system and drives its educational programing. One in three Alabamians are reached by Alabama Extension (Alabama Cooperative Extension System, 2020). The formal and nonformal agricultural education offered by the extension system is an invaluable part of agricultural education as it reaches far more agricultural professionals then schools and universities could alone. Land-grant universities have a critical responsibility to conduct research related to complex agricultural problems and disseminate educational programs through the Cooperative Extension System.

AAAE Research Agenda Priority

The American Association for Agricultural Education (AAAE) is a professional organization of university faculty and graduate students devoted to agricultural education, extension, leadership, and communications. The AAAE Board of Directors authorized the development of the current National Research Agenda to prioritize research questions for the 2016-2020 period. A four-stage Delphi process was used by the revision committee to identify and prioritize the research questions. The AAAE National Research Agenda exists to help

AAAE members and agricultural education scholars focus their research on addressing the issues prioritized by the expert panel in the Delphi study. The National Research Agenda aids researchers by creating a more coordinated national research effort. This in turn creates a more robust research process and encourages collaboration among scholars, universities, and states. The National Research Agenda consists of seven broad priority areas: (a) public and policy maker understanding of agriculture and natural resources, (b) new technologies, practices, and products adoption decisions, (c) sufficient scientific and professional workforce that addresses the challenges of the 21st century, (d) meaningful, engaged learning in all environments, (e) efficient and effective agricultural education programs, (f) vibrant, resilient communities, and (g) addressing complex problems (Roberts et al., 2016). The expansiveness of the priority areas facilitates and helps research on a wide variety of topics while still providing guidance. Research priority seven "addressing complex problems" includes pressing challenges in geographical space, agricultural production, natural resource management, energy consumption, and climate change (Andenoro et al., 2016). Climate change is the most significant of these and requires innovative solutions (Andenoro et al., 2016). There are three research priority questions in research priority seven and the first aligns with this study; "What methods, models, and programs are effective in preparing people to solve complex, interdisciplinary problems (e.g. climate change, food security, sustainability, water conservations, etc.)?" (Andenoro et al., 2016, p. 59). This study explored the perceptions of producers to better understand the potential of climate-smart agriculture programs to effectively address climate variability issues.

Climate Change

Climate change is the most pressing global issue this century (United Nations, 2020). The unprecedented consequences will be felt worldwide and are already impacting global industries from technology to transportation to agriculture. Climate change is real, and the main cause is from human related activities (Stocker et al., 2013). Climate change is the current and predicted changes in weather patterns, rainfall, temperatures, and other ecological impacts from the increase in greenhouse gas emissions. Greenhouse gases are naturally occurring to a certain extent in the Earth's atmosphere and keep temperatures warm enough for Earth to be inhabitable (Shaftel, 2020). Greenhouse gases trap some of the sun's rays while the rest are reflected into space. Since the industrial revolution, levels of greenhouse gases have been rising which causes more of the sun's rays to be trapped in the Earth's atmosphere. Levels of greenhouse gases have risen to record breaking concentrations and are continually rising year after year (United Nations, 2020). Higher levels of greenhouse gases create higher global temperatures. Increases in global temperatures will shift weather patterns and rise sea levels causing unprecedented changes for centuries to come (United Nations, 2020). Observable changes due to climate change have already been well documented. Glaciers are getting smaller, sea ice is being lost, intense heat waves are becoming more frequent, animal ranges have migrated, and plant seasons have shifted. Short and long-term impacts of climate change are predicted to be significant and to increase over time (Shaftel, 2020). Temperatures will rise, growing seasons will lengthen, precipitation patterns will change, droughts and heat waves will become more common, hurricanes and extreme weather events will become more frequent and intense, sea levels will rise, and the artic is likely to become ice-free (Shaftel, 2020). The United States is expected to experience milder immediate impacts with intensity depending on region. The Southeast will experience extreme heat, decreased water availability, and sea level rise (Shaftel, 2020). The region's economy and environment will experience widespread decline across sectors from energy to health to agriculture.

It is important to understand the difference between climate change and climate variability. Climate change refers to significant change in the mean state of the climate over an extended period of time (World Meteorological Organization, 2020). Climate variability refers to changes in regional climate patterns over a month, season, or year (World Meteorological Organization, 2020). Spatial and temporal variations of the climate beyond individual weather events like changes in seasonal rainfall amounts or seasonal temperatures are categorized under climate variability. The term climate change is often used interchangeably to refer to all climate change related impacts, both short-term and long-term changes. It is important to note that the short-term potential impacts from increased variability are less discussed because they are less known. The slow onset changes like global temperature changes and sea level rise are more well known. Climate variability impacts will be felt first and may pose greater threats to producers. Climate variability impacts can fall into two categories: extreme weather events and regional weather variability. Extreme weather events are localized events like floods, droughts, tornados, hurricanes, and wildfires. Regional weather variability is year-to-year changes in precipitation patterns, pressure, and temperature fluctuations (International Research Institute for Climate and Society, n.d.). Both categories require adaptations measures to increase resiliency to extreme weather events and increase adaptive capacities to regional weather variability (Food and Agriculture Organization of the United Nations, 2013).

Agricultural Impacts

Current and projected impacts of climate change on agriculture are increasingly concerning (Kurukulasuriya & Rosenthal, 2003). Precipitation and temperature changes will impact agricultural productivity in every country on Earth. Agriculture is inherently intertwined with natural resources and therefore will be directly impacted by climate change. Extreme weather events like drought, flooding, hurricanes, tornados, and wildfires are becoming more common and more severe. The frequency and intensity of extreme weather events are expected to increase which will cause significant problems for communities around the globe (Shukla et al., 2019). Changes in water supply due to climate change will impact agricultural production which is the biggest user of freshwater globally (Calzadilla et al., 2013). Over 80% of agricultural production worldwide is rainfed (Gornall et al., 2010). Changes to seasonal rainfall quantity and distribution will impact agricultural production around the world. Rainfed and irrigated agriculture will both face challenges. Irrigated production in the United States is expected to decline (Calzadilla et al., 2013). Long-term water shortages, desertification, pest outbreaks, and worsening soil conditions are among the expected agricultural impacts of climate change (Kurukulasuriya & Rosenthal, 2003). Changes will undoubtedly impact local, regional, and global production and distribution systems.

Tropical regions will experience climate change impacts on agricultural production the hardest (IPCC, 2001). Higher temperatures will increase heat stress on crops as well as water loss caused by evaporation (Gornall et al., 2010). Production will shift away from these areas to the north and south towards the temperate and polar regions (IPCC, 2001). Many tropical regions depend on agriculture for community livelihoods and food security. Rural poverty will only be exacerbated by a shift in production areas. The United States could experience an increase in demand for exported products. This increase in demand will only increase the stress on the United States' agricultural industry already struggling with the impacts of climate change. Climate change and variability will have several implications for agriculture. The combined impact of these implications is even less known and harder to predict (Gornall et al., 2010). Providing a robust assessment of the projected impacts on agriculture is very difficult due to so many unpredictable factors (Thornton & Cramer, 2012). Short-term impacts of climate change could benefit some areas of North America, however regional areas are predicted to suffer significant losses (Lobell & Field, 2006; United States Global Change Research Program, 2018). Lower yields will result from variability of precipitation and temperature (Cohen & Miller, 2001). Overall yields are predicted to decline in the United States due to changes in water availability, increased temperature, soil erosion, and disease outbreaks (United States Global Change Research Program, 2018). Warmer temperatures could also shorten crop lifecycles by speeding decomposition (Smith et al., 2014). Crop production and livestock health are at risk due to the numerous challenges of climate change. Some regions will benefit in the short-term from warmer temperatures lengthening the growing season, however a change in land use is expected in North America as growing seasons lengthen and temperatures increase. Changes in rainfall patterns and crop yields will cause a shift in production areas (Padgham, 2009). Adverse effects are more likely where summer temperatures will limit irrigation. Increased temperatures will significantly alter the relationship between crops and weeds and pests (Cohen & Miller, 2001). Extreme weather events could reduce the efficacy of pesticide applications and warmer winters could prevent the kill-off of insects (Cohen & Miller, 2001). The southeast region has so far experienced milder impacts of climate change such as smaller changes in precipitation and temperature fluctuations (Morris et al., 2014). Model studies predict losses in crop production will occur across the Southeast (Smith et al., 2014). Agricultural production in the Southeast will experience the impacts of climate change and variability. Over the next few decades agricultural production is expected to experience issues related to climate variability and increased frequency of extreme weather events (Padgham, 2009). Long-term impacts will be a combination of climate variability and extreme weather events with changes in mean climatic conditions.

Adaptation and Mitigation

The growing demands for increased agricultural production in the face of climate change calls for industry wide transformations. Climate change threatens agriculture's ability to provide for the growing global population (Arslan et al., 2017). Combating climate change and variability involves both adaptation and mitigation strategies. Mitigation focuses on changes in behavior and policy that reduce greenhouse gas emission helping to mitigate the progression of climate change. Agriculture represents about a third of global greenhouse gas emissions but has tremendous potential for mitigating climate change (Food and Agriculture Organization of the United Nations, 2013). Agricultural systems have the potential to capitalize on natural biological processes through storing carbon and reducing greenhouse gas emissions. Mitigation involves transforming traditional practices to more sustainable land-use and soil-use methods. Challenges with mitigation strategies involve the quantification of carbon sequestration which makes it difficult to identify emissions reductions (Schnetzer, 2016). Adaptation focuses on changes in behavior and adjustments in response to current and projected impacts of climate change and variability. Adaptation can be based on three questions: Who is adapting? What are they adapting to? And how will adaptation occur? (Smit et al., 1999). There are three levels of adaptation to climate change and variability: responses to current variability, observed medium to long-term effects, and anticipatory planning in response to model scenarios (Adger et al., 2007). Adaptation responses are often intertwined between the three levels. Local, regional, and national social and economic systems can all adapt to the projected impacts of climate change and variability. Climate change and variability impacts on agricultural production require both adaptation and mitigation strategies. Adaptation strategies to short-term climate variability concerns are just as crucial as adaptation strategies to long-term climate change concerns.

Immediate adaptation strategies address the weather effects of climate variability by increasing a producer’s resiliency. Adaptation strategies for longer term impacts include modifying production times, products, and production locations.

Adaptation strategies take place throughout different tiers such as the micro level, market level, institutional changes, and technological developments (Kurukulasuriya & Rosenthal, 2003). Climate change adaptation is most effective when all tiers implement strategies that work together cohesively. Micro level adaptations refer to the personal and household level. Adaptations implemented by a producer such as production adjustments through diversification or intensification are micro level adaptations. Changes in land use, modifying irrigation methods, and altering operation timings are also examples of micro level adaptations implemented by producers. Market level adaptation measures focus on crop and flood insurance development, credit schemes, innovative investment opportunities, and income diversification opportunities. Institutional level changes most often require government action through policy adjustments. Changes to subsidies and trade policies, agricultural market improvements, and the mandating and funding of agricultural support and insurance programs are some adaptation strategies for institutional level change. Technological development adaptation strategies aid micro level adaptations through the development of new crop varieties or the promotion of new water management techniques like conservation tillage.

The ability of adaptation at the micro level heavily depends on the adaptation strategies implemented within the other tiers. Producers’ ability to implement adaptation strategies is also constrained by economic, cultural, and geographical barriers. Traditions can be difficult to change and adaptations too costly for producers to undertake without assistance. Short-term adaptations can include diversification of crops and livestock and altering the intensity of fertilizer and pesticide application. Long-term adaptations like changes in timing, location, and intensity of production are implemented in gradually. Development of new technologies, improving water management practices, and permanent labor migration are strategies that can be phased into long-term plans. Short-term and long-term strategies will sometimes complement each other, but in many cases they will not. Adaptation strategies a producer implements now are often not long-term solutions. Reducing short-term vulnerabilities through policies and adaptation strategies will not necessarily transfer to a reduction in long-term vulnerabilities. Strengthening capacity to climate change and variability threats requires practical response strategies like adaptation (Smith, 1997). Adaptation will significantly decrease the felt impacts of climate change.

Climate-smart Agriculture

Climate-smart agriculture (CSA) is a relatively new integrated approach to climate change adaptation. The goal of CSA is to transform agricultural systems to meet future demands of climate change adaptation while ensuring food security (Food and Agriculture Organization of the United Nations, 2020; The World Bank, 2020; Consultative Group on International Agricultural Research, 2014). The term “climate-smart agriculture” was coined by the FAO for the 2010 Hague Conference on Food Security, Agriculture, and Climate Change (CGIAR, 2020). CSA aims to simultaneously achieve three goals: increased productivity, reduced greenhouse gas emissions, and enhanced resiliency (Food and Agriculture Organization of the United Nations, 2020; The World Bank, 2020; Consultative Group on International Agricultural Research, 2020). Increasing productivity will increase food and nutrition security as well as local incomes. Reducing greenhouse gas emissions will avoid further deforestation from agriculture production and decrease emitted emissions per unit of agricultural product produced. Enhancing resiliency will enhance long term adaptive capacity aiding producers in future challenges including shortened seasons or unpredictable weather patterns. Each of these three goals can be broken down further into action categories. Each goal has three action categories. Increasing productivity involves increasing resource use efficiency, diversifying production systems, and managing ecosystem services and biodiversity (Food and Agriculture Organization of the United Nations, 2019b). Enhancing resiliency includes diversifying production systems, managing ecosystem services and biodiversity, and adjusting production to reduce exposure risk and adapt to changing conditions (Food and Agriculture Organization of the United Nations, 2019b). Reducing greenhouse gas emissions includes increased resource use efficiency, sequestering carbon in agro-ecosystems, and replacing fossil fuels with renewable energy (Food and Agriculture Organization of the United Nations, 2019b). Many actions needed to achieve one of the goals will simultaneously benefit another. CSA is part of the future of sustainable agriculture, it is included in the strategic objectives of the FAO and part of the Rainforest Alliance's 2017 Sustainable Agriculture Standard (Food and Agriculture Organization of the United Nations, 2019b; Food and Agriculture Organization of the United Nations, 2019c; Rainforest Alliance, 2020).

CSA is a form of sustainable agriculture that combines various sustainable methods directly intended to combat climate change threats (Rainforest Alliance, 2020; Wall & Smit, 2005). CSA approaches pay specific attention to planning for adaptive transitions, investing in managing climate risks, and exploring opportunities to reduce or remove greenhouse gas emissions (Consultative Group on International Agricultural Research, 2014). Sustainable approaches that actively account for climate change threats and adaptive transitions are made a priority. CSA is not a single approach or practice that can be applied universally, it instead provides agricultural adaptation approaches suitable to local conditions (Food and Agriculture Organization of the United Nations, 2020). It is an approach requiring location specific assessments to identify technologies and practices best suitable to local conditions. CSA programs are location specific and highly knowledge intensive (Food and Agriculture Organization of the United Nations, 2013). Knowledge intensive programs require comprehensive capacity development built on sweeping assessments of individual and organizational level needs. Developing a CSA program involves analyzing the situation, prioritizing, program support, and monitoring and evaluation (Consultative Group on International Agricultural Research, 2020). The first step to developing and implementing a CSA program is to assess localized climate risks (Rainforest Alliance, 2020). Climate change will impact different geographical areas differently. Assessing and identifying local climate change challenges is a crucial first step as a producer facing frequent flooding will need different adaptive strategies than a producer confronting prolonged water shortages. Adaptation strategies and CSA programs must be developed individually with local conditions considered. CSA uses a variety of tools when assessing the vulnerability and climate change risks of a landscape. CSA is "smart" as it combines management techniques specific to a producer's climate change and variability threats while building resiliency to future climate change and variability challenges and impacts (Rainforest Alliance, 2020). Needs-based capacity development is required to facilitate the transition to CSA. The four categories required for this development are: information management, research, stakeholder processes, and evidence-based decision making (Arslan, 2017). Feasibility studies for CSA programs collect relevant information and collaboration opportunities for future projects. Feasibility studies in Botswana, Ecuador, and Ethiopia were conducted by examining indigenous knowledge practices, existing CSA technologies, conducting awareness-raising workshops, and developing localized CSA best practices (Food and Agriculture Organization of the United Nations, 2019a).

Extension programs focusing on climate change and variability adaptation and mitigation have recently been implemented in a handful of states in the United States. Regions already feeling extensive climatic changes like the Southwest and Midwest have started to establish adaptation programs (Morris et al., 2014). These existing programs develop and disseminate local climate variability best management practices (Fraisse et al., 2009). These programs are crucial for climate variability adaptation and the future of agriculture. The University of California in collaboration with the California Department of Food and Agriculture initiated a climate-smart farming program to help producers reduce greenhouse gas emissions, build resiliency, and increase profit (Warnert, 2019). The Cornell Climate Smart Farming Program focuses on helping producers through the development of decision support tools (Cornell Institute for Climate Smart Solutions, 2020). Their interactive website integrates climate information within a specific region to support farm level decision making. A toolkit was developed to help producers in the Northeast improve their productivity and resiliency (Cornell Institute for Climate Smart Solutions, 2020). Many of the tools help farmers determine the best time for planting, harvesting, and irrigation. The toolkit also helps producers plan for potential extreme weather events. The University of Vermont's Farming and Climate Change Program investigates not only how producers can adapt to climate variability, but also the potential of agricultural production to help mitigate climate change (University of Vermont, 2020). They provide consultation and educational opportunities to producers on sustainable strategies for adapting to and mitigating the impact of climate change and variability. Florida is the only state in the Southeast region with a climate change extension program (Morris et al., 2014). The

University of Florida along with six other universities in Florida created the Florida Climate Institute that aims to provide climate research, education, and outreach activities through interdisciplinary projects (Florida Climate Institute, n.d.).

The uncertainty of climate change and variability requires the transition to CSA through the engagement of local and national support and formal and nonformal education (Food and Agriculture Organization of the United Nations, 2013). Extension and other advisory services are critical in supporting the transition to CSA (Food and Agriculture Organization of the United Nations, 2013). Programs implemented through extension systems will need innovative ways to engage producers on climate variability. Some areas view extension as one of the most trusted sources of information about climate change and variability (Prokopy et al., 2015). However, some studies have found extension programs have difficulty maintaining themselves as a source of prominent trusted information on topics like climate change and variability (Evans et al., 2011; Tobin et al., 2017). Special attention needs to be paid to distribution strategies of climate change knowledge as producers have shown distrust in climate change research (Evans et al., 2001). Extension professionals must be educated on not only what information to pass on to producers, but how to talk about this contentious topic. Many studies have found the use of appropriate terminology as a crucial aspect of engaging in dialog with producers (Telg et al., 2020; Diehl et al., 2015). The term "climate change" is too charged and negative a term and should be avoided (Arbuckle et al., 2014; Telg et al., 2020). Proper training of extension professionals is also severely lacking. Some studies have found extension professionals are not as convinced as scientists that climate change is happening and there is too much uncertainty surrounding it to justify advising adaptation measures (Prokopy et al., 2015). Extension professionals are not prepared or adequately trained to provide climate change and variability support to producers (Diehl et al., 2015; Prokopy et al., 2015; Tobin et al., 2017). Extension professionals must engage in and be able to provide climate change and variability management training events (de Koff & Broyles, 2019; Diehl et al., 2015). Extension agents interviewed in four southeast states report a need for accessible climate adaptation trainings to enable them to engage producers in conversations about climate change and variability management and technology related adaptation strategies (Diehl et al., 2015). Extension agents in North Carolina were interested in implementing climate change programming but perceived a lack of interest among producers (Burnett et al., 2014). Most extension educators believe they need to help producers prepare for climate change and variability impacts (Prokopy et al., 2015).

Generating and documenting indigenous and scientific knowledge needed to localize CSA programs can be implemented through established extension systems. Changes in behavior, agricultural practices, and improved access to technologies that are needed for a successful transition to CSA need to be supported by extension professionals (Schnetzer, 2016). Given the individualized and localized nature of climate change adaptation and CSA, extension agents will need to move away from blanket recommendations. CSA programs need to be developed in a client-oriented way and be relevant for local producers to be successful (Burnett et al., 2014; Doll, 2017; Schnetzer, 2016). Climate change programming needs to account for local sociocultural, economic, and environmental conditions (Evans et al., 2011). The development of climate change and variability extension programs must begin with an assessment of producers' current perceptions, attitudes, and decision-making information (Doll, 2017; Fraisse et al., 2009). After enough data has been gathered, localized adaptation strategies can be developed. Creating awareness of climate change and variability impacts as well as facilitating access to adaptation technologies should be a goal of any climate variability program (Somboonsuke et al., 2018;

Wetende et al., 2018). The Cooperative Extension System is ideally suited to provide climate change and variability outreach and localized adaptation education (Morris et al., 2014; Tobin et al., 2017). Developing climate change extension programs involves understanding current perceptions and attitudes producers hold as well as their adaptive capacities (Evans et al., 2011). Successful programs depend on the involvement of participants (Schein, 1996).

Theoretical Framework

One of the most effective approaches to climate change and variability uncertainty is to reduce vulnerability and increase resiliency (Food and Agriculture Organization of the United Nations, 2013). Increasing resiliency to climate change is crucial to ensuring improved food security and producer success (Food and Agriculture Organization of the United Nations, 2019b; Marshall & Marshall, 2007). Resiliency is the capacity of systems, communities, or individual producers to cope with risk through mitigation and adaptation. An individual producer is more resilient when they are less vulnerable to shocks and stressors. Building resilience can be achieved by reducing exposure, reducing the sensitivity of systems to shocks, and increasing adaptive capacity (Food and Agriculture Organization of the United Nations, 2013).

