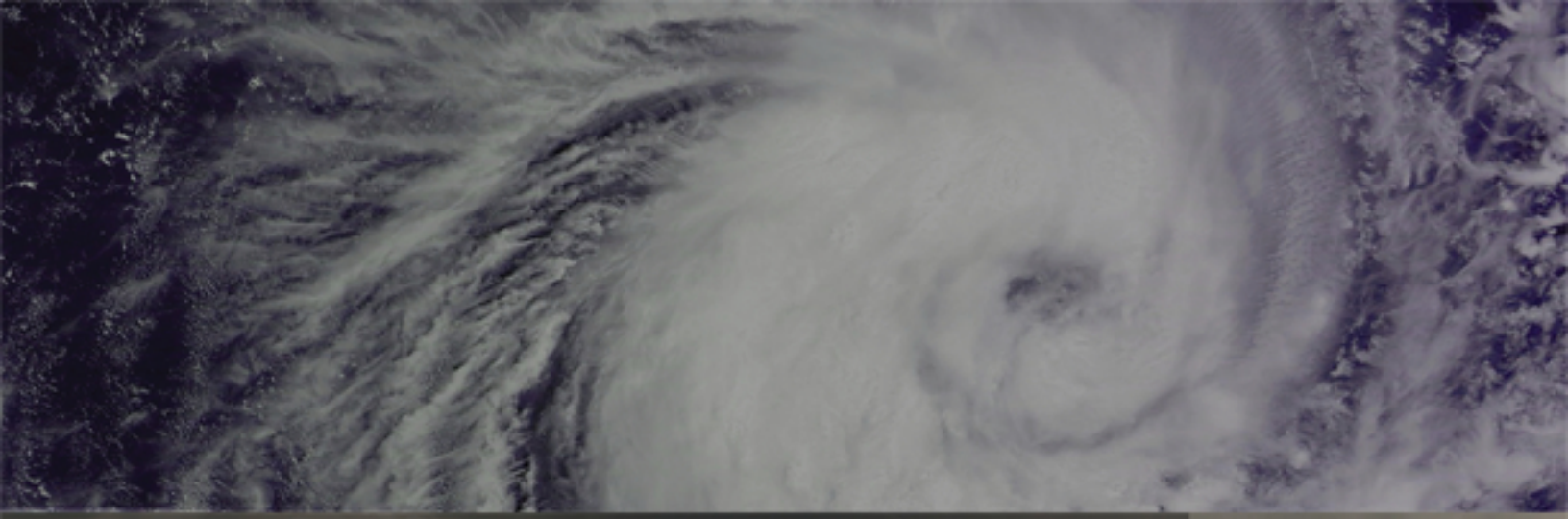
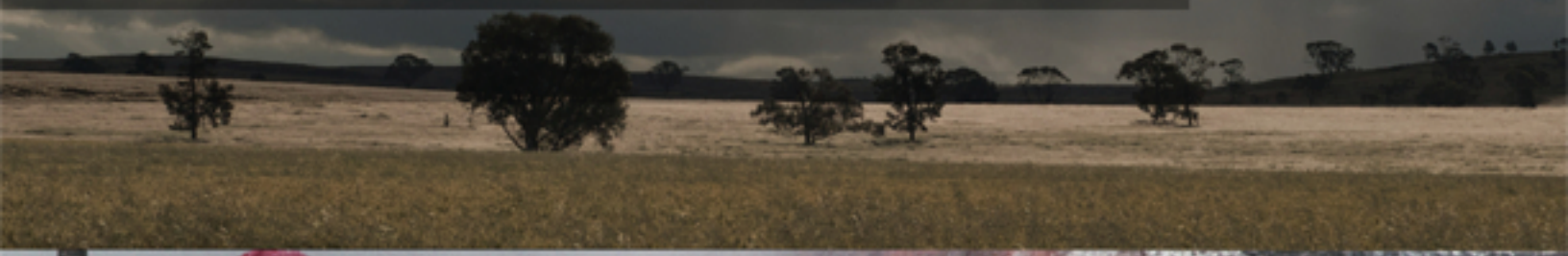


South Central U.S. Hazard and Climate Change Planning Assessment



SCIPP
Southern Climate Impacts Planning Program

University of Oklahoma
Louisiana State University

[This page intentionally left blank.]

South Central U.S. Hazard and Climate Change Planning Assessment

Southern Climate Impacts Planning Program
University of Oklahoma
Louisiana State University

Rachel Riley, Renee Edwards, Lynne Carter, Mark Shafer, and Margret Boone

September 2013

Suggested Citation: Riley, R., R. Edwards, L. Carter, M. Shafer, and M. Boone, 2013: South Central U.S. Hazard and Climate Change Planning Assessment. Southern Climate Impacts Planning Program, 55 pp. [Available online at http://www.southernclimate.org/publications/Hazard_Planning_Assessment.pdf].

THE SOUTHERN CLIMATE IMPACTS PLANNING PROGRAM

The Southern Climate Impacts Planning Program (SCIPP) is a climate hazards and research program whose mission is to increase our region's resiliency and level of preparedness for weather extremes. The area we serve includes the 6-state region of Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. The South experiences among the nation's most extensive collection of climate-related hazards such as severe storms, floods, droughts, hurricanes, storm surges, heat waves, wildfires, and winter storms. Many southern states rank at or near the top of the lists in disaster declarations and billion dollar disasters.

SCIPP research is conducted through active engagement and partnership with a community of regional, state, and local stakeholder groups. SCIPP combines the expertise of climate scientists, meteorologists, geographers, and social scientists with the experiences of decision makers and planners through workshops, meetings, interviews, and surveys. The goal of the two-way interaction is to allow a transfer of climate science and information to decision makers while likewise allowing decision makers the opportunity to reveal their challenges, concerns, and needs for information.

SCIPP is a Regional Integrated Sciences and Assessments (RISA) team housed at the University of Oklahoma and Louisiana State University (Figure 1). It is supported by the National Oceanic and Atmospheric Administration (NOAA) Climate Program Office. The RISA program funds interdisciplinary teams to conduct research, develop experimental products, and provide innovative services to support decision makers with a range of climate-related challenges related to short-term extreme weather events and long-term climate adaptation. SCIPP strives to continue the successful model developed by other RISA teams across the United States in performing application-based climate research that actively engages participation, interaction and feedback from a diverse community of stakeholders.

Figure 1: SCIPP region. SCIPP is housed at the University of Oklahoma and Louisiana State University.

EXECUTIVE SUMMARY

The south central U.S. states of Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas are among the most hazard-prone in the country. The region experiences hurricanes, storm surges, droughts, wildfires, flash floods, tornadoes, hail, ice storms, and more. In light of the impact of these hazards and the importance of planning for them, we sought to better understand local and regional hazard planning across the Southern Climate Impacts Planning Program (SCIPP) region.

An online survey was used to assess 1) hazard planning, 2) planning for climate change, and 3) information use and applications across the region. Initially administered in 2009 when SCIPP was first established (see Hocker and Carter 2010), the survey was administered again in early 2013 to determine whether changes have occurred since the first iteration. It was sent to decision makers working at governmental and non-governmental organizations at various levels throughout the SCIPP region that were thought to be involved in weather and climate hazard management, preparedness, or planning.

Survey Demographics

The respondents were fairly well dispersed throughout the SCIPP region with a higher concentration near urban population centers. The respondents were more evenly distributed across the six states in the current survey than in 2009. The mean age of the respondents was 49.7 years. Seventy-two percent were male, slightly fewer than in 2009 (76%). The vast majority were Caucasian and well educated.

Local (49.7%) and state (30.0%) government were the most predominantly represented types of agencies or organizations. About 33% of the respondents were emergency managers and 19.5% were planners. The rest worked in a variety of positions such as but not limited to extension, administration, or environmentally-related.

Hazard Planning

Over three quarters of the survey respondents (n = 269, 78.7%) were involved in hazard planning, slightly fewer than the 84.4% in 2009. Most of these were involved in hazard planning at the county/parish or city/community level. On average, 3.32 staff shared hazard planning responsibilities in their departments.

