COMMUNICATING ABOUT CLIMATE CHANGE:

PREPARING COMMUNITY GARDENS FOR AN UNCERTAIN FUTURE

by

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(Under the Direction of Alexa Lamm)

ABSTRACT

Across the globe, climate change is impacting the agricultural sector with increased intensity and frequency of droughts, heat waves, changes in rainfall patterns, and changes in growing seasons. Climate change adaptation is an increasingly significant need for agricultural producers, including those involved in local food systems. Community gardens serve as a source of fresh fruits and vegetables in areas that may otherwise lack access. Community gardens are public entities usually operated by schools, churches, local government, nonprofits, as well as other local organizations or groups. Many community gardens give away or discount their produce to community members or those in need. This study used a mixed-methods approach to explore public engagement in community gardens and perceptions surrounding climate-smart adaptations. This research should be used to inform environmental communication and education strategies that encourage community gardens to adopt climate-smart practices to ensure the continual contributions to their local food supply.

INDEX WORDS: Community gardens, climate change, diffusion of innovations, climate-smart, climate adaptation, food security, food system

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DEDICATION

I would like to dedicate my thesis to my mom, Julie. I would not be anywhere without her and her unconditional love and support. Thank you for everything, mom.

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CHAPTER 1

INTRODUCTION

Need for the Study

Climate change threatens the well-being of humans, the environment, and our planet (IPCC, 2023). Climate change, caused overwhelmingly by human activities since the 1800s, results in long-term changes in temperatures and weather patterns that are impacting every region across the globe (IPCC, 2023). It takes tremendous amounts of added heat energy to increase Earth's average yearly surface temperature, so the 2-degree Fahrenheit increase in Earth's average surface temperature has caused a significant increase in amassed heat (Lindsey & Dahlman, 2024). Climate change impacts include frequent and severe heat waves, changes in rainfall (e.g. increased floods and droughts), rising sea levels, poor air quality, and increases in frequency and intensity of severe weather events (U.S. Environmental Protection Agency, 2022). Community gardens can be directly impacted by these effects through soil and plant damage, drought, flooding, heat waves, and freezes (Frankson et al., 2022). Adaptations to climate change effects include reducing water use, capturing rainwater to use in the garden, watering early or late in the day, using climate-resilient plants, using cover crops, and diversifying crop varieties (Tomatis et al., 2023).

Community gardens differ from private gardens in the sense of ownership, access, and democratic decision-making (Draper & Freedman, 2010). Public gardens provide food for their communities and help establish food, financial, and health security (Draper & Freedman, 2010). Community gardens have existed in the United States (U.S.) since the 1890s with some

suggesting the practice dates to communal lands associated with American frontier towns (Draper & Freedman, 2010; Lawson, 2005). In the 1890s, vacant lots in cities like New York, Philadelphia, and Detroit were turned into communal gardens to provide land and technical assistance to the jobless, and during this time, school gardens were rising in popularity (Lawson, 2005). Community gardens have aided in times of war (e.g. World War I and II) and in recessions (e.g. the Great Depression in the 1930s; Lawson, 2005). The issue of sustainable development was identified in the second half of the 20th century by the United Nations, and they identified urban agriculture as a strategy for sustainable urban development because of the provision of fresh foods and composting (Dobele & Zvirbule, 2020). Urban agriculture entered a renaissance from this time until the present fostered by technological development and social initiatives (Dobele & Zvirbule, 2020). Specifically, urban agriculture has been associated with grassroots efforts to fight social and environmental justice with community organizing since the 1970s (Aptekar & Myers, 2020). Today, community gardens are still used to address food injustice, educate youth, beautify vacant lots, increase environmental awareness, and much more (Aptekar & Myers, 2020). They can promote community engagement, collective action, and build social capital (Berg et al., 2023). Gardens can be located in cities, rural areas, schools, neighborhoods, prisons, hospitals, nursing homes, and other areas (Draper & Freedman, 2010).

Community gardens can serve both rural and urban areas and sometimes vary due to many aspects including geographic location, access to resources, purpose, and culture. Past research has primarily focused on urban gardens where people live close to each other or attend school together as opposed to rural settings where there is low population density, large distances between gardens and consumers, and lack of public transportation (Berg et al., 2023). Community gardens are needed in rural areas due to lack of access to healthy foods and grocery

stores as well as higher rates of nutrition-related chronic diseases as compared to urban/suburban areas (Berg et al., 2023). Urban populations in the U.S. continue to grow with 80% of the U.S. population living within urban areas (U.S. Census Bureau, n.d.). As stated previously, urban areas have more access to public transportation, larger population density, and closer resident proximity as compared to rural areas. However, urban spaces have their own obstacles including less green space, more built-up area, and fragmentation of natural vegetation (Humaida et al., 2023). Limited space results in unique placements for gardens such as on roof tops, porches, and inside shipping containers with use of vertical growing to save space. Tomatis et al. (2023) reviewed articles and books published in the last twenty years to describe the relationship between climate change and urban gardening. The study reported evidence for the negative impacts of climate change on urban agriculture, ways to adapt gardens to a changing climate, and how community gardens can help mitigate these impacts. Urban areas can exacerbate climate change effects (i.e. urban heat islands), which is why adaptation is necessary to sustain healthy gardens (Tomatis et al., 2023). Urban gardens can actually help cities adapt because they support carbon dioxide sequestration and reduction, regulate temperature, retain water, and reduce runoff and solar radiation (Tomatis et al., 2023). Across the country, community gardens are facing challenges as a result of climate change, so research is needed to determine current climate preparation and perceptions surrounding the need for climate adaptations.

Problem Statement

There is limited scientific research on climate change adaptation in community gardens. Most research studies focus on social, health, and communal benefits of community gardens (Berg et al., 2023; Odera et al., 2013; Zutter & Stoltz, 2023) as well as how community gardens can aid in adapting communities to climate change (Frantzeskaki et al., 2022; Ossola & Lin,

2021; Ossola et al., 2021). Research is needed to determine how gardens are adapting to and preparing for climate change.

Adaptation plans have shown benefits and varying levels of effectiveness, but there is still an adaptation gap that will continue to widen with the current rate of implementation (IPCC, 2023). Global financial support, especially in developing countries, for climate change adaptation is insufficient and inhibits further implementation (IPCC, 2023). As stated previously, community gardens can provide food security in areas that lack access to fresh foods (Draper & Freedman, 2010; Moore, 2021). Almost 13% of U.S. households in the U.S. were food insecure in 2022, meaning providing enough food for all household members was difficult due to lack of resources (United States Department of Agriculture, 2023). Approximately 5% of households, or 6.8 million people, had very low food security, meaning food intake was reduced and normal eating patterns were disrupted (United States Department of Agriculture, 2023). Both types of food insecurity were statistically significantly higher in 2022 than in 2021 (United States Department of Agriculture, 2023). Community gardens that provide low or no-cost fresh foods to their communities need to ensure their longevity because of those that depend on them for fresh fruits and vegetables.

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The theoretical framework for the current study is based on Rogers' (2003) Diffusion of Innovations (DOI) theory. Rogers (2003) defined an innovation as, "an idea, practice, or object that is perceived as new by an individual or another unit of adoption." Something is an innovation if it is new to a person, or if they have not yet formed a favorable/unfavorable attitude toward it or have not yet adopted or rejected it (Rogers, 2003). Although climate change adaptation is not a new idea, it serves as the "innovation" in this research as it can be seen as novel to some. Rogers (2003) identifies many variables that affect the adoption rate of innovations including five perceived attributes: relative advantage, complexity, compatibility, trialability, and observability (Rogers, 2003). Relative advantage is how people view an innovation, superior or inferior, compared to the precedent; compatibility is how adopters see the innovation as aligning with their needs and experiences; complexity is the perception of how difficult or easy to use the innovation is; trialability is the degree to which the innovation can be tested/experienced; and observability is how visible the results of the innovation are to the public/viewers (Rogers, 2003).

Opinion leadership is another factor that impacts DOI. Opinion leadership is defined as the degree to which someone can influence people's attitudes or behaviors with a high frequency (Rogers, 2003). Communities identify their own opinion leaders in different areas of innovation. For example, an opinion leader in a rural community could be a pastor or clergy member. Opinion leaders do not necessarily have to hold positions of power, but they have a peer-

appointed role of passing along information and upholding social norms, which makes them more persuasive in their social networks (Dalrymple et al., 2013). Opinion leaders can be an extremely useful tool for innovators and change agents to disseminate inventions. Dalrymple et al. (2013) surveyed bait vendors, who were identified as opinion leaders in preventing aquatic invasive species, and found those with higher self-efficacy were more likely to participate in behaviors that would influence their peers. Self-efficacy and other factors like personal bias and limited control are factors to consider when including opinion leaders in diffusion. As climate change issues continue to enter public discussions, policy makers and educators should consider the important role opinion leaders can play in advocating for climate-smart practices while emphasizing self-efficacy to their opinion leaders (Dalrymple et al., 2013). In the current study, opinion leaders were identified as community garden coordinators. The operational definition of a community garden coordinator for the study was the person in a community garden who makes decisions about what to plant and what gardening practices and methods to use.

DOI theory has been used to guide research in environmental, conservation, and agricultural issues. For example, Mascia & Mills (2018) analyzed adoption of conservation interventions in Tanzania and the Pacific (i.e. islands like Fiji and Samoa) and found DOI can highlight new areas of conservation research and provide significant insights for conservation policy and implementation, and the diffusion of the interventions were correlated with differences in innovation characteristics. For example, one of the interventions in Tanzania provided higher relative advantage for the villagers including greater autonomy, resource control, and financial benefits, which made that intervention more adoptable to them (Mascia & Mills, 2018). Additionally, Oumarur et al. (2015) used diffusion of innovations theory to guide their study analyzing the role of social networks in supporting the diffusion and adoption of

agricultural innovations as a strategy to face climate change and variability. The researchers interviewed stakeholders in a region in Quebec that is one of the most important agricultural regions in the province, and the study found trust between independent agricultural advisors and landowners was a more significant contribution to effective implementation of climate change adaptation programs (Oumarur et al., 2015). The study emphasized the success of an agricultural adaptation process is highly dependent on informal social networks at the local level (Oumarur et al., 2015). The results described how an innovation was disseminated in Quebec's agricultural industry and how many factors contributed to the DOI, and the stakeholders who were surveyed were able to identify the opinion leaders in the industry that acted to spread the innovations starting at a local level (Oumarur et al., 2015). The opinion leaders in the industry did not have to hold the same positions, and the study stressed that multiple opinion leaders, change agents, and locals involved in the industry working together would create a significant impact on DOI.

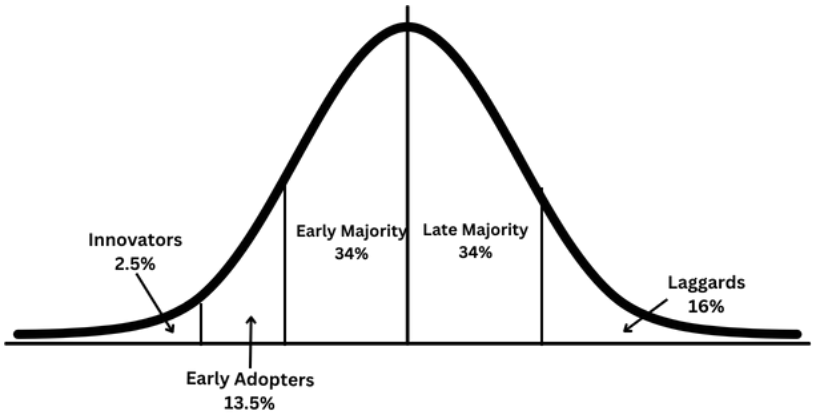

Figure 1.
Adopter Categorization on the Basis of Innovativeness by Rogers (2003)

DOI is frequently used to inform agricultural and environmental communication (Chin-Ling et al., 2023; Mascia & Mills, 2018; Ruth et al., 2018; Warner et al., 2019). Communication messaging can be based on DOI findings, which influence the acceptance or rejection of an innovation. For example, environmental communicators that want to increase the use of a new

water conservation tool should use, or conduct, DOI research to determine if the public perceives the innovation as better than their current tools, compatible in their homes, and not too complex to use or learn. Reciprocally, messaging can inform target audiences about positive attributes of the innovation they may not know about. For example, if the target audience does not know the water conservation tool is trialable, environmental communicators should create messages around the trialability of the tool to persuade the public to test it out and potentially adopt it.

