

Message in a Bottleneck? Attitudes and Perceptions of Climate Change in the Cooperative Extension Service in the Southeastern United States

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This paper addresses factors affecting climate change perceptions and attitudes among Cooperative Extension professionals in the Southeastern United States. Extension serves as a critical link between climate researchers and stakeholders who have the capacity to directly affect climate change impacts through on-the-ground action. We used the Six Americas scale, developed by the Yale Project on Climate Change Communication and George Mason Center for Climate Change Communication, as the basis for a web-based survey of 2,758 Extension professionals in eight Southeastern states between August 2011 and March 2012. Given their role as science communicators, one might expect Extension professionals to be as concerned as climate scientists about potential climate changes. We found, however, that Extension professionals are similar to the general public and represent the full range of Six Americas categories. Factors correlated with Six Americas results included: gender, political leaning, education, state Extension program, Extension program area, role within Extension, and coastal/inland location. Our results suggest the importance of engaging Extension staff in a long-term professional development strategy that involves improved training and climate education, preparing Extension professionals to effectively communicate climate change information to farmers and forest landowners whose actions impact climate outcomes.

Keywords: Extension, Six Americas, attitudes, climate change perceptions, Southeastern U.S.

Introduction

Forests and farms are expected to be significantly affected by, and to be key factors in a U.S. response to, climate change. Forest lands have been identified as relatively low cost, high yield carbon sinks (Adams, Adams, Callaway, Chang, & McCarl, 1993; Adams, Alig,

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McCarl, Callaway, & Winnett, 1999; Nunery & Keeton, 2010; van Kooten, Eagle, Manley, & Smolak, 2004) that can be managed to maximize carbon storage as well as other environmental benefits, such as soil erosion control, biomass production to replace fossil fuel use, and improved water quality and wildlife habitat (Richards, Sampson, & Brown, 2006). Under various scenarios of carbon pricing and carbon sequestration from agricultural and forested lands, forests are expected to contribute overwhelmingly to greenhouse gas mitigation (e.g., Lee, McCarl, Gillig, & Murray, 2006; Murray, 2004). This role of forests as a carbon sink is particularly important in the Southeastern United States, where forests comprise 60% of the total land area (Martin, 2010). Farms are heavy users of energy and other inputs that impact greenhouse gas emissions, and they are likely to experience significant impacts from climate change, including more extreme weather events, changing growing conditions, and increased pest outbreaks (Howden, Soussana, Tubiello, Chhetri, Dunlop, & Meinke, 2007). As a result, farmers may have a number of opportunities both to mitigate climate change and adapt to its impacts.

Although farmers and forest landowners could play a significant role in mitigating and adapting to global warming, their robust participation is far from certain (e.g., Dickinson, Stevens, Lindsay, & Kittredge, 2012; Markowski-Lindsay et al., 2011). They would need to be motivated to mitigate current impacts, adapt to changing conditions, explore strategies to overcome challenges, and share experiences; and if they perceive climate change as a risk, they would need to be willing to support important public policy and behavior changes (Leiserowitz, 2006). Therefore, disseminating meaningful, relevant information about climate change projections can play an important role in increasing the resilience and productivity of agriculture and forestry in the foreseeable future.

Despite mounting scientific evidence linking climate change with human activities (Intergovernmental Panel on Climate Change, 2007) and the ease of access to this information for urban Americans (Kellstedt, Zahran, & Vedlitz, 2008), public opinions and attitudes about climate change continue to vary greatly and have been inconsistent over time (Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011; Weber & Stern, 2011). Inherent variability in weather and the complex and long-term nature of climate forecasting have hampered public recognition of climate change as an existential concern (Hansen, Sato, & Ruedy, 2012). Confusion over climate change persists in the American public. This is perpetuated by those in the media who often frame the issue in extremes, as either a matter of scientific debate by climate change skeptics or of doomsday certainty by climate change believers (Boykoff & Boykoff, 2004; Moser, 2010; Moser & Dilling, 2007; Weber & Stern, 2011), creating formidable obstacles to the pursuit of meaningful and lasting education programs and policy changes that address climate risks.

Public awareness and education through media and schools have become important components of efforts to translate scientific findings into public knowledge and overcome these challenges. Tracking public opinion and understanding why it shifts (Bruelle, Carmichael, & Jenkins, 2012; McCright & Dunlap, 2011; McDonald, 2009; Smith, 2010), as well as exploring how to use mass media to reach the citizenry (Center for Research on

Environmental Decisions, 2009; Pike, Doppelt, & Herr, 2010), are essential efforts contributing to the creation of effective programs that build support for actions that affect climate change in the United States (Moser, 2010). Reaching farmers and forest landowners across the region, however, requires a different approach—one involving the U.S. Cooperative Extension Service (Extension).