The respondents were asked to rate how important it is for them to plan for 14 weather and climate hazards on a scale of 1 "not important at all" to 5 "critically important." The hazards were then ranked by their mean rating. Across the region, floods ranked the highest (M = 4.17) and were followed closely by tornadoes (M = 4.13). In 2009, tornadoes slightly edged out floods. A significant change was evident by how drought was ranked: 8th in 2009 and 3rd in 2013. Lightning, which ranked 3rd in 2009, slipped to 8th in 2013. Storm surge and inundation, two coastal hazards, ranked 12th and 13th in both iterations among all respondents.

The mean planning importance ratings were also computed by state. Not surprisingly, decision makers in different states were concerned about different hazards. For example, hurricane ranked in the top 3 in both Louisiana and Mississippi. Surprisingly, neither hurricane, inundation nor storm surge ranked in Texas' top 5. This was due, in part, to the fact that a large portion of the Texas respondents were located far from the coast. Flood ranked the highest in Arkansas and Tennessee, and the only hazard ranked in the top 5 for all states was tornado. Drought was only ranked in the top 5 in 2009 for one state, Texas, but ranked in the top 5 in four states in this round.

In terms of the types of hazard plans the respondents' agencies had, multi-hazard/all hazards plans were the most common; 73.8% of respondents cited having one. At least half of the respondents' organizations had a mitigation plan, response plan, or emergency evacuation plan of some kind. In terms of the specific hazards for which the respondents' agencies or organizations planned, floods were most commonly cited followed by tornadoes and severe winter storms. In 2009, the top 3 were tornadoes, floods, and wildfires.

The respondents were asked several questions about the local, regional or state, federal, and non-governmental groups with whom they interact in regards to hazard planning. The local groups with whom the respondents most commonly interacted were county/parish commissioners or township officials (77.4%), public safety agencies (72.9%), and public works (71.4%). For regional or state groups, respondents interacted most commonly with their state department of emergency management (79.0%). The Federal Emergency Management Agency (82.6%) was the federal group with whom the respondents most commonly interacted. In terms of non-governmental groups, the vast majority interacted with the American Red Cross (81.3%).

The respondents were also asked which of seven challenges and limitations, if any, they experience in developing hazard plans for their area of responsibility. The most prominent challenges were "limited or no funds" and "limited or no staff available to support hazard planning", with slightly more respondents selecting them in 2009. "Higher work priorities in other areas" remained the third most common challenge, but 9.1% more respondents selected it in 2013 than in 2009.

Planning for Climate Change

Climate change may exacerbate some of the hazards faced by the decision makers. Therefore, we asked several questions about whether and how the respondents incorporate climate change into their planning. First, we introduced the concept and gathered data about their views on climate change. A majority said "Yes" (n=152, 56.7%), there is solid evidence that the average temperature on Earth has been getting warmer over the past few decades, while 27.2% (n=73) said "No" and 16.0% (n=43) said "Don't Know". As for the reasoning behind the warming, 42.0% (n = 63) said "mostly because of human activity, such as burning fossil fuels" whereas 29.3% (n=44) said "mostly because of natural patterns in the Earth's environment" and 28.6% (n = 43) said "don't know". Almost 90% (n=174) said climate change is at least a "somewhat serious" problem.

In terms of how well informed the respondents felt they were about climate change on a scale of 1 "not at all informed" to 5 "very well informed", the average of the sample was between "somewhat informed" and "well informed" (M=3.52). The most commonly chosen statement was "somewhat informed" (n=128, 54.0%).

The respondents were also asked whether they have ever considered including climate change in the hazard plan for their area of responsibility. About one-third said "yes" and 69.7% said "no." To find out more information on the reasoning behind their response, respondents were asked about barriers to incorporating climate change into planning activities. A majority said financial constraints (68.0%), higher work priorities (61.0%), lack of community or political interest (56.4%), and staff (55.6%) constraints were barriers. Three of these were also among the top four barriers in 2009.

Another question asked the respondents to rate their level of concern with several climate changes that are projected to occur on a scale of 1 "not at all concerned" to 5 "extremely concerned". The changes about which the respondents were most concerned included "more intense droughts" (M = 3.82), "more intense floods" (M = 3.74), and "changes to rainfall patterns/timing" (M = 3.66). The respondents were between "somewhat" and "moderately concerned" about seven of the nine projected changes.

The three most critical needs for including climate change in hazard planning were "more climate information that is applicable to my particular area," "information pertaining to future anticipated climate hazards," and "instruction on where to find trustworthy climate information." These were the most commonly selected needs in 2009 as well.

Information Use and Applications

For climate information to be most useful to decision makers it should be provided on the temporal and spatial scale(s) that are of interest to them. In this study, 62.1% of the respondents' maximum planning timescale was 5 years or less. Only 4.7% planned for greater than 50 years in the future. About 80% most commonly planned out to 5 years or less and only 1.3% commonly planned on a timescale greater than 50 years. The most common spatial scale of interest was "regional within a state" (34.4%) followed by "county scale" (22.4%). Another important component of climate change data is how it is analyzed and displayed. "Changes in extremes" was selected as most useful by 51.5% of respondents, but "changes in average trends" was a close second; 49.1% of respondents selected it. Only 22.8% of respondents chose "changes in the distribution of a variable".

In order to best serve decision makers in the SCIPP region, we were interested in the types of engagement opportunities that are most useful to them. Respondents rated "hands-on training on how to use information and/or tools in real-life settings" as the most useful (M = 3.96) followed by "routine workshops where presenters illustrate the use of information and tools in real-life settings" (M = 3.81) and "online tutorials on how to use information tools and products" (M = 3.63).

INTRODUCTION

The states in the region of the Southern Climate Impacts Planning Program (SCIPP), Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas, are among the most hazard-prone in the country (Table 1). The region experiences hurricanes, storm surges, droughts, wildfires, flash floods, tornadoes, hail, ice storms, and more. Planning for and mitigating the impact of these hazards is an important obligation for many agencies and organizations across the region, and for good reason. On average, society is saved $4 for every $1 the Federal Emergency Management Agency spends on hazard mitigation (National Institute of Building Sciences 2005). Furthermore, Burby (2005) found that for the period of 1994 to 2000, insured losses to residential property would have been reduced by 0.52% if all states in the country required local comprehensive plans and an additional 0.47% if natural hazards were considered in the local plans. Natural hazards are costly, but anticipating and planning for them can benefit communities.

Table 1: FEMA disaster declarations through May 7, 2013. SCIPP states are highlighted in green. FEMA disaster declarations include hazards such as severe storms, hurricanes, severe ice storms, fires, floods, snow, tornadoes, coastal storms, and freezes. Drought is not represented in FEMA data since it is under the auspices of the U.S. Department of Agriculture.

Rank	State	# of Disaster Declarations, 1953-2013
1	Texas	86
2	California	78
3	Oklahoma	73
4	New York	67
5	Florida	65
6	Louisiana	60
7	Alabama	57
8	Kentucky	56
9	Arkansas	54
10	Missouri	53
11	Mississippi	52
12	Illinois	51
12	Tennessee	51

Based on the importance of hazard planning and preparing for disasters, the goal of this study was to better understand local and regional hazard planning across the SCIPP region. The hazard planning community involves a dense network of decision making entities that provide an excellent resource of stakeholders with valuable insight. Due to this community's role in planning for hazards, it was important to involve them in the study.

DEVELOPMENT AND DISTRIBUTION OF THE SURVEY

An online survey was disseminated to assess 1) hazard planning, 2) planning for climate change, and 3) information use and applications across the region (see the Appendix for the full list of questions). Hazard planning represented the first major survey topic and was included to obtain key information on hazard perceptions and how these perceptions vary geographically. Next, climate change and related planning were included for the purpose of quantifying perceptions of climate change and determining relevant planning challenges and needs. The final section on information use and applications gauged the types of information sources used in hazard planning, decision contexts and information needs.