Overall, DOI theory provides a robust framework for understanding the adoption of climate change adaptation practices with emphasis on the five perceived attributes. The application of DOI theory not only highlights the pathways of innovation diffusion but also portrays the significance of communication strategies informed by DOI findings as evidenced by previous research.

Purpose and Objectives

The purpose of the mixed-method study detailed in this thesis was to explore perceptions surrounding climate-smart adaptations in community gardens to aid in effective communication strategies that encourage community gardens to prepare for climate change. The following research questions and objectives guided each component of the study:

Chapter III: Exploring community garden coordinators' perceptions of climate-smart adaptations to support local food systems.

1. What are community garden coordinators' perceptions of the need for climate change adaptation?
2. What are community garden coordinators' perceptions regarding the five perceived attributes of climate change adaptation?

3. Where are community garden coordinators in the innovation-decision process when it comes to climate change adaptation?

Chapter IV: Public engagement in community gardens: Preparing for a changing climate.

1. Describe public engagement in community gardens;
2. Describe reasons for public engagement in community gardens;
3. Describe the level of importance associated with climate-smart adaptations in community gardens; and
4. Determine if reasons for engagement in community gardens predict level of importance associated with climate-smart adaptations in community gardens.

Definition of Terms

Climate change adaptation – "taking action to prepare for and adjust to both the current and projected impacts of climate change" (U.S. Environmental Protection Agency, 2023a)

Climate-smart – agricultural practices that sustainably increase productivity, adapt and build resilience to climate change, and reduce and/or remove greenhouse gas emissions when possible (Food and Agriculture Organization, 2024; U.S. Department of Agriculture, n.d.-b)

Community garden – a plot of land cultivated by a group of individuals that is owned, accessed, or democratically controlled in some way by the public in diverse settings (schools, churches, neighborhoods, city blocks, prisons) that exists to produce fruits and vegetables for eating, sharing, or selling in a community (Berg et al., 2023; Draper and Freedman, 2010; Ferris et al., 2001; Kwartnik-Pruc & Droj, 2023)

Community garden coordinator – the person in a community garden who makes decisions about what to plant and what gardening practices and methods to use

Compatibility – how well an innovation matches adopters' needs or current systems (Rogers, 2003)

Complexity – how difficult an innovation is to learn, teach, or implement (Rogers, 2003)

Diffusion of Innovation – a theory created to explain the rate and process of how a novel idea, practice, or object is adopted through a social system (Rogers, 2003)

Innovation – "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (Rogers, 2003)

Observability – visibility of results of an innovation to potential adopters (Rogers, 2003)

Relative advantage – determines if the innovation has an advantage over the predecessor (Rogers, 2003)

Trialability – the ability of an innovation to be tested (Rogers, 2003)

CHAPTER 3

EXPLORING COMMUNITY GARDEN COORDINATORS' PERCEPTIONS OF CLIMATE-SMART ADAPTATIONS TO SUPPORT LOCAL FOOD SYSTEMS[1]

[1] Erskine, O. M., Lamm, A. J., Sanders, C. E., & Lamm, K. W. To be submitted to *Sustainability*.

Abstract

Climate-smart adaptations are becoming increasingly important because of impacts caused by a changing climate. Extreme weather events, increased intensity of droughts and floods, and changes to growing seasons are results of climate change and impact agriculture and food systems. In the United States (U.S.), Georgia, North Carolina, and South Carolina experience similar problems caused by climate change such as rising sea levels and extreme heat. Food producers in this area will have to adopt climate-smart practices to ensure the continual supply of food. Community gardens can be a source of local, fresh foods especially in places experiencing food insecurity. The purpose of the study was to explore community garden coordinators' perceptions of climate change adaptation, the adoption process, and their current climate-smart practices in Georgia, North Carolina, and South Carolina to inform effective environmental education and communication strategies that encourage community gardens to adopt climate-smart practices.

Introduction

Climate change is happening, and it is significantly impacting humans, the environment, and the economy (U.S. Environmental Protection Agency, 2023b). The world's climate is rapidly changing at a pace quicker than natural variations with the average global temperature rising approximately 1.8ºF from 1901 to 2016 (Hayhoe et al., 2018). A global temperature change of one or two degrees can cause potentially devastating shifts in both climate and weather (U.S. Environmental Protection Agency, 2023b). Evidence for this increase in temperature has consistently pointed to human activities and evidence lacks natural explanations (Hayhoe et al., 2018). Impacts and changes caused by climate change include more frequent and intense floods, droughts, and rain and more frequent and severe heat waves (U.S. Environmental Protection Agency, 2023b). Agriculture requires the use of land, water, and other natural resources and is very sensitive to climate and weather (U.S. Environmental Protection Agency, 2023c). Climate change will lengthen some growing seasons and allow some crops to be grown in different regions, but it will also make agricultural practices more difficult in other regions (U.S. Environmental Protection Agency, 2023c). For example, major commodity crops like corn, oats, and rice will have lower yields in years to come compared to a world without climate change (U.S. Environmental Protection Agency, 2023c).

The southeastern United States' (U.S.) coastal plain has a rapidly growing population that is extremely vulnerable to climate change impacts (Carter et al., 2018). Without adaptation strategies, the effects of extreme rainfall events and sea level rise are predicted to result in daily high tide flooding by the end of the 21st century (Carter et al., 2018). The state of Georgia is expected to have unprecedented warming this century causing an increase in heat wave intensity and soil moisture loss leading to intense droughts and more competition over water resources

(Frankson et al., 2022a). North Carolina is also expected to have unprecedented warming this century as temperatures in the state have risen over 1°F since the beginning of the 20th century (Frankson et al., 2022b). North Carolina has a high variability of hurricanes from year to year, and storm intensity and rainfall associated with hurricanes are predicted to increase as the climate warms (Frankson et al., 2022b). Extreme precipitation is expected to increase in South Carolina along with extreme heat events increasing the intensity of droughts (Runkle et al., 2022). These three coastal states are all vulnerable to sea level rise with North Carolina's northern coastal plain especially susceptible due to its low elevation and subsidence of land (Frankson et al., 2022a, 2022b; Runkle et al., 2022). Because of the changing climate and increase in extreme weather events, community gardens connected to the food system in these states will need to adopt climate-smart practices to ensure longevity and sustainability in their gardens.

Community gardens are collaborative spaces usually implemented on public land where participants share in the maintenance and production of the garden (U.S. Department of Agriculture, 2020). They can serve as a space to bring communities together, create green space, and tackle food insecurity (Fisch, 2023). These gardens are usually operated by communal entities like counties, schools, neighborhoods, churches, and nonprofits. Community gardens have existed for over a century, but they have risen in popularity over the past twenty years and exist to produce fruits and vegetables to eat, share, and/or sell in a community (Berg et al., 2023). Most research studies have focused on social, health, and communal benefits of community gardens (Berg et al., 2023; Odera et al., 2013; Zutter & Stoltz, 2023) as well as how community gardens can aid in adapting communities to climate change (Frantzeskaki et al., 2022; Ossola & Lin, 2021; Ossola et al., 2021), but there is a gap in the literature that explores how community

gardens are preparing for climate change specifically, through the lens of those who make the decisions in a community garden. Although community gardens can aid in fighting climate change through water retention, food security, and carbon capture (Tomatis et al., 2023), they are susceptible to climate change impacts such as drought, flooding, heat waves, soil damage, and freezes (Frankson et al., 2022a). Because of the changing climate and increase in extreme weather events, the agricultural industry, including community gardens, will have to adopt climate-smart practices to ensure sustainability of the global food supply (U.S. Environmental Protection Agency, 2023c).

Theoretical Framework

The theoretical framework for the study was based on Rogers' (2003) Diffusion of Innovations (DOI) theory. Rogers (2003) defines an innovation as, "an idea, practice, or object that is perceived as new by an individual or another unit of adoption." Something is an innovation if it is new to a person, or if they have not yet formed a favorable or unfavorable attitude toward it or have not yet adopted or rejected it (Rogers, 2003). Climate change adaptation is not a new idea, but it served as the innovation in the current study as it can be seen as new to some groups or individuals. DOI theory has been used extensively to guide agricultural and environmental research, and it can be used to effectively communicate about these topics (Hasin & Smith, 2016; Mascia & Mills, 2018; Oumarur et al., 2015; Rumble et al., 2016; Warner et al., 2020).

DOI theory identifies many variables that affect the adoption rate of innovations including opinion leadership, which is defined as the degree to which someone can influence people's attitudes or behaviors with a high frequency (Rogers, 2003). In the current study, a community garden coordinator is defined as the person in a community garden who makes

decisions about what to plant and what gardening practices and methods to use serving as opinion leaders. As climate change issues continue to enter public discussions, policy makers and educators should consider the important role opinion leaders can play in advocating for climate-smart practices while emphasizing self-efficacy to their opinion leaders (Dalrymple et al., 2013).

Furthermore, Rogers (2003) identified five perceived characteristics of innovations including relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is how people view an innovation, superior or inferior, compared to the precedent; compatibility is how adopters see the innovation as aligning with their needs and experiences; complexity is the perception of how difficult or easy to use the innovation is; trialability is the degree to which the innovation can be tested or experienced; and observability is how visible the results of the innovation are to the potential adopters or general public (Rogers, 2003).

Previous studies have examined how the perceived attributes of DOI impact adoption of an innovation. Hasin and Smith (2016) analyzed how farmer's market managers perceived the implementation of electronic benefit transfer (EBT) as a form of payment at the markets. They found market managers may be more willing to implement EBT when it is perceived as better than other food stamp systems and is less complex, and relative advantage and complexity were found to significantly predict EBT adoption in the study (Hasin & Smith, 2016). Warner et al. (2020) examined perceptions of urban landscape water conservation innovations in Florida. The study found relative advantage and complexity to predict adoption of water conservation innovations in certain groups (Warner et al., 2020).

Additionally, the innovation-decision process in DOI theory can lead to adoption or rejection of an innovation and includes a sequence as follows: knowledge, persuasion, decision,

implementation, and confirmation (Rogers, 2003). Types of innovation decisions include optional, meaning the audience has a choice in whether or not they want to adopt the innovation; authoritative, meaning the audience is forced to adopt the innovation (e.g. wearing seat belts in cars is required); and collective, meaning a social system as a whole decides to adopt the innovation (e.g. members of Congress come to a consensus to pass a law; Rogers, 2003). This process is significant for climate-smart practices in community gardens as researchers explore whether community gardens are choosing to prepare for climate change or if they will be forced to adapt in the future to sustain food supply from their gardens.

Purpose and Research Questions

The purpose of the study was to explore community garden coordinators' perceptions of climate change adaptation, the adoption process, and their current climate-smart practices to inform effective environmental education and communication strategies that encourage community gardens to adopt climate-smart practices. The following research questions guided the study:

1. What are community garden coordinators' perceptions of the need for climate change adaptation?
2. What are community garden coordinators' perceptions regarding the five perceived attributes of climate change adaptation?
3. Where are community garden coordinators in the innovation-decision process when it comes to climate change adaptation?