Described as “the world’s most successful change agency” (Rogers, 1995, p. 357), Extension is arguably the most influential institution involved with educating farmers and forest landowners in the United States. The Extension Service was authorized by the Smith-Lever Act in 1914 and is a three-way partnership between the U.S. Department of Agriculture (USDA), state land-grant universities, and county governments. Initially, its mission was to “develop practical applications for research, and instruct and provide practical demonstrations of existing and improved agricultural technologies or practices” (USDA, 2012), but today Extension is involved with both rural and urban stakeholders on a number of issues (e.g., youth and community development, food safety, wildlife management, water conservation, horticulture).

Under the Extension umbrella, land-grant university faculty members who work at the state level are known as Extension specialists, and those assigned to provide programs in counties are Extension agents. Extension’s success is partly credited to the practice of hiring county agents who are similar to and respected by their audiences (Rogers, 1995). Specialists and agents work closely with stakeholders and are highly responsive to the stakeholders’ stated needs, identifying gaps in information and other resources, developing new communication and implementation strategies, and assisting in the development of relevant solutions using the best available science (Monroe & Hochmuth, 2007). For farmers and forest landowners, Extension programs offer guidance and support to increase productivity, protect natural resources, and access valuable markets.

Because of its effectiveness and role as a direct link between scientific research and stakeholders, Extension could be a key player in an overall strategy to influence forest landowners and farmers in the U.S. to mitigate and adapt to climate change. Given their responsibility for understanding and communicating science-based research findings to members of the public, we hypothesized that Extension professionals would be at least as concerned as climate scientists about climate change issues. The effects of climate change are projected to have far-reaching impacts over the next several decades (Intergovernmental Panel on Climate Change, 2007), and Extension agents working in many different program areas (e.g., coastal issues, community development, disaster preparedness) could inform and engage the public in community-based climate discussions and education programs. Research-driven management practices, which are developed by land-grant university researchers and Extension specialists, communicated to Extension agents through materials and training, and then shared with landowners by agents, have the potential to reduce greenhouse gas emissions; maximize carbon sequestration; establish new genetic varieties; reduce the impact of climate change on the productivity of agricultural and forest systems; and reduce the carbon, nitrogen, and water footprints as climate changes (Pine Integrated

Network: Education, Mitigation, and Adaptation Project, 2012). A number of federally funded regional initiatives have specific expectations for Extension contributions to disseminate climate research findings and work with key audiences, such as forest landowners, poultry farmers, livestock ranchers, and coastal municipalities. Essential to these projects is the development of training materials and communication strategies for Extension agents that effectively convey information, outline strategies for effective stakeholder engagement, and provide programming ideas to agents, who are then able to effectively involve target audiences.

Since the 1990s, a number of studies have sought to understand people's perceptions of and attitudes about climate change, climate variability, and global warming, and the factors that contribute to these views (e.g., Borick & Rabe, 2010; Brody, Zahran, Vedlitz, & Grover, 2008; Maibach, Leiserowitz, Roser-Renouf, & Mertz, 2011; Maibach, Roser-Renouf, & Leiserowitz, 2009; McCright & Dunlap, 2011; Weber & Stern, 2011). Because perceptions of risks like global warming tend to be more strongly linked with ideological than knowledge variables (Kellstedt et al., 2008; McCright & Dunlap, 2011; O'Connor, Bord, Yarnal, & Wiefek, 2002), how and by whom information is conveyed affects how recipients interpret the information. A large body of research has also demonstrated a close association between people's beliefs and their behaviors (Ajzen, 1991, 2005; Ajzen & Fishbein, 1980); people with more pro-environmental attitudes are more likely to take action to reduce greenhouse gas emissions, for example (O'Connor et al., 2002). Although views on climate change have been studied with respect to the general public, the views of Extension professionals on this issue have yet to be addressed.

The goal of this study was to assess the climate change attitudes and perceptions of Extension professionals in the Southeastern U.S. by classifying them according to their views on the issue, identifying factors that influence these classifications, and providing information to guide material development and support Extension programs focused on climate change. Insights from this study will help Extension leaders determine how to meet the challenges and needs for training and resources that will fully engage specialists and agents across the region, with the ultimate goal of addressing potential climate change adaptation and mitigation measures among Extension's audiences.

Survey and Statistical Methods

Survey Development

In 2011–2012, we developed, pre-tested, and implemented a survey assessing Extension professionals' attitudes and perceptions about global warming in eight Southeastern states. The survey enabled us to answer the questions: How do Extension professionals in the Southeastern U.S. perceive the issue of climate change? What factors (e.g., state, role in Extension, Extension program area, demographic characteristics) may affect Extension professionals' perceptions?