Initially administered in 2009 when SCIPP was first established (see Hocker and Carter 2010), the survey was revised in 2012 through an iterative internal review and administered in early 2013. This assessment serves as a guide for SCIPP engagement and research efforts while also serving as a record of decision maker perceptions and needs throughout time. The 48-question survey was hosted by SurveyMonkey (www.surveymonkey.com) and approved by the University of Oklahoma Institutional Review Board. Participation was voluntary and anonymous. Following the survey, each respondent was routed to an external website where they were given an option to provide contact information for the purposes of obtaining the results and/or participating in future work with SCIPP.

The survey was sent to decision makers working at governmental and non-governmental organizations at various levels throughout the SCIPP region that were thought to be involved in weather and climate hazard management, preparedness or planning, or were environmental personnel. The decision makers included but were not limited to emergency management officials, city officials, regional planning districts, councils of government, public works specialists, city planners, water managers, agricultural extension agents, and environmental engineers. Survey invitations were sent to 1,700 contacts via email, some of which had received the 2009 invitation (in the cases where a respondent was no longer in the position, attempts were made to locate contact information for their replacement) and some of whom were known through previous work. About 160 emails were returned as undeliverable and were not included in the calculation of the response rate. Although we attempted to survey as many of the same 2009 contacts as possible, anonymity limits us from knowing how comparable the samples are. The response rate for this survey was 22% and is unknown for 2009. This rate is comparable to other external email surveys administered by academic institutions (Sheehan 2001).

ANALYSIS

IBM SPSS Statistics 21 and Microsoft Excel 2007 were used to analyze the data. Although some questions were revised between the 2009 and 2013 iterations, a comparison between the two

datasets is made in many instances. For the complete 2009 results, see Hocker and Carter (2010). In cases where the question wording changed significantly between 2009 and the current survey, only a qualitative comparison was made.

DEMOGRAPHICS

Three hundred forty-two people responded to this survey; 278 did in 2009. We asked how many respondents had previously worked with SCIPP (a question that was irrelevant in 2009). Only 18.6% (n = 45) of the 242 respondents who answered the question had, which highlighted the survey as an opportunity to reach out to people with whom we have not yet engaged. To find out more, we asked how they had been involved with SCIPP and how the information they had obtained has been used. While the sample size was small, figure 2 shows that the most common involvement included "participating in or attending an in-person workshop or meeting" (n = 23) or "using information or a tool on the SCIPP website" (n = 20). "Background information on a topic" (n = 30) was the most common way information was used (Figure 3).

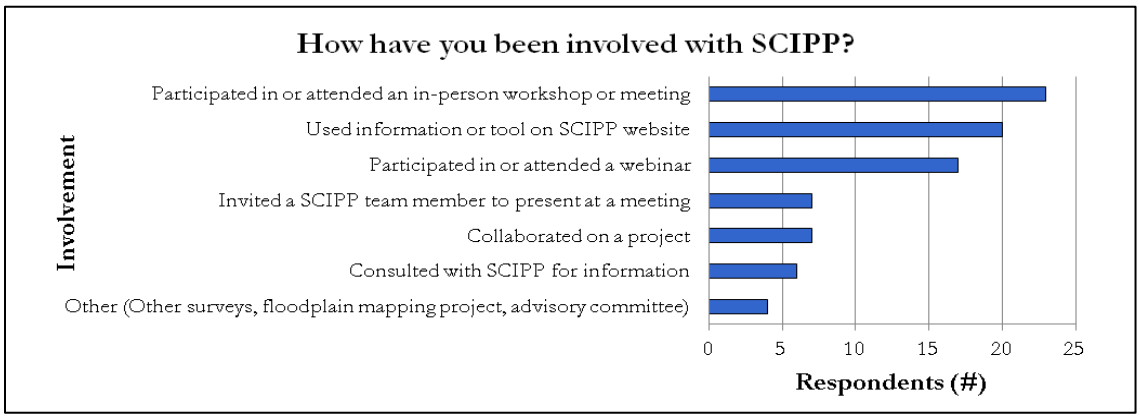


Figure 2: Responses to the question, "If you have worked with SCIPP before, how have you been involved? Check all that apply." N = 42.

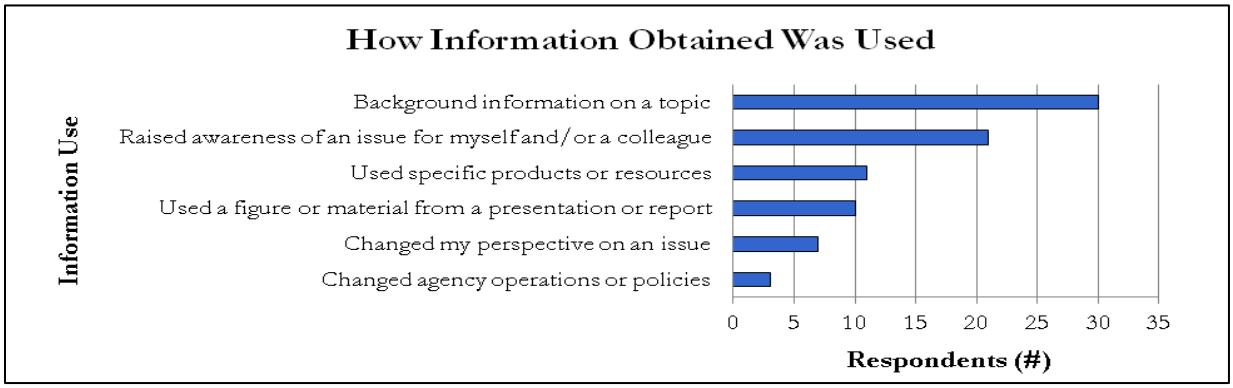


Figure 3: Responses to the question, "If you have worked with or attended a meeting or webinar that was hosted by SCIPP, please mark how the information you obtained was used. Check all that apply." N = 40.

The ages of the respondents ranged from 25 to 82 years and 49.7 years was the mean. About seventy-two percent were male, slightly fewer than in 2009 (Table 2). The vast majority were Caucasian (2013, 90.0%; 2009, 92.3%) and well educated: 76.9% had at least a bachelor's degree; 58.6% of the sample did in 2009.

Table 2: Gender of respondents.

Gender	2013 (%)	2009 (%)
Males	71.9	76.0
Females	28.1	24.0

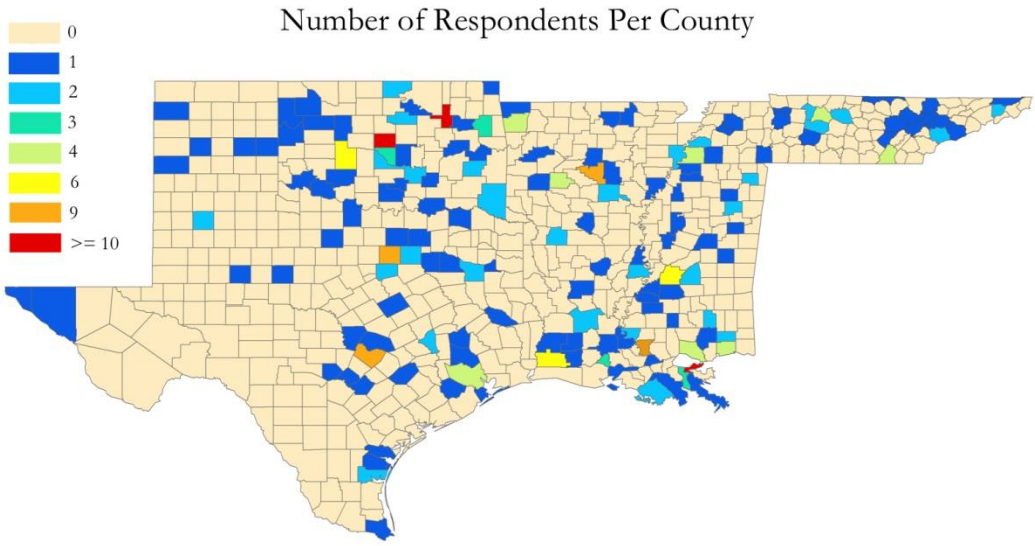


Figure 4: Number of respondents per county. Note that the county boundaries do not necessarily portray the respondent's area of responsibility. N = 342.