The concept of resiliency is relatively new and was originally used in the field of population ecology (Holling, 1973). An essential component of resiliency is human adaptation. Identifying what actors in a system are most resilient, what opportunities exist for innovation and adaptive capacity, and at what points of an intervention resiliency can be increased are fundamental to the pragmatic approach that is Resilience Theory (Atwell et al., 2008). Resilience Theory has been increasingly used in human environmental interactions like climate change and variability (Janssen et al., 2006). Ecological and social systems are inherently connected as their long-term sustainability is dependent on adapting to change. Resiliency measures the ability to absorb and respond to change. Change can come in periods of growth and improvement as well as collapse and reorganization (Atwell et al., 2008).

Many approaches to change theories exist to varying degrees of recognition. The three-stage change model was the first to be introduced by Kurt Lewin (Kritsonis, 2005). This three-stage model is also known as the unfreezing-change-refreeze model as it emphasizes relearning. Prior learning must be rejected and replaced to move from old practices to new more effective ones (Medley & Akan, 2008). Change theories represent how engagement and learning can enable change (Maru et al., 2018; Thornton et al., 2017). Creating and sustaining change involves innovative approaches to raising awareness and building capacity. Sustainable agricultural production and the transition to CSA consists of four action areas that together conceptualize the theory of change (Arslan, 2017). Evidence, dialogue, tools, and practice change are all required activities. An evidence base must be created to support, motivate, and monitor change. Continuous dialogue creates inclusive platforms and encourages joint action. Tools formulation enables change through regulations, financing, and guidance. CSA strives to achieve the outcomes associated with the practice change action areas (Arslan, 2017). CSA works to enhance capacities and establish continuous feedback loops. The desired impact is to improve agricultural production and sustainability through the creation of resilient systems.

Other change theories include Social Cognitive Theory and The Theory of Reasoned Action and Planned Behavior (Kritsonis, 2005). Social Cognitive Theory involves experiential learning and was development by Albert Bandura in 1986. Bandura (1986) theorized that learning occurs within a social context involving interaction between the learner, environment, and behavior. A basic premise of Social Cognitive Theory is people learn through their own experiences, by observing others, and the results of actions (Bandura, 1986). Social Cognitive

Theory involves experiential learning which is the foundation of agricultural education. Successful change requires individuals to have self-efficacy, as in they must believe in their ability to exhibit a behavior and perceive a benefit from doing so. Past experiences are assumed to influence a person's behavior and why they engage in that behavior.

Everett Rogers developed the Diffusion of Innovations Theory in 1962 and it is one of the oldest social science theories still widely used today. The adoption and diffusion of new ideas and innovations in a community, region, and the world can be explained using this theory. The Diffusion of Innovations Theory has been extensively used in agricultural education and the Cooperative Extension System. There is often a lag time from when an innovation or new technology becomes available and when it becomes widely adopted. The inherent urgency imposed by climate change and variability pose a problem in the face of slow adoption and diffusion rates (Long et al., 2016). The rate of diffusion and how to influence it or speed it up is the premise for the Diffusion of Innovations Theory. Increasing our understanding of adoption barriers is required to speed up the rate of adoption. The four main elements of the diffusion process are the innovation, communication channels, time, and the social system (Rogers, 2003). These elements and the process of diffusion are identifiable in every type of diffusion of innovations. The Cooperative Extension System and extension services around the world heavily rely on this theory to promote and speed up the rate of adoption of various agricultural innovations and technologies. The capacity to innovate and change is an inherent component of adaptive capacity (Cohen et al., 2016). The extensive history of the Diffusion of Innovations Theory coupled with the newer Resilience Theory provides an approach to understand the interplay of the multiscale drivers of change (Atwell et al., 2008). This approach seeks to understand the adaptive capacity for the adoption of climate variability adaptation strategies.

Adaptive capacity is essential to resiliency and considers modifications through the assessment of all potential shocks together. Adaptive capacity covers two dimensions: responses to changes (coping with uncertainty) and recovery from shocks (Food and Agriculture Organization of the United Nations, 2013). Climate variability adaptation is the response to current or projected adverse effects of climate variability (Smit et al., 1999). Adaptation strategies reduce one's vulnerability to these threats. The enhancement of capacity is identified as a top adaptation strategy (Somboonsuke et al., 2018). Adaptive capacity is defined as "the potential or variability of a system to adapt to (to alter to better suit) climatic stimuli or their effects or impacts" (Smit & Pilifosova, 2001, p. 894). Adaptive capacity is the ability to successfully respond to climate change and variability threats. Reducing producers' vulnerability to climate change threats involves strengthening their adaptive capacity (Kurukulasuriya & Rosenthal, 2003). Adaptive capacity is comprised of the three interrelated components of contextual factors (available resources), objective capacity (access to resources and technologies), and perceived capacity (behavior change) (Adger et al., 2007; Gardezi, 2017). Perceived adaptive capacity is the extent producers feel prepared to handle risks and their willingness to take actions to manage those risks (Gardezi, 2017). Producers are particularly vulnerable to climate variability because their livelihoods are highly sensitive to changes in climatic conditions (Eakin et al., 2016). The adaptive capacity of farmers is therefore a function of their perceptions and experience (Eakin et al., 2016). Both subjective and relational factors as well as objective measures need to be considered when measuring capacity (Brown & Westaway, 2011). Objective measures have been the focus of much of the adaptation literature, however the internal subjective and relational measures influence risk behavior and must also be accounted for (Eakin et al., 2016). How producers perceive information, their self-efficacy, and the effectiveness of adaptation measures all influence risk behavior and decision making (Eakin et al., 2016).

The predicted broad impacts of climate change and variability require a collaborative approach to adaptation strategies. The local individual level, private industrial level, and the national governmental level all need respective adaptative strategies. Individual level adaptive capacity and the institutional level have multidirectional relations. Individual producers and organized groups can effectively influence governing institutions (Eakin et al., 2016). Social capital is dependent on the collective capacities and shared values (Eakin et al., 2016). Micro level adaptation strategies include modifying inputs, production changes, adjusting management strategies, and adopting new technologies (United States Global Change Research Program, 2018). The success of climate variability adaptation depends on knowledge access and technology affordability of proposed strategies (Fraisse et al., 2009). The capability of producers to adopt proposed strategies is measured through adaptive capacity. Capacity to adapt to climate change and variability is unequal both across and within societies (Adger et al., 2007). Adaptation fundamentally depends on the characteristics of the vulnerabilities of the system or individual (Smit et al., 2000). The capacity to adapt is considerably varied among countries, regions, and socioeconomic groups (Smit & Pilifosova, 2001). All successful and sustainable projects need to carefully assess the capacities and needs of producers (Food and Agriculture Organization of the United Nations, 2013). These assessments ensure the understanding of existing capacities and identify current needs. Pilot projects in Kenya and the United Republic of Tanzania provided capacity development to help build climate-smart farming systems. The projects' initial phase consisted of a capacity needs assessment (Food and Agriculture Organization of the United Nations, 2010; Food and Agriculture Organization of the United

Nations, 2011). CSA programs cannot be successful without customization to local contexts. Assessing capacity related activities and their development is an integral part of any programing framework (Food and Agriculture Organization of the United Nations, 2013).

Summary

The expansive history of agricultural education and the Cooperative Extension System in the United States provides the groundwork and systemic networking needed to effectively combat climate change. Climate change and variability will impact agricultural production around the globe and threatens to cost producers their livelihoods. Adaptation and mitigation strategies must be implemented across the spectrum of agricultural producers. Climate-smart agriculture integrates increased productivity, reduced greenhouse gas emissions, and enhanced resiliency. Increasing resiliency improves producers' ability to cope with climate change and variability threats. Adopting climate change and variability adaptation and mitigation strategies through climate-smart agriculture programs increases a producers' adaptive capacity therefore increasing their ability to successfully respond to shocks and stressors. How producers perceive their adaptive capacity directly relates to their decisions to adopt new innovations and technologies.

CHAPTER III

METHODS

Introduction

The purpose of this study was to describe Alabama farmers' adaptive capacity to climate variability. Climate variability adaptive capacity was measured through five components: (a) risk-taking, (b) knowledge seeking, (c) decision constrains, (d) adaptive management, and (e) self-efficacy. Thirteen research objectives guided this study:

1. Describe participant demographics: (a) sex, (b) age, (c) household size, (d) school aged children, (e) experience, and (f) education level.
2. Describe participant farming characteristics: (a) products produced, (b) acreage, (c) state region, (d) land ownership, (e) income volatility in a good year, and (f) income volatility in a bad year.
3. Describe participants' perceptions of their adaptive capacity using five different cognitive dimensions: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy.
4. Describe participants' perceptions of their place and occupational attachment using three components: (a) value of agriculture, (b) individual-community interdependence, and (c) community commitment.
5. Describe participants' level of urgency related to climate variability.
6. Describe participants' attitudes towards the terms *climate variability* and *climate change*.

7. Describe participants' previous experience with climate variability trainings and gage interest in future participation.
8. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and participant demographics.
9. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and farming characteristics.
10. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and urgency levels.
11. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and attitudes towards *climate variability* and *climate change* terms.
12. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and interest in future climate variability trainings.
13. Determine the influence of place and occupational attachment on adaptive capacity.

Research Approach and Design

Quantitative methodology was used in this study. Quantitative research can be defined as "a research strategy that emphasizes quantification in the collection and analysis of data" (Bryman, 2012, p. 35). Bryman (2012) further defines quantitative research as entailing "a deductive approach to the relationship between theory and research" (p. 36). There are four main types of quantitative research: experimental research, correlational research, causal-comparative research, and survey research (Fraenkel & Wallen, 2009). The purpose of survey research is to describe characteristics of a given population (Fraenkel & Wallen, 2009). Researchers will generalize their findings beyond the participants sampled assuming they have created a representative sample for their study. Correlational research seeks to help understand human behavior or predict likely outcomes (Fraenkel & Wallen, 2009). This quantitative correlational study used descriptive survey research methods. It was implemented through an online questionnaire which was determined to be most appropriate due to the research objectives, population, and type of data being collected. Participants completed a three-part questionnaire on their experiences with climate variability. The first part of the questionnaire collected data on the different components of adaptive capacity. The second part of the questionnaire collected data on place and occupational attachment. The third part of the questionnaire collected data on the characteristics of participants' farming operations and the personal demographics of the participants. The study also collected data on participants' interest in future climate variability mitigation education. A quantitative survey design was chosen as this study aimed to describe the climate variability adaptive capacity of Alabama agricultural producers.

Population and Sample

The target population for this study was adult agricultural producers with membership in the Alabama Farmers Federation (ALFA). ALFA is Alabama's largest farm organization with over 300,000 members (C. M. Hornady, personal communication, April 23, 2020). ALFA works within all 67 Alabama counties to improve production agriculture and protect supply chains through responsible resource management (Alabama Farmers Federation, 2020a). ALFA supports its member through 17 different commodity groups: (a) bee and honey producers, (b) beef farmers, (c) catfish producers, (d) cotton producers, (e) dairy producers, (f) equine enthusiasts, (g) forest producers, (h) greenhouse, nursery and sod, (i) hay and forage growers, (j) horticulture producers, (k) meat goat and sheep producers, (l) peanut producers, (m) pork producers, (n) poultry producers, (o) soybean producers, (p) wheat and feed grain producers, and

(q) wildlife producers (Alabama Farmers Federation, 2020b). Of the 17 commodities, each commodity has a 12-person member committee. Each of the 67 counties in Alabama has an elected board that varies in size from six to 20 board members (C. M. Hornady, personal communication, August 10, 2020). The state board consists of members selected through a statewide election with each position representing a few of the counties. This combination of members was recommended by ALFA to be more likely to respond to the questionnaire (C. M. Hornady, personal communication, July 28, 2020). This study was limited to Alabama ALFA members.

Instrumentation and Data Collection

The questionnaire used to collect data for this study was designed and delivered through Qualtrics (Appendix A). This web-based questionnaire was determined to be the most appropriate method as it allowed for data collection from producers across the state of Alabama. The data collection period lasted approximately one month (July 28, 2020 to August 28, 2020). The online nature of this questionnaire allowed participants to complete it on any device with an internet connection. The questionnaire took approximately fifteen minutes to complete and responses were instantly recorded. Participants were contacted through an electronic recruitment letter sent to their email registered with ALFA. Web-based survey implementation methods such as using multiple contacts, keeping email communications short, and providing clear instructions on how to access the survey were used (Dillman et al., 2009). Two email recruitment letters were sent to participants. The first email recruitment letter was sent on July 28, 2020 to 871 ALFA members. This sample consisted of commodity committee members, county board members, and state board members. A follow up reminder email was sent on August 17, 2020 to 80 participants of commodity committees that use irrigation. The decisions surrounding the reminder email were made by ALFA. Relying on an organization to disperse your web-based questionnaire hinders personalization and reminder correspondence which ultimately reduces response rate (Monroe & Adams, 2012).

The research instruments for adaptive capacity and place and occupational attachment were adapted from Eakin et al. (2016) and Gardezi (2017). The adaptive capacity instrument measures five different cognitive dimensions of adaptive capacity: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy. These dimensions are understood as indicative of an individual's capacities to respond to climate variability (Eakin et al., 2016). Each dimension had various items each using a five-point summated scale, 1 = *strongly disagree,* 2 = *somewhat disagree,* 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*. The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly agree* = 4.51 – 5.00. Learning and knowledge seeking measures producers' desire for more information on the agricultural impacts of climate variability. Experimentation and risk-taking measures the entrepreneurial nature of producers. Decision constraints focuses on external impacts on decision making such as infrastructure and regulations. Adaptive management measures producers' stewardship through their level of concern and commitment. The perceived efficacy construct was added as a component of capacity to measure if farmers believe they possess the financial and technical resources to adapt to climate variability (Gardezi, 2017). The research instruments for place and occupational attachment consisted of three components: (a) value of agriculture, (b) individual-community interdependence, and (c) community commitment. Each dimension had various items each using a five-point summated scale, 1 = *strongly disagree*, 2 = *somewhat* *disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*. The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly agree* = 4.51 – 5.00. Participants were also asked statements regarding their level of urgency, their attitudes towards the terms *climate variability* and *climate change*, and their past experience and future interest in climate variability trainings. Participant demographics questions consisted of their sex, age, household size, school aged children living in the home, experience, and education level. Farming characteristic questions consisted of their products produced, acreage, region, land ownership, income volatility in a good year, and income volatility in a bad year.

Data Analysis

Statistical Package for Social Science (SPSS, 24.0) was used to analyze the data. Alpha levels for analysis were set *a priori* to .05. Participants' personal demographics (sex, age, household size, school aged children living in the home, experience, and education level) and farming characteristics (products produced, acreage, region, land ownership, income volatility in a good year, and income volatility in a bad year) were calculated using *frequencies* and *percentages*. Each item of participants' perceptions of their adaptive capacity and place and occupational attachment were calculated using *frequencies* and *percentages*. Summated scores for participants' perceptions of their adaptive capacity and place and occupational attachment were used to calculate the *mean* and *standard deviation* for each scale. Participants' perception of their level of urgency was calculated using *frequencies, percentages*, *means*, and *standard deviations*. Participants' attitudes towards the terms *climate variability* and *climate change* were calculated using *frequencies, percentages, means*, and *standard deviations*. Participants' previous experience and future interest in climate variability training were calculated using *frequencies, percentages, means*, and *standard deviations*. *T-tests* and *analysis of variance (ANOVA)* were used to examine significant differences. The five dimensions of adaptive capacity and the three components of place and occupational attachment were the dependent variables. *Cohen's d* was used to determine effect size and the following interpretation was used for *t-tests*; small (d = .20), medium (d = .50), and large (d = .80) effect size (Cohen, 1988). The following interpretation was used for *analysis of variance (ANOVA)*; small (η^2 = .01), medium (η^2 = .06), and large (η^2 = .14) effect size (Cohen, 1988). A *multiple regression* was used to determine the influence of place and occupational attachment on adaptive capacity. Adaptive capacity was the dependent variable, and the three components of place and occupational attachment were the independent variables. The following interpretation was used to determine effect size for *regression*; small (R^2 = .01), medium (R^2 = .09), and large (R^2 = .25) (Cohen, 1988).

Validity and Reliability

A pilot test was conducted to test for face and content validity with experienced professionals in our field. These professionals responded with critique and feedback to improve the instrument. Cronbach's alpha coefficient was calculated for each of the five scales for adaptive capacity and each of the three scales for place and occupational attachment (Cronbach, 1951). A reliability coefficient of .70 is acknowledged as acceptable, however lower thresholds have been used (Santos, 1999). Table 1 indicates the reliability levels of each scale.

Table 1

Scale Reliability Levels

Scale	Number of Items	α
Learning and Knowledge Seeking	8	.66
Risk-taking and Experimentation	5	.66
Decision Constraints	6	.36
Adaptive Management	6	.80
Perceived Efficacy	4	.76
Value of Agriculture	3	.58
Individual-community Interdependence	2	.12
Community Commitment	3	.49

Note. Reliability levels less than .70 were deemed acceptable.

Limitations exist in every study and many factors can contribute to these limitations. Participants only being contacted through ALFA could have unknowingly excluded Alabama producers who are not registered members of ALFA. The population of this study was also limited to Alabama producers which limits generalizability. The contentious nature of this topic could have also impacted response rates and who ultimately responded to the survey.

Summary

This study used a quantitative research design to describe Alabama farmers' perceptions of their adaptive capacity to climate variability. Adult agricultural producers in Alabama with ALFA membership was the target population for this study. The sample included committee members and county and state elected board members. The questionnaire was administered entirely electronically through Qualtrics. Appropriate measures were used to account for reliability and validity. Various procedures were used to analyze the data including *frequencies, percentages, means, standard deviations, t-tests, analysis of variance (ANOVA), post-hoc pairwise comparisons*, and *regression.*

CHAPTER IV

FINDINGS

Introduction

The findings of this study are presented and organized by research objective. The research objectives were based on the research questions that guided this study. The purpose of this study was to describe the adaptive capacity to climate variability of Alabama farmers. SPSS was used to analyze the data.

Research Objectives

1. Describe participant demographics: (a) sex, (b) age, (c) household size, (d) school aged children, (e) experience, and (f) education level.
2. Describe participant farming characteristics: (a) products produced, (b) acreage, (c) state region, (d) land ownership, (e) income volatility in a good year, and (f) income volatility in a bad year.
3. Describe participants' perceptions of their adaptive capacity using five different cognitive dimensions: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy.
4. Describe participants' perceptions of their place and occupational attachment using three components: (a) value of agriculture, (b) individual-community interdependence, and (c) community commitment.
5. Describe participants' level of urgency related to climate variability.
6. Describe participants' attitudes towards the terms *climate variability* and *climate change*.
7. Describe participants' previous experience with climate variability trainings and gage interest in future participation.

8. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and participant demographics.
9. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and farming characteristics.
10. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and urgency levels.
11. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and attitudes towards *climate variability* and *climate change* terms.
12. Determine if significant differences were present between adaptive capacity and place and occupational attachment levels and interest in future climate variability trainings.
13. Determine the influence of place and occupational attachment on adaptive capacity.

Response Rate

The target population for this study included current adult agricultural producers in Alabama with ALFA membership. The combination of commodity member committees, county boards, and the state board was 871 members (C. M. Hornady, personal communication, July 28, 2020). Eighty of those participants received a reminder to increase the response rate. A final response rate of 27.32% (N = 238) was achieved. Forty-five participants declined to partake, and 104 responses were removed due to item non-response leaving 238 total usable responses.

Non-response Error

Non-response error was handled by comparing early and late respondents. Late respondents were identified as those who responded in the last wave of stimulus (Lindner et al., 2001). Early respondents were grouped as the first 201 (83.1%) participants and late respondents as the last 37 (15.3%) respondents. Independent samples *t-tests* were administered comparing early and late respondents on each of the five dimensions of adaptive capacity and three components of place and occupational attachment.

Table 2 shows no significant differences were found between early and late respondents for each of the five dimensions of adaptive capacity: (a) learning and knowledge seeking, $t(236) = 1.12$, $p = .26$; (b) risk-taking and experimentation $t(236) = 0.81$, $p = .42$; (c) decision constraints $t(236) = 0.10$, $p = .92$; (d) adaptive management $t(236) = 0.01$, $p = .99$; and (e) perceived efficacy $t(228) = 0.84$, $p = .40$.

Table 2

Early and Late Respondents Comparison for Components of Adaptive Capacity

	n	*M*	*SD*	*t*	*p*
Learning and Knowledge Seeking					
Early	201	3.77	0.51	1.12	.26
Late	37	3.87	0.46		
Risk-taking and Experimentation					
Early	201	3.83	0.60	0.81	.42
Late	37	3.92	0.53		
Decision Constraints					
Early	201	3.21	0.52	0.10	.92
Late	37	3.22	0.50		
Adaptive Management					
Early	201	4.06	0.60	0.01	.99
Late	37	4.06	0.67		
Perceived Efficacy					
Early	196	3.26	0.77	0.84	.40
Late	34	3.38	0.73		

Note. Summated Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 3 shows no significant differences were observed for each of the components of place and occupational attachment: (a) value of agriculture $t(223) = 0.38$, $p = .71$; (b) individual-community interdependence $t(224) = 1.34$, $p = .18$; and (c) community commitment $t(224) = 1.74$, $p = .08$. No significant differences were found between early and late respondents indicating that findings are generalizable to the population from which the sample was drawn (Lindner et al., 2001).