To classify respondents by their views on global warming, we employed the 15-item “Six Americas” scale developed by Maibach, Leiserowitz, Roser-Renouf, Mertz, and Akerlof (2011), which reports 84% accuracy. It relies on audience segmentation analysis in a manner similar to approaches taken in marketing, public health, and political science to understand audiences and design effective communications campaigns (Maibach, Leiserowitz, Roser-Renouf, & Mertz, 2011). The scale allows researchers to characterize audiences based on their beliefs, behaviors, policy preferences, and issue engagement. Respondents are classified into six segments, or Six Americas, with different levels of belief, concern, and motivation related to global warming. These categories range from “Alarmed” and “Concerned” for respondents who are convinced about and engaged in global warming issues, to “Cautious” and “Disengaged” for respondents who are less certain and less likely to perceive global warming threats, to “Doubtful” and “Dismissive” for respondents who are unsure about global warming or are quite convinced that it is not happening.

Since the goal of our study was to help guide the development of Extension training materials and programs focused on climate change, we included questions to help understand the work and priorities of Extension professionals. In addition to the 15 questions of the Six Americas scale, we asked nine supplemental questions about global warming perceptions. Eight questions asked respondents to reflect upon the climate-related views of their target audiences. Nine questions addressed respondents’ past experience and willingness to participate in climate-related Extension programs. We included a total of 15 questions about the demographic and professional characteristics of respondents. The survey included 56 questions and was designed to take less than 20 minutes to complete.

We developed, pre-tested ($N = 32$ Extension professionals in five states), and revised the survey for online implementation with SurveyMonkey® in mid-2011. In keeping with the original Six Americas questions, we used the term “global warming” rather than another climate-related term. The literature suggests that although the terms can be interpreted in many ways, the term “global warming” is useful when trying to assess the range of perceptions and opinions around human-induced climate change (Akerlof & Maibach, 2011; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010; Villar & Krosnick, 2011; Whitmarsh, 2009).

Data Collection

We worked with State Extension Directors in each state to obtain contact information for potential respondents, which included all personnel working with the Cooperative Extension Service, and followed the Tailored Design Method (Dillman, Smyth, & Christian, 2009) for survey implementation. This approach includes a suite of repeated, personalized interactions and follow-up messages addressed to potential respondents to boost response rates (Monroe & Adams, 2012). Given the politically charged nature of the survey topic, we asked administrators and project collaborators in each state to lend their names to survey communications. Administrators were also asked to send reminder messages to increase response rates.

Data were collected from August 2011 to March 2012 in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, Texas, and Virginia. We received 2,758 responses and achieved a 67% overall response rate. Follow-up interviews by email and phone with randomly selected non-respondents ($N = 62$) indicated no serious concerns with non-response bias.

Data Analysis

Data were analyzed using the statistical software package SPSS version 20. Six Americas classifications were calculated for each respondent according to the 15-item syntax for audience segmentation analysis from the Six Americas Codebook (Maibach, Leiserowitz, Roser-Renouf, Mertz, & Akerlof, 2011). This protocol requires the creation of several composite variables and the replacement of a small number of missing item responses with mean values. Each state's respondents were treated as an independent group; replacements were done on a state-by-state basis. For the 41 survey questions added by the authors, we reviewed all "Other" responses and either coded them to appropriate existing categories or created new categories when warranted.

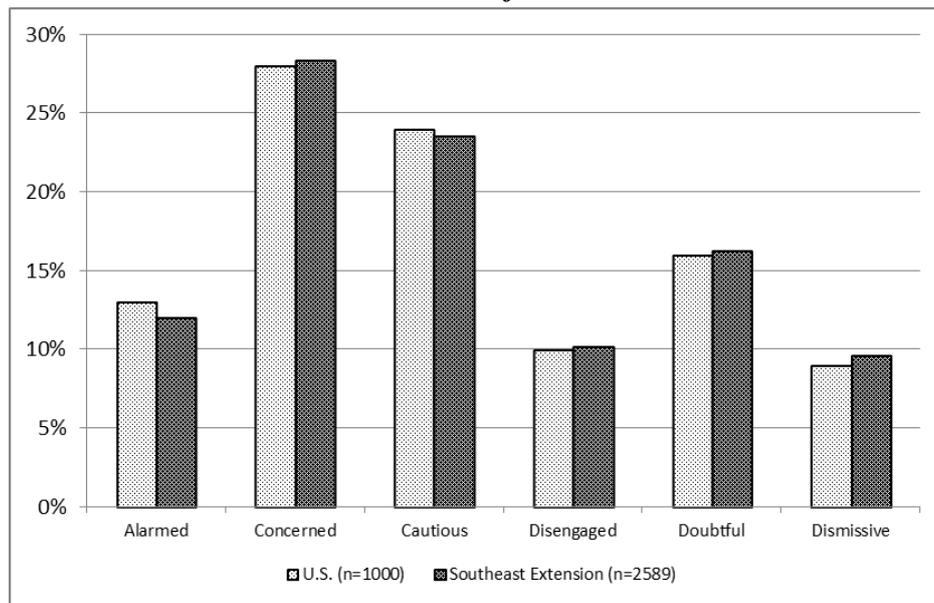
Responses from subgroups were compared using Pearson's chi-square test. When the expected frequency was less than five for more than one cell, we used Fisher's exact test to compare the subgroups (Agresti & Finlay, 1997). Categories were collapsed when subgroups were not significantly different at $p < .05$ and when collapsing seemed logical based on the context of the categories. This process was repeated for several variables of interest (e.g., political views, Extension program area). Finalized categories listed in the results were also compared to each other using Pearson's chi-square test or Fisher's exact test. All p -values provided below refer to the significance yielded in those tests.