Respondents were located in a variety of areas, with large urban centers such as Austin, Dallas, Oklahoma City, and New Orleans accounting for a high concentration of them (Figure 4). Texas (n = 72, 23.1%), Oklahoma (n = 66, 21.2%) and Louisiana (n = 57, 18.3%) had the highest number of respondents, followed by Tennessee (n = 44, 14.1%), Mississippi (n = 38, 12.2%) and Arkansas (n = 34, 10.9%). The respondents were more evenly distributed across the six states in this round than the previous survey.

While figure 4 shows that many respondents were located in urban centers, figure 5 shows that the respondents' jurisdictions varied in size, supporting the notion that the assessment is fairly representative of the SCIPP region.

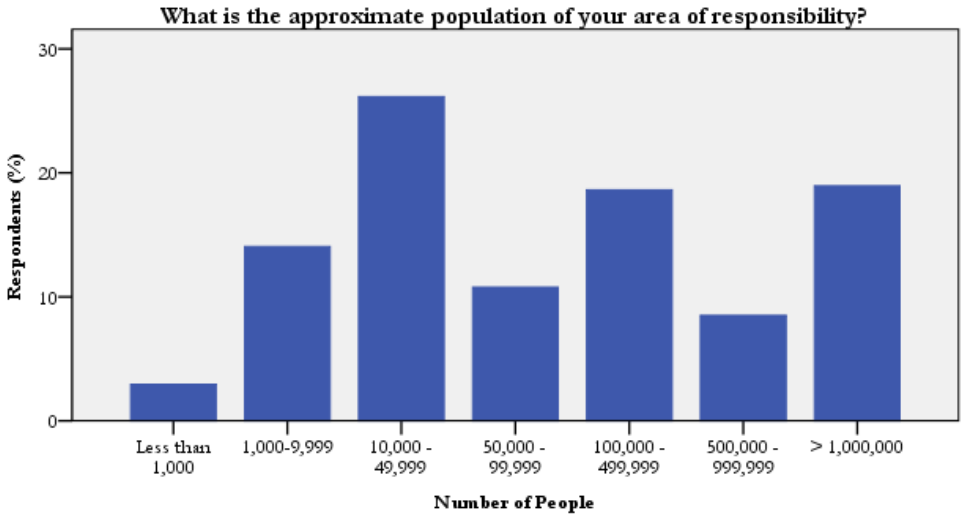


Figure 5: Approximate population of the respondents' area of responsibility.

In terms of the type of the agencies and organizations for which the respondents worked, local (49.7%) and state (30.0%) government were most predominant (Figure 6).

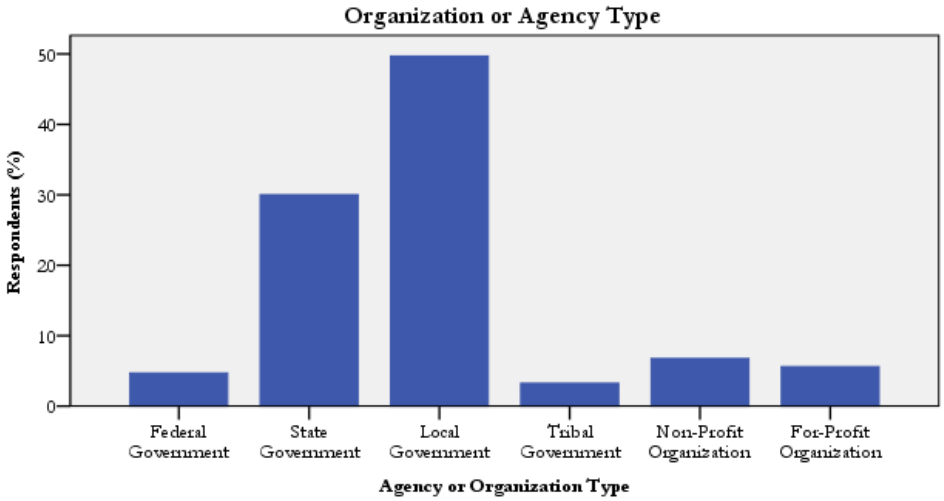


Figure 6: Type of organization or agency for which the respondents' worked.

We contacted emergency management officials, city planners, water managers, and agricultural extension agents for the survey but needed to know the make-up of the respondents more clearly. Therefore, we asked about the position they held in their agency or organization. Just over half were emergency managers and planners (Table 3). Other prominent categories included extension agents, administrators and environmental specialists.

Table 3: Position held in the respondents' organization or agency and whether they were involved in hazard planning. N = 338.

Position	% of Total Respondents	% of Total Involved in Hazard Planning
Emergency Manager	32.5	31.4
Planner	19.5	13.3
Extension Agent	10.4	5.3
Administrator	8.6	6.8
Environmental Specialist	7.1	6.2
Elected Official (e.g., Mayor, Commissioner, City Council Member)	4.4	3.8
Engineer	4.1	3.0
Education	2.4	0.9
Earth Scientist	2.1	1.8
Consultant	2.1	1.5
Forester	1.8	0.6
Police or Fire Department	1.2	1.2
Health Official	0.6	0.6
GIS Specialist	0.6	0.3
Developer	0.6	0.6
Other	2.1	1.5
Total	**100.0**	**78.7**

HAZARD PLANNING

One focus of this assessment was to understand hazard planning practices across the SCIPP region. SCIPP's mission is to increase the region's resiliency and preparedness for weather and climate extremes, and one way of doing so is to promote and facilitate planning for those hazards.

Hazard Planning Demographics

Although we targeted decision makers who were involved in hazard planning, we could not assume that everyone we contacted was in fact involved in hazard planning. Over three quarters of the respondents (n = 269, 78.7%) were involved in hazard planning, slightly fewer than the 84.4% in 2009. This statistic is important to keep in mind while interpreting the survey results. The 70% response rate for many of the later questions in the survey is fairly consistent with the overall percent of respondents involved in hazard planning. With that in mind, one may wonder why we did not exclude those not involved in hazard planning from the rest of the survey. The reason is that even those not directly involved may have insight that was informative to the other questions.

Table 3 shows that hazard planning responsibilities were covered by decision makers working in a variety of positions, although emergency managers and planners made up a large portion of the sample. Further, the most common levels at which respondents were involved in hazard planning were county/parish and city/community, followed by state and multi-county/parish (Figure 7). The respondents represented a strong local presence.

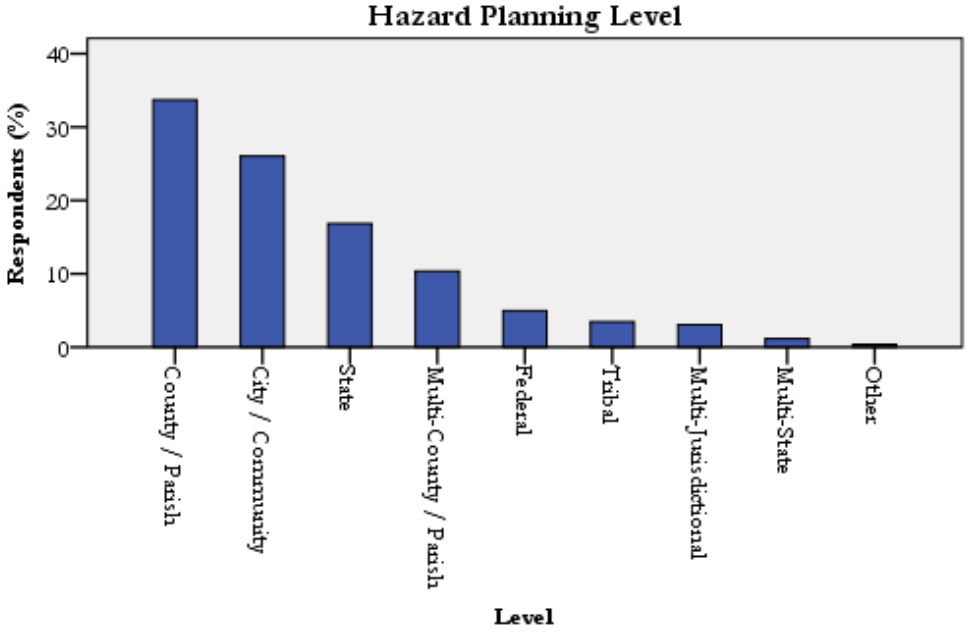


Figure 7: Level at which those involved in hazard planning were involved. Note that "city/community" includes respondents who did not necessarily work in a government position but were responsible for a single entity (e.g., hospital, office, school). This coding scheme applied to any of the levels; the levels do not necessarily correspond to a government position.