Table 3

Early and Late Respondents Comparison for Components of Place and Occupational Attachment

	n	*M*	*SD*	*t*	*p*
Value of Agriculture [a]					
Early	191	4.65	0.48	0.38	.71
Late	34	4.61	0.58		
Individual-community Interdependence					
Early	191	4.08	0.73	1.34	.18
Late	35	3.90	0.77		
Community Commitment					
Early	191	4.23	0.60	1.74	.08
Late	35	4.42	0.58		

Note. Summated Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Equal variances not assumed.

Objective One: Participant Demographics

Participants' sex, age, household size, school aged children living in the home, experience, and education level were the demographic information collected in this study. Table 4 shows the distribution of participants for each of these demographics. Approximately 71.5% ($n = 173$) of participants were male and 12.4% ($n = 30$) were female. The highest number of participants reported to be aged 60 to 69 years ($n = 82$) and the fewest reported to be aged less than 49 years ($n = 27$). Approximately 54.5% ($n = 132$) of participants reported a household size of two including themselves. Over two-thirds ($n = 169$, 69.8%) of participants reported having no school aged children living in the same household. The highest number of participants reported having 21 to 40 years (*n* = 76, 31.4%) of farming experience and the fewest reported having less than 20 years (*n* = 43, 17.8%) of farming experience. About 28% (*n* = 68) of participants reported a Bachelor's degree as their highest level of education, about 17% (*n* = 41) reported having a Master's degree, about 13% (*n* = 32) reported having high school as their highest level of education, and about 9% (*n* = 22) reported having a Professional or Doctoral degree.

Table 4

Distribution of Participants by Demographics

		f	%
Sex [a]	Female	30	12.4
	Male	173	71.5
	Prefer not to answer	2	0.8
Age [a]	Less than 49	27	11.2
	50 – 59 years	30	12.4
	60 – 69 years	82	33.9
	70+ years	59	24.4
Household size	1	17	7.0
	2	132	54.5
	3	26	10.7
	4+	31	12.8
School aged children	0	169	69.8
	1	18	7.4
	2+	19	7.8
Farming Experience [a]	Less than 20 years	43	17.8
	21 – 40 years	76	31.4
	41+ years	74	30.6
Education level [a]	High school	32	13.2
	Some college, no degree	27	11.2
	Associate's degree	12	5.0
	Bachelor's degree	68	28.1
	Master's degree	41	16.9
	Professional or Doctoral degree	22	9.1

Note. *N* = 206.

[a] Total does not equal *N* due to item non-response.

Objective Two: Farming Characteristics

Participants' products produced, acreage, region, land ownership, income volatility in a good year, and income volatility in a bad year were the farming operation characteristics included in this study. Table 5 indicates the distribution of participants for each of these characteristics. One-hundred-forty-four (59.5%) participants produce only crops, 36 (14.9%) produce both crops and animals, and 18 (7.4%) produce only animals. Crops include hay, forage, wheat, and feed grains along with corn, soybeans, cotton, peanuts, vegetables, and specialty crops such as pecans, hemp, and honey. Timber producers were also included in this category. Animals produced included beef cattle, dairy, poultry, and goats. About 25% (*n* = 61) of participants reported having over 501 acres in their farming operation. Participants were evenly distributed among the seven regions in the state with the highest responses in area one (*n* = 38, 15.7%) and the lowest in area seven (*n* = 22, 9.1%). Almost two-thirds (*n* = 144, 59.5%) of participants owned their land, 22.7% (*n* = 55) owned a portion of their farming operation and leased the rest, and 4.1% (*n* = 10) entirely leased the land for their farming operation. The highest (*n* = 67, 27.7%) number of participants indicated 26 – 50% income volatility in a good year and the lowest (*n* = 25, 10.3%) number of participants indicated 76 – 100% income volatility in a good year. The highest (*n* = 84, 34.7%) number of participants indicated 26 – 50% income volatility in a bad year and the lowest (*n* = 23, 9.5%) number of participants indicated 76 – 100% income volatility in a bad year.

Table 5

Distribution of Participants by Farming Operation Characteristics

		f	%
Farm production [a]	Animals	18	7.4
	Crops	144	59.5
	Both	36	14.9
Acreage [a]	Less than 30	34	14.0
	31 – 99	32	13.2
	100 – 200	36	14.9
	201 – 500	35	14.5
	501+	61	25.2
Region [a]	Area 1	38	15.7
	Area 2	35	14.5
	Area 3	29	12.0
	Area 4	27	11.2
	Area 5	24	9.9
	Area 6	25	10.3
	Area 7	22	9.1
Land Ownership	Own	144	59.5
	Lease	10	4.1
	Own a portion and lease a portion	55	22.7
Income volatility good year [a]	Less than 25%	57	23.6
	26 – 50%	67	27.7
	51 – 75%	37	15.3
	76 – 100%	25	10.3
Income volatility bad year [a]	Less than 25%	50	20.7
	26 – 50%	84	34.7
	51 – 75%	27	11.2
	76 – 100%	23	9.5

Note. N = 209.

[a] Total does not equal N due to item non-response.

Objective Three: Perceptions of Adaptive Capacity

Tables 6, 7, 8, 9, and 10 describe the distribution for each item of the five components of adaptive capacity. Responses ranged from *strongly disagree* to *strongly agree* on a five-point scale. The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly* *agree* = 4.51 – 5.00. All five components of adaptive capacity combined, participants showed somewhat strong adaptive capacity (*M* = 3.64, *SD* = 0.36). Table 6 shows the items for learning and knowledge seeking with participants overall somewhat agreeing (*M* = 3.78, *SD* = 0.51). Item "it is important to talk to other farmers about new farming practices and strategies" had the highest *mean* (*M* = 4.43, *SD* = 0.75) in this scale with about 54% (*n* = 131) of participants strongly agreeing. Item "it is important to visit other farms to see their practices and strategies" was the second highest (*M* = 4.29, *SD* = 0.85) with nearly 50% (*n* = 120) of participants strongly agreeing. The three lowest items at less than 10% of participants strongly agreeing: "I have the skills to adapt my land to threats caused by climate variability" (*n* = 23, *M* = 3.33, *SD* = 1.03), "I have the knowledge to protect my land from climate variability" (*n* = 17, *M* = 3.23, *SD* = 0.99), and "my current approach for dealing with climate variability will be sufficient for dealing with future climate variability" (*n* = 18, *M* = 3.10, *SD* = 0.98).

Table 6

Learning and Knowledge Seeking

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
It is important to talk to other farmers about new farming practices and strategies	1	0.4	6	2.5	13	5.4	89	36.8	131	54.1
It is important to visit other farms to see their practices and strategies	1	0.4	8	3.3	31	12.8	81	33.5	120	49.6
I seek the advice of other farmers in the region	1	0.4	10	4.1	44	18.2	106	43.8	79	32.6
I am interested in learning about climate variability's potential impacts on agriculture	7	2.9	8	3.3	51	21.1	94	38.8	80	33.1
I like to discuss challenges facing agriculture with researchers	7	2.9	16	6.6	63	26.0	87	36.0	67	27.7
I have the skills to adapt my land to threats caused by climate variability	15	6.2	33	13.6	74	30.6	95	39.3	23	9.5
I have the knowledge to protect my land from climate variability	15	6.2	33	13.6	92	38.0	83	34.3	17	7.0
My current approach for dealing with climate variability will be sufficient for dealing with future climate variability	11	4.5	52	21.5	96	39.7	63	26.0	18	7.4

Note. Grand M = 3.78, Grand SD = 0.51

Table 7 shows the items for risk-taking and experimentation with participants overall somewhat agreeing (*M* = 3.84, *SD* = 0.60). Item "I believe that opportunity comes from taking calculated risks" had the highest *mean* (*M* = 4.18, *SD* = 0.76) with 35% (*n* = 85) of participants strongly agreeing. "I like to experiment with new ways to irrigate" was the item with the lowest *mean* (*M* = 3.40, *SD* = 1.02) for the risk-taking and experimentation scale with only 15% (*n* = 37) of participants strongly agreeing.

Table 7

Risk-taking and Experimentation

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I believe that opportunity comes from taking calculated risks	1	0.4	7	2.9	25	10.3	123	50.8	85	35.1
I like to experiment with new approaches to managing my farm	2	0.8	7	2.9	41	16.9	130	53.7	61	25.2
I like to try different pest control methods	2	0.8	12	5.0	43	17.8	120	49.6	63	26.0
I have tried new tillage production methods like no-till cultivation, cover crop usage, or maintaining crop residues	17	7.0	11	4.5	75	31.0	72	29.8	65	26.9
I like to experiment with new ways to irrigate	13	5.4	18	7.4	107	44.2	65	26.9	37	15.3

Note. Grand *M* = 3.84, Grand *SD* = 0.60

Table 8 shows the items for decision constraints with participants overall neither agreeing nor disagreeing (M = 3.21, SD = 0.51). Item "crop insurance and other programs will protect the viability of my farm operation regardless of climate variability" had the highest *mean* (M = 3.40, SD = 1.10) for the decision constraints scale with about 3% (n = 7) of participants strongly agreeing, 19% (n = 47) somewhat agreeing, and 34% (n = 83) neither agreeing nor disagreeing. "My farm operations are impacted by inadequate state-supported infrastructure" had the lowest mean (M = 3.04, SD = 1.07) with about 9% (n = 21) of participants strongly agreeing, 23% (n = 56) somewhat agreeing, and 41% (n = 99) neither agreeing nor disagreeing.

Table 8

Decision Constraints

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Crop insurance and other programs will protect the viability of my farm operation regardless of climate variability	51	21.1	53	21.9	83	34.3	47	19.4	7	2.9
My ability to manage change on my farm is constrained by government regulations	14	5.8	42	17.4	69	28.5	88	36.4	28	11.6
Changes in weather patterns are hurting my farm operation	19	7.9	28	11.6	86	35.5	84	34.7	24	9.9
There's too much uncertainty about the impacts of climate variability to justify changing my agricultural practices and strategies	16	6.6	40	16.5	85	35.1	84	34.7	16	6.6
Available technologies are not effective enough to protect the land I farm from the impacts of climate variability	15	6.2	47	19.4	106	43.8	51	21.1	21	8.7
My farm operations are impacted by inadequate state-supported infrastructure	23	9.5	42	17.4	99	40.9	56	23.1	21	8.7

Note. Grand M = 3.21, Grand SD = 0.51

Table 9 shows the items for adaptive management with participants overall somewhat agreeing (M = 4.06, SD = 0.61). Item "I like to think of myself as responsible for the future productivity of my land" had the highest *mean* (M = 4.58, SD = 0.60) for the adaptive management scale with almost two-thirds (n = 152) of participants strongly agreeing. The two lowest items in this scale had about 25% of participants strongly agreeing. Sixty-two participants (M = 3.79, SD = 1.00) strongly agreed to "changing my practices to cope with increasing climate variability is important for the long-term success of my farm" and 60 participants (M = 3.74, SD = 0.99) strongly agreed to "I should take additional steps to protect the land I farm from increased climate variability."

Table 9

Adaptive Management

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I like to think of myself as responsible for the future productivity of my land	0	0.0	0	0.0	13	5.4	75	31.0	152	62.8
I continually monitor the condition of my land so that I can recognize important changes	1	0.4	2	0.8	21	8.7	118	48.8	98	40.5
Profitable markets for alternative crops should be developed to encourage diversified crop rotations	4	1.7	4	1.7	46	19.0	97	40.1	89	36.8
Farmers should take additional steps to protect farmland from increased climate variability	6	2.5	9	3.7	66	27.3	91	37.6	68	28.1
Changing my practices to cope with increasing climate variability is important for the long-term success of my farm	8	3.3	13	5.4	63	26.0	94	38.8	62	25.6
I should take additional steps to protect the land I farm from increased climate variability	7	2.9	13	5.4	75	31.0	85	35.1	60	24.8

Note. Grand M = 4.06, Grand SD = 0.61

Table 10 shows the items for perceived efficacy with participants overall neither agreeing nor disagreeing (M = 3.27, SD = 0.77). The item with the highest *mean* (M = 3.70, SD = 1.02) was the statement "I am confident in my ability to apply weather forecasts to my farming operation related decisions" with about 20% (n = 48) of participants strongly agreeing. "I have the financial capacity to deal with climate variability threats to my farm" was the item with the lowest *mean* (M = 2.78, SD =1.08) for the perceived efficacy scale with only 5% (n = 13) of participants strongly agreeing.

Table 10

Perceived Efficacy

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I am confident in my ability to apply weather forecasts to my farming operation related decisions	9	3.7	22	9.1	46	19.0	108	44.6	48	19.8
I have the technical skills to deal with climate variability threats to my farm	8	3.3	41	16.9	72	29.8	94	38.8	18	7.4
I have the knowledge to deal with climate variability threats to my farm	10	4.1	39	16.1	76	31.4	87	36.0	21	8.7
I have the financial capacity to deal with climate variability threats to my farm	27	11.2	73	30.2	70	28.9	50	20.7	13	5.4

Note. Grand M = 3.27, Grand SD = 0.77

Objective Four: Perceptions of Place and Occupational Attachment

Tables 11, 12, and 13 describe the distribution for each item of the three components of place and occupational attachment. Responses ranged from *strongly disagree* to *strongly agree* on a five-point scale. The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly agree* = 4.51 – 5.00. All three components of place and occupational attachment combined, participants displayed somewhat strong place and occupational attachment (*M* = 4.34, *SD* = 0.45). Table 11 shows the items for value of agriculture with participants overall strongly agreeing (*M* = 4.64, *SD* = 0.49). The "agriculture has a central role to play in Alabama's future" item had the highest *mean* (*M* = 4.81, *SD* = 0.44) for the value of agriculture scale with about 78% (*n* = 188) of participants strongly agreeing. The "being a farmer is a lifestyle, it is not just my job" item had the lowest *mean* (*M* = 4.39, *SD* = 0.88) with 53% (*n* = 129) of participants strongly agreeing.

Table 11

Value of Agriculture

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Agriculture has a central role to play in Alabama's future	0	0.0	1	0.4	1	0.4	38	15.7	188	77.7
Agriculture in Alabama provides benefits to the community beyond just the value of farm products	1	0.4	3	1.2	4	1.7	45	18.6	175	72.3
Being a farmer is a lifestyle, it is not just my job	6	2.5	4	1.7	13	5.4	76	31.4	129	53.3

Note. Grand *M* = 4.64, Grand *SD* = 0.49

Table 12 shows the items for individual-community interdependence with participants overall somewhat agreeing (*M* = 4.04, *SD* = 0.75). About 46% of participants (*n* = 112, *M* = 4.19, *SD* = 1.03) strongly agreed to item "my success in farming depends on farmers in my community also being successful" and about 30% (*n* = 72, *M* = 3.89, *SD* = 1.03) strongly agreed to item "I have many options available to me other than being a farmer" in the individual-community interdependence scale.

Table 12

Individual-community Interdependence

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
My success in farming depends on farmers in my community also being successful	8	3.3	11	4.5	22	9.1	76	31.4	112	46.3
I have many options available to me other than being a farmer	6	2.5	19	7.9	42	17.4	90	37.2	72	29.8

Note. Grand *M* = 4.04, Grand *SD* = 0.75

Table 13 shows the items for community commitment with participants overall somewhat agreeing (*M* = 4.26, *SD* = 0.60). Item "I plan to do all I can to continue farming in this region" had the highest *mean* (*M* = 4.50, *SD* = 0.66) of the community commitment scale with about 56% (*n* = 135) of participants strongly agreeing. The item with the lowest *mean* (*M* = 3.91, *SD* = 1.12) was "I seek out the advice of local extension agents" with about 32% (*n* = 77) of participants strongly agreeing.

Table 13

Community Commitment

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I plan to do all I can to continue farming in this region	0	0.0	2	0.8	15	6.2	78	32.2	135	55.8
Helping other farmers in my community is important, even when it means making small sacrifices	1	0.4	0	0.0	25	10.3	89	36.8	114	47.1
I seek out the advice of local extension agents	13	5.4	14	5.8	31	12.8	94	38.8	77	31.8

Note. Grand *M* = 4.26, Grand *SD* = 0.60.

Objective Five: Level of Urgency

Table 14 shows the distribution for the items concerning level of urgency. Responses ranged from *strongly disagree* to *strongly agree* on a five-point scale. The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly agree* = 4.51 – 5.00. Table 14 shows participants neither agreed nor disagreed that water availability problems are unlikely to manifest in their region for some time (M = 3.31, SD = 1.17) and immediate action is needed to prepare for climate change (M = 3.41, SD = 1.08). Participants somewhat agreed that they cannot plan more than a few years in advance because of uncertainty (M = 3.69, SD = 1.03).

Table 14

Level of Urgency

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	*M*	*SD*
I can't plan more than a few years in advance, things are too uncertain	11	4.5	17	7.0	48	19.8	105	43.4	45	18.6	3.69	1.03
Immediate action is needed to prepare for the impact of changing climate conditions on agriculture	13	5.4	26	10.7	80	33.1	69	28.5	38	15.7	3.41	1.08
Problems in water availability are unlikely to manifest in this region for some time	18	7.4	43	17.8	49	20.2	83	34.3	33	13.6	3.31	1.17

Objective Six: Attitudes Towards Terms

Tables 15 and 16 show participants' attitudes towards the terms *climate variability* and *climate change*. Responses ranged from *strongly disagree* to *strongly agree* on a five-point scale.

The scale was interpreted as *strongly disagree* = 1.00 – 1.50, *somewhat disagree* = 1.51 – 2.50, *neither agree nor disagree* = 2.51 – 3.50, *somewhat agree* = 3.51 – 4.50, and *strongly agree* = 4.51 – 5.00. Participants overall neither agreed nor disagreed (*M* = 3.25, *SD* = 1.06) with having negative feelings towards the term *climate variability*. Participants overall somewhat disagreed (*M* = 3.19, *SD* = 1.15) with having positive feelings towards the term *climate change*.

Table 15

Attitudes Towards Climate Variability Term

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I have negative feelings towards the term "climate variability"	15	6.2	33	13.6	87	36.0	63	26.0	28	11.6

Note. *M* = 3.25, *SD* = 1.06.

Table 16

Attitudes Towards Climate Change Term

	Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree		Somewhat Agree		Strongly Agree	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
I have positive feelings towards the term "climate change"	37	15.3	43	17.8	91	37.6	36	14.9	19	7.9

Note. *M* = 3.19, *SD* = 1.15.

Objective Seven: Experience and Interest in Trainings

Participants were asked if they have previously attended any type of training or workshop related to climate variability. Over two-thirds (*n* = 172, 71.1%) of participants responded that they had not and 14.0% (*n* = 33) responded that they had. Those who had previous training reported to have attended those trainings with in the last few years with the events hosted by various organizations. Table 17 shows participants' attitudes towards interest in attending future trainings related to climate variability mitigation. Responses ranged from *definitely not* to *definitely yes* on a five-point scale. The scale was interpreted as *definitely not* = 1.00 – 1.50, *probably not* = 1.51 – 2.50, *might or might not* = 2.51 – 3.50, *probably yes* = 3.51 – 4.50, and *definitely yes* = 4.51 – 5.00. Participants overall stated they might or might not (*M* = 3.04, *SD* = 1.08) attend a climate variability training.

Table 17

Interest in Climate Variability Training

	Definitely Not		Probably Not		Might or Might Not		Probably Yes		Definitely Yes	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Would you like to attend a training or workshop related to climate variability mitigation strategies?	19	7.9	41	16.9	75	31.0	53	21.9	17	7.0

Note. *N* = 205. *M* = 3.04, *SD* = 1.08.

An independent samples *t-test* was used to determine if a significant difference exists between previously attending a training and interest in a future training. A significant difference was found between participants who have had previous trainings on climate variability and those participants who have not. Table 18 shows on average, participants who had previous training (*M* = 3.39, *SD* = 0.97) were more likely than those who had not (*M* = 2.97, *SD* = 1.09) to be interested in future trainings. This difference of 0.42 was significant *t*(203) = 2.08, *p* = .04 and represented a medium effect size (*d* = .41).

Table 18

Independent Samples t-test for Previous Training Attendance and Future Training Interest

Had Previous Training	*n*	*M*	*SD*	*t*	*p*
No	172	2.97	1.09	2.08	.04
Yes	33	3.39	0.97		

Objective Eight: Significant Differences and Participant Demographics

The existence of significant differences was examined between the five adaptive capacity dimensions and the three place and occupational attachment components and participant demographics. *An analysis of variance (ANOVA)* was calculated for each participant demographic: (a) sex, (b) age, (c) household size, (d) school aged children, (e) farming experience, and (f) education level. Table 19 shows there is a significant difference between sex and the learning and knowledge seeking dimension of adaptive capacity $F(2, 202) = 6.55$, $p < .00$ with a medium effect size ($\eta^2 = .06$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences ($SMD = 0.33$, $p < .00$) were found between group one (females) and group two (males). The summated scale interprets both groups as somewhat agreeing. Male participants had significantly higher learning and knowledge seeking values than those female participants. Table 19 shows no significant differences were found between sex and the following dimensions of adaptive capacity: (a) risk-taking and experimentation $F(2, 202) = 0.45$, $p > .05$, (b) decision constraints $F(2, 202) = 0.39$, $p > .05$, (c) adaptive management $F(2, 201) = 0.72$, $p > .05$, and (d) perceived efficacy $F(2, 201) = 2.87$, $p > .05$.