Results

Respondents were distributed almost equally by gender (49.4% women, 50.6% men). The age group with the greatest number of respondents was 51–60 (34.8%). Over 75% of respondents had obtained at least a Master's degree, an expectation typical for promotion among Extension agents. The largest proportion of respondents identified as conservative or very conservative in their political perspective (45.6%), followed by moderates (36.8%); only 15.7% of respondents self-identified as liberal or very liberal. More than half of respondents (56.3%) were Extension agents; other respondents were distributed among administrative, specialist, and support positions within the Extension Service. We included these respondents because administrative and support staff may also provide programs; 90.3% of all respondents indicated that they provide programs. Interestingly, there was no significant difference in the Six Americas classifications between those who do and those who do not provide programs.

Respondents mirrored the national pattern of Six Americas categories (Leiserowitz et al., 2012) (Figure 1).

Figure 1. Comparison of Six Americas Categories for U.S. Sample and Southeastern U.S. Extension Professionals

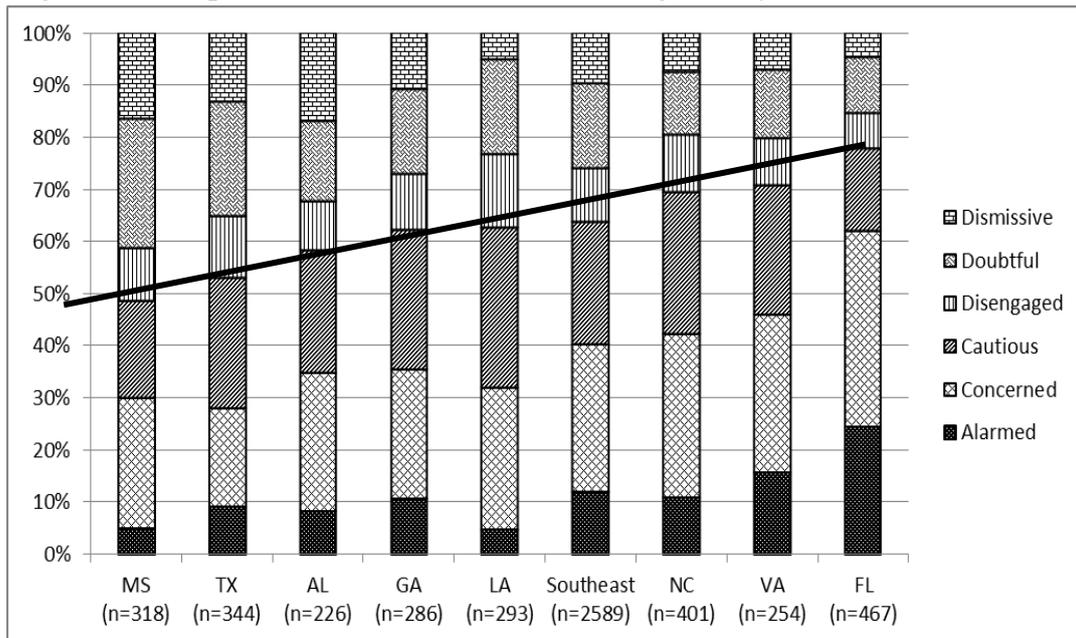


Note: U.S. sample fielded October 20 through November 16, 2012 (Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2012). Southeast Extension sample size includes only those respondents who completed enough of the Six Americas questions to be included in these analyses, not the full $N = 2,758$.