Methods

A qualitative research design was used to address all three research questions. The research presented here was part of a larger, mixed-methods study designed to explore how

community gardens are preparing for climate change. The larger study sought to understand community garden participants' and community garden coordinators' perceptions of climate change and adopting climate-smart adaptations within the DOI theory to further explore relationships between the variables.

Participant Selection and Data Collection

The target population was community garden coordinators in Georgia, North Carolina, and South Carolina. A garden coordinator was identified as the decision-maker for plant selections and gardening methods and practices. The operational definition of a community garden was a plot of land cultivated by a group of individuals that is owned, accessed, or democratically controlled in some way by the public in diverse settings (ex. schools, churches, neighborhoods, city blocks, prisons) that exists to produce fruits and vegetables for eating, sharing, or selling in a community (Berg et al., 2023; Draper & Freedman, 2010; Ferris et al., 2001; Kwartnik-Pruc & Droj, 2023). The community gardens were required to be connected to the food system either by (a) distributing some produce (free or discounted) in their community or (b) donating some produce to a local food bank or charity. Community gardens connected to the food system were explored to determine if being an affordable source of fresh foods to their communities led to more concern for climate change adaptation.

Participants were recruited in October 2023 using purposive sampling methods. Social science researchers use purposive sampling because it uses limited resources, purposefully selects participants who will yield the most appropriate information, and aims to increase the depth of understanding of the topics (Campbell et al., 2020). Purposive sampling techniques rely on the researcher's experience in the field of study and rapport with the targeted groups, and this method is popular among social science researchers (Barratt et al., 2014; Guarte & Barrios,

2006). The number of participants is determined by data saturation in purposive sampling (Etikan et al., 2016; Tuckett, 2004). Data were continually collected until the researcher began to receive the same information and see similar patterns from the participants, known as data saturation (Saunders et al., 2018).

Community garden coordinators were identified in Georgia, North Carolina, and South Carolina through internet searches and professional connections. The three states were selected due to similarities between the states' predicted experiences with climate change including unprecedented warming, changes in rainfall, and rising sea levels (Frankson et al., 2022a, 2022b; Runkle et al., 2022). Additionally, the states share similar geographical configurations, including the Blue Ridge Mountains, part of the Appalachian Trail, that run through the three states. (Encyclopedia Britannica, 2023). The states are categorized as water-rich states due to substantial precipitation (National Integrated Drought Information System, n.d.). Further, Georgia, North Carolina, and South Carolina have coastal plains on the Atlantic Ocean that have rapidly growing populations which are extremely vulnerable to climate change impacts like flooding, storm surge, and salt-water intrusion (Carter et al., 2018).

An attempt to identify garden coordinators was made by searching the internet for community garden websites and then for contact information. If a contact for the garden coordinator could not be identified, any email or phone number on the website was used for recruitment. Additionally, professional connections at universities and Extension offices were used as sources to identify potential participants. University and Extension professionals sent emails and phone numbers of individuals they believed would match the operational definition of a garden coordinator, or they forwarded the study's information to potential participants. Potential participants were contacted, and if the contact did not match the operational definition

of a garden coordinator, the contact usually provided the name of the person at their garden they believed most closely matched the operational definition. Additionally, when participants were contacted, they were told the garden had to be connected to the food system either by (a) distributing some produce (free or discounted) in their community or (b) donating some produce to a local food bank or charity to participate in the study.

Instrumentation and Data Analysis

Semi-structured interviews were conducted with participants to answer all three research questions. Interviews were conducted in person, via Zoom, or over the phone based on researcher and participant availability. Interviews conducted in-person can sometimes yield richer conversations and information due to non-verbal cues (Johnson et al., 2019). Interview questions were guided by Rogers' (2003) DOI theory; specifically, the five perceived characteristics of innovations: relative advantage, compatibility, complexity, trialability, and observability. Other constructs in the interview protocol related to garden coordinators' educational backgrounds, experience with climate change in their community garden, current level of adoption, and definitions and examples of climate-smart adaptations. Examples of climate-smart adaptations were adapted from the University of Maryland Extension (2023). The interview protocol consisted of five broad questions and additional sub-questions to guide the interview. Questions were developed and reviewed by a committee of social scientists in agricultural and environmental communication and education. The content accuracy and face validity of the study were determined by one pilot interview and by a panel of faculty members in natural resource conservation, social science, and communication studies. The University of Georgia Institutional Review Board (IRB #00008095) approved the study design. The primary

author conducted 17 interviews in October 2023: five in Georgia, six in North Carolina, and six in South Carolina.

Interviews were audio-recorded and lasted an average of 35 minutes. If the interviews were conducted via Zoom, they were transcribed verbatim with Zoom version 5.16 audio transcription and revised for errors. If the interviews were conducted in person or over the phone, the interviews were transcribed by RiversideFM's artificial intelligence (AI) transcription tool and revised for errors by the researcher. Interview transcripts were then coded with MAXQDA 24 qualitative analysis software. Codes and themes were determined *a priori* using deductive content analysis. Deductive analysis applies pre-existing theoretical frameworks, in this case, DOI theory, to similar problems, and the theories aim to explain current behavior or behavioral changes (Hurley et al., 2021).

Data points, or interview quotes, were color-coded by the predetermined themes of DOI's five perceived attributes. The primary author developed a codebook with quotes and their subsequent themes. Peer debriefing followed as recommended by Lincoln and Guba (1985) to establish trustworthiness and credibility. Pseudonyms were assigned to each participant to ensure anonymity.

Subjectivity Statement

As the primary researcher of these studies, I have certain experiences and biases that may have impacted the research. I am a white, cisgender, female who grew up in South Carolina and who currently lives in Georgia. I am a graduate student in agricultural and environmental education and my research focuses on agricultural and environmental issues and science communication. My studies in agricultural and environmental spaces may have impacted my views and perceptions surrounding community gardens. I do not have experience gardening or

experience participating in a community garden. I am interested in environmental justice and sustainability, which led me to choose this topic for my thesis research. As a researcher in qualitative studies, I acknowledge my potential bias and influence on this study.

Results

The predetermined deductive themes examined were the five perceived attributes of DOI theory: relative advantage, compatibility, complexity, trialability, and observability. Results were based on participants' perceptions of climate-smart adaptations described by the five attributes.

Relative Advantage

Participants needed to see a relative advantage over what they were currently implementing to adopt new practices. One of the climate-smart adaptations presented to participants in the interview guide was the use of rain barrels to collect rainwater for watering their gardens. A few participants relayed disadvantages to using rain barrels in their community gardens including the limited capacity of rain barrels even if they used more than one. For example, Mary from North Carolina said, "We did have a rain barrel, but it was just such a low flow thing... One little rain barrel wasn't cutting it." The problem with rain barrels being low flow and not holding enough water was repeated by multiple participants including Mark from North Carolina:

> We would not have an advantage to using rain barrels…drip irrigation would take us 71 gallons per minute, roughly, and the well will produce 100 gallons per minute. And so, you could have a lot of rain barrels and just not get any benefit out of that.

Time was also mentioned as a disadvantage to using rain barrels. Many garden coordinators had full-time jobs apart from working in the garden, so they wanted a watering system that would not take up a lot of their day even if alternate methods were less sustainable.

For example, Julie from South Carolina said, “Sometimes I just use the hose because it’s a lot faster and saves time.”

Stagnant water was another disadvantage to using rain barrels. Water infested with mosquitoes can be an issue caused by stagnant water, and cleaning the water collected by rain barrels just adds extra effort and expense. Katie from South Carolina said, “A big problem we have at our site is mosquitoes and I think a big thing that people don’t realize is standing water equals mosquitoes.” Daniel from North Carolina discussed the issues that arose and effort was needed to clean stagnant water:

> We don’t want to put chlorine in, or anything like that, so we don’t try to sterilize the water, or UV is too expensive to try to keep it clean at this point. So that’s something we did try. And there’s just, you know, water lines get clogged...algae kind of tends to grow. So it’s just more of a pain in the butt.

A few participants noted they were already using rain barrels, but they were not the primary source of water for the garden. One reason for having a different main source of water was, again, due to the capacity of the rain barrels. Michael from South Carolina said, “We actually harvest our own rainwater here. So we have about a thousand gallon cistern...But a thousand gallons is not enough for this space.” Lack of rainfall was another problem for a garden that already used rain barrels. Maggie from North Carolina explained, “We have six 50-gallon rain barrels. But unfortunately, in our spot, we don’t get much rain.”

Climate-smart irrigation (e.g. drip irrigation) was another adaptation presented to participants. Most participants were already using some form of irrigation in their gardens. Water conservation was mentioned by participants as an advantage to using irrigation as opposed to sprinkler systems or hoses. Water conservation was noted as a strategy to decrease use of already

limited resources. Michael from South Carolina stated, “We have finite resources. And because of that, we have to implement strategies that can help us combat that. We use drip irrigation. We go low and slow.” Another advantage mentioned was convenience. Using irrigation systems can save time and effort as noted by Emma from Georgia:

> I live 35 minutes away, so a lot of times when I’m thinking through different products, it’s what’s gonna survive when I go home for a weekend and I’m not in the county watching after it…just the ease of the garden maintaining itself where I’m not having to be out there every single day.

Cost was another disadvantage mentioned by participants. Some seemed unsure about the actual cost of setting up an irrigation system, but they perceived it to be too expensive to start, maintain, and/or replace their current system with. Mary from North Carolina said, “So no, we weren’t gonna ask to do any sort of irrigation like that. It would have been too much expense, I think.” Macie from South Carolina agreed that she was not sure but thought irrigation would be too expensive for their garden, “Potentially cost. I don’t really know. I’m not super familiar with irrigation, but the initial setup and the supplies, and then like whatever upkeep is involved with it.”

The effort to install an irrigation system was mentioned as a disadvantage as well. Labor was an issue for many gardens due to lack of volunteers or limited mobility of some participants. Clarke from North Carolina said, “In my view, that would take so much effort… just digging trenches for all that PVC pipe. And I mean, I guess it could be done. It’s not something that I'm pushing for real hard.”

Composting was another climate-smart adaptation discussed with participants. Many garden coordinators were already either using compost in the gardens or composting garden

scraps. Saving money was a noted benefit of composting in the gardens. Many gardens were restricted by budgets, so composting was a way to enrich the soil without spending a lot, or any, money. Anna from South Carolina stated, “In 10 months...if I don’t have a new grant in place, then we’re gonna be in a different situation than we are right now, which is part of the reason I’m trying to work on that sustainability. So that it won’t cost as much to run.”

Another advantage of composting was increased nutrients for the gardens’ soil. Jane from Georgia explained how her team transformed their garden’s soil by using compost:

> First thing we did was to work on the soil for probably a good two years. We use a lot of compost that we make ourselves that helped enormously and gave us the nutrients that we needed to loosen that soil so it wouldn't be so compact.

Mary from North Carolina also praised their compost as what really makes their vegetables grow, “It’s what makes our veggies grow…Our beds [pH] are like eight, and you need like 6.5 to grow vegetables, so if we didn’t have the compost we would not be growing vegetables in those beds.”

Participants also discussed perceived disadvantages to composting including the labor it takes to maintain a compost system. Amy from North Carolina explained difficulties with getting enough help to turn the compost, “The issue has been that it’s not being rotated. You know, it’s supposed to be rotated at least...2 to 3 times a week. And it’s trying to get the other people to help with that.” Mark from North Carolina mentioned the cost associated with the labor of buying compost from a supplier rather than making your own compost:

> So, it’s a price we can afford. It’s just, that’s not the only cost. You know, you’ve got the cost of getting it transported to the site, and then, we’ve got the cost of getting it spread. And it has to be done when we’re not doing crops on there. It’s just not gotten done.