Figure 8: Number of staff members in the respondents department, including themselves, who shared hazard planning responsibilities for their area.

In an average work week, 54.2% (n = 175) of the respondents spent less than 20% of their time (up to 1 day/week) on hazard planning activities. Further, 20.7% (n = 67) did not devote any time to hazard planning. Only 5.6% (n = 18) spent over 75% of their time on hazard planning. The number of staff members in a department who shared hazard planning responsibilities varied considerably (Figure 8), but over two-thirds of respondents (n = 204, 71.1%) said there were 3 or fewer staff sharing the responsibilities for their area. Just over 2.1% were part of a very large team and had more than 20 staff members sharing the responsibilities.

Hazard Concerns and Planning Importance

Before we asked more in-depth questions about hazard planning processes and involvement, we needed to know the weather and climate hazards for which the decision makers thought it was most important to plan. This information helps us know how to provide the most locally-relevant and useful climate information to our stakeholders.

Across the SCIPP Region. The respondents were asked to rank how important planning is for 14 hazards as they currently affect their area of responsibility on a scale from 1 "not important at all" to 5 "critically important". Table 4 shows that in this survey floods (from rain or rivers; M = 4.17) ranked the highest, followed closely by tornadoes (M = 4.13). In 2009, tornadoes slightly edged out floods. A significant change occurred in how drought was ranked. In 2009 it ranked 8th, whereas it ranked 3rd in this round. It is probable that the recency of the 2011-ongoing drought in the southern plains impacted this ranking. Alternatively, lightning, which ranked 3rd in 2009, slipped to 8th in this survey. Storm surge and inundation ranked 12th and 13th in both iterations although their importance rating was slightly higher in this survey. It was not surprising that they ranked near the bottom of the list since most of the respondents were not located along the coast. See pages 16 and 17 for a comparison between coastal and non-coastal respondents.

Table 4: Rank and mean rating for how important planning is for climate hazards across the SCIPP region. The scale ranged from 1 "not important at all" to 5 "critically important".

	2013		2009	
Hazard	**Rank**	**Mean Rating**	**Rank**	**Mean Rating**
Flood (from rain or rivers)	1	4.17	2	4.19
Tornado	2	4.13	1	4.21
Drought	3	3.68	8	3.41
Heat Wave	4	3.64	6	3.51
Wildfire	5	3.55	9	3.40
Windstorm	6	3.44	4	3.83
Severe Winter Storm	7	3.42	7	3.43
Lightning	8	3.25	3	3.90
Hurricane	9	3.21	10	2.97
Hail	10	3.10	5	3.70
Extreme Cold	11	2.93	11	2.89
Storm Surge	12	2.89	12	2.61
Inundation (from sea-level rise or land subsidence)	13	2.79	13	2.08
Dust Storm	14	2.16	14	2.00

An analysis of variance of the current survey revealed significant differences across the 14 hazards in their level of importance for planning, F (13, 2314) = 47.37, $p < .001$, based on the 179 participants who rated all of them (Table 5). Confidence intervals constructed around means suggest five categories of hazard. Planning for Category 1, flood and tornado, was rated significantly more important than planning for any other hazard. The second category, which includes drought, heat wave, wildfire, and windstorm, was more important than planning the third category which consisted of severe winter storm, lightning, hurricane, and hail. Planning for Category 4 (extreme cold, storm surge, and inundation) was significantly less important than for the Category 3 hazards, and significantly more important than planning for the Category 5 hazard, dust storm.

Table 5: Differences in planning importance across climate hazards in the SCIPP region. The rating scale ranged from 1 "not important at all" to 5 "critically important".

Hazard Category	Hazard	Mean Rating	95% Confidence Interval
Category 1	Flood (from rain or rivers)	4.17	4.268
	Tornado	4.13	4.250
Category 2	Drought	3.68	3.865
	Heat Wave	3.64	3.811
	Wildfire	3.55	3.773
	Windstorm	3.44	3.670
Category 3	Severe Winter Storm	3.42	3.560
	Lightning	3.25	3.376
	Hurricane	3.21	3.360
	Hail	3.10	3.192
Category 4	Extreme Cold	2.93	2.970
	Storm Surge	2.89	2.989
	Inundation (from sea-level rise or land subsidence)	2.79	2.868
Category 5	Dust Storm	2.16	2.274

By State. Reviewing planning importance by hazard across the region provides us with a snapshot of the region but does not tell us anything about localized challenges. Thus, we computed the mean ratings for the five highest ranked hazards in each state (Figure 9). Not surprisingly, decision makers in different states were concerned about different hazards. For example, hurricane ranked in the top 3 in both Louisiana and Mississippi, whose jurisdictions include coastline. Surprisingly, neither hurricane, inundation, nor storm surge ranked in Texas' top 5. The same held true in 2009, and may be due to the fact that most of the Texas respondents were located in the interior part of the state.

Flood ranked the highest in Arkansas and Tennessee, and the only hazard ranked in the top 5 for all states was tornado. Drought was only ranked in the top 5 for one state in 2009, Texas, but ranked in the top 5 in four states in 2013. The top 5 hazards were rated between important (3) and critically important (4) for all states. See Hocker and Carter (2010) for the 2009 ratings.