Statistical tests indicated several demographic factors that were strongly correlated with the Six Americas categories among Extension respondents, including:

- **U.S. State** (Figure 2): Florida, Virginia, and North Carolina respondents were categorized as Concerned and Alarmed more often than respondents from Georgia or the states adjacent to the Gulf of Mexico. Respondents from Florida are significantly more likely to be Alarmed or Concerned than other states ($p < .01$).
- **Gender** (Table 1): Women are more likely to be Concerned than men ($p < .01$).
- **Political Leaning** (Table 1): Over 59% of “very conservative” respondents are either Dismissive or Doubtful; more than 80% of both “liberal” and “very liberal” respondents are Alarmed or Concerned. Respondents who fell into the “moderate” category leaned toward the Alarmed/Concerned end of the scale, with over 50% of moderates categorized as Alarmed or Concerned. The Six Americas distribution is significantly different when looking across all political categories ($p < .05$).
- **Education** (Table 1): Those with education beyond a Master’s degree are more likely to be more Alarmed and less Disengaged ($p < .01$). Those with a Bachelor’s or Master’s degree are significantly more likely to be on the Dismissive/Doubtful end of the spectrum than those who have not earned a Bachelor’s degree ($p < .01$).

Figure 2. Comparison across Six Americas Categories by State



Note: The line separates respondents who were at least somewhat concerned (Alarmed, Concerned, and Cautious) from those who are at least somewhat unconcerned (Disengaged, Doubtful, and Dismissive). MS = Mississippi; TX = Texas; AL = Alabama; GA = Georgia; LA = Louisiana; NC = North Carolina; VA = Virginia; FL = Florida. The full sample of Southeastern U.S. Extension professionals is included for comparison.

In addition to the demographic characteristics of respondents, professional factors also correlate with Six Americas categories, including:

- **Program Area** (Figure 3): Extension professionals focused on agriculture tend to fall more toward the Dismissive end of the spectrum than professionals working in any other program area; those working on natural resource issues are most likely to be categorized as Alarmed ($p < .01$).
- **Role in Extension** (Table 1): Extension agents tend to be less Alarmed and more Dismissive than specialists or programming personnel working in Extension ($p < .05$).
- **Coastal Connection** (Table 1): Among those who reported the county in which they work, respondents who work in coastal counties are more likely to be Alarmed or Concerned than those who work in inland counties ($p < .01$) or serve both areas ($p < .05$).

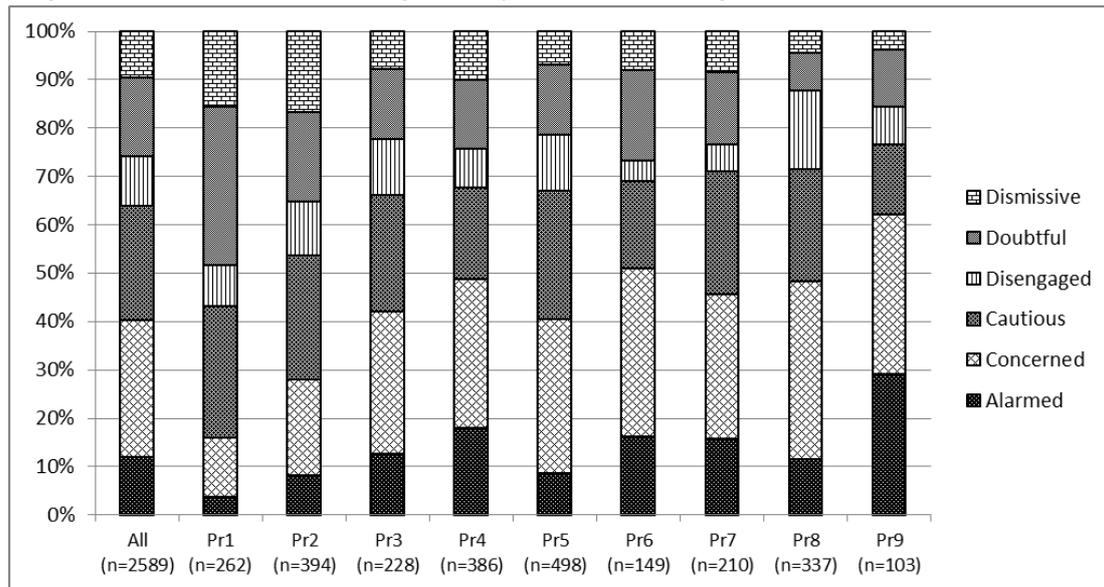
Table 1. Six America Results by Gender, Self-Reported Political Leaning, Education Level, Extension Role, and Geographic Focus of Extension Work (Coastal, Inland, Both)*