Another noted disadvantage of composting was mismanagement. Participants mentioned that composting could be tricky, especially when it takes communal contributions. Garden coordinators said they must make sure certain things are not placed in their compost systems. Deci from Georgia explained their issues with mismanagement, “Composting is a chore all on its own…You tell people that they do it wrong, they don’t wanna help. You don’t tell them they did it wrong, and then, you become overwhelmed with the amount of correcting, so it’s tricky.” Jacob from Georgia mentioned similar issues concerned with spreading diseases within their composting system, “We’ve tried that, and I just haven’t perfected that yet. If you don’t do it exactly right, you can introduce diseases and stuff into your garden.”

Climate-resilient plants were another adaptation presented to participants. Many gardens were already implementing climate-resilient plants even if the selection of plants was unintentional. Some coordinators said they had selected certain plants that were more tolerant to weather events but did not necessarily know or use the term ‘climate resilient.’ Heat and drought tolerance was a major advantage noted by participants. For example, certain tomato species are bred to be more tolerant to heat to ensure survival. Katie from South Carolina explained her experimentation with climate-resilient plants, “I did try to experiment a bit this year with different types of plants, either ones that would have staggered harvest or could maybe handle a little bit more heat and drought.” Deci from Georgia also said she changed the tomatoes in their garden because of heat and drought, “The extreme dry heat forced me to look at what tomatoes would do better, so I changed the next year, the types of tomatoes that we grew.” Maggie from North Carolina echoed this theme, “We’re definitely researching on the plants. More, we’re looking at … heat and drought-resistant plants.”

Participants mentioned climate-resilient plants were advantageous for disease and pest resistance. Jackson from Georgia mentioned pest and disease resiliency in relation to a changing climate, “I haven’t done a lot of varietal selection yet, but...a lot of our stuff is probably more selected around disease, disease and pest resistance, but I would say that disease incidence is probably tied to temperature and climate.” Jacob, another participant in Georgia, mentioned how the heat and humidity play a huge role in disease in his area. He added an advantage of using disease-resistance plants is using less agrichemicals:

> Generally, what I try to select for are disease resistance in plants. Just because in south Georgia, the disease issue is...it’s just so humid, hot here. I mean, every kind of plant disease you can have, we have down here. When you plant a resistant plant, you don’t have to use fungicides and things like that. It’s better for the environment and better for you eating it too...you don't have all these pesticides on your plants.

Other participants noted disadvantages to climate-resilient plants including cost and working with limited resources. For example, Mary in North Carolina said, “I’m not doing that level of research on the plants because we get them donated and we’ll take what we can get.” Amy from North Carolina repeated this theme stating, “Probably the disadvantage would be... just for our sake, the money. Trying to buy those plants.”

Taste was also mentioned as a perceived disadvantage to using climate-resilient plants. Participants noted these types of plants may not be what their community members are familiar with growing, cooking, or eating. Katie from South Carolina addressed this issue:

> I think sometimes more resilient plants are maybe hairier or tougher, and I don’t know if That’s quite as tasty...at least in my experience with more of the resilient plants. They’re usually tougher to harvest, in my opinion. I always get a little bit like a skin rash or you

> need to space out the plants a little bit more so you're not, I don't know, like they have a little bit of a different set of rules that we would need to learn for the community.

Compatibility

Community garden coordinators placed high emphasis on the compatibility of climate-smart adaptations within their gardens. Three subthemes emerged from discussion on compatibility. The first was financial restraint such as working with a budget and having limited resources. Many community gardens were funded through grants, which sometimes come with a set of rules and stipulations. Anna from South Carolina explained problems with their grant funding:

> The deer have been our biggest issue because our grant will not provide for fencing…So our grant is a 70/30. So, for every dollar that we spend, the [garden's organization name] has to come up with 30 cents of that, and the grant pays 70 cents of that. So, we're still working on donated funds at all times and have to always look at the stewardship of everything we do.

Amy from North Carolina explained their struggle with grant funds ending and having to work with what is left over, "The garden was kind of funded from two different grants. So now those cycles have both ended. So now we just try to work off of what we have."

Many coordinators said their biggest barrier in their community gardens was finances. Most, if not all, gardens had to raise or find money through donations, renting out personal garden beds, small grants, and sponsorships. Daniel from North Carolina said, "That's always been our biggest barrier being a community garden…I guess you could say there's people in the community that support the garden, but financially, we're always very dependent on specific

fundraisers that we do." Lily from South Carolina agreed their gardens' biggest issue was money, "I would say our biggest one [barrier] is finances."

Cultural incompatibility was a concern for participants including issues surrounding the how the community gardens operate. Some community gardens rented garden beds to community members, and renters were able to choose what plants to grow even though they had to donate a portion of their produce to charity. Daniel in North Carolina explained how he does not regulate members on what plants they grow, "Unfortunately, with the community garden people want to grow the fast turn and burn crops which aren't necessarily more resistant. So, I don't necessarily limit that when it comes to...planning out the garden."

Incompatibility with cultural food preferences was another disadvantage noted by participants. Many garden coordinators said they try to be aware of what they grow to match the needs of their recipients. For example, Deci in Georgia explained certain climate-resilient plants may be unfamiliar to the people receiving food from charities her garden donates to, "I don't know who we're feeding. They might not look like me. They might not eat like me. They might be from other countries, and this might be a little sense of home for them." Katie from South Carolina similarly discussed the reasons their garden does not always select climate-resilient produce for their donations:

> No one wants the purple okra that can handle the heat, and no one wants the basil that smells like licorice. So, I think that's just not a huge priority of ours for the next couple of years...Our area really prioritizes what they grew up with. That's always gonna be the first thing that people think about as well. 'This is what I've known for 60 years. Why would I trust this other technique when this has worked for multiple generations?' So, I think that's going to be a big part of it.

Interviewees addressed adaptations that they had tested or implemented and found to be incompatible. Some adaptations will not work for some gardens due to circumstances that are unable to change. For example, Daniel in North Carolina had issues with a rain cistern because it was across the road from the garden, “We had a 1,200-gallon cistern across the road… members had to lug...watering cans across, fill up, and then go water the garden. And in the heat of summer. You can imagine no one really wants to do that.”

Other unchangeable circumstances mentioned were city regulations. Maggie in North Carolina explained how their water source is connected to their town’s water system for only half the year, “We have an irrigation system that’s hooked up to the town water system. It runs six months out of the year and then it’s shut off…it’s not a system that was set up for freezing...it’s just not an option.”

Many participants noted a major incompatibility with the missions of their organizations. Climate-smart irrigation was seen as incompatible because it reduced participation within the garden. Some garden coordinators wanted community members and volunteers to spend time in the garden and provide an easy task (hose watering) to those that needed tasks with less mobility involved. Macie from South Carolina explained, “Our mission of our organization is to connect people with their parks, and people really love watering in the gardens. It’s less rigorous than some of our other volunteering opportunities. It’s on their own schedule." Daniel from North Carolina echoed this sentiment and added he wanted garden members to be held accountable, “I want the community to be accountable. And so with that, going to water every day if you need to, or 3, 4 times a week... gives them that sense of...at least having to check in at the garden.”

A few aspects of climate adaptation behavior were compatible. Composting worked well in many community gardens as a way to create fertilizer and provide natural remedies for disease. For example, Michael in South Carolina explained their unique composting system:

> We then feed our compost to worms, the worms then produce their byproduct, which is worm manure. And then we use that to create sprays for the plants and for fertilizers. Their actual gut biome in a worm is a fascinating thing. When we make it into a spray, it actually helps to fight off a lot of the diseases that are readily available, or in our area.

Clarke from North Carolina explained the use of a composting system in their garden for recycling kitchen scraps and fortifying their soil with the end product, "We do have a compost system in our garden, and we encourage people to...bring their kitchen scraps and put them in there. So, by the time it comes out the other end we have some awfully good compost."

Complexity

Higher levels of complexity were identified as a barrier to climate-smart adaptations. Many of the participants relied on volunteers to help in the garden, had other full-time jobs apart from their gardens, and wanted to teach others how to grow their own food with ease. Some adaptations, like automated irrigation, were less complex and offered participants more time for other practices. For example, Deci from Georgia made a statement about trying to be as environmentally conscious as possible, "There's a balance between saving all that you can, saving the planet, and killing yourself in the process."

Garden maintenance also needed to have a low level of complexity. For example, in Katie's community in South Carolina, garden maintenance needed to be simple for community members because that is what is realistic for them. Community members do not always have extra time to tend to their gardens every day. Katie stated:

> If we planted something new we would hand water it just for maybe the first two weeks whenever it looked like it needed it. But I was kind of on the like, if it wants to survive, let it survive, and if it wants to die, let it die… Because that's a lot more realistic for people in the [name of area] community. They're not going to be out there every day watering their garden. They want something that can kind of be like set it, forget it, and harvest when it's ready.

Trialability

Participants had varying preferences on how they would like to trial climate-smart adaptations. Some preferred to try new practices in their own garden to determine if the practices would meet their specific requirements. A few gardens had very specific regulations implemented by funding or location institutions. For example, Lily in South Carolina stated, "I think trying it in our own garden is gonna be the most helpful in our scenario because we do kind of face some specific restrictions."

Other coordinators preferred to learn if other gardens had success with certain practices before implementing them into their own gardens. Visiting and learning from other gardens was a popular idea among participants. For example, Jacob in Georgia said, "If I'm visiting someone else's garden, and they're doing something I think is pretty cool and it's working, then, I'll adopt certain things." Mary from North Carolina mentioned a resource to learn about new ideas and practices was their local extension community garden. She stated:

> Our extension has a demonstration garden, and so they are constantly doing little research projects there. Like they did the downy mildew study for the basil, and I think they're going to start looking at different hybrids of tomatoes. So, we go to the extension once a month for our meetings, and we get up to date on that.

Clarke from North Carolina gave a simple explanation of implementing new practices. If he and the other members could hear about and understand new practices that would benefit their garden, they would adopt them. Clarke explained:

> That would have the biggest impact on me and probably many of the other gardeners... would be if somebody had like a reason for doing it this way and they tried it, and it was successful. I mean, I think most of us would say, 'Okay, if I'm growing Cherokee purple tomatoes, and they did a whole lot better than these celebrities that they grew in the garden next to me, then yeah, I'm probably gonna grow whatever grows the best.'

Observability

Observability was viewed as a positive reinforcer of climate change adaptation behaviors. Participants wanted to be able to lay their eyes on successful implementations of adaptations. Visualizing successful practices in someone else's garden or farm was a popular sentiment. Jackson from Georgia said, "I would say hearing and seeing success from another farmer...if I see it in practice working, I'm much more likely to take the jump and try and invest in it, than having read in just a scientific publication."

Participants also noted observing success in their own garden was important and had impact on their decision making. For example, Clarke in North Carolina addressed the effort it took to implement a garden bed layering technique, "You'd have to see a whole lot of payoff for the effort that you put in. But I saw that last year, so I was willing to put in the effort this year to do another one."

Another aspect of observability mentioned was transparency. Being able to see success is one thing, but trusting the source of that success is also important. Anna in South Carolina said she wanted to hear success stories from those that are not incentivized to promote the practices,

"Even talking to someone who's actually used it. Who isn't getting paid to use it. Things like that would be great. Seeing it in person is always helpful."

Discussion and Conclusions

Local agricultural production is being affected by droughts, changes in rainfall patterns, heat waves, and subsequently, increased pest and disease pressure (U.S. Environmental Protection Agency, 2023b, 2023c). Climate-smart adaptations in community gardens may be necessary to ensure a continual supply of local, affordable produce. This study explored community garden coordinators' perceptions of climate change adaptations through DOI theory to inform effective environmental education and communication strategies that encourage community gardens to adopt climate-smart practices.