Table 19

Analysis of Variance for Adaptive Capacity Dimensions and Sex

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Female	30	3.51	0.52	6.55	.00
Male	173	3.84	0.47		
Prefer not to answer	2	4.06	0.27		
Risk-taking and Experimentation					
Female	30	3.75	0.59	0.45	.64
Male	173	3.89	0.63		
Prefer not to answer	2	3.90	0.14		
Decision Constraints					
Female	30	3.13	0.52	0.39	.68
Male	173	3.22	0.55		
Prefer not to answer	2	3.25	0.59		
Adaptive Management [a]					
Female	30	4.20	0.60	0.72	.49
Male	172	4.06	0.62		
Prefer not to answer	2	3.92	0.12		
Perceived Efficacy [a]					
Female	30	3.00	0.84	2.87	.06
Male	172	3.35	0.79		
Prefer not to answer	2	2.75	0.71		

Note. *N* = 205. Learning and Knowledge Seeking: *M* = 3.80, *SD* = 0.49. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.62. Decision Constraints: *M* = 3.21, *SD* = 0.54. Adaptive Management: *M* = 4.08, *SD* = 0.62. Perceived Efficacy: *M* = 3.29, *SD* = 0.80. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 20 shows no significant differences were found between sex and the components of place and occupational attachment: (a) value of agriculture $F(2, 201) = 0.34$, $p > .05$, (b) individual-community interdependence $F(2, 202) = 0.31$, $p > .05$, and (c) community commitment $F(2, 202) = 0.95$, $p > .05$.

Table 20

Analysis of Variance for Place and Occupational Attachment Components and Sex

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Female	30	4.58	0.45	0.34	.72
Male	172	4.64	0.51		
Prefer not to answer	2	4.83	0.24		
Individual-community Interdependence					
Female	30	3.93	0.97	0.31	.74
Male	173	4.05	0.73		
Prefer not to answer	2	4.00	0.71		
Community Commitment					
Female	30	4.36	0.51	0.95	.39
Male	173	4.24	0.62		
Prefer not to answer	2	3.83	0.24		

Note. *N* = 205. Value of Agriculture: *M* = 4.63, *SD* = 0.50. Individual-community Interdependence: *M* = 4.03, *SD* = 0.77. Community Commitment: *M* = 4.25, *SD* = 0.61. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 21 shows there is a significant difference between age and the adaptive management dimension of adaptive capacity $F(3, 193) = 2.65$, $p = .05$ with a medium effect size ($\eta^2 = .04$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.39, $p = .03$) were found between group one (49 years or younger) and group four (70 years or older). Participants who were 49 years or younger had significantly higher adaptive management values than those participants 70 years or older. The summated scale interprets both groups as somewhat agreeing. Table 21 shows no significant differences were found between age and the following dimensions of adaptive capacity: (a) learning and knowledge seeking $F(3, 194)$ =

2.127, $p > .05$, (b) risk-taking and experimentation $F(3, 194) = 2.32$, $p > .05$, (c) decision constraints $F(3, 194) = 0.43$, $p > .05$, and (d) perceived efficacy $F(3, 193) = 1.25$, $p > .05$.

Table 21

Analysis of Variance for Adaptive Capacity Dimensions and Age

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Less than 49	27	3.99	0.47	2.13	.10
50 – 59 years	30	3.78	0.48		
60 – 69 years	82	3.73	0.47		
70+ years	59	3.79	0.48		
Risk-taking and Experimentation					
Less than 49	27	4.11	0.63	2.32	.08
50 – 59 years	30	3.89	0.61		
60 – 69 years	82	3.84	0.63		
70+ years	59	3.73	0.61		
Decision Constraints					
Less than 49	27	3.30	0.65	0.43	.73
50 – 59 years	30	3.26	0.43		
60 – 69 years	82	3.19	0.54		
70+ years	59	3.18	0.56		
Adaptive Management [a]					
Less than 49	27	4.34	0.57	2.65	.05
50 – 59 years	30	4.14	0.55		
60 – 69 years	82	4.11	0.62		
70+ years	58	3.95	0.61		
Perceived Efficacy [a]					
Less than 49	27	3.50	0.63	1.25	.29
50 – 59 years	30	3.43	0.86		
60 – 69 years	82	3.23	0.85		
70+ years	58	3.21	0.81		

Note. $N = 198$. Learning and Knowledge Seeking: $M = 3.79$, $SD = 0.48$. Risk-taking and Experimentation: $M = 3.85$, $SD = 0.63$. Decision Constraints: $M = 3.21$, $SD = 0.55$. Adaptive Management: $M = 4.10$, $SD = 0.61$. Perceived Efficacy: $M = 3.29$, $SD = 0.81$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 22 shows no significant differences were found between age and the components of place and occupational attachment: (a) value of agriculture $F(3, 194) = 0.34$, $p > .05$, (b) individual-community interdependence $F(3, 194) = 0.49$, $p > .05$, and (c) community commitment $F(3, 194) = 0.85$, $p > .05$.

Table 22

Analysis of Variance for Place and Occupational Attachment Components and Age

	n	*M*	*SD*	*F*	*p*
Value of Agriculture					
Less than 49	27	4.71	0.44	0.34	.80
50 – 59 years	30	4.67	0.50		
60 – 69 years	82	4.62	0.53		
70+ years	59	4.62	0.47		
Individual-community Interdependence					
Less than 49	27	4.07	0.60	0.49	.69
50 – 59 years	30	3.92	0.97		
60 – 69 years	82	4.05	0.76		
70+ years	59	4.12	0.68		
Community Commitment					
Less than 49	27	4.32	0.66	0.85	.47
50 – 59 years	30	4.29	0.60		
60 – 69 years	82	4.31	0.59		
70+ years	59	4.16	0.61		

Note. $N = 198$. Value of Agriculture: $M = 4.64$, $SD = 0.49$. Individual-community Interdependence: $M = 4.05$, $SD = 0.75$. Community Commitment: $M = 4.26$, $SD = 0.61$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 23 shows no significant differences were found between household size and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(3, 202) = 1.63$, $p > .05$, (b) risk-taking and experimentation $F(3, 202) = 1.01$, $p > .05$, (c) decision constraints $F(3, 202) =$

0.60, $p > .05$, (d) adaptive management $F(3, 202) = 1.10$, $p > .05$, and (e) perceived efficacy $F(3, 202) = 0.86$, $p > .05$.

Table 23

Analysis of Variance for Adaptive Capacity Dimensions and Household Size

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
1	17	3.91	0.39	1.63	.18
2	132	3.78	0.48		
3	26	3.66	0.55		
4+	31	3.91	0.45		
Risk-taking and Experimentation					
1	17	3.91	0.49	1.01	.39
2	132	3.81	0.64		
3	26	3.80	0.70		
4+	31	4.01	0.56		
Decision Constraints					
1	17	3.28	0.44	0.60	.62
2	132	3.17	0.54		
3	26	3.27	0.66		
4+	31	3.28	0.51		
Adaptive Management					
1	17	4.17	0.52	1.10	.35
2	132	4.05	0.62		
3	26	4.01	0.69		
4+	31	4.25	0.56		
Perceived Efficacy					
1	17	3.29	0.80	0.86	.47
2	132	2.23	0.85		
3	26	3.34	0.80		
4+	31	3.48	0.55		

Note. $N = 206$. Learning and Knowledge Seeking: $M = 3.79$, $SD = 0.48$. Risk-taking and Experimentation: $M = 3.85$, $SD = 0.62$. Decision Constraints: $M = 3.21$, $SD = 0.54$. Adaptive Management: $M = 4.08$, $SD = 0.61$. Perceived Efficacy: $M = 3.29$, $SD = 0.80$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 24 shows no significant differences were found between household size and the components of place and occupational attachment: (a) value of agriculture $F(3, 201) = 0.49$, $p > .05$, (b) individual-community interdependence $F(3, 202) = 2.16$, $p > .05$, and (c) community commitment $F(3, 202) = 2.03$, $p > .05$.

Table 24

Analysis of Variance for Place and Occupational Attachment Components and Household Size

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
1	17	4.59	0.51	0.49	.69
2	131	4.62	0.50		
3	26	4.54	0.60		
4+	31	4.70	0.47		
Individual-community Interdependence					
1	17	4.21	0.71	2.16	.09
2	132	4.05	0.79		
3	26	3.69	0.71		
4+	31	4.11	0.70		
Community Commitment					
1	17	4.02	0.83	2.03	.11
2	132	4.24	0.59		
3	26	4.23	0.51		
4+	31	4.45	0.57		

Note. $N = 206$. Value of Agriculture: $M = 4.62$, $SD = 0.51$. Individual-community Interdependence: $M = 4.02$, $SD = 0.77$. Community Commitment: $M = 4.25$, $SD = 0.60$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 25 shows no significant differences were found between school aged childred living at home and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(2, 203) = 2.22$, $p > .05$, (b) risk-taking and experimentation $F(2, 203) = 2.19$, $p > .05$, (c) decision constraints *F*(2, 203) = 0.39, *p* > .05, (d) adaptive management *F*(2, 203) = 1.31, *p* > .05, and (e) perceived efficacy *F*(2, 203) = 1.27, *p* > .05.

Table 25

Analysis of Variance for Adaptive Capacity Dimensions and School Aged Children

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
0	169	3.79	0.48	2.22	.11
1	18	3.67	0.52		
2+	19	3.99	0.44		
Risk-taking and Experimentation					
0	169	3.83	0.64	2.19	.12
1	18	3.70	0.56		
2+	19	4.10	0.51		
Decision Constraints					
0	169	3.20	0.54	0.39	.68
1	18	3.21	0.52		
2+	19	3.32	0.56		
Adaptive Management					
0	169	4.06	0.62	1.31	.27
1	18	4.09	0.68		
2+	19	4.30	0.48		
Perceived Efficacy					
0	169	3.26	0.83	1.27	.28
1	18	3.29	0.65		
2+	19	3.57	0.64		

Note. *N* = 206. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.48. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.62. Decision Constraints: *M* = 3.21, *SD* = 0.54. Adaptive Management: *M* = 4.08, *SD* = 0.61. Perceived Efficacy: *M* = 3.29, *SD* = 0.80. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 26 shows no significant differences were found between school aged children living at home and the components of place and occupational attachment: (a) value of agriculture

F(2, 202) = 0.65, *p* > .05, (b) individual-community interdependence *F*(2, 203) = 1.47, *p* > .05, and (c) community commitment *F*(2, 203) = 1.92, *p* > .05.

Table 26

Analysis of Variance for Place and Occupational Attachment Components and School Aged Children

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
0	168	4.62	0.51	0.65	.52
1	18	4.56	0.50		
2+	19	4.74	0.47		
Individual-community Interdependence					
0	169	4.01	0.79	1.47	.23
1	18	3.89	0.70		
2+	19	4.29	0.56		
Community Commitment					
0	169	4.23	0.61	1.92	.15
1	18	4.20	0.53		
2+	19	4.51	0.56		

Note. *N* = 206. Value of Agriculture: *M* = 4.62, *SD* = 0.51. Individual-community Interdependence: *M* = 4.02, *SD* = 0.76. Community Commitment: *M* = 4.25, *SD* = 0.60. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 27 shows no significant differences were found between farming experience and the dimensions of adaptive capacity: (a) learning and knowledge seeking *F*(2, 190) = 0.24, *p* > .05, (b) risk-taking and experimentation *F*(2, 190) = 0.48, *p* > .05, (c) decision constraints *F*(2, 190) = 1.31, *p* > .05, (d) adaptive management *F*(2, 190) = 1.43, *p* > .05, and (e) perceived efficacy *F*(2, 190) = 0.98, *p* > .05.

Table 27

Analysis of Variance for Adaptive Capacity Dimensions and Farming Experience

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Less than 20 years	43	3.78	0.50	0.24	.79
21 – 40 years	76	3.76	0.46		
41+ years	74	3.82	0.47		
Risk-taking and Experimentation					
Less than 20 years	43	3.91	0.56	0.48	.62
21 – 40 years	76	3.88	0.60		
41+ years	74	3.81	0.69		
Decision Constraints					
Less than 20 years	43	3.10	0.51	1.31	.27
21 – 40 years	76	3.25	0.55		
41+ years	74	3.26	0.56		
Adaptive Management					
Less than 20 years	43	4.16	0.56	1.43	.24
21 – 40 years	76	4.15	0.61		
41+ years	74	4.00	0.65		
Perceived Efficacy					
Less than 20 years	43	3.34	0.85	0.98	.38
21 – 40 years	76	3.20	0.82		
41+ years	74	3.38	0.77		

Note. *N* = 193. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.47. Risk-taking and Experimentation: *M* = 3.86, *SD* = 0.62. Decision Constraints: *M* = 3.22, *SD* = 0.55. Adaptive Management: *M* = 4.10, *SD* = 0.61. Perceived Efficacy: *M* = 3.30, *SD* = 0.81. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 28 shows no significant differences were found between farming experience and the components of place and occupational attachment: (a) value of agriculture $F(2, 189) = 0.60$, $p > .05$, (b) individual-community interdependence $F(2, 190) = 1.47$, $p > .05$, and (c) community commitment $F(2, 190) = 2.72$, $p > .05$.

Table 28

Analysis of Variance for Place and Occupational Attachment Components and Farming Experience

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Less than 20 years	43	4.64	0.45	0.60	.55
21 – 40 years	76	4.68	0.52		
41+ years	73	4.59	0.52		
Individual-community Interdependence					
Less than 20 years	43	4.20	0.70	1.47	.23
21 – 40 years	76	4.05	0.84		
41+ years	74	3.95	0.72		
Community Commitment					
Less than 20 years	43	4.43	0.60	2.72	.07
21 – 40 years	76	4.28	0.64		
41+ years	74	4.16	0.54		

Note. *N* = 193. Value of Agriculture: *M* = 4.64, *SD* = 0.50. Individual-community Interdependence: *M* = 4.04, *SD* = 0.77. Community Commitment: *M* = 4.27, *SD* = 0.60. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 29 shows no significant differences were found between education level and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(6, 195) = 0.27$, $p > .05$, (b) risk-taking and experimentation $F(6, 195) = 0.39$, $p > .05$, (c) decision constraints $F(6, 195) = 1.01$, $p > .05$, (d) adaptive management $F(6, 195) = 0.27$, $p > .05$, and (e) perceived efficacy $F(6, 195) = 1.22$, $p > .05$.

Table 29

Analysis of Variance for Adaptive Capacity Dimensions and Education Level

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
High school	32	3.86	0.49	0.27	.93
Some college, no degree	27	3.75	0.51		
Associate's degree	12	3.77	0.66		
Bachelor's degree	68	3.82	0.48		
Master's degree	41	3.74	0.48		
Professional or Doctoral degree	22	3.80	0.34		
Risk-taking and Experimentation					
High school	32	3.77	0.65	0.39	.86
Some college, no degree	27	3.94	0.48		
Associate's degree	12	3.72	0.88		
Bachelor's degree	68	3.89	0.66		
Master's degree	41	3.84	0.63		
Professional or Doctoral degree	22	3.83	0.51		
Decision Constraints					
High school	32	3.26	0.55	1.01	.41
Some college, no degree	27	3.17	0.55		
Associate's degree	12	3.01	0.67		
Bachelor's degree	68	3.29	0.55		
Master's degree	41	3.08	0.49		
Professional or Doctoral degree	22	3.13	0.52		
Adaptive Management					
High school	32	4.02	0.64	0.27	.93
Some college, no degree	27	4.09	0.58		
Associate's degree	12	4.00	0.50		
Bachelor's degree	68	4.10	0.65		
Master's degree	41	4.09	0.63		
Professional or Doctoral degree	22	4.20	0.59		
Perceived Efficacy					
High school	32	3.17	0.81	1.22	.30
Some college, no degree	27	3.07	0.68		
Associate's degree	12	3.10	0.78		
Bachelor's degree	68	3.45	0.81		
Master's degree	41	3.32	0.93		
Professional or Doctoral degree	22	3.28	0.66		

Note. *N* = 202. Learning and Knowledge Seeking: *M* = 3.80, *SD* = 0.48. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.63. Decision Constraints: *M* = 3.21, *SD* = 0.54. Adaptive Management: *M* = 4.0, *SD* = 0.62. Perceived Efficacy: *M* = 3.30, *SD* = 0.81. Scale: 1 = *strongly* *disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 30 shows there is a significant difference between education level and the individual-community interdependence component of place and occupational attachment $F(6, 195) = 4.81$, $p < .00$ with a large effect size ($\eta^2 = .11$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences ($SMD = 0.63$, $p < .00$) were found between group one (high school) and group five (master's degree). Statistically significant mean differences ($SMD = 0.79$, $p < .00$) were also found between group one and group six (professional or doctoral degree). Participants who had a master's degree or professional or doctoral degree had significantly higher individual-community interdependence values than those participants who only had high school education levels. The summated scale interprets all three groups as somewhat agreeing. Statistically significant mean differences ($SMD = 0.51$, $p = .05$) were also found between group four (bachelor's degree) and group six (Professional or doctoral degree). Participants who had a professional or doctoral degree had significantly higher individual-community interdependence than participants who had bachelor's degrees. The summated scale interprets both groups as somewhat agreeing. Table 30 shows no significant differences were found between education level and the following components of place and occupational attachment: (a) value of agriculture $F(6, 194) = 0.74$, $p > .05$ and (b) community commitment $F(6, 195) = 1.33$, $p > .05$.

Table 30

Analysis of Variance for Place and Occupational Attachment Components and Education Level

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
High school	32	4.54	0.51	0.74	.60
Some college, no degree	27	4.62	0.58		
Associate's degree	12	4.86	0.22		
Bachelor's degree	67	4.34	0.45		
Master's degree	41	4.60	0.58		
Professional or Doctoral degree	22	4.65	0.53		
Individual-community Interdependence					
High school	32	3.69	0.81	4.81	.00
Some college, no degree	27	3.93	0.73		
Associate's degree	12	3.83	1.03		
Bachelor's degree	68	3.97	0.70		
Master's degree	41	4.32	0.65		
Professional or Doctoral degree	22	4.48	0.55		
Community Commitment					
High school	32	4.24	0.67	1.33	.25
Some college, no degree	27	4.16	0.53		
Associate's degree	12	4.36	0.48		
Bachelor's degree	68	4.15	0.59		
Master's degree	41	4.34	0.71		
Professional or Doctoral degree	22	4.47	0.42		

Note. N = 202. Value of Agriculture: M = 4.63, SD = 0.50. Individual-community Interdependence: M = 4.04, SD = 0.75. Community Commitment: M = 4.25, SD = 0.61. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal N due to item non-response.

Objective Nine: Significant Differences and Farming Characteristics

The existence of significant differences was examined between the five adaptive capacity dimensions and the three place and occupational attachment components and farm characteristics. *ANOVAs* were calculated for each farming operation characteristic: (a) farm production, (b) acreage, (c) region, (d) land ownership, (e) income volatility in a good year, and (f) income volatility in a bad year. Table 31 shows no significant differences were found between farm production and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(2, 195) = 1.23$, $p > .05$, (b) risk-taking and experimentation $F(2, 195) = 2.22$, $p > .05$, (c) decision constraints $F(2, 195) = 0.15$, $p > .05$, (d) adaptive management $F(2, 195) = 0.23$, $p > .05$, and (e) perceived efficacy $F(2, 195) = 0.39$, $p > .05$.

Table 31

Analysis of Variance for Adaptive Capacity Dimensions and Farm Production

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Animals	18	3.81	0.34	1.23	.30
Crops	144	3.76	0.50		
Both	36	3.90	0.47		
Risk-taking and Experimentation					
Animals	18	3.61	0.56	2.22	.11
Crops	144	3.92	0.62		
Both	36	3.87	0.63		
Decision Constraints					
Animals	18	3.16	0.54	0.15	.87
Crops	144	3.22	0.55		
Both	36	3.18	0.52		
Adaptive Management					
Animals	18	4.01	0.72	0.23	.79
Crops	144	4.10	0.59		
Both	36	4.13	0.68		
Perceived Efficacy					
Animals	18	3.18	0.84	0.39	.68
Crops	144	3.29	0.81		
Both	36	3.38	0.78		

Note. N = 198. Learning and Knowledge Seeking: M = 3.79, SD = 0.49. Risk-taking and Experimentation: M = 3.87, SD = 0.62. Decision Constraints: M = 3.20, SD = 0.54. Adaptive Management: M = 4.10, SD = 0.61. Perceived Efficacy: M = 3.30, SD = 0.81. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 32 shows no significant differences were found between farm production and the components of place and occupational attachment: (a) value of agriculture $F(2, 194) = 0.62$, $p > .05$, (b) individual-community interdependence $F(2, 195) = 0.75$, $p > .05$, and (c) community commitment $F(2, 195) = 0.63$, $p > .05$.