Variable Category	Total responses		Alarmed		Concerned		Cautious		Disengaged		Doubtful		Dismissive	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gender														
Female	1,253	49.4	174	13.9	439	35.0	291	23.2	143	11.4	144	11.5	62	4.9
Male	1,285	50.6	132	10.3	285	22.2	310	24.1	109	8.5	269	20.9	180	14.0
<i>Total</i>	2,538		306	12.1	724	28.5	601	23.7	252	9.9	413	16.3	242	9.5
Self-Reported Political Leaning														
Very conservative	213	8.8	8	3.8	27	12.7	35	16.4	16	7.5	63	29.6	64	30.0
Conservative	921	37.8	24	2.6	166	18.0	258	28.0	117	12.7	223	24.2	133	14.4
Moderate	915	37.6	113	12.3	352	38.5	237	25.9	85	9.3	99	10.8	29	3.2
Liberal	332	13.6	125	37.7	143	43.1	35	10.5	19	5.7	6	1.8	4	1.2
Very liberal	53	2.2	33	62.3	14	26.4	3	5.7	0	0.0	2	3.8	1	1.9
<i>Total</i>	2,434		303	12.4	702	28.6	568	23.5	237	10.0	393	16.1	231	9.5
Education Level														
Less than Bachelor's	143	5.6	13	9.1	53	37.1	34	23.8	25	17.5	13	9.1	5	3.5
Bachelor's or Master's	1,760	69.1	171	9.7	463	26.3	445	25.3	193	11.0	304	17.3	184	10.5
Beyond Master's	644	25.3	124	19.3	208	32.3	120	18.6	39	6.1	99	15.4	54	8.4
<i>Total</i>	2,547		308	12.1	724	28.4	599	23.5	257	10.1	416	16.3	243	9.5

Variable	Total Responses		Alarmed		Concerned		Cautious		Disengaged		Doubtful		Dismissive	
<i>Category</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
Role in Extension														
Agent	1,448	61.0	138	9.5	382	26.4	351	24.2	159	11.0	269	18.6	149	10.3
Faculty/ Specialist (progs)	545	23.0	93	17.1	166	30.5	104	19.1	41	7.5	82	15.0	59	10.8
Admin	165	7.0	20	12.1	43	26.1	47	28.5	15	9.1	28	17.0	12	7.3
Program/ Support	190	8.0	22	11.6	66	34.7	45	23.7	24	12.6	20	10.5	13	6.8
Faculty/ Specialist (no progs)	24	1.0	7	29.2	7	29.2	5	20.8	0	0.0	3	12.5	2	8.3
<i>Total</i>	<i>2,372</i>		<i>280</i>	<i>11.8</i>	<i>664</i>	<i>28.0</i>	<i>552</i>	<i>23.3</i>	<i>239</i>	<i>10.1</i>	<i>402</i>	<i>16.9</i>	<i>235</i>	<i>9.9</i>
Geographic Focus														
Coastal	226	15.2	47	20.8	91	40.3	45	19.9	15	6.6	17	7.5	11	4.9
Inland	982	65.9	131	13.3	299	30.4	245	24.9	102	10.4	135	13.7	70	7.1
Both	283	19.0	50	17.7	93	32.9	46	16.3	23	8.1	44	15.5	27	9.5
<i>Total</i>	<i>1,491</i>		<i>228</i>	<i>15.3</i>	<i>483</i>	<i>32.4</i>	<i>336</i>	<i>22.5</i>	<i>140</i>	<i>9.4</i>	<i>196</i>	<i>13.1</i>	<i>108</i>	<i>7.2</i>

* Row percentages calculated for each response option (e.g., percent of "Alarmed" female respondents)

Figure 3. Six Americas Categories by Extension Program Areas



Note: Full sample of Southeastern U.S. Extension professionals included for comparison.

Program areas grouped by results of Pearson chi-squared tests, as follows:

- | | |
|--|---|
| 10 All Entire study population | 6 Marine, forestry, wildlife, and aquaculture programs |
| 11 1 Agriculture (Livestock programs) | 7 Community development and general family and community science programs |
| 12 2 Agriculture (Crops and business management) | 8 Family nutrition and health |
| 13 3 Program support staff | 9 Freshwater, environmental education, and natural resources programs |
| 14 4 Horticulture and pest management programs | |
| 15 5 4-H leadership and other programs | |

Discussion

Farmers and forest landowners have the potential and the opportunity to take critical climate mitigation and adaptation actions, provided that these landowners receive climate-related information in a way that is both understandable and palatable. On most issues, Extension provides this service and brings science-based information to those who can effect change through their management practices. We hypothesized that Extension professionals, who are responsible for understanding and communicating science-based research findings to members of the public, would be at least as concerned as climate scientists about climate change issues. Yet our findings point to an Extension Service that is similar to the U.S. public in its climate change views, representing a broad distribution of Extension professionals along the Six Americas spectrum (Leiserowitz et al., 2012). This presents a challenge and potential bottleneck in climate change communication to farmers and forest landowners. In particular, more than half of the agricultural Extension professionals who responded were classified as Dismissive, Doubtful, or Disengaged.