The results of this study suggest relative advantages and low levels of complexity are needed for adoption. Participants emphasized these two attributes as being the most important for what they need to change their current systems and adopt climate-smart practices. These results support the findings of Hasin and Smith (2016) who found farmers' market managers were more likely to implement new payment technology when they perceived it as better than the previous system and simple to implement. The results of this study also support Warner et al. (2020) who found relative advantage and complexity to predict adoption of water conservation innovations.

Proving an innovation has a relative advantage over old practices is necessary because garden coordinators do not have the time or resources to adopt something that is not going to better their current systems. Relative advantage of an innovation would have to be shown in many categories such as efficiency, cost-effectiveness, and management. Garden coordinators are not the only ones working in their gardens, so the innovations need to be easy to teach to other garden members as well. This low level of complexity also needs to translate to the

everyday use of the innovation. The new practice must be easy to implement and teach as well as easy to manage. Garden coordinators and other members usually have other jobs and responsibilities apart from their gardens, so adaptations must be easy to manage on a variety of schedules. In other words, the adaptations need to be low maintenance for community gardens to implement them.

Furthermore, Rogers (2003) portrayed the five perceived attributes as distinct and separate from one another, but this study found the opposite. Many attributes and subsequent themes overlapped each other and were directly tied to one another. For example, a relative advantage of climate-smart irrigation could be its low level of complexity, which was relayed by multiple participants. Compatibility was another characteristic that participants overlapped with other attributes. Compatibility was also seen as a relative advantage for garden coordinators because innovations had to be compatible for adoption, both within the garden and within the community, to be desired. Further, some gardens considering adopting an innovation wanted to trial the innovation in their own garden to determine if it was specifically compatible in their own space. Some gardens had unique restrictions that meant they could not adopt an innovation just by seeing it in another garden because they needed to know if it would work under their restrictions (i.e. institutional, grant, and geographic regulations and restrictions). Participants closely related observability and trialability because they wanted to determine the success of an adaptation by physically seeing it whether that was in their own garden or someone else's garden. These results suggest the perceived attributes of DOI are not always separate from one another. In this case, perceived attributes were highly interrelated and dependent on one another suggesting environmental educators and communicators should tie characteristics of innovations together to encourage adoption.

In addition, this study found most participants were already implementing some climate adaptations even if their use of adaptations were not because of climate change experience. Some climate adaptations were implemented because of characteristics like cost-effectiveness and ease of management. For example, drip irrigation uses less water, which means lower costs, and it can operate automatically without someone attending to it every day. On the other hand, some participants were implementing adaptations as a direct result of their climate change experience. Many participants selected certain varieties of plants that were more heat and drought resistant because of previous experience with losing plants to extreme heat and drought.

Additionally, most, if not all, of the garden coordinators mentioned financial barriers to implementing innovations. Some gardens were funded through grants that came with stipulations, and the funding only lasted a certain amount of time. Other gardens had to raise money through fundraisers, donations, and sponsorships. These gardens budgeted their money and tried to save what they could because none of them had endless or substantial resources. Financial restrictions limited garden coordinators' adoption of innovations even if they wanted to implement something new. Community gardens need additional funding from local, state, and/or federal governments or other agencies if they want community gardens to continue to support local food systems and survive the impacts of climate change. For example, the U.S. Department of Agriculture invested over $3 billion in 141 projects from small and underserved producers of climate-smart commodities (U.S. Department of Agriculture, n.d.-a). Applications had to be submitted for this type of funding, which poses issues to community gardens because garden coordinators and members may not have the time or knowledge to tackle an application like this.

Limitations of this study include the nature of qualitative research, which can rely on a small number of participants with the aim of studying their experiences in depth (Tuckett, 2004).

This research purposefully selected participants who were able to give the type of information desired. The results of this study should not be generalized due to these restrictions of qualitative research (Tuckett, 2004). This limitation was supplemented by requiring community gardens to be connected to the food system, which is a characteristic that can be identified across the U.S. Additionally, a limitation to deductive coding is the restrictions with determining themes *a priori*. Some subthemes emerged under the predetermined themes during analysis possibly due to the overlap of data within the five DOI attributes. Similar research using DOI attributes in thematic analysis may benefit from using abductive analysis to find a middle ground between deductive and inductive analysis to address this limitation (Thompson, 2022).

Future research should explore community garden coordinators' perceptions of climate-smart adaptations in different areas, potentially studying coordinators across the entire U.S. Variations in geographic areas like rurality, political majority, socioeconomic status, and culture could be explored to determine their impact on perceived attributes and adoption rate. This study focused on community gardens in the southeastern U.S., which can be culturally different from other areas in the U.S. The southeastern U.S. has historically associated with the Republican Party which views environmental protection as harmful to the free market and economic growth (Gibson et al., 2021b). Regions with different political affiliations should be studied to determine if their perceived attributes of climate adaptations differ, which would impact communication messaging. A case study on an individual community garden could also be studied. Researchers could study a garden over the course of a few years to determine what variables impact the rate of adoption over time along with the impact of the changing climate. The case study could explore how individual adaptations are perceived and adopted within the context of a single garden. This type of study would be beneficial because, as the current study found, community

gardens even within the same region have varying needs, beliefs, and desires when it comes to adaptations. A study of a single garden could show how time impacts these variables.

Moreover, this study aimed to explore community garden coordinators' perceptions of climate change adaptation, the adoption process, and their current climate-smart practices. This research should inform environmental communication strategies that encourage community gardens to adopt climate-smart practices through emphasis of relative advantages and low complexity of innovations. Communicators should also initiate two-way communication with community gardens. These community gardens already have knowledge of a variety of gardening practices and innovations, so they would not benefit from additional education from communicators on topics in which they are already familiar. Two-way communication would allow community gardens to talk to environmental researchers, educators, and communicators about what parts of these adaptations are not working for them. For example, many participants noted issues with stagnant water within rain barrels. They do not need education on how to use rain barrels, but they need information on techniques that would prevent or eliminate mosquitoes and algae from contaminating the water. The techniques would also have to align with many of their desires of not using chemicals to treat the water. Overall, this exploratory study is just the beginning of informing communication to encourage climate-smart adaptations in community gardens. Creating communication channels and participation between researchers, communicators, and garden coordinators is a start to ensuring the resilience of local, fresh foods.

CHAPTER FOUR

PUBLIC ENGAGEMENT IN COMMUNITY GARDENS:

PREPARING FOR A CHANGING CLIMATE[2]

[2] Erskine, O. M., Lamm, A. J., Lamm, K. W., & Sanders, C. E. To be submitted to *Journal of Applied Communications*.

Abstract

Climate change threatens human health, the environment, and the global economy. Extreme temperatures, changes in rainfall patterns, changes in growing seasons, and intensifying droughts are all results of a changing climate. Adaptations to climate change will need to be implemented in the agricultural sector to ensure the longevity and sustainability of the global supply of food. Community gardens are one part of the agricultural sector that provide access to fresh and affordable foods. The purpose of this study was to determine U.S. adults' motivations for engagement and level of importance associated with climate-smart adaptations in community gardens so effective communication strategies can be developed which encourage community gardens to prepare for climate change to ensure a sustainable supply of and access to fresh foods. The study found respondents engaged in community gardens primarily for health and social reasons, and respondents assigned some level of importance to climate-smart adaptations in their community gardens. Future research should explore the impact of rurality, food accessibility, and socioeconomic status on reasons for engaging in a community garden and associated level of importance related to climate-smart adaptations.

Introduction

Climate change is a real threat to the environment, economy, and human health (U.S. Environmental Protection Agency, 2022) but presents a communication challenge as its existence continues to be rejected or doubted (Merzdorf et al., 2019; Rohling et al., 2016; Sanders et al., 2022). Impacts of climate change include warmer temperatures that increase the intensity and frequency of heat waves, increase in extreme weather events, worsening air and water quality, changes in rainfall patterns, and changing ecosystem lifecycle events including migration and reproduction (U.S. Environmental Protection Agency, 2022). The world's climate is changing more quickly than the pace of natural variations in climate that have occurred throughout the Earth's history, and the evidence for this rapid change in climate consistently points to human activities (Hayhoe et al., 2018). Water quantity and quality are decreasing across the globe (Devineni et al., 2015). Variable precipitation and increased temperatures are intensifying droughts and heavy downpours, and reduced snow-to-rain ratios are leading to significant differences between the timing of the water supply and demand (Lall et al., 2018). Increased stress from diseases, pests, and weeds will cause a decrease in crop production in many areas, which will have consequences for food security (Hatfield et al., 2014). Because of the changing climate and increase in extreme weather events, the agricultural industry will likely have to adopt climate-smart practices to ensure longevity and sustainability of the global food supply (U.S. Environmental Protection Agency, 2023).

One part of the agricultural industry that supports access to local food in many rural and urban areas are community gardens. Community gardens are usually operated by communal entities like neighborhoods, schools, nonprofits, and churches. They provide access to fresh produce and can help establish food and health security (Draper & Freedman, 2010). Community

gardens can alleviate or supplement food deserts (Moore, 2021). Food deserts are areas that lack access to healthy, affordable food, which are usually located in lower-income areas without grocery stores or that are far away from grocery stores (Jang & Kim, 2018). Americans growing food in community gardens increased by 200% between 2008 and 2016, and there are currently over 29,000 community gardens in the 100 largest U.S. cities alone (Moore, 2021; NC State College of Agriculture and Life Sciences, 2023).

Community gardens face many issues due to climate change. For example, community gardens can be directly impacted by climate change through soil and plant damage, drought, flooding, heat waves, and freezes (Frankson et al., 2022). Previous research studies have focused on the social, health, and communal benefits of community gardens (Berg et al., 2023; Odera et al., 2013; Zutter & Stoltz, 2023) and how community gardens can mitigate climate change impacts (Frantzeskaki et al., 2022; Ossola & Lin, 2021; Ossola et al., 2021) However, a gap in the literature exists that explores if members of the public growing food in community gardens in the U.S. are preparing for climate change. Garden adaptations to climate change could include using climate-smart practices such as reducing water use, capturing rainwater to use in the garden, only watering early or late in the day, using climate-resilient plants, using cover crops, and diversifying crop varieties (Tomatis et al., 2023).

There are many reasons members of the public choose to grow food in community gardens. Lack of access to food, rising food prices, or general food insecurity may all be motivating factors. Seventeen million households in the U.S. were food insecure at least some time during the year 2022 (U.S. Department of Agriculture, 2023) and community gardens have been shown to help alleviate food access issues in food deserts because they provide access to low-cost, fresh produce (Moore, 2021). Community gardens are typically owned and operated by

members of the public. Therefore, determining motivations for public engagement in U.S. community gardens may aid in developing effective environmental messaging that will ensure those involved in managing community gardens are prepared for climate change impacts.

Literature Review

Motivation

Motivation for engaging in certain behaviors have been studied throughout the literature across disciplines. In the environmental space, researchers have studied the impact of motivation on pro-environmental behavior and communication. For example, Barbarossa and De Pelsmacker (2016) analyzed motivations for purchasing eco-friendly products across different consumer groups (green versus non-green consumers). The study found significant differences between the consumer groups' motivations and found both positive (i.e., green self-identity and morals) and negative (i.e., perceived inconvenience of purchasing eco-friendly products) ego-centric motives were at least as important and relevant as altruistic (i.e., care for the environmental consequences of purchasing) motives (Barbarossa & De Pelsmacker, 2016). The findings suggested developing communication campaigns that are specifically tailored toward green and non-green consumers and that appeal to the most effective antecedents/motivations for eco-friendly purchasing (Barbarossa & De Pelsmacker, 2016).

Stea and Pickering (2019) analyzed motivational factors that underpinned red meat consumption in Canada. The study found taste and quality were the most important motivators for eating meat, while moral/ethical factors were the least important (Stea & Pickering, 2019). The findings from this study can aid in informing environmental messaging and potentially segment audiences based on their most important motivations behind consuming meat. For example, environmental communicators that want to create messaging to reduce red meat

consumption can target audiences based on their motivations behind consuming meat. Messaging tailored for people with stronger pro-environmental values should articulate the harmful environmental consequences (Stea & Pickering, 2019).