Table 32

Analysis of Variance for Place and Occupational Attachment Components and Farm Production

	n	*M*	*SD*	*F*	*p*
Value of Agriculture					
Animals	18	4.74	0.29	0.62	.54
Crops	143	4.60	0.53		
Both	36	4.65	0.53		
Individual-community Interdependence					
Animals	18	3.83	0.89	0.75	.48
Crops	143	4.07	0.75		
Both	36	4.07	0.79		
Community Commitment					
Animals	18	4.17	0.69	0.63	.53
Crops	143	4.25	0.59		
Both	36	4.35	0.63		

Note. $N = 198$. Value of Agriculture: $M = 4.62$, $SD = 0.51$. Individual-community Interdependence: $M = 4.05$, $SD = 0.77$. Community Commitment: $M = 4.26$, $SD = 0.60$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 33 shows there is a significant difference between acreage and the risk-taking and experimentation dimension of adaptive capacity $F(4, 193) = 4.03$, $p < .00$ with a medium effect size ($\eta^2 = .08$) and the decision constraints dimension of adaptive capacity $F(4, 193) = 2.94$, $p = .02$ with a medium effect size ($\eta^2 = .06$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences ($SMD = 0.41$, $p = .02$) were found between group one (less than 30 acres) and group five (more than 501 acres) for the risk-taking and experimentation dimension. Statistically significant mean differences ($SMD = 0.40$, $p = .02$) were also found between group three (100 to 200 acres) and group five for the risk-taking and experimentation dimension. Participants who had more than 501 acres had significantly higher risk-taking and experimentation values than those participants who had less than 30 acres or 100 to 200 acres. The summated scale interprets all three groups as somewhat agreeing. Statistically significant mean differences (*SMD* = 0.33, $p = .04$) were also found between group one and group five for the decision constraints dimension. Participants who had more than 501 acres had significantly higher decision constraints values than those participants who had less than 30 acres. The summated scale interprets both groups as neither agreeing nor disagreeing. Table 33 shows no significant differences were found between acreage and the following dimensions of adaptive capacity: (a) learning and knowledge seeking $F(4, 193) = 2.25$, $p > .05$, (b) adaptive management $F(4, 193) = 0.72$, $p > .05$, and (c) perceived efficacy $F(4, 193) = 1.38$, $p > .05$.

Table 33

Analysis of Variance for Adaptive Capacity Dimensions and Acreage

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Less than 30	34	3.64	0.55	2.25	.07
31 – 99	32	3.78	0.35		
100 – 200	36	3.77	0.50		
201 – 500	35	3.70	0.53		
501+	61	3.92	0.48		
Risk-taking and Experimentation					
Less than 30	34	3.71	0.62	4.03	.00
31 – 99	32	3.80	0.57		
100 – 200	36	3.73	0.69		
201 – 500	35	3.79	0.60		
501+	61	4.12	0.57		
Decision Constraints					
Less than 30	34	3.01	0.50	2.94	.02
31 – 99	32	3.28	0.66		
100 – 200	36	3.09	0.44		
201 – 500	35	3.30	0.47		
501+	61	3.34	0.56		
Adaptive Management					
Less than 30	34	3.95	0.62	0.72	.58
31 – 99	32	4.17	0.50		
100 – 200	36	4.16	0.65		
201 – 500	35	4.10	0.66		
501+	61	4.11	0.62		
Perceived Efficacy					
Less than 30	34	3.35	0.67	1.38	.24
31 – 99	32	3.13	0.71		
100 – 200	36	3.13	0.77		
201 – 500	35	3.39	0.90		
501+	61	3.43	0.81		

Note. *N* = 198. Learning and Knowledge Seeking: *M* = 3.78, *SD* = 0.49. Risk-taking and Experimentation: *M* = 3.87, *SD* = 0.62. Decision Constraints: *M* = 3.22, *SD* = 0.54. Adaptive Management: *M* = 4.10, *SD* = 0.61. Perceived Efficacy: *M* = 3.31, *SD* = 0.79. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 34 shows no significant differences were found between acreage and the components of place and occupational attachment: (a) value of agriculture $F(4, 192) = 1.55$, $p > .05$, (b) individual-community interdependence $F(4, 193) = 2.27$, $p > .05$, and (c) community commitment $F(4, 193) = 2.21$, $p > .05$.

Table 34

Analysis of Variance for Place and Occupational Attachment Components and Acreage

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Less than 30	34	4.47	0.43	1.55	.19
31 – 99	32	4.77	0.32		
100 – 200	36	4.61	0.50		
201 – 500	34	4.68	0.54		
501+	61	4.61	0.60		
Individual-community Interdependence					
Less than 30	34	4.10	0.66	2.27	.06
31 – 99	32	4.34	0.30		
100 – 200	36	4.03	0.89		
201 – 500	35	4.04	0.71		
501+	61	3.85	0.82		
Community Commitment					
Less than 30	34	3.98	0.71	2.21	.07
31 – 99	32	4.33	0.54		
100 – 200	36	4.31	0.49		
201 – 500	35	4.29	0.54		
501+	61	4.31	0.63		

Note. $N = 198$. Value of Agriculture: $M = 4.62$, $SD = 0.51$. Individual-community Interdependence: $M = 4.04$, $SD = 0.77$. Community Commitment: $M = 4.25$, $SD = 0.60$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 35 shows no significant differences were found between region and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(6, 193) = 0.87$, $p > .05$, (b) risk-taking and experimentation $F(6, 193) = 0.70$, $p > .05$, (c) decision constraints $F(6, 193) = 0.72$, $p > .05$, (d) adaptive management $F(6, 193) = 0.21$, $p > .05$, and (e) perceived efficacy $F(6, 193) = 0.99$, $p > .05$.

Table 35

Analysis of Variance for Adaptive Capacity Dimensions and Region

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Area 1	38	3.82	0.51	0.87	.52
Area 2	35	3.74	0.58		
Area 3	29	3.76	0.47		
Area 4	27	3.85	0.41		
Area 5	24	3.78	0.51		
Area 6	25	3.89	0.38		
Area 7	22	3.60	0.55		
Risk-taking and Experimentation					
Area 1	38	3.98	0.39	0.70	.65
Area 2	35	3.74	0.74		
Area 3	29	3.74	0.75		
Area 4	27	3.83	0.61		
Area 5	24	3.80	0.64		
Area 6	25	3.85	0.52		
Area 7	22	3.91	0.58		
Decision Constraints					
Area 1	38	3.21	0.61	0.72	.63
Area 2	35	3.19	0.53		
Area 3	29	3.18	0.55		
Area 4	27	3.20	0.45		
Area 5	24	3.19	0.39		
Area 6	25	3.15	0.61		
Area 7	22	3.43	0.50		
Adaptive Management					
Area 1	38	1.14	0.51	0.21	.97
Area 2	35	4.06	0.59		
Area 3	29	4.01	0.71		
Area 4	27	4.06	0.61		
Area 5	24	4.13	0.57		
Area 6	25	4.07	0.72		
Area 7	22	4.01	0.62		
Perceived Efficacy					
Area 1	38	3.26	0.67	0.99	.43
Area 2	35	3.14	0.81		
Area 3	29	3.22	0.77		
Area 4	27	3.42	0.56		
Area 5	24	3.38	0.86		
Area 6	25	3.42	0.87		
Area 7	22	2.99	1.10		

Note. N = 200. Learning and Knowledge Seeking: M = 3.78, SD = 0.50. Risk-taking and Experimentation: M = 3.84, SD = 0.61. Decision Constraints: M = 3.21, SD = 0.53. Adaptive Management: M = 4.07, SD = 0.61. Perceived Efficacy: M = 3.26, SD = 0.80. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 36 shows no significant differences were found between region and the components of place and occupational attachment: (a) value of agriculture $F(6, 192) = 0.29$, $p > .05$, (b) individual-community interdependence $F(6, 193) = 0.76$, $p > .05$, and (c) community commitment $F(6, 193) = 0.27$, $p > .05$.

Table 36

Analysis of Variance for Place and Occupational Attachment Components and Region

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Area 1	38	4.64	0.57	0.29	.94
Area 2	34	4.57	0.58		
Area 3	29	4.60	0.51		
Area 4	27	4.68	0.38		
Area 5	24	4.56	0.52		
Area 6	25	4.70	0.38		
Area 7	22	4.64	0.56		
Individual-community Interdependence					
Area 1	38	4.24	0.76	0.76	.61
Area 2	35	3.91	0.78		
Area 3	29	3.90	0.72		
Area 4	27	3.98	0.70		
Area 5	24	3.96	0.85		
Area 6	25	4.02	0.82		
Area 7	22	4.02	0.82		
Community Commitment					
Area 1	38	4.25	0.61	0.27	.95
Area 2	35	4.30	0.58		
Area 3	29	4.20	0.57		
Area 4	27	4.32	0.57		
Area 5	24	4.19	0.62		
Area 6	25	4.23	0.67		
Area 7	22	4.35	0.59		

Note. *N* = 200. Value of Agriculture: *M* = 4.62, *SD* = 0.51. Individual-community Interdependence: *M* = 4.01, *SD* = 0.77. Community Commitment: *M* = 4.26, *SD* = 0.59. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 37 shows there is a significant difference between land ownership and the learning and knowledge seeking dimension of adaptive capacity $F(2, 206) = 4.04$, $p = .02$ with a medium effect size ($\eta^2 = .04$) and the risk-taking and experimentation dimension of adaptive capacity

$F(2, 206) = 3.11$, $p = .05$ with a small effect size ($\eta^2 = .03$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.20, $p = .03$) were found between group one (own land) and group three (own a portion and lease a portion) for the learning and knowledge seeking dimension. Participants who owned a portion and leased a portion of land had significantly higher learning and knowledge seeking values than those participants who own all their land. The summated scale interprets both groups as somewhat agreeing. No significant mean difference was found for the risk-taking and experimentation dimension most likely due to the sample size of group two being so small ($n = 10$). Table 37 shows no significant differences were found between land ownership and the following dimensions of adaptive capacity: (a) decision constrains $F(2, 206) = 1.01$, $p > .05$, (b) adaptive management $F(2, 206) = 1.43$, $p > .05$, and (c) perceived efficacy $F(2, 206) = 0.26$, $p > .05$.

Table 37

Analysis of Variance for Adaptive Capacity Dimensions and Land Ownership

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Own	144	3.72	0.50	4.04	.02
Lease	10	3.96	0.53		
Own a portion and lease a portion	55	3.92	0.44		
Risk-taking and Experimentation					
Own	144	3.78	0.61	3.11	.05
Lease	10	4.12	0.66		
Own a portion and lease a portion	55	3.98	0.62		
Decision Constraints					
Own	144	3.18	0.53	1.01	.37
Lease	10	3.22	0.47		
Own a portion and lease a portion	55	3.30	0.58		
Adaptive Management					
Own	144	4.06	0.57	1.43	.24
Lease	10	4.40	0.67		
Own a portion and lease a portion	55	4.07	0.69		
Perceived Efficacy					
Own	144	3.25	0.79	0.26	.77
Lease	10	3.30	0.77		
Own a portion and lease a portion	55	3.35	0.84		

Note. *N* = 209. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.50. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.62. Decision Constraints: *M* = 3.22, *SD* = 0.54. Adaptive Management: *M* = 4.08, *SD* = 0.61. Perceived Efficacy: *M* = 3.28, *SD* = 0.80. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 38 shows there is a significant difference between land ownership and the community commitment component of place and occupational attachment $F(2, 206) = 4.47$, $p = .01$ with a medium effect size ($\eta^2 = .04$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.27, $p = .01$) were found between group one (own land) and group three (own a portion and lease a portion) for the community commitment component. Participants who owned a portion and leased a portion of land had significantly higher community commitment values than those participants who owned all their land. The summated scale interprets both groups as somewhat agreeing. Table 38 shows no significant differences were found between land ownership and the following components of place and occupational attachment: (a) value of agriculture $F(2, 205) = 2.17$, $p > .05$ and (b) individual-community interdependence $F(2, 206) = 0.46$, $p > .05$.

Table 38

Analysis of Variance for Place and Occupational Attachment Components and Land Ownership

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Own	143	4.57	0.50	2.17	.12
Lease	10	4.73	.038		
Own a portion and lease a portion	55	4.73	.053		
Individual-community Interdependence					
Own	144	4.04	0.75	0.46	.64
Lease	10	4.20	0.63		
Own a portion and lease a portion	55	3.96	0.83		
Community Commitment					
Own	144	4.17	0.62	4.47	.01
Lease	10	4.37	0.66		
Own a portion and lease a portion	55	4.44	0.49		

Note. $N = 209$. Value of Agriculture: $M = 4.62$, $SD = 0.51$. Individual-community Interdependence: $M = 4.03$, $SD = 0.77$. Community Commitment: $M = 4.25$, $SD = 0.60$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 39 shows no significant differences were found between income volatility in a good year and the dimensions of adaptive capacity: (a) learning and knowledge seeking $F(3, 182) = 1.26$, $p > .05$, (b) risk-taking and experimentation $F(3, 182) = 1.35$, $p > .05$, (c) decision constraints $F(3, 182) = 0.62$, $p > .05$, (d) adaptive management $F(3, 182) = 0.91$, $p > .05$, and (e) perceived efficacy $F(3, 182) = 1.46$, $p > .05$.

Table 39

Analysis of Variance for Adaptive Capacity Dimensions and Income Volatility in a Good Year

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Less than 25%	57	3.74	0.46	1.26	.29
26 – 50%	67	3.80	0.50		
51 – 75%	37	3.84	0.49		
76 – 100%	25	3.96	0.40		
Risk-taking and Experimentation					
Less than 25%	57	3.87	0.60	1.35	.26
26 – 50%	67	3.89	0.63		
51 – 75%	37	3.74	0.57		
76 – 100%	25	4.06	0.71		
Decision Constraints					
Less than 25%	57	3.16	0.45	0.62	.60
26 – 50%	67	3.28	0.57		
51 – 75%	37	3.29	0.60		
76 – 100%	25	3.27	0.58		
Adaptive Management					
Less than 25%	57	4.00	0.62	0.91	.44
26 – 50%	67	4.16	0.64		
51 – 75%	37	4.18	0.59		
76 – 100%	25	4.15	0.58		
Perceived Efficacy					
Less than 25%	57	3.21	0.79	1.46	.23
26 – 50%	67	3.40	0.77		
51 – 75%	37	3.18	0.86		
76 – 100%	25	3.51	0.86		

Note. *N* = 186. Learning and Knowledge Seeking: *M* = 3.81, *SD* = 0.47. Risk-taking and Experimentation: *M* = 3.87, *SD* = 0.62. Decision Constraints: *M* = 3.25, *SD* = 0.54. Adaptive Management: *M* = 4.11, *SD* = 0.62. Perceived Efficacy: *M* = 3.31, *SD* = 0.81. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 40 shows no significant differences were found between income volatility in a good year and the components of place and occupational attachment: (a) value of agriculture

F(3, 181) = 0.32, *p* > .05, (b) individual-community interdependence *F*(3, 182) = 0.84, *p* > .05, and (c) community commitment *F*(3, 182) = 1.53, *p* > .05.

Table 40

Analysis of Variance for Place and Occupational Attachment Components and Income Volatility in a Good Year

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Less than 25%	57	4.60	0.58	0.32	.81
26 – 50%	67	4.64	0.52		
51 – 75%	37	4.68	0.46		
76 – 100%	24	4.68	0.39		
Individual-community Interdependence					
Less than 25%	57	4.19	0.67	0.84	.47
26 – 50%	67	4.00	0.76		
51 – 75%	37	4.05	0.81		
76 – 100%	25	3.98	0.78		
Community Commitment					
Less than 25%	57	4.33	0.65	1.53	.21
26 – 50%	67	4.17	0.60		
51 – 75%	37	4.40	0.47		
76 – 100%	25	4.37	0.56		

Note. *N* = 186. Value of Agriculture: *M* = 4.64, *SD* = 0.51. Individual-community Interdependence: *M* = 4.07, *SD* = 0.74. Community Commitment: *M* = 4.29, *SD* = 0.59. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 41 shows no significant differences were found between income volatility in a bad year and the dimensions of adaptive capacity: (a) learning and knowledge seeking *F*(3, 180) = 0.10, *p* > .05, (b) risk-taking and experimentation *F*(3, 180) = 1.38, *p* > .05, (c) decision constraints $F(3, 180) = 1.24$, $p > .05$, (d) adaptive management $F(3, 180) = 0.66$, $p > .05$, and (e) perceived efficacy $F(3, 180) = 1.44$, $p > .05$.

Table 41

Analysis of Variance for Adaptive Capacity Dimensions and Income Volatility in a Bad Year

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Less than 25%	50	3.84	0.44	0.10	.96
26 – 50%	84	3.80	0.51		
51 – 75%	27	3.84	0.44		
76 – 100%	23	3.80	0.47		
Risk-taking and Experimentation					
Less than 25%	50	3.99	0.62	1.38	.25
26 – 50%	84	3.80	0.63		
51 – 75%	27	3.99	0.57		
76 – 100%	23	3.81	0.71		
Decision Constraints					
Less than 25%	50	3.17	0.55	1.24	.30
26 – 50%	84	3.20	0.53		
51 – 75%	27	3.35	0.49		
76 – 100%	23	3.38	0.66		
Adaptive Management					
Less than 25%	50	4.02	0.70	0.66	.58
26 – 50%	84	4.15	0.55		
51 – 75%	27	4.19	0.73		
76 – 100%	23	4.14	0.53		
Perceived Efficacy					
Less than 25%	50	3.50	0.90	1.44	.23
26 – 50%	84	3.23	0.74		
51 – 75%	27	3.29	0.91		
76 – 100%	23	3.16	0.76		

Note. $N = 184$. Learning and Knowledge Seeking: $M = 3.82$, $SD = 0.47$. Risk-taking and Experimentation: $M = 3.88$, $SD = 0.63$. Decision Constraints: $M = 3.23$, $SD = 0.55$. Adaptive Management: $M = 4.12$, $SD = 0.62$. Perceived Efficacy: $M = 3.30$, $SD = 0.82$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

Table 42 shows no significant differences were found between income volatility in a bad year and the components of place and occupational attachment: (a) value of agriculture $F(3, 179) = 1.62$, $p > .05$, (b) individual-community interdependence $F(3, 180) = 0.30$, $p > .05$, and (c) community commitment $F(3, 180) = 1.05$, $p > .05$.

Table 42

Analysis of Variance for Place and Occupational Attachment Components and Income Volatility in a Bad Year

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Less than 25%	50	4.56	0.61	1.62	.19
26 – 50%	84	4.71	0.45		
51 – 75%	26	4.71	0.46		
76 – 100%	23	4.51	0.50		
Individual-community Interdependence					
Less than 25%	50	3.97	0.73	0.30	.83
26 – 50%	84	4.09	0.74		
51 – 75%	27	4.09	0.67		
76 – 100%	23	4.04	0.89		
Community Commitment					
Less than 25%	50	4.29	0.68	1.05	.37
26 – 50%	84	4.27	0.57		
51 – 75%	27	4.46	0.43		
76 – 100%	23	4.19	0.47		

Note. $N = 184$. Value of Agriculture: $M = 4.64$, $SD = 0.51$. Individual-community Interdependence: $M = 4.05$, $SD = 0.74$. Community Commitment: $M = 4.29$, $SD = 0.57$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Objective Ten: Significant Differences and Urgency Levels

The existence of significant differences was examined between the five adaptive capacity dimensions and the three place and occupational attachment components and level of urgency. *ANOVAs* were calculated for future planning, immediate action needs, and water availability. Table 43 shows there is a significant difference between future planning and the adaptive management dimension of adaptive capacity $F(4, 220) = 2.89$, $p = .02$ with a medium effect size ($\eta^2 = .05$). Significant difference was also found between future planning and the perceived efficacy dimension of adaptive capacity $F(4, 220) = 2.88$, $p = .02$ with a medium effect size ($\eta^2 = .05$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.43, $p = .02$) were found between group two (somewhat disagree) and group five (strongly agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.49, $p = .05$) were also found between group two (somewhat disagree) and group five (strongly agree) for the perceived efficacy dimension. Participants who somewhat disagreed to the statement "I can't plan more than a few years in advance, things are too uncertain" had significantly higher adaptive management response values than those participants who strongly agreed. The summated scale interprets both groups as somewhat agreeing. Participants who strongly agreed to the statement "I can't plan more than a few years in advance, things are too uncertain" had significantly higher perceived efficacy values than participants who somewhat disagreed. The summated scale interprets group two as neither agreeing nor disagreeing and group five as somewhat agreeing. Table 43 shows no significant differences were found between future planning and the following dimensions of adaptive capacity: (a) learning and knowledge seeking

$F(4, 221) = 2.18$, $p > .05$, (b) risk-taking and experimentation $F(4, 221) = 0.55$, $p > .05$, and (c) decision constraints $F(4, 221) = 1.23$, $p > .05$.

Table 43

Analysis of Variance for Adaptive Capacity Dimensions and Future Planning

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Strongly Disagree to "I can't plan more than a few years in advance…"	18	4.03	0.34	2.18	.07
Somewhat Disagree to "I can't plan more than a few years in advance…"	43	3.67	0.53		
Neither Agree nor Disagree to "I can't plan more than a few years in advance…"	49	3.72	0.64		
Somewhat Agree to "I can't plan more than a few years in advance…"	83	3.82	0.46		
Strongly Agree to "I can't plan more than a few years in advance…"	33	3.86	0.41		
Risk-taking and Experimentation					
Strongly Disagree to "I can't plan more than a few years in advance…"	18	3.92	0.46	0.55	.70
Somewhat Disagree to "I can't plan more than a few years in advance…"	43	3.93	0.58		
Neither Agree nor Disagree to "I can't plan more than a few years in advance…"	49	3.75	0.66		
Somewhat Agree to "I can't plan more than a few years in advance…"	83	3.85	0.64		
Strongly Agree to "I can't plan more than a few years in advance…"	33	3.84	0.59		
Decision Constraints					
Strongly Disagree to "I can't plan more than a few years in advance…"	18	3.30	0.60	1.23	.30
Somewhat Disagree to "I can't plan more than a few years in advance…"	43	3.27	0.50		
Neither Agree nor Disagree to "I can't plan more than a few years in advance…"	49	3.31	0.48		
Somewhat Agree to "I can't plan more than a few years in advance…"	83	3.15	0.53		
Strongly Agree to "I can't plan more than a few years in advance…"	33	3.11	0.55		
Adaptive Management [a]					
Strongly Disagree to "I can't plan more than a few years in advance…"	18	4.23	0.77	2.89	.02
Somewhat Disagree to "I can't plan more than a	43	4.30	0.51		

	n	M	SD	F	p
few years in advance…”					
Neither Agree nor Disagree to “I can’t plan more than a few years in advance…”	49	4.02	0.64		
Somewhat Agree to “I can’t plan more than a few years in advance…”	82	4.05	0.54		
Strongly Agree to “I can’t plan more than a few years in advance…”	33	3.87	0.68		
Perceived Efficacy [a]					
Strongly Disagree to “I can’t plan more than a few years in advance…”	18	2.99	0.89	2.88	.02
Somewhat Disagree to “I can’t plan more than a few years in advance…”	43	3.08	0.81		
Neither Agree nor Disagree to “I can’t plan more than a few years in advance…”	49	3.21	0.68		
Somewhat Agree to “I can’t plan more than a few years in advance…”	82	3.37	0.72		
Strongly Agree to “I can’t plan more than a few years in advance…”	33	3.57	0.87		

Note. N = 226. Learning and Knowledge Seeking: M = 3.79, SD = 0.51. Risk-taking and Experimentation: M = 3.85, SD = 0.61. Decision Constraints: M = 3.21, SD = 0.52. Adaptive Management: M = 4.08, SD = 0.61. Perceived Efficacy: M = 3.28, SD = 0.78. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal N due to item non-response.