The trends observed in this study are likely due in part to Extension’s practice of hiring county agents who are similar to their audiences. This has created a system of field staff who

may reflect the skepticism and political perspectives of the people they serve. This finding is consistent with studies of other populations on political orientation and climate change perceptions, with more conservative political views correlated with more dismissive perspectives (e.g., Davidson & Haan, 2012; Hamilton, 2011; McCright, 2011; Zia & Todd, 2010). Our results are also consistent with studies on the role of gender and climate change views, with men less convinced about climate problems than women (Davidson & Haan, 2012; McCright, 2010; McCright & Dunlap, 2011) and more likely to report conservative political leanings than women (Davidson & Haan, 2012).

These demographic factors also influence the differences we observed among respondents working in different Extension program areas. Agriculture agents, for example, were more Doubtful and Dismissive than all other agents; they are also more often male and conservative. Natural resource Extension respondents are less likely to be Doubtful and Dismissive, perhaps because these respondents are also less conservative politically and more likely to have Ph.D. degrees than respondents working specifically in agriculture.

Within the study region, we observed considerable variation in perceptions across the eight states. Florida emerged as the state with the most people categorized as Alarmed and Concerned, contrasting with Mississippi and Alabama, for example, on the opposite end of the spectrum. Our data support results from an earlier survey, which found that most Florida residents were convinced that global warming is happening now, and that climate change should be addressed by key leaders (Leiserowitz & Broad, 2008). Florida has an expansive, populated coastline near sea level (Titus & Richman, 2001), making it likely that more respondents are engaging with the issue of sea-level rise directly.

Two additional factors may play a role. First, the Florida Extension program has developed an active climate program; it hired the first climate specialist in the nation (Breuer, Fraisse, & Cabrera, 2010) and is home to the Southeast Climate Consortium (SECC), whose mission is “to use advances in climate sciences, including improved capabilities to forecast seasonal climate and long-term climate change, to provide scientifically sound information and decision support tools for agricultural ecosystems, forests and other terrestrial ecosystems, and coastal ecosystems of the Southeastern USA” (SECC, 2008, para. 1). Their practice of involving researchers with agents may be a useful strategy for other programs. Second, a higher proportion of university-based Extension specialists responded to the survey in Florida than elsewhere. These respondents possess Ph.D. degrees and are unencumbered by the local politics that county agents may face.

Extension works well when stakeholders seek answers to perplexing problems; it is challenged, however, when audiences, as well as agents, must first become convinced that there is a problem. Extension hiring practices, credited for Extension’s success (Rogers, 1995), can also hinder its effectiveness when issues are not perceived to be of vital importance to stakeholder audiences or the Extension agents themselves. Agents may need training and support to communicate information that they do not personally believe. This may then contribute to a push-pull between scientists, Extension agents, and critical

stakeholders—such as farmers and landowners—and add to the difficulty of communicating climate-related issues. Just as doctors' recommendations significantly influence their patients' vaccination rates (Bovier, Chamot, Gallachi, & Loutan, 2001), landowners may be similarly unlikely to take important actions to mitigate or adapt to climate-related changes if trusted Extension agents do not support or encourage these activities.

Our data suggest that a voluntary regional training program for Extension professionals across the Southeastern U.S. in climate change programming will not generate enthusiasm across the full spectrum of states and program areas. Those already convinced that this is an important topic may be eager to use climate-related educational resources, but these Alarmed and Concerned respondents represent only 40% of the full Extension workforce and few of those associated with agriculture. Agriculture and horticulture professionals are not likely to be in this first wave of enthusiastic participants, yet their audiences will be among the most impacted by drought, pests, wildfire, and other potential outcomes of climate change. Therefore, it is important to consider how to best develop long-term strategies to understand, cultivate leadership, and provide support for the Cautious, Doubtful, Disengaged, and Dismissive Extension professionals in these program areas.

Numerous strategies hold potential for addressing these challenges. Extension leadership at the state level might express support for climate programming and actively reward the efforts Extension professionals make to learn about, adopt, and adapt climate programs. Partnerships with climatologists and other scientists who are already conducting climate education may help legitimize and support these efforts. An education process internal to the Cooperative Extension Service that changes the way climate issues are discussed should also be considered. In the short-term, such a process might ignore specific climate science explanations and focus instead on the impacts that even climate change doubters and deniers also care about—such as weather extremes, seasonal climactic trends, and energy efficiency (Center for Research on Environmental Decisions, 2009). Extension professional development programs can frame issues to make clear the immediate value to their program areas, which may also make information more meaningful (Nisbet, 2009; Pike et al., 2010). For example, speaking about weather forecasting and the potential impacts of more dramatic changes in precipitation may resonate with agricultural Extension agents. Launching phenology programs or working with growers who have observed recent changes may help people seek strategies to adapt, regardless of the cause.