Community gardens provide many benefits to communities and individuals. Social, health, and financial benefits include fostering community engagement, exercising through gardening, providing access to affordable produce, or simply providing people with an opportunity to enjoy the outdoors (Armstrong, 2000; Berg et al., 2023; Odera et al., 2013; Zutter & Stoltz, 2023). Armstrong (2000) surveyed 20 community garden program coordinators and found access to fresh/better tasting food, the enjoyment of nature, and health benefits were the most common motivations for participating in a community garden. There were some differences in motivations between urban and rural garden program participants including the garden providing food for low-income households in urban areas and gardening serving as a traditional cultural practice in rural areas (Armstrong, 2000).

Diffusion of Innovations

Rogers' (2003) DOI theory assists in understanding behavioral change, especially related to the adoption of innovations, defined as "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (p. 12). An idea, practice, or object can be an innovation if it is new to a person if they have not yet formed a favorable or unfavorable attitude toward it or if they have not yet adopted or rejected it (Rogers, 2003). Although climate change adaptation is not a new idea, it can be seen as novel to those who have not yet adopted. Rogers (2003) identified many variables that affect the adoption rate of innovations including perceived attributes, type of innovation-decision, communication channels, nature of social systems, and extent of change agents' promotion efforts (Rogers, 2003).

Rogers' (2003) DOI theory, and research that uses DOI, provides evidence of how perceived attributes of an innovation can affect the rate to which an innovation diffuses. The perceived attributes include relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). Relative advantage determines if the innovation has an advantage over the predecessor; compatibility is how well the innovation matches adopters' needs or current systems; complexity how difficult the innovation is to learn, teach, or implement; trialability is the ability of the innovation to be tested; and observability is visibility of results to potential adopters (Rogers, 2003). For example, Rumble et al. (2016) used DOI theory to survey millennial students in a college of agriculture at a university to determine how genetically modified (GM) science diffused among the students and their intent to consume citrus from a GM tree. The study found out of all five perceived attributes, relative advantage was the only attribute the students viewed positively, meaning they are more likely to adopt and accept GM food and science than the public (Rumble et al., 2016). The students viewed the other four characteristics, compatibility, complexity, trialability, and observability, as neutral possibly due to the fact that millennials are generally unsure about GM food, trialability and observability of GM foods are difficult to for consumers to experience, and the students may have already been exposed to some GM science due to the fact that they are in an agricultural program (Rumble et al., 2016). Additionally, Silvert et al. (2023) surveyed Florida residents on their experiences and perceptions pollinator-friendly gardening to determine the barriers to engagement and adoption. The study found decreasing perceived complexity and increasing observability of pollinator-friendly gardens are key actions needed to promote adoption (Silvert et al., 2023). Because different attributes affect the diffusion differently, it is crucial to survey potential adopters to

determine which attributes to emphasize, clarify, and adapt to the audiences' needs when communicating.

Purpose and Research Objectives

The purpose of this study was to determine U.S. adults' motivation behind engagement in community gardens and the level of importance they associate with climate-smart adaptations in community gardens across the U.S. The results can inform the development of effective communication strategies that encourage community garden participants to prepare for climate change to ensure a sustainable food supply for the future. The study was guided by the following research objectives:

2. Describe public engagement in community gardens;
3. Describe motivations for public engagement in community gardens;
4. Describe the level of importance associated with climate-smart adaptations in community gardens;
5. Determine if motivations for engagement in community gardens predict level of importance associated with climate-smart adaptations in community gardens.

Methods

A quantitative research design was used to address all five research objectives. The research presented here was part of a larger study designed to explore perceptions related to environmental issues including climate change perceptions and the use of plastic.

Data Collection

The target population for the study was U.S. residents who were 18 years of age or older. Respondents were recruited in September 2023 using non-probability opt-in sampling via Qualtrics. Non-probability opt-in sampling is well accepted in communication research and

public opinion research, although it poses several limitations, such as limiting respondents to individuals with internet access and attracting specific types of people due to the nature of online surveys (Baker et al., 2013; Lamm & Lamm, 2019). Responses were collected from 1,010 respondents found to be representative of the U.S. adult population based on quotas set *a priori* and weighting conducted based on the U.S. Census data *ex post facto*.

Instrumentation

The survey instrument contained demographic and Likert-type questions. To address the first research objective respondents' engagement in a community garden was measured by selecting "yes" or "no" to the question "Do you or someone in your household engage in a community garden?" Engagement included volunteering, financially supporting, or receiving produce from a community garden. Only respondents that selected "yes" were further analyzed.

For research objective two respondents were asked to indicate their level of agreement or disagreement with a set of statements adapted from Armstrong (2000) regarding their motivations for engaging in a community garden. Statements included *it is my hobby, it keeps me busy, I get exercise from gardening, it helps/improves my mental health, it is a good family/children's activity, I enjoy nature/open space, it is a tradition/cultural practice, I consume the produce I grow, fresh food is/tastes better, there is a lack of fresh produce in my area, it is less expensive than buying fresh produce, it is an income supplement (from sale of grown foods), and I want to know what is used (pesticides, fertilizer, etc.) to grow the produce I consume*. Responses were on a five-point Likert-type scale (1 = *Strongly Disagree*; 2 = *Somewhat Disagree*; 3 = *Neither Agree Nor Disagree*; 4 = *Somewhat Agree*; 5 = *Strongly Agree*). Responses were averaged to create three separate scales for motivation to engage in a community garden: social (five items), financial (four items), and health (four items). Grouping of items can

be seen in Table 2. Scale reliability was calculated using Cronbach's alpha, and all scales were deemed reliable (social scale $\alpha = 0.78$; financial scale $\alpha = 0.72$; health scale $\alpha = 0.84$).

For research objective three respondents were asked to indicate the level of importance they associated with each of the following items associated with climate-smart adaptations in community gardens adapted from a survey conducted by the University of Maryland Extension (2023): *keep climate change and its impacts in mind when working in my community garden; keep climate change and its impacts in mind when planning my community garden; using sustainable practices in my community garden; using compost in my community garden; collecting rainwater to water my community garden; using gray water or recycled water in my community garden; using water conservation practices in my community garden; using climate-resilient plants in my community garden; using native plants in my community garden; growing my own food in my community garden because climate change can impact produce availability; growing my own food in my community garden because climate change can impact produce prices; growing my own food in my community garden to reduce carbon emissions from produce transportation; adapting my community gardening methods because of climate change impacts (warmer weather, flooding, droughts, or other extreme weather events); and adapting the produce I grow in my community garden because of climate change impacts (warmer weather, flooding, droughts, or other extreme weather events)*. Respondents ranked their level of importance with eat item on a five-point Likert-type scale (1 = *Not Important At All*; 2 = *Slightly Important*; 3 = *Important*; 4 = *Fairly Important*; 5 = *Very Important*). All 14 items were averaged to create one scale to measure importance associated with climate-smart adaptations in community gardens. The scale was found to be reliable ($\alpha = 0.96$).

The survey was reviewed for content accuracy and face validity by a panel of faculty members in natural resource conservation, survey design, and communication studies. The [University] Institutional Review Board (IRB # 00008095) approved the study design. The instrument was pilot tested for content validity with 50 individuals who were representative of the sample. The resulting Cronbach alpha coefficients were all above 0.70 and, therefore, the scales were deemed reliable (Cortina, 1993) and no changes were made following the pilot test.

Data Analysis

Data were analyzed descriptively, using means and standard deviations, to address objectives one through three. A multiple regression analysis was used to address objective five. In the regression model, the dependent variable was the overall scale of importance associated with climate-smart adaptability in community gardens. The independent variables were motivations for engaging in a community garden that were grouped into three scales: social, health, and financial. The independent variables were used to predict importance associated with climate-smart adaptations in community gardens. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 29 (Chicago, IL, USA).

Results

Respondents were asked to indicate if they or someone in their household engaged in a community garden. Out of 1,010 respondents, 172 respondents answered yes, which equates to 17% of the sample. Detailed demographics of both the entire set of respondents and those indicating they engaged in a community garden can be seen in Table 1. Men were more likely to engage in community gardens than women. Respondents engaged in community gardens were younger than the overall set of respondents, had a higher level of family income, and were more likely to be a registered Democrat.

Table 1
Demographics of respondents.

	Overall Respondents N = 1,010		*Respondents who Garden N = 172*	
	F	*%*	*F*	*%*
Sex				
Male	490	48.5	98	57.0
Female	520	51.5	74	43.0
Age				
18-34 years	291	29.1	80	46.5
35-54 years	271	27.7	61	35.5
55+ years	442	44.2	31	18.0
Race*				
White	771	76.3	120	69.8
Black or African American	138	13.7	37	21.5
Asian or Pacific Islander	62	6.1	11	6.4
American Indian or Alaska Native	22	2.2	6	3.5
Other	40	4.0	6	3.5
Ethnicity				
Hispanic	184	18.2	48	27.9
Non-Hispanic	826	81.8	124	72.1
Rurality				
Within the city or town limits	765	75.7	148	86.0
Outside the city or town limits	245	24.3	24	14.0
Education				
Less than 12th grade	27	2.7	4	2.3

High school diploma	257	25.4	46	26.7
Some college	251	24.9	29	16.9
2-year college degree	129	12.8	18	10.5
4-year college degree (Bachelor's, etc.)	229	22.7	47	27.3
Graduate or Professional degree	117	11.6	28	16.3
Political Affiliation				
Republican	266	26.3	51	29.7
Democrat	371	36.7	76	44.2
Independent	268	26.5	30	17.4
Non-affiliated	105	10.4	15	8.7
Total Family Income				
Less than $24,999	233	23.1	32	18.6
$25,000 to $49,999	314	31.1	40	23.3
$50,000 to $74,999	215	21.3	43	25.0
$75,000 to $149,999	180	17.8	38	22.1
$150,000 to $249,999	54	5.3	14	8.1
$250,000 or more	14	1.4	5	2.9

Note: *Respondents were allowed to select more than one race.

Respondents indicating they engaged in a community garden (n = 172) were asked to indicate their level of agreement on their motivations for engaging in a community garden. Items were grouped into three scales representing motivation for engaging in a community garden. Motivations related to health had the highest mean score (M = 4.09) while the financial motivation scale had the lowest mean score (M = 3.83). Detailed results can be seen in Table 2.

Table 2
*Motivations for engaging in a community garden (*N = *172)*

Motivation for engagement	Strongly Disagree %	Somewhat Disagree %	Neither Agree or Disagree %	Somewhat Agree %	Strongly Agree %
Social					
It is my hobby	3.5	6.4	16.3	40.1	33.7
It keeps me busy	2.9	7.6	9.3	47.7	32.6
It is a good family/children's activity	2.9	5.2	14.0	36.6	41.3
It is a tradition/cultural practice	4.1	9.3	20.9	29.7	36.0
I enjoy nature/open space	1.2	2.3	11.6	30.8	54.1
Health					
I get exercise from gardening	3.5	5.2	15.7	36.6	39.0
It helps/improves my mental health	2.9	5.8	14.0	30.2	47.1
Fresh food is/tastes better	0.6	7.0	10.5	27.3	54.7
I want to know what is used to grow the produce I consume	4.7	5.8	19.2	31.4	39.0
Financial					
It is less expensive than buying fresh produce	2.3	7.0	14.5	37.2	39.0
I consume the produce I grow	2.3	4.7	13.4	34.9	44.8
There is a lack of access to fresh produce in my area	8.7	12.8	22.1	26.2	30.2
It is an income supplement	11.6	9.9	19.2	27.3	32.0

Respondents were asked to indicate their associated level of importance related to climate-smart adaptations in community gardens. The items were combined into a single construct. The overall mean was *M* = 3.74. Detailed results can be seen in Table 3.