Table 44 shows no significant differences were found between future planning and the components of place and occupational attachment: (a) value of agriculture $F(4, 219) = 0.58$, $p > .05$, (b) individual-community interdependence $F(4, 220) = 0.82$, $p > .05$, and (c) community commitment $F(4, 220) = 1.41$, $p > .05$.

Table 44

Analysis of Variance for Place and Occupational Attachment Components and Future Planning

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Strongly Disagree to “I can’t plan more than a few years in advance…”	18	4.80	0.62	0.58	.68
Somewhat Disagree to “I can’t plan more than a few years in advance…”	43	4.64	0.44		
Neither Agree nor Disagree to “I can’t plan more than a few years in advance…”	48	4.59	0.48		
Somewhat Agree to “I can’t plan more than a few years in advance…”	82	4.63	0.50		
Strongly Agree to “I can’t plan more than a few years in advance…”	33	4.65	0.55		
Individual-community Interdependence					
Strongly Disagree to “I can’t plan more than a few years in advance…”	18	4.06	0.75	0.82	.52
Somewhat Disagree to “I can’t plan more than a few years in advance…”	43	4.03	0.77		
Neither Agree nor Disagree to “I can’t plan more than a few years in advance…”	48	3.95	0.90		
Somewhat Agree to “I can’t plan more than a few years in advance…”	83	4.15	0.59		
Strongly Agree to “I can’t plan more than a few years in advance…”	33	3.92	0.88		
Community Commitment					
Strongly Disagree to “I can’t plan more than a few years in advance…”	18	4.54	0.61	1.41	.23
Somewhat Disagree to “I can’t plan more than a few years in advance…”	43	4.21	0.59		
Neither Agree nor Disagree to “I can’t plan more than a few years in advance…”	48	4.18	0.55		
Somewhat Agree to “I can’t plan more than a few years in advance…”	83	4.31	0.59		
Strongly Agree to “I can’t plan more than a few years in advance…”	33	4.23	0.65		

Note. N = 224. Value of Agriculture: M = 4.64, SD = 0.49. Individual-community Interdependence: M = 4.04, SD = 0.75. Community Commitment: M = 4.27, SD = 0.59. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree.*

[a] Total does not equal *N* due to item non-response.

Table 45 shows there is a significant difference between immediate action needs and all five dimensions of adaptive capacity: (a) learning and knowledge seeking $F(4, 221) = 4.18$, $p < .00$ with a medium effect size ($\eta^2 = .07$), (b) risk-taking and experimentation $F(4, 221) = 3.46$, $p = .01$ with a medium effect size ($\eta^2 = .06$), (c) decision constraints $F(4, 221) = 3.32$, $p = .01$ with a medium effect size ($\eta^2 = .06$), (d) adaptive management $F(4, 220) = 34.54$, $p < .00$ with a very large effect size ($\eta^2 = .39$), and (e) perceived efficacy $F(4, 220) = 3.58$, $p = .01$ with a medium effect size ($\eta^2 = .06$).

Pairwise comparison analysis using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.42, $p < .00$) were found between group two (somewhat disagree) and group four (somewhat agree) for the learning and knowledge seeking dimension. Participants who somewhat agreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher learning and knowledge seeking values than participants who somewhat disagreed. The summated scale interprets both groups as somewhat agreeing. Statistically significant mean differences (*SMD* = 0.43, $p = .04$) were found between group two (somewhat disagree) and group five (strongly agree) for the risk-taking and experimentation dimension. Participants who strongly agreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher risk-taking and experimentation values than participants who somewhat disagreed. The summated scale interprets both groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.43, $p = .05$) were found between group one (strongly disagree) and group four (somewhat agree) for the decision constraints dimension. Statistically significant mean differences (*SMD* = 0.47, $p = .04$) were also found between group one and group five (strongly agree) for the decision constraints dimension. Participants who somewhat agreed or strongly agreed with the statement “immediate action is needed to prepare for the impact of changing climate conditions on agriculture” had significantly higher decision constraints values than participants who strongly disagreed. The summated scale interprets both groups as neither agreeing nor disagreeing.

Statistically significant mean differences (*SMD* = 0.81, $p < .00$) were found between group one (strongly disagree) and group two (somewhat disagree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.90, $p < .00$) were also found between group one and group three (neither agree nor disagree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 1.29, $p < .00$) were also found between group one and group four (somewhat agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 1.58, $p < .00$) were also found between group one and group five (strongly agree) for the adaptive management dimension. Participants who somewhat disagreed, neither agreed nor disagreed, somewhat agreed, or strongly agreed with the statement “immediate action is needed to prepare for the impact of changing climate conditions on agriculture” had significantly higher adaptive management values than participants who strongly disagreed. The summated scale interprets group one as neither agreeing nor disagreeing, groups two, three, and four as somewhat agreeing, and group five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.47, $p < .00$) were found between group two (somewhat disagree) and group four (somewhat agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.77, $p < .00$) were also found between group two and group five (strongly agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.39, $p < .00$) were found between group three (neither agree nor disagree) and group four (somewhat agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.69, $p < .00$) were also found between group three and group five (strongly agree) for the adaptive management dimension. Participants who somewhat agree or strongly agreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher adaptive management values than participants who somewhat disagreed or neither agreed nor disagreed. The summated scale interprets groups two, three, and four as somewhat agreeing and group five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.75, $p = .01$) were found between group one (strongly disagree) and group three (neither agree nor disagree) for the perceived efficacy dimension. Statistically significant mean differences (*SMD* = 0.73, $p = .02$) were also found between group one and group four (somewhat agree) for the perceived efficacy dimension. Statistically significant mean differences (*SMD* = 0.88, $p = .04$) were also found between group one and group five (strongly agree) for the perceived efficacy dimension. Participants who strongly disagreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher perceived efficacy values than participants who neither agreed nor disagreed, somewhat agreed, or strongly agreed. The summated scale interprets group one as somewhat agreeing and groups three, four, and five as neither agreeing nor disagreeing.

Table 45

Analysis of Variance for Adaptive Capacity Dimensions and Immediate Action Needs

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Strongly Disagree to "immediate action is needed to prepare for…"	13	3.87	0.56	4.18	.00
Somewhat Disagree to "immediate action is needed to prepare for…"	26	3.52	0.63		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	3.72	0.49		
Somewhat Agree to "immediate action is needed to prepare for…"	69	3.94	0.49		
Strongly Agree to "immediate action is needed to prepare for…"	38	3.86	0.38		
Risk-taking and Experimentation					
Strongly Disagree to "immediate action is needed to prepare for…"	13	3.75	0.67	3.46	.01
Somewhat Disagree to "immediate action is needed to prepare for…"	26	3.62	0.70		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	3.74	0.58		
Somewhat Agree to "immediate action is needed to prepare for…"	69	3.97	0.57		
Strongly Agree to "immediate action is needed to prepare for…"	38	4.05	0.60		
Decision Constraints					
Strongly Disagree to "immediate action is needed to prepare for…"	13	2.88	0.67	3.32	.01
Somewhat Disagree to "immediate action is needed to prepare for…"	26	3.12	0.47		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	3.14	0.49		
Somewhat Agree to "immediate action is needed to prepare for…"	69	3.32	0.49		
Strongly Agree to "immediate action is needed to prepare for…"	38	3.35	0.57		
Adaptive Management [a]					
Strongly Disagree to "immediate action is needed to prepare for…"	13	3.01	0.55	34.54	.00
Somewhat Disagree to "immediate action is needed to prepare for…"	26	3.83	0.48		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	3.91	0.48		
Somewhat Agree to "immediate action is needed	68	4.30	0.52		

	n	*M*	*SD*	*F*	*p*
to prepare for…"					
Strongly Agree to "immediate action is needed to prepare for…"	38	4.60	0.38		
Perceived Efficacy [a]					
Strongly Disagree to "immediate action is needed to prepare for…"	13	3.98	1.13	3.58	.01
Somewhat Disagree to "immediate action is needed to prepare for…"	26	3.41	0.78		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	3.23	0.65		
Somewhat Agree to "immediate action is needed to prepare for…"	68	3.25	0.77		
Strongly Agree to "immediate action is needed to prepare for…"	38	3.10	0.81		

Note. *N* = 226. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.51. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.61. Decision Constraints: *M* = 3.21, *SD* = 0.52. Adaptive Management: *M* = 4.08, *SD* = 0.61. Perceived Efficacy: *M* = 3.28, *SD* = 0.78. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 46 shows there is a significant difference between immediate action needs and all three components of place and occupational attachment: (a) value of agriculture $F(4, 219) = 2.36$, $p = .05$ with a medium effect size ($\eta^2 = .04$), (b) individual-community interdependence $F(4, 220) = 3.35$, $p = .01$ with a medium effect size ($\eta^2 = .06$), and (c) community commitment $F(4, 220) = 2.92$, $p = .02$ with a medium effect size ($\eta^2 = .05$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.79, $p = .01$) were found between group one (strongly disagree) and group five (strongly agree) for the individual-community interdependence component. Participants who strongly agreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher individual-community interdependence values than participants who strongly disagreed. The summated scale interprets both groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.44, *p* = .03) were found between group two (somewhat disagree) and group five (strongly agree) for the community commitment component. Participants who strongly agreed with the statement "immediate action is needed to prepare for the impact of changing climate conditions on agriculture" had significantly higher community commitment values than participants who strongly disagreed. The summated scale interprets both groups as somewhat agreeing. No statistically significant mean differences were found for the value of agriculture component.

Table 46

Analysis of Variance for Place and Occupational Attachment Components and Immediate Action Needs

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Strongly Disagree to "immediate action is needed to prepare for…"	13	4.41	0.77	2.36	.05
Somewhat Disagree to "immediate action is needed to prepare for…"	25	4.59	0.65		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	79	4.61	0.42		
Somewhat Agree to "immediate action is needed to prepare for…"	69	4.62	0.51		
Strongly Agree to "immediate action is needed to prepare for…"	38	4.83	0.33		
Individual-community Interdependence					
Strongly Disagree to "immediate action is needed to prepare for…"	13	3.53	0.88	3.35	.01
Somewhat Disagree to "immediate action is needed to prepare for…"	25	3.88	0.81		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	4.01	0.81		
Somewhat Agree to "immediate action is needed to prepare for…"	69	4.09	0.65		
Strongly Agree to "immediate action is needed to prepare for…"	38	4.33	0.63		
Community Commitment					
Strongly Disagree to "immediate action is needed to prepare for…"	13	4.08	0.76	2.92	.02
Somewhat Disagree to "immediate action is needed to prepare for…"	25	4.05	0.67		
Neither Agree nor Disagree to "immediate action is needed to prepare for…"	80	4.21	0.60		
Somewhat Agree to "immediate action is needed to prepare for…"	69	4.32	0.54		
Strongly Agree to "immediate action is needed to prepare for…"	38	4.49	0.51		

Note. N = 225. Value of Agriculture: M = 4.64, SD = 0.49. Individual-community Interdependence: M = 4.04, SD = 0.75. Community Commitment: M = 4.27, SD = 0.59. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat*

agree, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 47 shows there is a significant difference between water availability and the adaptive management dimension of adaptive capacity $F(4, 220) = 7.51$, $p < .00$ with a large effect size ($\eta^2 = .12$). A significant difference was also found between water availability and the decision constraints dimension of adaptive capacity $F(4, 221) = 5.79$, $p < .00$ with a medium effect size ($\eta^2 = .09$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.78, $p < .00$) were found between group one (strongly disagree) and group four (somewhat agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.81, $p < .00$) were also found between group one and group five (strongly agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.36, $p = .01$) were found between group three (neither agree nor disagree) and group four (somewhat agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.38, $p = .02$) were also found between group three and group five (strongly agree) for the adaptive management dimension. Participants who somewhat agreed or strongly agreed to the statement "problems in water availability are unlikely to manifest in this region for some time" had significantly higher adaptive management response values than those participants who strongly disagreed and those participants who neither agreed nor disagreed. The summated scale interprets group one as neither agreeing nor disagreeing and groups three, four, and five as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.60, $p = .02$) were found between group one (strongly disagree) and group two (somewhat disagree) for the decision constraints dimension. Statistically significant mean differences (*SMD* = 0.64, $p < .00$) were found also between group one and group four (somewhat agree) for the decision constraints dimension. Statistically significant mean differences (*SMD* = 0.71, $p < .00$) were also found between group one and group five (strongly agree) for the decision constraints dimension. Participants who somewhat disagreed, somewhat agreed or strongly agreed to the statement "problems in water availability are unlikely to manifest in this region for some time" had significantly higher decision constraints response values than those participants who strongly disagreed. The summated scale interprets all four groups as neither agreeing nor disagreeing.

Table 47 shows no significant differences were found between future planning and the following dimensions of adaptive capacity: (a) learning and knowledge seeking $F(4, 221) = 1.16$, $p > .05$, (b) risk-taking and experimentation $F(4, 221) = 0.85$, $p > .05$, and (c) perceived efficacy $F(4, 220) = 1.34$, $p > .05$.

Table 47

Analysis of Variance for Adaptive Capacity Dimensions and Water Availability

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Strongly Disagree to “problems in water availability are unlikely…”	11	3.88	0.66	1.16	.33
Somewhat Disagree to “problems in water availability are unlikely…”	17	3.80	0.56		
Neither Agree nor Disagree to “problems in water availability are unlikely…”	48	3.70	0.54		
Somewhat Agree to “problems in water availability are unlikely…”	105	3.77	0.50		
Strongly Agree to “problems in water availability are unlikely…”	45	3.92	0.43		
Risk-taking and Experimentation					
Strongly Disagree to “problems in water availability are unlikely…”	11	3.65	0.72	0.85	.50
Somewhat Disagree to “problems in water availability are unlikely…”	17	3.96	0.74		
Neither Agree nor Disagree to “problems in water availability are unlikely…”	48	3.76	0.55		
Somewhat Agree to “problems in water availability are unlikely…”	105	3.86	0.59		
Strongly Agree to “problems in water availability are unlikely…”	45	3.92	0.66		
Decision Constraints					
Strongly Disagree to “problems in water availability are unlikely…”	11	2.64	0.41	5.79	.00
Somewhat Disagree to “problems in water availability are unlikely…”	17	3.24	0.57		
Neither Agree nor Disagree to “problems in water availability are unlikely…”	48	3.07	0.51		
Somewhat Agree to “problems in water availability are unlikely…”	105	3.28	0.50		
Strongly Agree to “problems in water availability are unlikely…”	45	3.34	0.51		
Adaptive Management [a]					
Strongly Disagree to “problems in water availability are unlikely…”	11	3.42	0.88	7.51	.00
Somewhat Disagree to “problems in water availability are unlikely…”	17	4.01	0.61		
Neither Agree nor Disagree to “problems in water availability are unlikely…”	48	3.85	0.52		
Somewhat Agree to “problems in water	104	4.21	0.52		

	n	*M*	*SD*	*F*	*p*
availability are unlikely…"					
Strongly Agree to "problems in water availability are unlikely…"	45	4.23	0.66		
Perceived Efficacy [a]					
Strongly Disagree to "problems in water availability are unlikely…"	11	3.73	1.15	1.34	.26
Somewhat Disagree to "problems in water availability are unlikely…"	17	3.46	0.78		
Neither Agree nor Disagree to "problems in water availability are unlikely…"	48	3.19	0.68		
Somewhat Agree to "problems in water availability are unlikely…"	104	3.26	0.74		
Strongly Agree to "problems in water availability are unlikely…"	45	3.22	0.86		

Note. N = 226. Learning and Knowledge Seeking: M = 3.79, SD = 0.51. Risk-taking and Experimentation: M = 3.85, SD = 0.61. Decision Constraints: M = 3.21, SD = 0.52. Adaptive Management: M = 4.08, SD = 0.61. Perceived Efficacy: M = 3.28, SD = 0.78. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal N due to item non-response.

Table 48 shows no significant differences were found between water availability and the components of place and occupational attachment: (a) value of agriculture $F(4, 219) = 1.94, p > .05$, (b) individual-community interdependence $F(4, 220) = 0.96, p > .05$, and (c) community commitment $F(4, 220) = 1.02, p > .05$.

Table 48

Analysis of Variance for Place and Occupational Attachment Components and Water Availability

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Strongly Disagree to "problems in water availability are unlikely…"	11	4.45	0.78	1.94	.11
Somewhat Disagree to "problems in water availability are unlikely…"	17	4.51	0.72		
Neither Agree nor Disagree to "problems in water availability are unlikely…"	47	4.54	0.53		
Somewhat Agree to "problems in water availability are unlikely…"	105	4.67	0.43		
Strongly Agree to "problems in water availability are unlikely…"	44	4.76	0.39		
Individual-community Interdependence					
Strongly Disagree to "problems in water availability are unlikely…"	11	3.82	1.23	0.96	.43
Somewhat Disagree to "problems in water availability are unlikely…"	17	3.79	0.94		
Neither Agree nor Disagree to "problems in water availability are unlikely…"	48	4.03	0.75		
Somewhat Agree to "problems in water availability are unlikely…"	105	4.07	0.61		
Strongly Agree to "problems in water availability are unlikely…"	44	4.15	0.85		
Community Commitment					
Strongly Disagree to "problems in water availability are unlikely…"	11	4.52	0.46	1.02	.40
Somewhat Disagree to "problems in water availability are unlikely…"	17	4.12	0.78		
Neither Agree nor Disagree to "problems in water availability are unlikely…"	48	4.24	0.58		
Somewhat Agree to "problems in water availability are unlikely…"	105	4.25	0.57		
Strongly Agree to "problems in water availability are unlikely…"	44	4.35	0.61		

Note. $N = 225$. Value of Agriculture: $M = 4.64$, $SD = 0.49$. Individual-community Interdependence: $M = 4.04$, $SD = 0.75$. Community Commitment: $M = 4.27$, $SD = 0.59$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat*

agree, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Objective Eleven: Significant Differences and Attitudes Towards Terms

The existence of significant differences was examined between the five adaptive capacity dimensions and the three place and occupational attachment components and attitudes towards the terms *climate variability* and *climate change*. *ANOVAs* were calculated for attitudes towards the term *climate variability* and *climate change*. Table 49 shows there is a significant difference between attitudes towards the term *climate variability* and the adaptive management dimension of adaptive capacity $F(4, 220) = 4.12$, $p < .00$ with a medium effect size ($\eta^2 = .07$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences ($SMD = 0.55$, $p < .00$) were found between group two (somewhat disagree) and group five (strongly agree). Statistically significant mean differences ($SMD = 0.39$, $p = .02$) were also found between group two (somewhat disagree) and group four (somewhat agree). Participants who somewhat disagreed to the statement "I have negative feelings towards the term *climate variability*" had significantly higher adaptive management response values than those participants who somewhat agreed or strongly agreed. The summated scale interprets all three groups as somewhat agreeing. Table 49 shows no significant differences were found between attitudes towards the term *climate variability* and the following dimensions of adaptive capacity: (a) learning and knowledge seeking $F(4, 221) = 1.46$, $p > .05$, (b) risk-taking and experimentation $F(4, 221) = 1.26$, $p > .05$, (c) decision constraints $F(4, 221) = 0.27$, $p > .05$, and (d) perceived efficacy $F(4, 220) = 0.32$, $p > .05$.