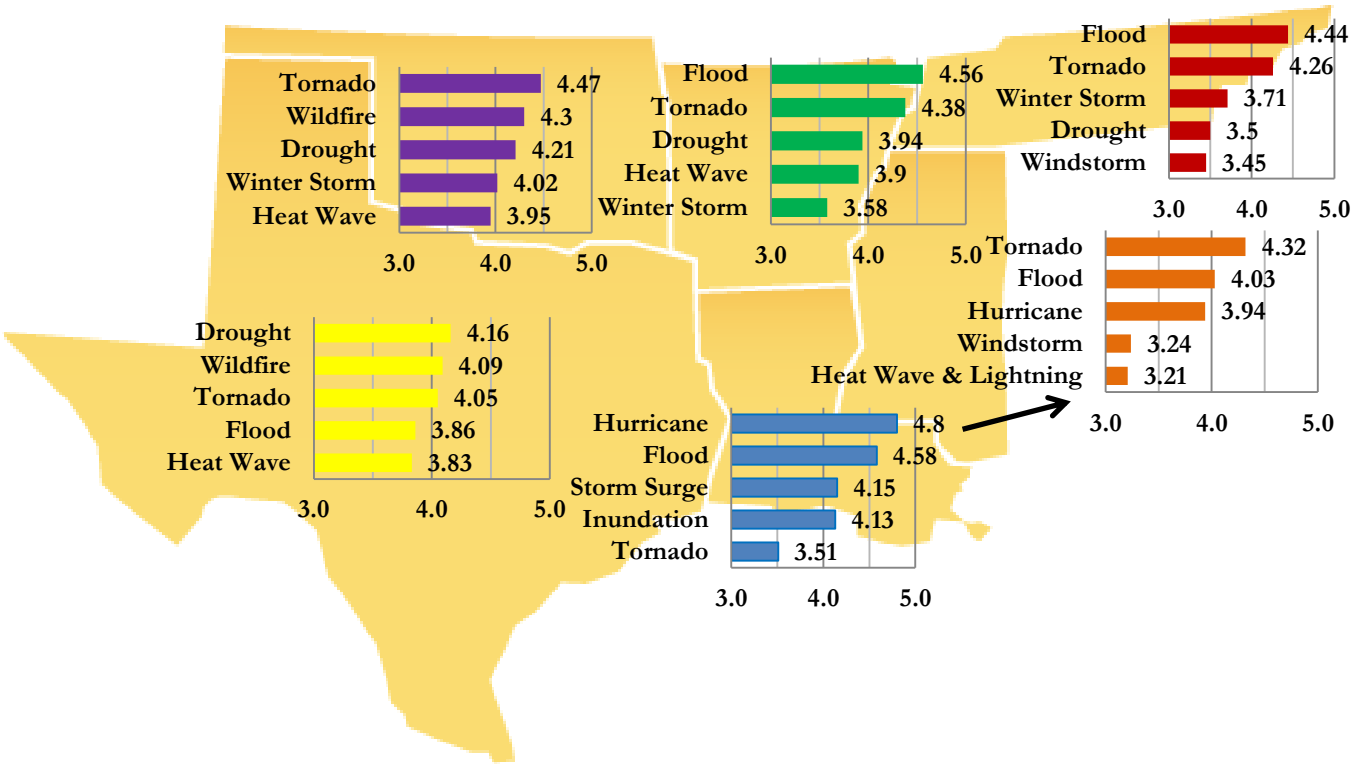


Figure 9: The five highest rated hazards, by state, in terms of how important the respondents think it is to plan for them. The scale ranged from 1 "not important at all" to 5 "critically important".

Coastal vs. Non-Coastal. We compared planning importance for coastal and non-coastal respondents by county/parish (Table 6) to better assess the concerns of coastal respondents. Less than one-fifth of respondents (17.0%) were located in coastal counties or parishes. Since no single definition of coastal exists, we used a U.S. Geological Survey definition. For Texas and Mississippi, that equates to approximately the two tiers of counties that are closest to the coast. In Louisiana, coastal parishes represent a similar area in addition to some that are farther inland because of the state's unique geography and land cover.

For *every* hazard except windstorm, there was a significant difference between how the two groups rated the hazards. Coastal respondents said it was most important to plan for hurricanes (M = 4.95). They also judged planning for inundation, floods and storm surge as significantly more important than non-coastal respondents. However, perhaps because of their focus on these hazards, they perceived all other hazards (except windstorm) as less important for planning than non-coastal respondents. This is significant because offices located in coastal areas may still need to prepare for cold, hail, heat, lightening, tornadoes, winter storms, and even drought. The ratings among non-coastal respondents followed the overall ratings closely; tornado, flood and drought ranked in the top three for planning importance.

Table 6: Importance of planning for hazards for coastal and non-coastal respondents. The scale ranged from 1 "not important at all" to 5 "critically important".

	Coastal		Non-Coastal	
Hazard	**Rank**	**Mean Rating**	**Rank**	**Mean Rating**
Hurricane	1	4.95*	11	2.69*
Inundation (from sea-level rise or land subsidence)	2	4.52*	14	2.26*
Flood (from rain or rivers)	3	4.50*	2	4.09*
Storm Surge	3	4.50*	12	2.37*
Tornado	5	3.40*	1	4.31*
Heat Wave	6	3.31*	5	3.72*
Windstorm	7	3.30	7	3.47
Lightning	8	2.93*	8	3.32*
Drought	9	2.79*	3	3.89*
Wildfire	10	2.69*	4	3.75*
Hail	11	2.57*	9	3.22*
Severe Winter Storm	12	2.31*	6	3.68*
Extreme Cold	13	2.16*	10	3.10*
Dust Storm	14	1.64*	13	2.28*

* two-tailed $p < .01$

Types of Plans. Prior to asking about the specific hazards for which the respondents' agencies or organizations had developed a plan, we asked about the general types of hazard plans they had (Table 7). Multi-Hazard/All Hazards Plans were the most common; 73.8% of respondents cited having one. At least half of the respondents' organizations had a mitigation plan, response plan, or emergency evacuation plan of some kind. The commonality of a multi-hazard plan may indicate that it is more efficient and effective to plan for all of the relevant hazards as opposed to planning for individual hazards, since many of the same mitigation and response actions can be implemented for multiple hazards.

Hazards For Which They Plan. In terms of the specific hazards for which the respondents' agencies or organizations had at least one type of plan, flood was most commonly cited followed by tornado and severe winter storm. In 2009, tornado, flood and wildfire were the top three hazards most commonly included in a plan. Table 8 shows the full results. Outside of flood, wildfire and drought, it was more common for agencies to have a response plan than a mitigation plan. These planning tendencies are inconsistent with the National Institute of Building Sciences' (2005) finding that mitigation is more beneficial than just being prepared to respond. There appears to be a disconnect that may result from a lack of economic incentives for mitigation projects, inadequate understanding of vulnerabilities or lack of personnel needed to adequately champion both response

and mitigation efforts. These tendencies may also relate to the challenges and limitations associated with hazard planning, which will be discussed beginning on page 21.

Table 7: Types of hazard plans the respondents' agencies or organizations had. *In an effort to simplify some questions from 2009, this question was revised for this survey. Therefore, an exact comparison cannot be computed for all plan types.

	2013 (N = 271)	2009 (N = 226)*
Type of Hazard Plan	**%**	**%**
Multi-Hazard / All Hazards Plan	73.8	n/a
Mitigation Plan	60.1	n/a
Response Plan	57.2	n/a
Emergency Evacuation Plan	50.6	80.1
Land Use Plan	32.1	58.8
Storm Water Plan	31.4	n/a
Comprehensive Water Plan (Quality or Quantity)	24.7	53.5
Species and/or Habitat Protection Plan	8.5	15.9
Sediment / Beach Management Plan	3.7	15.9
Other	7.7	12.4

Table 8: Hazards for which the respondents' agencies and organizations had at least one type of plan, whether mitigation, response, or both.

	2013 (N = 245)		2009 (N = 244)	
Hazard	**Mitigation (%)**	**Response (%)**	**Mitigation (%)**	**Response (%)**
Flood (from rain or rivers)	64.5	62.4	57.0	54.5
Tornado	48.2	58.4	41.0	59.4
Wildfire	42.4	41.6	31.1	52.0
Drought	38.0	35.5	30.7	36.1
Severe Winter Storm	36.3	49.0	32.4	44.3
Hurricane	33.5	44.1	29.5	34.0
Heat Wave	29.4	32.7	20.9	36.1
Windstorm	29.4	34.3	30.3	45.9
Extreme Cold	24.1	33.5	18.0	33.6
Lightning	23.3	26.5	23.8	43.4
Hail	22.0	23.7	23.4	41.8
Storm Surge	20.0	24.5	23.4	26.6
Inundation (from sea-level rise/land subsidence)	17.6	19.2	15.2	15.2
Dust Storm	4.9	12.2	6.1	13.9

In this survey the importance of planning for a hazard was a significant predictor of whether an agency had either a mitigation or response plan for that hazard. That was truer for some hazards than others. Table 9 displays the point biserial correlations between importance of each hazard and having a plan for it. The relationship was strongest for hurricanes, storm surge, and inundation, perhaps because of greater variability in the importance of those hazards across the sample of respondents. The weakest relationship was for heat wave. Other factors that may play a role in whether a particular hazard is accounted for in planning are predictability, climatology, spatial coverage, and economic impact.

Table 9: Correlation between having a mitigation or response plan and the importance of planning for a hazard.

Hazard Importance (n)	Mitigation Plan	Response Plan
Drought (294)	.29	.27
Dust Storm (250)	.21	.30
Extreme Cold (274)	.31	.29
Flood (296)	.34	.22
Hail (281)	.32	.26
Heat Wave (287)	.20	.12
Hurricane (254)	.62	.60
Inundation (239)	.51	.33
Lightning (288)	.29	.24
Winter Storm (291)	.37	.43
Storm Surge (236)	.57	.48
Tornado (297)	.36	.29
Wildfire (290)	.38	.28
Windstorm (287)	.38	.36

Note: all correlations are significant at the .001 level except $r = .12$, which is significant at $p < .05$, two-tailed.