Several Extension professionals made reference to the potential value of reframing climate-related issues. One respondent, who works on forestry, wood products, and wildlife issues in Florida remarked:

I believe climate is changing and I'm pretty certain human activities are a big catalyst to that but I don't believe we will address this issue within the context of "global warming" or even "climate change." We should be addressing these issues in terms of concrete elements we are already engaged in—energy, efficiency and economics. All of those point to cleaner and renewable sources

of energy and reduced greenhouse gases are an important by-product of that. I believe we are trying too hard to paddle upstream tackling this issue directly with most audiences, especially rural/agrarian.

An Extension agent focused on livestock and commercial horticulture from Virginia agreed about the potential benefits of reframing climate-related issues:

Improving fuel efficiency in our farm operations makes good economic sense, no-till farming and building soil carbon makes good long-term productivity sense, incorporating timber management and timber establishment into our land use management makes good economic and environmental sense, helping consumers make smart choices for their health and nutrition can have direct and indirect impact on the environment. These are all solid tried-and-true topics where Extension has excelled and where there is still a huge need.

While reframing climate-related communications within Extension may yield positive results in the short term, it may also be important to develop longer-term Extension programming strategies to facilitate greater integration of research on climate change impacts to crops, economies, and communities. Fortunately, providing information to Extension professionals is not limited to a short sound bite, but can occur over several years through in-service training. Since Extension programs are developed to encourage specific behaviors, a useful first step might be to separate adaptation strategies from mitigation, because they can depend on different assumptions and perceptions. Farmers and forest landowners may be willing to adapt to expected drought by altering the time of planting or the seed source without understanding why (Krantz, Monroe, & Bartels, 2012), and Doubtful agriculture agents may be the perfect people to deliver this message. In contrast, agents and landowners who are concerned about climate may feel a stewardship responsibility to sequester carbon or alter their management strategies to mitigate the effects of increased atmospheric carbon. These two groups will be interested in different types of climate programs and messages.

A comprehensive strategy is required to address climate change issues across an Extension program. This should involve Extension agents and Extension state specialists working side-by-side with research faculty members (e.g., climatologists, research agronomists, ecologists) in climate education training or workshops for farmers and landowners. Research faculty can provide in-depth information to farmers, if requested, during workshops. Agents also need skills in communicating information to respond helpfully to questions from audience members who fall in any of the Six Americas categories. Programs can gain momentum with people who are already seeking information about climate change and expand to include more skeptical agents. Finally, it is important that administrative leadership support faculty and agents who enter these challenging waters. It will invariably take strategic thinking for Extension to maximize its impacts on climate adaptation and mitigation in the long term. This strategic vision is critical if Extension is to serve its role as a liaison between cutting-edge climate research and the implementation of adaptation and mitigation strategies. The people affected by Extension's programs, particularly farmers and forest landowners, have an

opportunity to affect the climate. If the Extension system is ineffective in reaching its own members and in turn fails to reach the audiences it serves, this could lead to less carbon sequestration, leaving all citizens more vulnerable to the effects of climate change. Addressing potential bottlenecks in this communication flow is important not only for Extension audiences who are the immediate consumers of climate adaptation and mitigation information, but for all citizens affected by the decisions made by Extension audiences that have the potential to impact our shared future.

Conclusion

This study applied the Six Americas scale to assess the climate-related perceptions of Extension professionals in the Southeastern United States. Extension is an extremely important change agency with the potential to contribute to the dissemination of climate adaptation and mitigation strategies among key audiences. Results revealed that within this region, the distribution of Extension professionals across the Six Americas resembles that of the U.S. public. Several demographic variables, including gender, education, and political leaning, correlate with how Extension professionals perceive climate change. Professional characteristics of respondents are also correlated to these perceptions, with agricultural agents more likely to fall into the Doubtful and Dismissive categories than agents in all other program areas, and state specialists more likely to be Alarmed and Concerned about climate issues than Extension agents in the field.

Extension professionals are essential partners in addressing climate change mitigation and adaptation in all of our communities, especially rural areas where Extension agents are well respected by their clientele. The results of this study should help states in the Southeastern U.S. create effective programs and establish priorities for training; however, further exploration of the perceived barriers, misconceptions, and opinions within Extension, particularly among those less likely to agree with climatologists, is important future research. Similar studies in different regions of the U.S. could provide valuable insights about how climate-related issues can be customized and communicated at a regional scale.

Research might also provide valuable insights about how message framing impacts the effectiveness of climate programming and generate data about the best ways to introduce climate messages, so that Extension professionals across the Six Americas categories become more skilled in communicating this important topic. Framing issues to avoid the term “climate change” while referencing its observable impacts could be an immediate part of a long-term approach to changing perceptions within Extension. Our results suggest that a comprehensive climate communication strategy must not only engage climate change believers; it should also involve strategies that engage those who are skeptical about climate change to reach all audiences who can benefit from this information.

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