Table 3
*Respondents' associated level of importance related to climate-smart adaptations in community gardens (*N = *172)*

Adaptation	Not Important %	Slightly Important %	Important %	Fairly Important %	Very Important %
Keep climate change and its impacts in mind when working in my community garden	4.7	8.7	24.4	26.7	35.5
Keep climate change and its impacts in mind when	5.8	10.5	26.7	25.0	32.0

planning my community garden					
Using sustainable practices	2.9	9.9	25.6	23.3	38.4
Using compost	5.8	7.0	27.9	23.3	36.0
Collecting rainwater	4.1	12.8	25.0	22.1	36.0
Using gray or recycled water	11.0	14.0	20.3	26.2	28.5
Using water conservation practices	4.7	7.6	29.1	18.0	40.7
Using climate-resilient plants	5.2	10.5	23.3	25.6	35.5
Using native plants	4.7	8.7	22.7	26.2	37.8
Growing my own food because climate change can impact produce availability	8.1	9.9	20.9	23.3	37.8
Growing my own food because climate change can impact produce prices	6.4	12.8	23.3	20.9	36.6
Growing my own food to reduce carbon emissions from produce transportation	6.4	9.3	23.8	25.0	35.5
Adapting my gardening methods because of climate change impacts	5.2	12.2	24.4	22.1	36.0
Adapting the produce I grow because of climate change impacts	5.8	11.0	22.1	23.3	37.8

A multiple regression analysis was used to determine if motivations for engagement in community gardens predicted the level of importance associated with climate-smart adaptations in community gardens. Overall, motivations for engagement explained 42.2% of the variance in importance associated with climate-smart adaptations. Together, the motivations for engagement significantly predicted importance associated with climate-smart adaptations $F(3,168) = 40.81$, $p < .001$ (Table 5). The health variable was a significant predictor indicating for each one unit increase in health motivation, there was a 1.33 unit increase in associated level of importance of climate-smart adaptations in community gardens. The social motivation variable was also significant indicating for each one unit increase in social motivation, there was a 0.96 unit increase in associated importance of climate-smart adaptations in community gardens. The

financial motivation variable did not significantly predict importance associated with climate-smart adaptations.

Table 4
Motivation predictive capacity on level of importance associated with climate-smart adaptations in community gardens

	b	*p*
Health	1.33	.001
Social	0.96	0.02
Financial	0.44	0.18

Discussion and Conclusions

The study evaluated motivation for engaging in a community garden, the level of associated importance related to climate-smart adaptations in a community garden, and if certain motivations predicted associated levels of importance of climate-smart adaptations for community gardens. Over 58% of respondents indicating they engaged in a community garden reported a total family income of $50,000 or more. This may be a reason the financial motivations scale had the lowest mean score. These respondents may not be motivated to garden to supplement their income or save money because they have higher discretionary income. As stated previously, Armstrong (2000) found urban residents participating in community gardens, compared to rural residents, were motivated by the gardens providing food for low-income households. In this study, 86% of respondents indicating they engaged in a community garden lived within their city or town limits. This study found contradicting results to Armstrong (2000) because even though most of the respondents lived within the city limits, the financial motivations were the least popular. Overall, respondents somewhat agreed social, financial, and health motivations were motivations for engagement in a community garden. Results indicated both health and social motivations for engagement in a community garden significantly predicted associated level of importance related to climate-smart adaptations. These results are broadly

similar findings to Barbarossa and De Pelsmacker (2016) and Stea and Pickering (2019) in which underlying motivations impacted pro-environmental behaviors. These two studies do contradict this study which found health and social reasons to be the top motivators for engaging in a community garden indicting pro-environmental behavior. Barbarossa and De Pelsmacker (2016) found the highest mean construct for motivations to be care for environmental consequences, and Stea and Pickering (2019) found cost as the third most important and health as the fourth most important, out of 13 motivations, for respondents' motivations for pro-environmental behavior.

The findings could be used by policy makers communicating about the importance of climate-smart adaptations to the public who is often skeptical or doubtful climate change is a real issue they need to address (Sanders et al., 2022). Effective communication should be developed from a health or social lens to encourage adaptations in community gardens to ensure a sustainable food supply from the gardens as climate change continues to have a global impact. For example, a health message could state, "Ensure your mental health can be exercised for years to come in your community garden. Adapt now to a changing climate to ensure you can receive the mental health benefits the gardens provide." Another message could address underlying social motivations for engaging in a community garden. For example, "Ensure you and your family can engage outdoors together for years to come in your community garden. Adapt now to a changing climate."

Previous studies have segmented audiences based on differences in opinions and beliefs related to environmental behaviors (Gibson et al., 2021; Taylor et al., 2018). Perhaps, given how different those that garden were from the general population sample, audience segmentation would be an effective strategy. For example, developing a message showcasing visuals of people younger than 35 growing their own food in a community garden because it is their hobby should

be different from a message for people who grow their own food in a community garden because it is less expensive than buying fresh produce because they are motivated by different reasons.

The results suggest agricultural and environmental communicators should use health and social motivation underpinnings in their messaging to encourage climate-smart adaptations in community gardens. Those who engage in a community garden may increase their climate-smart practices in their garden if communication about needing climate-smart adaptations is conveyed as necessary to ensure the continual health and social support the garden provides them and their communities. For example, if a person engages in a community garden because there is a lack of fresh produce in their area, they need to be made aware that the produce they grow could be impacted by climate change, so they need to adopt climate-smart practices to sustain their personal food supply.

Additional research is needed to ensure effective climate-smart messaging is reaching those engaging with community gardens. Exploring the impact of location and rurality on motivations behind engagement in a community garden and associated level of importance related to climate-smart adaptations would further segment the audience allowing for specific communication messages to be developed. Location, whether regional or country-specific, could also be further explored to determine if areas outside the U.S. have the same motivations and level of importance associated with climate-smart adaptations in community gardens.

Rurality may impact motivations for engagement in a community garden including reasons related to food accessibility and distance to the nearest community garden. Other demographics such as socioeconomic status should be analyzed to determine its impact as well given those engaged in community gardens in this study were of higher socio-economic status than the general public. Socioeconomic status may impact motivations for engaging in

community gardens as well as climate-smart adaptation adoption decisions due to financial barriers including expense and accessibility.

Climate change is impacting food security as it relates to reduced access to fresh foods. In many cases community gardens are necessary to ensure resilience through adaptation. Community gardens can only contribute to food security if they survive the issues resulting from a changing climate. The findings implied the public engaged in community gardens already see the importance of climate-change adaptation. Communicators have an opportunity to capitalize on this by developing strategies to increase participants' associated levels of importance and encourage widespread adoption. Agricultural educators and communicators should also target participants who perceive adaptations as less important through education by placing an emphasis on their motivations for engagement. Understanding how those engaged in community gardens view the importance of climate-smart adaptations can contribute to how communicators relay messaging to further encourage climate-smart adaptation to ensure access to fresh, local foods.

CHAPTER FIVE

DISCUSSION, RECOMMENDATIONS, AND CONCLUSIONS

Climate-smart adaptations are needed for community gardens and beyond as climate change continues to impact human and environmental health (IPCC, 2023). This thesis identified community garden coordinators' perceptions of climate-smart adaptations in Georgia, North Carolina, and South Carolina. It also explored motivations for public engagement in community gardens and associated levels of importance of climate adaptations in the United States (U.S.). The goals of the two studies were to determine these perceptions and motivations to aid the development of effective communication strategies that encourage community gardens to prepare for climate change.

The first study found community garden coordinators in Georgia, North Carolina, and South Carolina valued relative advantage and low levels of complexity as attributes of climate-smart adaptations, which were similar to previous research findings (Hasin & Smith, 2016; Warner et al., 2020). The results also suggested garden coordinators already had years of experience and knowledge of gardening practices, so more education on gardening practices is not necessary. Instead, researchers and communicators should focus on two-way communication with community gardens to determine how they can aid in the problems coordinators have with implementing certain climate-smart adaptations.

The second study found U.S. community garden participants were motivated by health and social reasons such as knowing what inputs are used in the food they consume and participating in a community garden to enjoy nature and spend time with others. The results also

found respondents did believe climate-smart adaptations were important. These findings suggested environmental communicators should use health and social underpinnings in their communication messaging. Researchers and communicators should also develop strategies that increase current levels of importance and those who assign lower levels of importance to climate adaptation.

The results of the two studies both suggest that community garden participants in the U.S. already assign some importance to climate adaptation. Motivations for engagement and perceived attributes of innovations both impacted the level of importance and adoption of climate-smart practices in community gardens even though the participants differed between the two studies. These findings can work together to increase adoption of climate-smart practices. For example, relative advantages of adaptations could relate to the potential health and social benefits they provide. Those concerned with produce inputs may think composting has a relative health advantage because they know their garden and kitchen scraps are what is fortifying their plants. Others may find an advantage to rotating and spreading compost in their gardens because it is a form of exercise.

Additionally, these findings should be used when lobbying for financial support of community gardens. Governments and other agencies need to understand and connect reasons for community garden engagement and the struggles that come along with innovations. Again, this is why two-way communication between community garden coordinators and staff and researchers, communicators, and agencies is important. Decision makers must know what resources community gardens need to continually provide access to fresh fruits and vegetables. Highlights from these studies that should be relayed to decision makers are the importance of two-way communication and the financial need of community gardens that do not have resources

needed to fill out grant applications for climate-smart adaptations. Furthermore, incentive programs should also use these findings when promoting climate-smart practices. Incentive programs need to relay characteristics of innovations such as relative advantage, low levels complexity, health benefits, social benefits, and financial support. Adoption of climate-smart practices may increase by stressing these themes.

These results are just a starting point of determining how to best communicate to community garden participants about the importance of adopting climate-smart practices. Further research should explore public perceptions of adopting climate-smart adaptations through perceived attributes. Garden coordinators placed a high level of importance on ensuring relative advantage and low levels of complexity for potential adoption of adaptations. Perceived attributes from individuals that engage in community gardens across the U.S. should be explored to determine if similar results are found or if more emphasis is placed on other attributes. Additionally, more extensive and generalizable research should be conducted such as case studies of gardens in different regions of the U.S. Regions can vary by geographic traits, sources of water, demographics, and political affiliations, among others. The results of exploring these variables should be compared region to region to determine if significant differences exist. This would impact the messaging strategies environmental communicators use. There are many ways to analyze these variables. For example, one study could focus on political affiliation connected to level of importance associated with climate-smart adaptations. Another study could compare the most important perceived attributes across the entire country. More specific studies could analyze a specific garden over time in different regions to determine how time impacts the adoption process and rate. Community gardens' contributions to the food system should be

included in these studies to determine how these variables impact gardens that provide access to fresh foods.

Overall, this thesis aimed to provide insight into climate preparedness of community gardens in the U.S. Community gardens wanting to ensure the sustainability of the local food supply must act as climate change continues to impact the way producers grow food. There are about 30,000 community gardens in the 100 largest cities in the U.S. alone (NC State College of Agriculture and Life Sciences, 2023), and this study has only scratched the surface of information needed to help these gardens survive climate change. Community gardens are helping fight food insecurity because millions of Americans continue to be food insecure every year (United States Department of Agriculture, 2023). Using this research and conducting further studies will inform communication messaging strategies that aim to increase the resilience of community gardens across the U.S.