Group Interaction

The respondents were asked several questions about the local, regional or state, federal, and non-governmental groups with whom they interact in regards to hazard planning to help us understand the relationships outside of their organization that are important to them. Table 10 shows that a wide variety of local groups are involved in hazard planning activities. The groups with whom the respondents most commonly interacted were county/parish commissioners or township officials (77.4%), public safety agencies (72.9%), and public works (71.4%). Over half of the respondents worked with associations of city or council of governments (57.1%). For regional or state groups, respondents interacted most commonly with their state department of emergency management (79.0%), followed by floodplain managers (52.7%) and state department of environmental quality (51.9%). The Federal Emergency Management Agency (82.6%), National Weather Service (64.9%) and U.S. Army Corps of Engineers (50.6%) were the three federal groups the respondents most commonly interacted with. In terms of non-governmental groups, a vast majority interacted with the American Red Cross (81.3%) and other faith-based organizations (59.6%). At any level, it was clear that a variety of groups are involved in hazard planning.

Table 10: Local, state/regional, federal, and non-governmental groups with whom the respondents interacted in regards to hazard planning. *Due to a typographical error, "Local Environmental Planning Committee (LEPC)" appeared in the survey instead of "Local Emergency Planning Committee (LEPC)." Consequently, respondent's interaction with their LEPC may be higher than what the results show. A substantial number appear to have figured out our intent from the acronym, however.

Local Groups (N = 266)	Respondents (%)
County/Parish Commissioners or Township Officials	77.4
Public Safety Agencies	72.9
Public Works	71.4
Association of City/Council of Governments	57.1
Local Businesses or Industries	47.0
Citizen Groups (e.g. Environmental)	44.7
Local Emergency Planning Committee (LEPC)*	42.9
Consultant(s)	33.8
Scientists/Engineers	31.2
Chamber of Commerce	28.9
Economic Development Coalition of Agency	22.2
Rural Development	19.5
Homeowner Associations	16.5
Developers or Realtors	15.4
Local Land Trust(s)	7.1
Other (e.g., Healthcare Organizations, Schools, Transportation Authorities)	7.5
Regional or State Groups (N = 262)	**Respondents (%)**
State Department of Emergency Management	79.0
Floodplain Managers	52.7
State Department of Environmental Quality	51.9
State Department of Health	46.9
Council of Governments	43.5
Natural Resources Conservation Service	36.6
University Extension Services (e.g., Agriculture, Sea Grant, RISA)	36.3
State Department of Agriculture	35.5
State Climate Office/Regional Climate Center	28.6
State Department of Wildlife Conservation	26.3
Farm Service Agency	22.5
State Water Board	19.8
State Conservation Commission	18.3
Tribal Governments	14.9
State Municipal League	10.7
State Corporation Commission	5.3
Other (e.g., State Department of Transportation, State Department of Education, State National Guard, Universities)	6.1

Federal Groups (N = 259)	Respondents (%)
Federal Emergency Management Agency (FEMA)	82.6
National Weather Service (NWS)	64.9
U.S. Army Corps of Engineers (USACE)	50.6
National Oceanic and Atmospheric Administration (NOAA)	40.5
U.S. Environmental Protection Agency (EPA)	39.0
U.S. Department of Agriculture	30.5
U.S. Geological Survey (USGS)	26.3
U.S. Department of Health and Human Services (HHS)	19.7
U.S. Fish and Wildlife Service (FWS)	18.9
U.S. Department of Defense (DOD)	18.5
Small Business Administration (SBA)	12.7
U.S. Department of Housing and Urban Development (HUD)	12.4
U.S. Bureau of Reclamation (USBR)	4.6
Other (e.g., U.S. Department of Transportation, U.S. Department of Energy, Veterans Administration)	4.2
Non-Governmental Groups (N = 193)	**Respondents (%)**
American Red Cross	81.3
Other Faith-Based Organizations (e.g., Catholic Charities, Southern Baptist Convention)	59.6
Salvation Army	45.1
Other Environmentally-Based Organizations	19.7
The Nature Conservancy	9.3
National Wildlife Federation	7.3
Other (e.g., Community Emergency Response Team, Amateur Radio)	5.7

Challenges

Decision makers may be interested in hazard planning but are unable to make the progress they would like because of the various challenges and limitations they face. We asked the respondents which of seven challenges and limitations, if any, they experience in developing hazard plans for their area of responsibility. They also had the opportunity to write in their own. Two new response options were added to this survey. One of which, "lack of community or political interest", was a direct result of 2009 responses. As depicted in figure 10, the most prominent challenges were "limited or no funds" and "limited or no staff available to support hazard planning," with more respondents selecting them in 2009. "Higher work priorities in other areas" remained the third most common challenge, but 9.1% more respondents selected it than in 2009. Interestingly, there was less variation between the first and third choices compared to 2009, which suggests more consistency among the top three perceived barriers. Z-tests were used to compare the percentages for the two surveys. The choices of "other" and "limited or no staff available to support hazard planning" were

significantly less common in 2013 while "higher work priorities in other areas" was a significantly more common concern. The differences for the other challenges were not statistically significant.

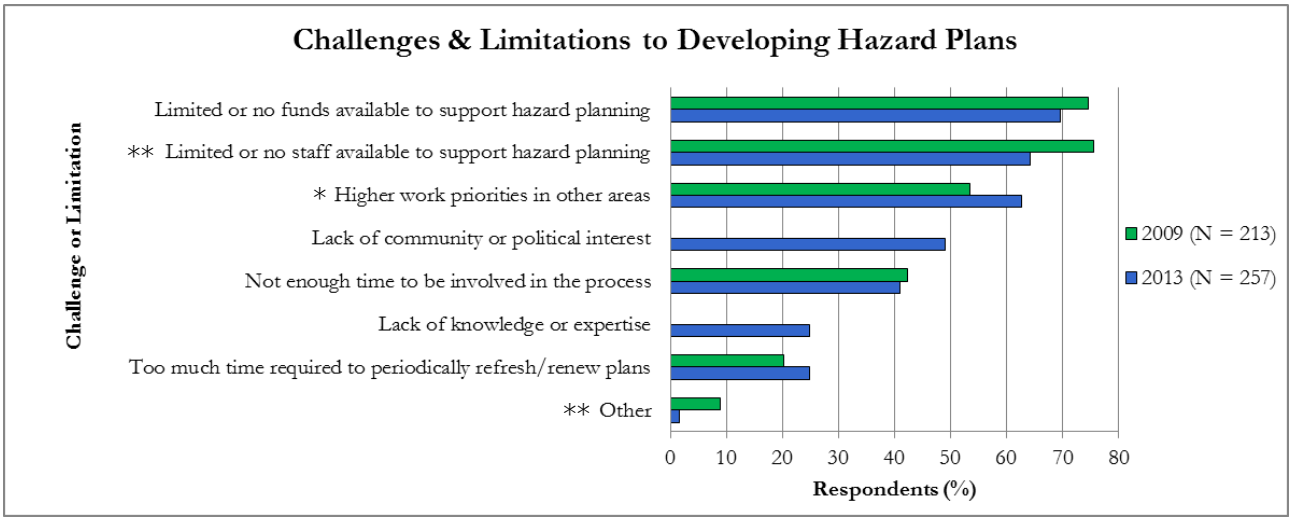


Figure 10: Challenges and limitations to developing hazard plans for the respondents' area of responsibility. Two new categories were added to the 2013 survey, hence the data gap for "lack of community or political response" and "lack of knowledge or expertise." *$p < .05$; **$p < .01$.