Table 49

Analysis of Variance for Adaptive Capacity Dimensions and Attitudes Towards Climate Variability

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	3.89	0.34	1.46	.22
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	3.94	0.43		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	87	3.78	0.56		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	3.78	0.43		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	28	3.65	0.66		
Risk-taking and Experimentation					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	3.92	0.63	1.26	.29
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	3.99	0.48		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	87	3.88	0.63		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	3.72	0.55		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	28	3.81	0.78		
Decision Constraints					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	3.18	0.73	0.27	.90
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	3.20	0.52		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	87	3.21	0.51		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	3.19	0.50		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	28	3.30	0.54		
Adaptive Management [a]					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	4.17	0.90	4.11	.00
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	4.35	0.55		
Neither Agree nor Disagree to "I have negative	86	4.14	0.56		

	n	*M*	*SD*	*F*	*p*
feelings towards the term *climate variability*"					
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	3.97	0.54		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	28	3.80	0.66		
Perceived Efficacy [a]					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	3.23	0.85	0.32	.87
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	3.14	0.69		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	86	3.30	0.78		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	3.32	0.78		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	28	3.29	0.91		

Note. *N* = 226. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.51. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.61. Decision Constraints: *M* = 3.12, *SD* = 0.52. Adaptive Management: *M* = 4.08, *SD* = 0.61. Perceived Efficacy: *M* = 3.28, *SD* = 0.78. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 50 shows there is a significant difference between attitudes towards the term *climate variability* and the individual-community interdependence component of place and occupational attachment $F(4, 220) = 3.25$, $p = .01$ with a medium effect size ($\eta^2 = .06$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.63, *p* = .01) were found between group two (somewhat disagree) and group five (strongly agree). Participants who somewhat disagreed to the statement "I have negative feelings towards the term *climate variability*" had significantly higher individual-community interdependence response values than those participants who strongly agreed. The summated scale interprets both groups as somewhat agreeing for the individual-community interdependence component of place and occupational attachment. Table 50 shows no significant differences were found between attitudes towards the term *climate variability* and the following components of place and occupational attachment: (a) value of agriculture $F(4, 219) = 0.18$, $p > .05$ and (b) community commitment $F(4, 220) = 1.75$, $p > .05$.

Table 50

Analysis of Variance for Place and Occupational Attachment Components and Attitudes Towards Climate Variability

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	4.64	0.65	0.18	.95
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	4.67	0.44		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	56	4.60	0.49		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	4.65	0.49		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	27	4.68	0.53		
Individual-community Interdependence					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	4.27	0.84	3.25	.01
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	4.33	0.57		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	87	3.98	0.75		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	4.08	0.67		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	27	3.70	0.95		
Community Commitment					
Strongly Disagree to "I have negative feelings towards the term *climate variability*"	15	4.60	0.46	1.75	.14
Somewhat Disagree to "I have negative feelings towards the term *climate variability*"	33	4.33	0.70		
Neither Agree nor Disagree to "I have negative feelings towards the term *climate variability*"	87	4.18	0.58		
Somewhat Agree to "I have negative feelings towards the term *climate variability*"	63	4.28	0.57		
Strongly Agree to "I have negative feelings towards the term *climate variability*"	27	4.25	0.56		

Note. *N* = 225. Value of Agriculture: *M* = 4.64, *SD* = 0.49. Individual-community Interdependence: *M* = 4.04, *SD* = 0.75. Community Commitment: *M* = 4.27, *SD* = 0.59. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat*

agree, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 51 shows there is a significant difference between attitudes towards the term *climate change* and the adaptive management dimension of adaptive capacity $F(4, 220) = 9.89$, $p < .00$ with a large effect size ($\eta^2 = .15$) and the learning and knowledge seeking dimension of adaptive capacity $F(4, 221) = 2.67$, $p = .03$ with a medium effect size ($\eta^2 = .05$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.36, $p = .04$) were found between group one (strongly disagree) and group two (somewhat disagree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.41, $p = .00$) were found between group one and group three (neither agree nor disagree). Statistically significant mean differences (*SMD* = 0.71, $p = .00$) were found between group one and group four (somewhat agree). Statistically significant mean differences (*SMD* = 0.82, $p = .00$) were also found between group one and group five (strongly agree). Participants who strongly agreed, somewhat agreed, neither agreed nor disagreed, or somewhat disagreed to "I have positive feelings towards the term *climate change*" had significantly higher adaptive management response values than those participants who strongly disagreed. The summated scale interprets all five groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.46, $p = .03$) were found between group two (somewhat disagree) and five (strongly agree) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.41, $p = .03$) were also found between group three (neither agree nor disagree) and group five (strongly agree). Participants who strongly agreed to “I have positive feelings towards the term *climate change*” had significantly higher adaptive management response values than those participants who neither agreed or disagreed and participants who somewhat disagreed. The summated scale interprets all three groups as somewhat agreeing.

No statistically significant mean differences were found for the learning and knowledge seeking dimension. Table 51 shows no significant differences were found between attitudes towards the term *climate change* and the following dimensions of adaptive capacity: (a) risk-taking and experimentation $F(4, 221) = 0.97$, $p > .05$, (b) decision constraints $F(4, 221) = 1.01$, $p > .05$, and (c) perceived efficacy $F(4, 220) = 1.28$, $p > .05$.

Table 51

Analysis of Variance for Adaptive Capacity Dimensions and Attitudes Towards Climate Change

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Strongly Disagree to “I have positive feelings towards the term *climate change*”	37	3.72	0.64	2.67	.03
Somewhat Disagree to “I have positive feelings towards the term *climate change*”	43	3.71	0.42		
Neither Agree nor Disagree to “I have positive feelings towards the term *climate change*”	91	3.75	0.51		
Somewhat Agree to “I have positive feelings towards the term *climate change*”	36	4.00	0.48		
Strongly Agree to “I have positive feelings towards the term *climate change*”	19	3.95	0.39		
Risk-taking and Experimentation					
Strongly Disagree to “I have positive feelings towards the term *climate change*”	37	3.75	0.66	0.97	.43
Somewhat Disagree to “I have positive feelings towards the term *climate change*”	43	3.74	0.67		
Neither Agree nor Disagree to “I have positive feelings towards the term *climate change*”	91	3.89	0.64		
Somewhat Agree to “I have positive feelings towards the term *climate change*”	36	3.94	0.38		
Strongly Agree to “I have positive feelings towards the term *climate change*”	19	3.93	0.61		
Decision Constraints					

	n	*M*	*SD*	*F*	*p*
Strongly Disagree to "I have positive feelings towards the term *climate change*"	37	3.12	0.51	1.01	.40
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	3.18	0.47		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	91	3.19	0.50		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	36	3.32	0.58		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	3.34	0.66		
Adaptive Management [a]					
Strongly Disagree to "I have positive feelings towards the term *climate change*"	37	3.67	0.58	9.89	.00
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	4.03	0.59		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	91	4.08	0.55		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	35	4.38	0.50		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	4.49	0.67		
Perceived Efficacy [a]				1.28	.28
Strongly Disagree to "I have positive feelings towards the term *climate change*"	37	3.45	0.80		
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	3.35	0.74		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	91	3.28	0.78		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	35	3.11	0.74		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	3.08	0.91		

Note. N = 226. Learning and Knowledge Seeking: M = 3.79, SD = 0.51. Risk-taking and Experimentation: M = 3.85, SD = 0.61. Decision Constraints: M = 3.21, SD = 0.52. Adaptive Management: M = 4.08, SD = 0.61. Perceived Efficacy: M = 3.28, SD = 0.78. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal N due to item non-response.

Table 52 shows there is a significant difference between attitudes towards the term *climate change* and the individual-community interdependence component of place and occupational attachment $F(4, 220) = 2.78$, $p = .03$ with a medium effect size ($\eta^2 = .05$) and the community commitment component of place and occupational attachment $F(4, 220) = 2.48$, $p = .05$ with a medium effect size ($\eta^2 = .04$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences ($SMD = 0.62$, $p = .03$) were found between group one (strongly disagree) and group five (strongly agree) for the individual-community interdependence component. Participants who strongly agreed to "I have positive feelings towards the term *climate change*" had significantly higher individual-community interdependence response values than those participants who strongly disagreed. The summated scale interprets both groups as somewhat agreeing. No statistically significant mean differences were found for the community commitment component. Table 52 shows no significant differences were found between attitudes towards the term *climate change* and the value of agriculture component of place and occupational attachment $F(4, 219) = 0.46$, $p > .05$.

Table 52

Analysis of Variance for Place and Occupational Attachment Components and Attitudes Towards Climate Change

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Strongly Disagree to "I have positive feelings towards the term *climate change*"	36	4.63	0.56	0.46	.76
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	4.60	0.53		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	90	4.61	0.50		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	36	4.72	0.44		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	4.70	0.37		
Individual-community Interdependence					
Strongly Disagree to "I have positive feelings towards the term *climate change*"	36	3.81	0.94	2.78	.03
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	3.98	0.71		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	91	4.02	0.78		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	36	4.22	0.54		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	4.42	0.54		
Community Commitment					
Strongly Disagree to "I have positive feelings towards the term *climate change*"	36	4.15	0.55	2.48	.05
Somewhat Disagree to "I have positive feelings towards the term *climate change*"	43	4.22	0.60		
Neither Agree nor Disagree to "I have positive feelings towards the term *climate change*"	91	4.21	0.63		
Somewhat Agree to "I have positive feelings towards the term *climate change*"	36	4.50	0.50		
Strongly Agree to "I have positive feelings towards the term *climate change*"	19	4.44	0.52		

Note. $N = 225$. Value of Agriculture: $M = 4.64$, $SD = 0.49$. Individual-community Interdependence: $M = 4.04$, $SD = 0.75$. Community Commitment: $M = 4.27$, $SD = 0.59$. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat*

agree, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Objective Twelve: Significant Differences and Training Interest

The existence of significant differences was examined between the five adaptive capacity dimensions and the three place and occupational attachment components and interest in future climate variability training. An *ANOVA* was calculated for interest in future training. Table 53 shows there is a significant difference between interest in future training and all five dimensions of adaptive capacity; (a) learning and knowledge seeking $F(4, 200) = 2.53$, $p = .04$ with a medium effect size ($\eta^2 = .05$), (b) risk-taking and experimentation $F(4, 200) = 3.93$, $p < .00$ with a medium effect size ($\eta^2 = .07$), (c) decision constraints $F(4, 200) = 4.19$, $p < .00$ with a medium effect size ($\eta^2 = .08$), (d) adaptive management $F(4, 199) = 15.13$, $p < .00$ with a very large effect size ($\eta^2 = .23$), and (e) perceived efficacy $F(4, 199) = 2.70$, $p = .03$ with a medium effect size ($\eta^2 = .05$).

Pairwise comparison analysis using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.39, $p = .05$) were found between group two (probably not) and group five (definitely yes) for the learning and knowledge seeking dimension. Participants who definitely would attend a training on climate variability had significantly higher learning and knowledge seeking values than participants who probably would not attend a training. The summated scale interprets both groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.39, $p = .02$) were found between group two (probably not) and group four (probably yes) for the risk-taking and experimentation dimension. Statistically significant mean differences (*SMD* = 0.59, $p = .01$) were also found between group two and group five (definitely yes) for the risk-taking and experimentation dimension. Participants who probably and definitely would attend a climate variability training had significantly higher risk-taking and experimentation values than participants who probably would not attend a training. The summated scale interprets all three groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.39, $p = .04$) were found between group one (definitely not) and group four (probably yes) for the decision constraints dimension. Statistically significant mean differences (*SMD* = 0.41, $p < .00$) were also found between group two (probably not) and group four for the decision constraints dimension. Participants who probably would attend a climate variability training had significantly higher decision constraints values than those participants who probably would not and definitely would not attend a training. The summated scale interprets all three groups as neither agreeing nor disagreeing.

Statistically significant mean differences (*SMD* = 0.69, $p < .00$) were found between group one (definitely not) and group three (might or might not) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.90, $p < .00$) were also found between group one and group four (probably yes) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 1.09, $p < .00$) were also found between group one and group five (definitely yes) for the adaptive management dimension. Participants who might or might not, probably would, and definitely would attend a training had significantly higher adaptive management values than those participants who definitely would not attending a training. The summated scale interprets group one as neither agreeing nor disagreeing, group three and four as somewhat agreeing, and group five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.33, $p = .02$) were found between group two (probably not) and group three (might or might not) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.54, $p < .00$) were also found between group two and group four (probably yes) for the adaptive management dimension. Statistically significant mean differences (*SMD* = 0.74, $p < .00$) were also found between group two and group five (definitely yes) for the adaptive management dimension. Participants who might or might not, probably would, and definitely would attend a training had significantly higher adaptive management values than those participants who probably would not attending a training. The summated scale interprets groups two, three, and four as somewhat agreeing and group five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.41, $p = .05$) were also found between group three (might or might not) and group five (definitely yes) for the adaptive management dimension. Participants who might or might not attend a training had significantly higher adaptive management values than those participants who definitely would not attending a training. The summated scale interprets group three as somewhat agreeing and group five as strongly agreeing. No statistically significant mean differences were found for the perceived efficacy dimension.

Table 53

Analysis of Variance for Adaptive Capacity Dimensions and Interest in Future Training

	n	*M*	*SD*	*F*	*p*
Learning and Knowledge Seeking					
Definitely Not	19	3.63	0.58	2.53	0.04
Probably Not	41	3.66	0.55		
Might or Might Not	75	3.83	0.48		
Probably Yes	53	3.81	0.49		
Definitely Yes	17	4.04	0.36		
Risk-taking and Experimentation					
Definitely Not	19	3.73	0.66	3.93	.00
Probably Not	41	3.58	0.73		
Might or Might Not	75	3.87	0.52		
Probably Yes	53	3.97	0.58		
Definitely Yes	17	4.16	0.64		
Decision Constraints					
Definitely Not	19	3.03	0.38	4.19	.00
Probably Not	41	3.01	0.50		
Might or Might Not	75	3.22	0.54		
Probably Yes	53	3.42	0.48		
Definitely Yes	17	3.17	0.71		
Adaptive Management [a]					
Definitely Not	18	3.43	0.57	15.13	.00
Probably Not	41	3.78	0.44		
Might or Might Not	75	4.11	0.57		
Probably Yes	53	4.33	0.51		
Definitely Yes	17	4.52	0.69		
Perceived Efficacy [a]					
Definitely Not	19	3.63	0.93	2.70	.03
Probably Not	41	3.50	0.70		
Might or Might Not	75	3.20	0.70		
Probably Yes	53	3.11	0.81		
Definitely Yes	17	3.46	1.05		

Note. *N* = 205. Learning and Knowledge Seeking: *M* = 3.79, *SD* = 0.50. Risk-taking and Experimentation: *M* = 3.85, *SD* = 0.62. Decision Constraints: *M* = 3.21, *SD* = 0.54. Adaptive Management: *M* = 4.08, *SD* = 0.61. Perceived Efficacy: *M* = 3.30, *SD* = 0.80. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Table 54 shows there is a significant difference between attitudes towards interest in future training and all three components of place and occupational attachment: (a) value of agriculture $F(4, 199) = 5.36$, $p < .00$ with a large effect size ($\eta^2 = .10$), (b) individual-community interdependence $F(4, 200) = 2.76$, $p = .02$ with a medium effect size ($\eta^2 = .05$), and (c) community commitment $F(4, 200) = 6.76$, $p < .00$ with a large effect size ($\eta^2 = .12$). *Pairwise comparison analysis* using the *Tukey HSD post hoc procedure* was conducted for all possible pairs. Statistically significant mean differences (*SMD* = 0.35, *p* = .04) were found between group one (definitely not) and group three (might or might not) for the value of agriculture component. Statistically significant mean differences (*SMD* = 0.55, *p* = .01) were also found between group one and group five (definitely yes) for the value of agriculture component. Participants who might or might not attend and definitely would attend a climate variability training had significantly higher value of agriculture values than those participants who definitely would not attend a training. The summated scale interprets group one as somewhat agreeing and groups three and five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.27, *p* = .03) were found between group two (probably not) and group three (might or might not) for the value of agriculture component. Statistically significant mean differences (*SMD* = 0.48, *p* = .01) were also found between group two and group five (definitely yes) for the value of agriculture component. Participants who might or might not attend and definitely would attend a training had significantly higher value of agriculture values than those participants who probably would not attend a training. The summated scale interprets group two as somewhat agreeing and groups three and five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.69, p = .05) were found between group one (definitely not) and group five (definitely yes) for the individual-community interdependence component. Participants who definitely would attend a training had significantly higher individual-community interdependence values than participants who definitely would not attend a training. The summated scale interprets both groups as somewhat agreeing.

Statistically significant mean differences (*SMD* = 0.44, p = .03) were found between group one (definitely not) and group three (might or might not) for the community commitment component. Statistically significant mean differences (*SMD* = 0.50, p = .01) were also found between group one and group four (probably yes) for the community commitment component. Statistically significant mean differences (*SMD* = 0.81, $p < .00$) were also found between group one and group five (definitely yes) for the community commitment component. Participants who might or might not, probably would, and definitely would attend a training had significantly higher community commitment values than those participants who definitely would not attending a training. The summated scale interprets groups one, three, and four as somewhat agreeing and group five as strongly agreeing.

Statistically significant mean differences (*SMD* = 0.34, p = .04) were found between group two (probably not) and group four (probably yes) for the community commitment component. Statistically significant mean differences (*SMD* = -0.65, $p < .00$) were also found between group two and group five (definitely yes) for the community commitment component. Participants who probably would and definitely would attend a training had significantly higher community commitment values than those participants who probably would not attending a training. The summated scale interprets groups two and four as somewhat agreeing and group five as strongly agreeing.

Table 54

Analysis of Variance for Place and Occupational Attachment Components and Interest in Future Training

	n	*M*	*SD*	*F*	*p*
Value of Agriculture [a]					
Definitely Not	19	4.35	0.68	5.36	.00
Probably Not	40	4.43	0.57		
Might or Might Not	75	4.70	0.45		
Probably Yes	53	4.70	0.42		
Definitely Yes	17	4.90	0.20		
Individual-community Interdependence					
Definitely Not	19	3.61	0.76	2.76	.02
Probably Not	41	3.89	0.83		
Might or Might Not	75	4.13	0.71		
Probably Yes	53	4.08	0.76		
Definitely Yes	17	4.29	0.66		
Community Commitment					
Definitely Not	19	3.86	0.70	6.76	.00
Probably Not	41	4.02	0.59		
Might or Might Not	75	4.30	0.60		
Probably Yes	53	4.36	0.51		
Definitely Yes	17	4.67	0.41		

Note. *N* = 205. Value of Agriculture: *M* = 4.63, *SD* = 0.50. Individual-community Interdependence: *M* = 4.03, *SD* = 0.76. Community Commitment: *M* = 4.23, *SD* = 0.60. Scale: 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*.

[a] Total does not equal *N* due to item non-response.

Objective Thirteen: Place and Occupational Attachment Influence on Adaptive Capacity

A *multiple regression* revealed the influence of place and occupational attachment on adaptive capacity. The dependent variable was all five dimensions of adaptive capacity and the independent variables were the three components of place and occupational attachment. Table 55 shows the value of agriculture component of place and occupational attachment was a statistically significant predictor of adaptive capacity (R = .34, p < .00) with a medium effect size (R^2 = .11). The R^2 indicates that 11% of the variance in adaptive capacity can be accounted for by its linear relationship with the value of agriculture component of place and occupational attachment.

Table 55

Regression Model

	R	R^2	F	t	p
Model 1	.34	.11	9.43		.00
Value of Agriculture				3.37	.00
Individual-community Interdependence				1.21	.23
Community Commitment				1.65	.10

Note. Dependent variable: Adaptive Capacity. Independent variables: Value of Agriculture, Individual-community Interdependence, and Community Commitment.

Summary

The findings of this study were presented and organized by research objective. The findings provided a deeper understanding of the adaptive capacity of Alabama farmers. This study also described the influence of place and occupational attachment on farmers' adaptive capacity. Their perceptions of adaptive capacity based on personal demographics, farm characteristics, level of urgency, attitudes towards terms, and interest in future climate variability training were also explained.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study was to describe adaptive capacity perceptions of Alabama farmers. Adaptive capacity is the ability of producers to successfully respond to threats. Climate change and variability threats to producers include regional weather variability, extreme weather events, and long-term significant changes to the mean climate state. Adaptation and mitigation to climate variability and climate change threats help producers adapt their practices to coming changes and transform their practices to more sustainable methods. Climate-smart agriculture (CSA) programs are an integrated approach to climate change and variability adaptation involving increasing productivity, reducing greenhouse gas emissions, and enhancing resiliency. CSA programs have the opportunity to help producers successfully respond to climate variability threats. Agricultural education through the extension system has the potential to develop and implement these programs on the local level with producer involvement. The willingness of producers to adopt CSA programs can be measured through their adaptive capacity. Data for this study was collected through an online questionnaire and analyzed using SPSS. Non-response error was a possible limitation along with the contentious nature of the topic of this study. Non-response error was controlled for by comparing early and late respondents. Other possible limitations include the manner in which participants were contacted using ALFA, participation limited to ALFA members, and participation limited to Alabama producers.

Objective One and Eight

The first objective was to describe participant demographics: (a) sex, (b) age, (c) household size, (d) school aged children, (e) experience, and (f) education level. The eighth objective was to determine if significant differences were present between adaptive capacity and place and occupational attachment levels and participant demographics. Participants in this study were mostly male, over the age of 60, had over 21 years of farming experience, and held a post-secondary degree. The sample was representative of the population as the 2017 census of agriculture reported Alabama producers to be about two-thirds male and over half ages 35-64 and a third over the age of 65 (United States Department of Agriculture, 2019c) which is also consistent with the national average (United States Department of Agriculture, 2019a). High experience levels are the national average as nearly three-fourths of U.S. producers have more than 11 years of farming experience (United States Department of Agriculture, 2019a). Most participants had household sizes of only two and did not have any school aged children living in the home. Participants' adaptive capacity and place and occupational attachment varied only slightly among demographics. Higher learning and knowledge seeking levels were found in male participants. Higher adaptive management levels were found in participants younger than 50 compared to participants older than 70. Participants with a graduate degree had higher individual-community interdependence values than participants with only a high school education. Participants with a professional or doctoral degree had higher individual-community interdependence values than participants with a bachelor's degree. Overall, the levels of difference did not translate to a difference in agreement when the vague qualifiers were used to interpret mean scores. More research would be needed to better understand the influence of age, sex, and education on producers' adaptive capacity and place and occupational attachment.