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Appendix A: IRB Approval Notice

UNIVERSITY OF GEORGIA

Tucker Hall, Room 212
310 E. Campus Rd.
Athens, Georgia 30602
TEL 706-542-3199 | FAX 706-542-5638
IRB@uga.edu
http://research.uga.edu/hso/irb/

Human Research Protection Program

EXEMPT DETERMINATION

August 22, 2023

Dear Alexa Lamm:

On 8/22/2023, the Human Subjects Office reviewed the following submission:

Title of Study:	Exploring Garden Coordinators' Perceptions of Climate Change Adaptation
Investigator:	Alexa Lamm
Co-Investigator:	Olivia Erskine
IRB ID:	PROJECT00008095
Funding:	None
Review Category:	Exempt 2

We have determined that the proposed research is Exempt. The research activities may begin 8/22/2023.

Since this study was determined to be exempt, please be aware that not all future modifications will require review by the IRB. For more information please see Appendix C of the Exempt Research Policy (https://research.uga.edu/docs/policies/compliance/hso/IRB-Exempt-Review.pdf). As noted in Section C.2., you can simply notify us of modifications that will not require review via the "Add Public Comment" activity.

A progress report will be requested prior to 8/22/2028. Before or within 30 days of the progress report due date, please submit a progress report or study closure request. Submit a progress report by navigating to the active study and selecting Progress Report. The study may be closed by selecting Create Version and choosing Close Study as the submission purpose.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103).

Sincerely,

Maricia Dilan, IRB Professional
Human Subjects Office, University of Georgia

Appendix B: Participant Consent Form

UNIVERSITY OF GEORGIA

CONSENT LETTER

Community garden coordinator perceptions research 2023

Dear Participant,

My name is Alexa Lamm and I am a faculty member in the Agricultural Leadership, Education and Communication Department at the University of Georgia. You are receiving this invitation for an interview because we are conducting a study about garden coordinators' perceptions on climate-smart adaptations and practices in community gardens connected to the food system. This interview will take approximately 60 minutes to complete. Information collected during this study will collect information about your occupational, personal, and educational background, information on current garden practices, and attitudes and perceptions surrounding climate change and climate change adaptation methods. I am looking for about 20-30 garden coordinators in Georgia, North Carolina, and South Carolina who are age 18 or older.

If you agree to take part in this study, the interview and survey will take approximately an hour and a half total. Participation is voluntary. You can refuse to take part or stop at any time without penalty. There is no penalty for not participating. You do not have to answer any question you do not wish to answer. Your decision to take part or not take part in this study will not affect your employment or employee evaluation.

If you agree to take part in this study, we will conduct the interview first, which will be audio recorded, and then, the survey will be completed online via iPad. If the meeting site does not have internet connection, a paper survey will be provided. If the meeting site is via Zoom, the interview will still be audio recorded, and the survey will take place online through a link we provide to the survey. Both the interview and survey are required to take part in this study.

Your responses will be anonymous and confidential in our later reports because there will not be any names attached to comments. There are minimal risks associated with this study. Some subjects may not wish to share information about their background if there are traumatizing issues associated with such. However, this research involves the transmission of data over the Internet. Every reasonable effort has been taken to ensure the effective use of available technology; however, confidentiality during online communication cannot be guaranteed.

The audio recording of the interview will be retained after data collection until analysis is complete and stored in a password-protected drive accessible only by researchers involved in this study. The audio recording will be retained for approximately 6 months after data collection.

There is no compensation or other direct benefit to you for participation. This information will not be used or distributed for future research.

Your responses may help us understand and develop generalizable knowledge about community gardens' climate-smart adaptation practices in the southeastern United States.

If you would like to learn more about this study, please contact me, Dr. Alexa Lamm at 706-542-5598 or by email at alamm@uga.edu. Questions about your rights as a research participant should be directed to The Chairperson, University of Georgia Institutional Review Board; telephone (706) 542-3199; email address irb@uga.edu.

Please keep this letter for your records.

Sincerely,
Alexa Lamm

I, _____, consent to participating in this study.

Signature: _____ Date: _____

Appendix C: Interview Protocol

1. Role and Garden characteristics
    a. Tell me about your role with this community garden.
        i. How long have you been here?
        ii. What do you grow?
        iii. How many people work here?
        iv. How does it serve your local food system?
        v. How much is produced?
        vi. How is food distributed?

2. Background in gardening/agriculture
    a. What experience did you have gardening before working with this garden?
        i. Do you have formal agricultural training? If so, can you describe it?
    b. What kind of formal training and/or educational background do you have that prepared you for this role?

3. Perceptions of the need for adaptation
    a. What have you heard about other gardeners having issues with extreme heat, freezes, excessive rainfall, droughts?
        i. Do you think these issues are happening in this area, surrounding areas, or areas far away? Please describe.
    b. Have you experienced any of these extreme weather events such as extreme heat, freezes, excessive rainfall, flooding, droughts that have impacted the plants or structure of your garden?
        i. If yes, which ones? Can you provide an example?
    c. How have you changed, or how do you plan to change, how you operate the garden due to the potential impacts of these changes in weather?

4. Perceived attributes of adaptation (relative advantage, compatibility, complexity, trialability, observability)

    Some things gardeners are doing to adapt to these weather changes are using recycled water, composting, changing to climate-resilient plants and using climate-smart irrigation.
    a. What do you believe are the advantages of these methods?
        i. Would these methods increase the efficiency of your garden?
    b. What do you believe are the disadvantages of these methods?
        i. Difficult to learn/teach, more expensive, etc.?

c. Could you implement any of these methods in your garden currently? If so, which ones?
    i. To what extent do these methods align with the needs of your garden?
    ii. What types of changes would you need to make to your garden to adopt these methods?
d. How would using any of these methods be perceived by you and your gardening team?
    i. What would be any barriers to using any of these methods by your gardening team?
        1. Why would they struggle?
        2. What would be difficult to understand about implementing the new approach?
e. Are there any of these new methods would you like to implement on a trial-basis? If so, which ones?
    i. To what extent would the trial-basis influence your decision to implement these methods?
f. To what extent would observing the methods being used at a different garden help you decide if they would work in your garden?
g. Can you tell me about any other gardens that have used or are currently using any of these methods?

5. Innovation-decision process (knowledge gathering, persuasion, decision, implementation, and confirmation)
    a. Currently, how do you feel about implementing any of these methods in your community garden?
    b. What would it take for you to implement one or more of these approaches?
    c. What factors would influence your decision?

Appendix D: Recruitment Plan

Recruitment Plan

1. Identify community gardens coordinators connected to the food system in Georgia, North Carolina, and South Carolina
    a. Community gardens connected to the food system requirements:
        i. Provide produce directly to their community (discounted or free)
        ii. Donate produce to a local food bank or charity
    b. Community garden coordinator definition
        i. The person(s) responsible for making garden decisions about what to plant and what gardening methods to use.

Initial Email to Community Garden Coordinators

Hello [Garden Coordinator Name],

My name is Olivia Erskine, and I am a graduate student in the Department of Agriculture Leadership, Education, and Communication at the University of Georgia. I work under Dr. Alexa Lamm in this department, and we are conducting a research study that explores community garden coordinators' perceptions of climate-smart adaptations and practices. We are looking for community gardens connected to the food system, which we are defining as gardens that a) provide produce directly to community members (free or discounted) and/or b) donate produce to a local food bank or charity.

I found your information through [insert website name, contact, etc.]. I am looking for garden coordinators, or those who make decisions in your garden about what to plant and what gardening methods you use, to participate in an interview within the next month or so. In total, this voluntary participation will take about an hour and a half, and any responses will be anonymous and confidential in later reports where your name will not be attached to any comments.

If at all possible, I would like to conduct the interviews in person, but if your schedule or preferences do not align with an in-person interview, I am happy to conduct it via Zoom or phone call.

If you would like to participate in this study, please feel free to contact me by replying to this email or calling me at 864-634-6960, and we can begin to set up a date and time for the interview. If you have any questions, please let me know.

Many Thanks,
Olivia

Second and Third Follow-Up Email to Garden Coordinators

Hello [Garden Coordinator Name],

I am following up on my last email regarding the research study on community garden coordinators' perceptions of climate-smart adaptations and practices. I emailed on [Date] and [Date] because you meet our requirements for a garden coordinator, and I would greatly appreciate the opportunity to interview you about your garden.

Your participation in an interview about your perceptions and practices will help our study develop generalizable knowledge about community garden coordinators in the southeastern United States.

This voluntary interview will take approximately an hour and a half to complete, and your responses will be anonymous and confidential in later reports where your name will not be attached to any comments.

If you would like to participate in this study, please respond to this email, and we can set a date and time for the interview. If you have any questions, please feel free to email me or give me a call at 864-634-6960.

If you are unable to participate in this research, I would greatly appreciate an email to let me know so that we can identify other garden coordinators.

Many Thanks,
Olivia Erskine

Appendix E: Survey Items

Dear Respondent,

You are receiving this survey because we are interested in your opinion regarding issues in the United States. Specifically, in this study you will be asked about gardening, climate change, and water issues.

- This survey will take approximately 20 minutes to complete.
- Your participation is completely voluntary.
- There is no penalty for not participating.
- You can withdraw from the survey at any time without penalty.
- You do not have to answer any question you do not wish to answer.
- Your identity will be unknown to the researchers, and your responses will be anonymous.
- There are no known risks associated with this study.
- There is no compensation or other direct benefit to you for participation.

If you would like to learn more about this study, please contact Alexa Lamm at 706-542-5598 or by email at alamm@uga.edu. Questions about your rights as a research participant should be directed to The Chairperson, University of Georgia Institutional Review Board; telephone (706) 542-3199; email address irb@uga.edu.

By clicking "Yes, I agree to participate" below you are agreeing to participate in this research.

Yes, I agree to participate

No, I do not agree to participate

Do you or someone in your household engage in a community garden (volunteer, receive food, financially support)?

Yes

No

Please indicate your level of agreement or disagreement with each of the following statements related to engaging with a community garden.

I (or someone in my household) engage in a community garden because:

	Strongly Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
It is my hobby.	○	○	○	○	○
It keeps me busy.	○	○	○	○	○
I get exercise from gardening.	○	○	○	○	○
It helps/improves my mental health.	○	○	○	○	○
It is a good family/children's activity.	○	○	○	○	○
I enjoy nature/open space.	○	○	○	○	○
It is a tradition/cultural practice.	○	○	○	○	○
I consume the produce I grow.	○	○	○	○	○
Fresh food is/tastes better.	○	○	○	○	○
There is a lack of access to fresh produce in my area.	○	○	○	○	○
It is less expensive than buying fresh produce.	○	○	○	○	○
It is an income supplement (from sale of grown foods).	○	○	○	○	○
I want to know what is used (pesticides, fertilizer, etc.) to grow the produce I consume.	○	○	○	○	○

Please indicate the level of importance for each of the following items related to engaging in a community garden.

	Not Important At All	Slightly Important	Important	Fairly Important	Very Important
Keep climate change and its impacts in mind when working in my community garden.	○	○	○	○	○
Keep climate change and its impacts in mind when planning my community garden.	○	○	○	○	○
Using sustainable practices in my community garden.	○	○	○	○	○
Using compost in my community garden.	○	○	○	○	○
Collecting rainwater to water my community garden.	○	○	○	○	○
Using gray water or recycled water in my community garden.	○	○	○	○	○
Using water conservation practices in my community garden.	○	○	○	○	○
Using climate-resilient plants in my community garden.	○	○	○	○	○
Using native plants in my community garden.	○	○	○	○	○

Growing my own food in my community garden because climate change can impact produce availability.	○	○	○	○	○
Growing my own food in my community garden because climate change can impact produce prices.	○	○	○	○	○
Growing my own food in my community garden to reduce carbon emissions from produce transportation.	○	○	○	○	○
Adapting my community gardening methods because of climate change impacts (warmer weather, flooding, droughts, or other extreme weather events).	○	○	○	○	○
Adapting the produce I grow in my community garden because of climate change impacts (warmer weather, flooding, droughts, or other extreme weather events).	○	○	○	○	○