Objective Two and Nine

The second objective was to describe participant farming characteristics: (a) products produced, (b) acreage, (c) state region, (d) land ownership, (e) income volatility in a good year, and (f) income volatility in a bad year. The nineth objective was to determine if significant differences were present between adaptive capacity and place and occupational attachment levels and farming characteristics. Participants' farming operations consisted of mostly crop only production, full ownership of their land, and most farms having over 100 acres. These findings are slightly different than national and state averages. Average farm size in Alabama is 211 acres (United States Department of Agriculture, 2019c). National averages for production are split close to fifty-fifty as half of farms produce only crops and the other half produce livestock and other animals (United States Department of Agriculture, 2019b). Participants in this sample represented similar ownership levels as most (69%) U.S. farmers are full owners of their farmland (United States Department of Agriculture, 2019b). Participants were generally equally distributed across the seven regions of Alabama. Acreage and land ownership were the only farm characteristics with differences in adaptive capacity and place and occupational attachment levels. Higher risk-taking and experimentation levels and decision constraints levels were found in participants with the biggest farms. Participants with more than 501 acres had higher risk-taking and experimentation levels than participants with less than 30 acres or participants with 100 to 200 acres. Participants with more than 501 acres also had higher decision constraints levels than participants with less than 30 acres. Higher learning and knowledge seeking levels were found as well as higher community commitment values in participants who owned and leased their land compared to those who owned all their land. Overall, the levels of difference in these adaptive capacity dimensions and place and occupational attachment component did not translate to a difference in agreement when using the vague qualifiers to interpret mean scores. More research would be needed to better understand the influence of acreage and land ownership on producers' adaptive capacity and place and occupational attachment.

Objective Three, Four, and Thirteen

The third objective was to describe participants' perceptions of their adaptive capacity using five different cognitive dimensions: (a) learning and knowledge seeking, (b) experimentation and risk-taking, (c) decision constraints, (d) adaptive management, and (e) perceived efficacy. The fourth objective was to describe participants' perceptions of their place and occupational attachment using three components: (a) value of agriculture, (b) individual-community interdependence, and (c) community commitment. The thirteenth objective was to determine the influence of place and occupational attachment on adaptive capacity. Adaptive capacity measured through all five dimensions resulted in participants showing somewhat strong perceptions of adaptive capacity. Place and occupational attachment measured through the three components showed participants having somewhat strong place and occupational attachment. The value of agriculture component of place and occupational attachment was found to be a statistically significant predictor of adaptive capacity which is consistent with the findings of Gardezi (2017). Including place and occupational attachment components with adaptive capacity measures can help predict individual transformation (Eakin et al., 2016). Strong place and occupational attachment may increase motivation or willingness to adapt, but it also has the potential to prevent producers from moving farming practices to more conducive locations (Eakin et al., 2016). The scales used for adaptive capacity and place and occupational attachment were adopted from other studies but could still use improvement. Research focusing on improving these measures of adaptive capacity and place and occupational attachment should be followed with more studies of producers' perceptions in different geographical areas. More research is needed to better understand the implications of place and occupational attachment being a predictor of adaptive capacity.

Objective Five and Ten

The fifth objective was to describe participants' level of urgency related to climate variability. The tenth objective was to determine if significant differences were present between adaptive capacity and place and occupational attachment levels and urgency levels. There were three items related to participants' level of urgency: water availability, immediate action needs, and future planning. Participants overall were indifferent over concern for future water availability problems. However, participants who did not feel concern for future water availability problems had higher adaptive management than participants who were indifferent or felt very concerned. Participants who were not concerned or indifferent were more likely to neither agree nor disagree to the adaptive management scale items whereas participants who were very concerned somewhat agreed to the adaptive management scale items. Participants who felt very concerned also had lower decision constraints values than participants who were slightly concerned or not concerned. The levels of difference in the decision constrains dimensions did not translate to a difference in agreement when using the vague qualifiers to interpret mean scores. More research is needed on producers' concerns with future water availability problems, especially in the Southeast where water availability concerns are not as pressing an issue compared to other parts of the country.

The second item related to level of urgency asked participants if immediate action is needed to prepare for climate change impacts. Participants overall were indifferent over immediate preparations needed for climate change adaptation. This is consistent with other studies as producers viewed the effects of climate change and variability as unlikely to be felt in their region for some time (Marshall et al., 2012). However, participants who did see a need for immediate action had higher learning and knowledge seeking, risk-taking and experimentation, decision constraints values, adaptive management, individual-community interdependence, and community commitment than participants who did not see a need. The adaptive management and perceived efficacy dimensions were the only scales with differing levels of agreement when interpreting the mean scores using the vague qualifiers. Participants who saw no need were more likely to neither agree nor disagree to the adaptive management scale items whereas participants who were indifferent or saw little need were more likely to somewhat agree to the items. Participants who definitely saw a need to immediately prepare for climate change where more likely to strongly agree to the adaptive management scale items. Participants who saw no need for immediate action also had higher perceived efficacy than participants who were indifferent or saw a need. Participants who saw no need were more likely to somewhat agree to the perceived efficacy scale items whereas participants who were indifferent and saw and need for immediate action were more likely to neither agree nor disagree with the perceived efficacy scale items. This could be explained by how producers see their self-efficacy as uncertain in the face of future climate change and variability threats (Eakin et al., 2016). Producers who see no need for immediate action have higher perceived efficacy due to not having strong concerns about the future. More research is needed on how producers perceive the need for immediate action to prepare for climate change impacts.

The last item concerning level of urgency asked participants about their ability to plan for the future given so much uncertainty. Participants overall indicated to a moderate degree that they cannot plan very far into the future due to too much uncertainty. However, participants who felt very strongly that they could not plan for the future were more likely to have higher perceived efficacy. Participants who felt they could not plan for the future were more likely to somewhat agree to the items in the perceived efficacy scale whereas participants who did not see too much uncertainty as a barrier to future planning were more likely to neither agree nor disagree to the perceived efficacy scale items. Those participants who felt they could somewhat plan for the future were more likely to have higher adaptive management levels however, using the vague qualifiers to interpret the mean scores showed no difference in agreement for the adaptive management dimension. More research is needed surrounding how producers feel future uncertainty impacts their ability to plan for the future.

Objective Six and Eleven

The sixth objective was to describe participants' attitudes towards the terms *climate variability* and *climate change.* The eleventh objective was to determine if significant differences were present between adaptive capacity and place and occupational attachment levels and attitudes towards *climate variability* and *climate change* terms. Participants overall felt indifferent to the term *climate variability* and moderately negative feelings towards the term *climate change*. However, participants who had some positive feelings towards the term *climate variability* had higher adaptive management than participants who felt some or strong negative feeling towards the term. Participants who had some positive feelings towards the term *climate variability* also had higher individual-community interdependence values than participants with strong negative feelings. Participants who had strong negative feelings towards the term *climate change* had lower adaptive management than participants who were indifferent or had some or strong positive feelings. Participants who had strong positive feelings towards the term *climate change* had higher adaptive management than participants who were indifferent or had some negative feelings. Participants who had strong positive feelings towards the term *climate change* had higher individual-community interdependence values than participants who had strong negative feelings. The levels of difference in these dimensions did not translate to a difference in agreement when using the vague qualifiers to interpret mean scores. Producers have the will power to address challenges of climate change and variability similar to other studies (Makuvaro et al., 2018), some producers might need more education on climate change and variability and the immediate needs of adopting adaptation strategies. Increases in educational programing on climate change and variability must be deliberately done to not exacerbate the already existing unease surrounding the terms *climate change* and *climate variability*. More research would help to better understand why producers have negative feelings towards these terms and where they stem from. More research would also help educators understand how they can effectively educate producers on these issues while navigating producers' negative feelings towards the terms.

Objective Seven and Twelve

The seventh objective was to describe participants' previous experience with climate variability trainings and gage interest in future participation. The twelfth objective was to determine if significant differences were present between adaptive capacity and place and occupational attachment levels and interest in future climate variability trainings. Most participants had no previous training related to climate variability and most were indifferent about attending a future training. Participants who had previously attended climate variability training were more likely to be interested in attending a future training. Other studies have found many producers as having little to no formal climate education or training (George et al., 2007).

Participants who were interested in attending a training had higher learning and knowledge seeking values, higher risk-taking and experimentation values, higher decision constrains values, and higher individual-community interdependence values than participants who were disinterested in attendance. This is consistent with other studies as producers interested in learning new skills are interested in learning about the effects of climate change and variability (Marshall et al., 2012). Participants who were disinterested in attending a training had lower adaptive management values than participants who felt indifferent and who were interested in attendance. Participants who had strong disinterest in attendance were more likely to neither agree nor disagree to the items in the adaptive management scale whereas participants who had some disinterest, indifferent, and some interest were more likely to somewhat agree and participants who had strong interest in attendance were more likely to strongly agree to the adaptive management scale items. Participants who had some interest and strong disinterest were more likely to somewhat agree to the value of agriculture scale items whereas participants with strong interest in training attendance were more likely to strongly agree to the value of agriculture scale items. Participants who were indifferent, had strong disinterest, and some interest in trainings were more likely to somewhat agree to the community commitment scale items whereas participants who had strong interest in attendance were more likely to strongly agree to the community commitment scale items.

Producers with previous climate variability training were more likely to have higher levels of the adaptive capacity dimensions, higher levels of the place and occupational attachment components, and more interest in attending future climate variability trainings. These types of producers could be labeled as early adopters of climate variability adaptation measures (Rogers, 2003). Training programs like climate-smart agriculture (CSA) should target these types of producers first and then be made more widely available.

Recommendations for Research and Practice

Climate-smart agriculture programs are becoming more popular and widespread. These programs target sustainable practices aimed to help producers mitigate and adapt to the current and future challenges of climate change and variability. Programs focused on mitigating climate variability risks are efficient and effective (Fraisse et al., 2009). The United States has been slow to accept and adapt to climate change and variability. Little is known concerning the impacts of climate change and variability in the Southeast and Alabama specifically. More research in this area would help in the development of climate variability educational programing and give producers a better understanding of their localized expected impacts. The extension system in the United States is ideally situated to implement CSA programing to producers. Education programs for extension professionals must also be developed before widespread CSA programing can be implemented. Research is needed to identify effective delivery methods to engage target audiences in climate change and variability programing. Extension professionals in the Northeast identified traditional face-to-face interactions as slightly more useful than other delivery methods (Thorn et al., 2017). Findings from this study suggest that once producers have received climate variability training, they are more likely to want future trainings. Climate variability trainings should be developed and made widespread and easily accessible to producers to encourage attendance. CSA programing can then be developed using participatory methods as producers will have more interest in climate variability and a better understanding of what's at risk if little to no action is taken to combat climate variability and climate change threats.

Increasing availability of climate variability trainings and CSA programs can only be one of the many interdependent approaches to increasing farmers' adaptation strategies. Participants showed somewhat strong adaptive capacity, however high adaptive capacity may not necessarily translate to successful adaptation implementations (Clay, 2017). Having high adaptive capacity does not guarantee that available adaptation strategies will actually be adopted (Adger et al., 2007; Clay, 2017). More research is needed to better understand the relationship between adaptive capacity and adoption and diffusion. Climate variability impacts may need to be felt locally by producers before they will approach extension seeking adaptation strategies in large numbers (Morris et al., 2014). Given the pressing nature of climate change and variability, we cannot wait until impacts are hard felt before taking action. This again highlights the need for more education among extension professionals and producers. Research should play a role in determining producer receptiveness and controversial terminology that should be avoided when promoting training events. More research is needed on how to improve producers' understanding of climate change and variability.

Summary

The purpose of this study was to describe the adaptive capacity perceptions of Alabama farmers. Participants overall had somewhat strong adaptive capacity and somewhat strong place and occupational attachment. Place and occupational attachment was found to be a predictor of adaptive capacity. Stronger climate variability adaptive capacity was indicated for participants who did not have negative feelings towards the terms *climate change* and *climate variability*. Stronger adaptive capacity was also observed in participants who had previously attended a type of climate variability training. More research is needed to identify effective delivery methods for climate variability trainings. More widespread educational programing on climate change and variability threats is also warranted.

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APPENDIX A

RESEARCH QUESTIONNAIRE

"Climate variability" refers to the short term variations in regional climate patterns such as changes in seasonal rainfall amounts or changes in seasonal temperatures. For example, a year or season that is dryer than usual or temperature variations that impact usual planting times.

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I am interested in learning about climate variability's potential impacts on agriculture	○	○	○	○	○
I have the knowledge to protect my land from climate variability	○	○	○	○	○
I have the skills to adapt my land to threats caused by climate variability	○	○	○	○	○
My current approach for dealing with climate variability will be sufficient for dealing with future climate variability	○	○	○	○	○
I like to discuss challenges facing agriculture with researchers	○	○	○	○	○
I seek the advice of other farmers in the region	○	○	○	○	○
It is important to talk to other farmers about new farming practices and strategies	○	○	○	○	○
It is important to visit other farms to see their practices and strategies	○	○	○	○	○

"Climate variability" refers to the short term variations in regional climate patterns such as changes in seasonal rainfall amounts or changes in seasonal temperatures. For example, a year or season that is dryer than usual or temperature variations that impact usual planting times.

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I like to experiment with new approaches to managing my farm	○	○	○	○	○
I like to experiment with new ways to irrigate	○	○	○	○	○
I like to try different pest control methods	○	○	○	○	○
I have tried new tillage production methods like no-till cultivation, cover crop usage, or maintaining crop residues	○	○	○	○	○
I believe that opportunity comes from taking calculated risks	○	○	○	○	○

"Climate variability" refers to the short term variations in regional climate patterns such as changes in seasonal rainfall amounts or changes in seasonal temperatures. For example, a year or season that is dryer than usual or temperature variations that impact usual planting times.

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
My ability to manage change on my farm is constrained by government regulations	○	○	○	○	○
My farm operations are impacted by inadequate state-supported infrastructure	○	○	○	○	○
Available technologies are not effective enough to protect the land I farm from the impacts of climate variability	○	○	○	○	○
There's too much uncertainty about the impacts of climate variability to justify changing my agricultural practices and strategies	○	○	○	○	○
Crop insurance and other programs will protect the viability of my farm operation regardless of climate variability	○	○	○	○	○
Changes in weather patterns are hurting my farm operation	○	○	○	○	○

"Climate variability" refers to the short term variations in regional climate patterns such as changes in seasonal rainfall amounts or changes in seasonal temperatures. For example, a year or season that is dryer than usual or temperature variations that impact usual planting times.

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I continually monitor the condition of my land so that I can recognize important changes	○	○	○	○	○
I like to think of myself as responsible for the future productivity of my land	○	○	○	○	○
Farmers should take additional steps to protect farmland from increased climate variability	○	○	○	○	○
I should take additional steps to protect the land I farm from increased climate variability	○	○	○	○	○
Profitable markets for alternative crops should be developed to encourage diversified crop rotations	○	○	○	○	○
Changing my practices to cope with increasing climate variability is important for the long-term success of my farm	○	○	○	○	○

"Climate variability" refers to the short term variations in regional climate patterns such as changes in seasonal rainfall amounts or changes in seasonal temperatures. For example, a year or season that is dryer than usual or temperature variations that impact usual planting times.

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I have the knowledge to deal with climate variability threats to my farm	○	○	○	○	○
I have the technical skills to deal with climate variability threats to my farm	○	○	○	○	○
I have the financial capacity to deal with climate variability threats to my farm	○	○	○	○	○
I am confident in my ability to apply weather forecasts to my farming operation related decisions	○	○	○	○	○

Please indicate your level of agreement with the following statements

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Being a farmer is a lifestyle, it is not just my job	○	○	○	○	○
Agriculture in Alabama provides benefits to the community beyond just the value of farm products	○	○	○	○	○
Agriculture has a central role to play in Alabama's future	○	○	○	○	○
My success in farming depends on farmers in my community also being successful	○	○	○	○	○
I have many options available to me other than being a farmer	○	○	○	○	○
I plan to do all I can to continue farming in this region	○	○	○	○	○
Helping other farmers in my community is important, even when it means making small sacrifices	○	○	○	○	○
I seek out the advise of local extension agents	○	○	○	○	○

Please indicate your level of agreement with the following statements

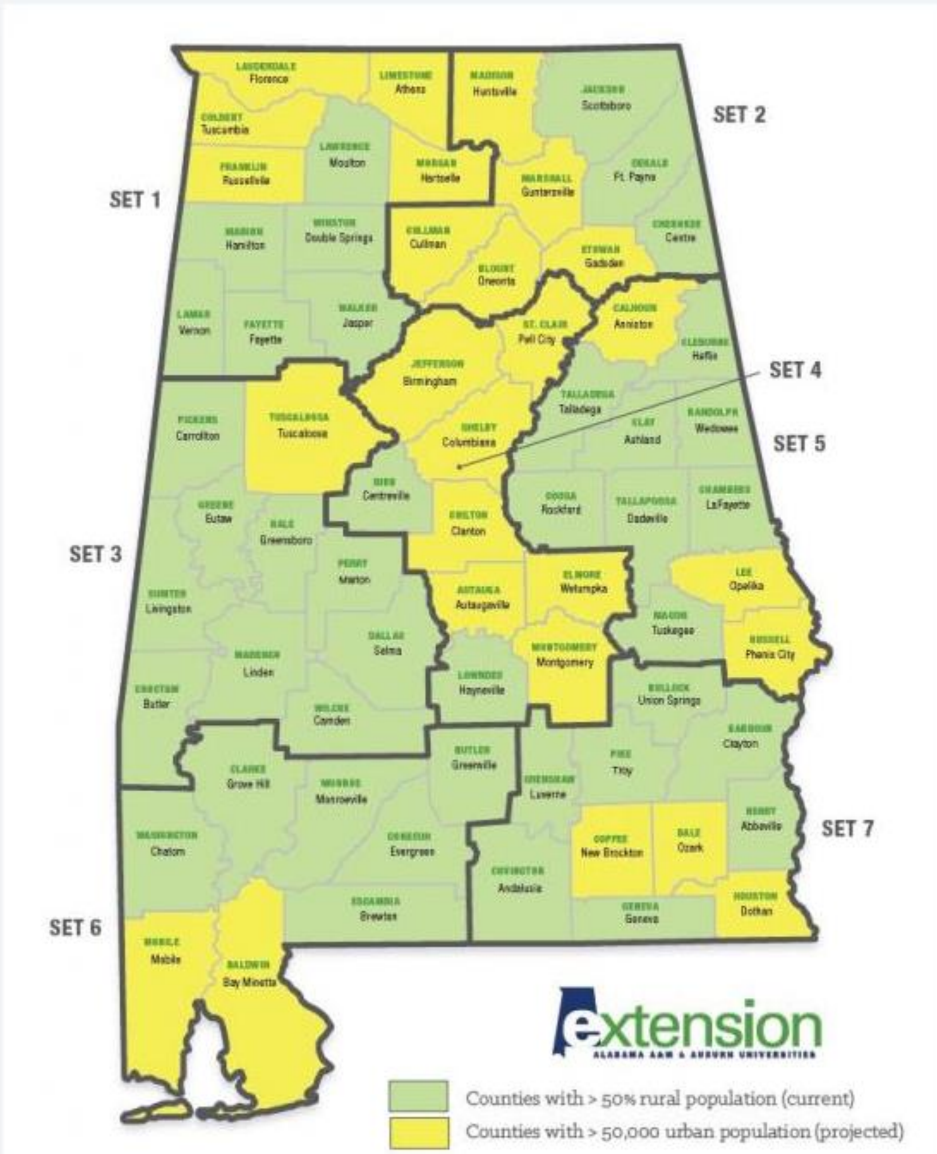
	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Problems in water availability are unlikely to manifest in this region for some time	○	○	○	○	○
Immediate action is needed to prepare for the impact of changing climate conditions on agriculture	○	○	○	○	○
I can't plan more than a few years in advance, things are too uncertain	○	○	○	○	○
I have negative feelings towards the term "climate variability"	○	○	○	○	○
I have positive feelings towards the term "climate change"	○	○	○	○	○

What crops are produced by your farming operation?

What is the acreage of your farming operation?

Using the map below, what region of Alabama is your farming operation located?

Set 1



Do you own or lease the land you farm?

- ○ I own the land
- ○ I lease the land
- ○ I own a portion of the land and lease the rest

Depending on production and sales, a "good year" or a "bad year" can cause income volatility to a farming operation's typical year's income. What percent change to you experience in a "good year" or a "bad year"?

	0	10	20	30	40	50	60	70	80	90	100
A "good year"											
A "bad year"											

Including yourself, how many people make up your household?

How many school aged children live with you?

What year were you born?

What is your sex?

- Female
- Male
- Prefer not to answer

How many years have you been farming?

What is the highest level of education you have completed?

- Some high school
- High school graduate
- Some college, no degree
- Associate's degree
- Bachelor's degree
- Master's degree
- Professional or Doctoral degree

Have you been to any trainings or workshops related to climate variability?

○ Yes

○ No

Condition: **No Is Selected**. Skip To: **Would you like to attend a training o....**

When did you attend this training or workshop?

[ ]

Who hosted the training or workshop you attended?

[ ]

Would you like to attend a training or workshop related to climate variability mitigation strategies?

○ Definitely yes

○ Probably yes

○ Might or might not

○ Probably not

○ Definitely not