Adjusting to Challenges

New to this year's survey, the respondents had the opportunity to answer an open-ended question about how they have adjusted to the challenges and limitations they experience in conjunction with hazard planning. Challenges and limitations are a reality for most decision makers in what they are able to accomplish in the workplace, so we wanted to see how the respondents were dealing with them. Sixty people provided valid responses (some provided more than one example), which were coded into 12 categories (Figure 11). The most common adjustment (n = 16) was "internal or external collaboration," which means that the decision maker leverages and shares resources with other departments within their organization or collaborates with outside organizations to accomplish hazard planning. The collaboration allows them to accomplish the task without putting all of the work on themselves. The next most common adjustment was to "make planning a priority." Ten respondents commented on the importance of planning and how they make it a priority in spite of the challenges they face. Several people (n = 7) mentioned staffing-related adjustments, such as assigning at least one staff member to be in charge or utilizing volunteers and interns to accomplish tasks. "As possible" (n = 6) indicates that decision makers do the best that they can with the resources they have. "Synergy" (n = 4) means that hazard planning is combined with existing planning activities and/or that they plan for multiple hazards at the same time, and "sacrifice" (n = 2) indicates that they take on the task even if it means sacrificing their time or other work.

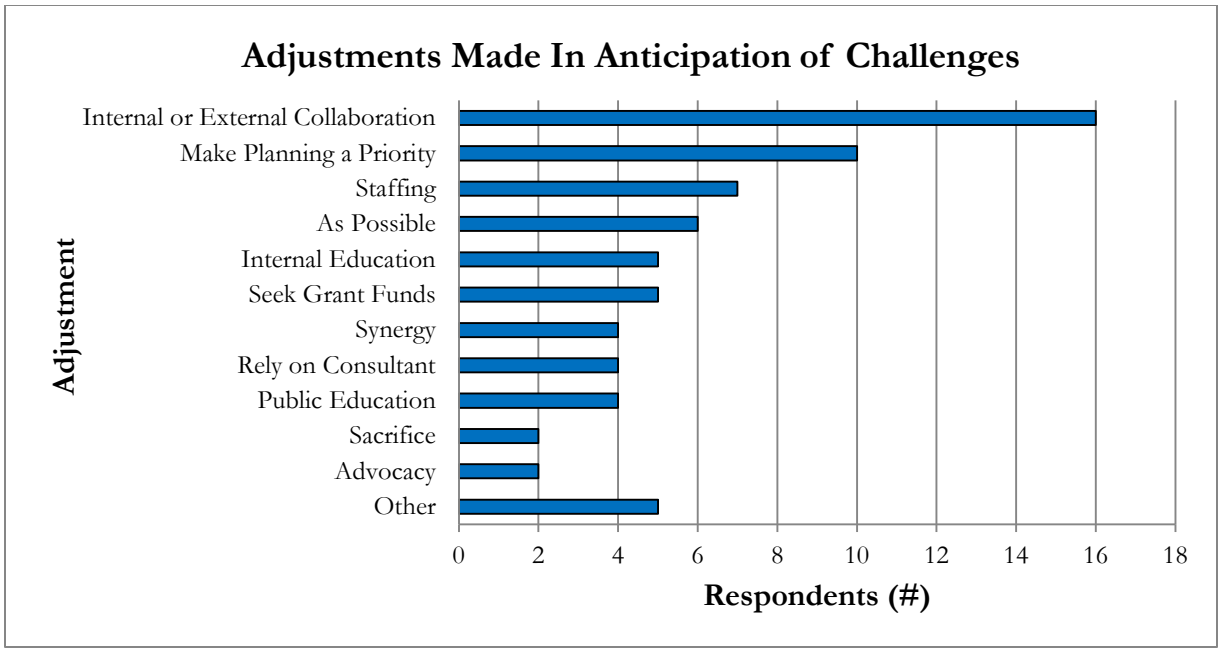


Figure 11: Coded responses to the open-ended question, "What adjustments have you made in your operations/practices in anticipation of these challenges, if any?" N = 60.

CLIMATE CHANGE

Planning and preparing for existing hazards is important, but climate change may exacerbate some of the impacts of those hazards. After asking the respondents about hazards and their planning tendencies, we asked them several questions about whether and how they incorporate climate change into their work. First, we introduced the concept and gathered data on the respondents' views on climate change and how it may affect hazard planning in their area of responsibility.

Views

For this survey we adapted three questions from the Pew Research Center (Kohut et al. 2010) to determine the respondents' stance on climate change. The first asked whether there is solid evidence that the average temperature on Earth has been getting warmer over the past few decades. A majority of the respondents said "Yes" (n = 152, 56.7%), while 27.2% (n = 73) said "No" and 16.0% (n = 43) said "Don't Know". The respondents who answered "Yes" were then asked to comment on the reasoning for why the Earth is warming. "Mostly because of human activity, such as burning fossil fuels" (n = 63, 42.0%) was a more common reason than "mostly because of natural patterns in the Earth's environment" (n = 44, 29.3%) and "don't know" (n = 43, 28.6%). Additionally, those who said the Earth is warming or did not know whether the Earth is warming were asked about the seriousness of climate change. Figure 12 shows that 89.7% (n = 174) of the respondents said it is at least a "somewhat serious" problem. Not surprisingly, the respondents who

said there is solid evidence that the Earth has been getting warmer thought that climate change was a more serious problem than those who were unsure whether the Earth's temperature is rising.

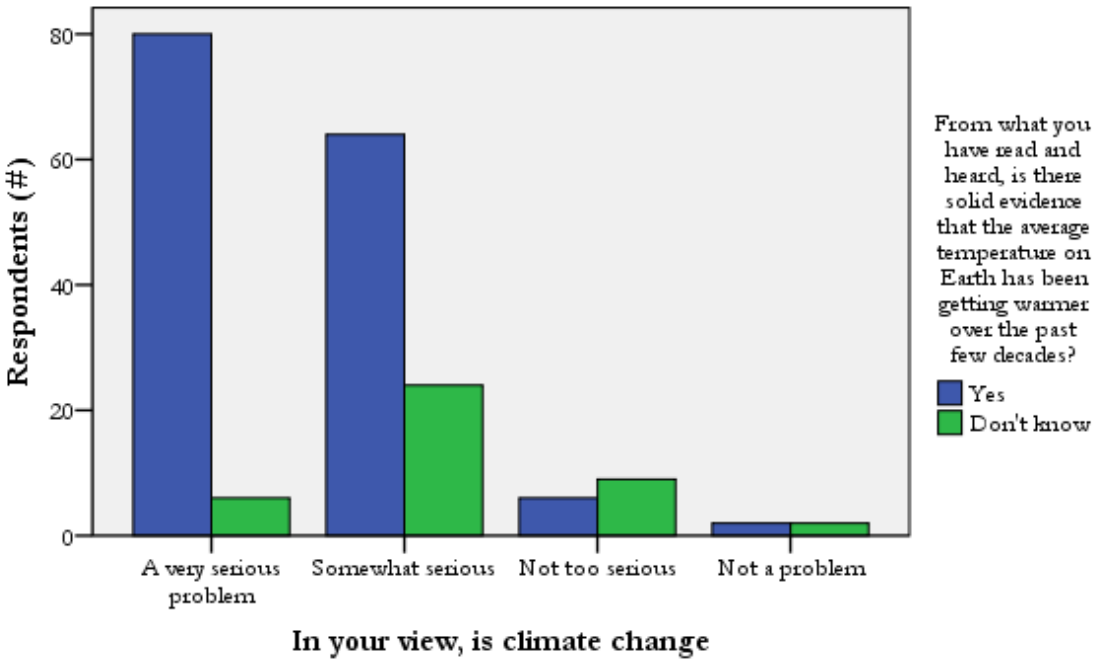


Figure 12: Responses to the question, "In your view, is climate change a very serious problem, somewhat serious, not too serious, or not a problem." This question was posed to the respondents who answered "Yes" or "Don't Know" to the question, "From what you have read and heard, is there solid evidence that the average temperature on Earth has been getting warmer over the past few decades?"

These results may be contrasted with the 2009 survey, which asked the questions in different ways. In 2009, participants responded to the statement, "Climate change is real and already happening." Seventy point nine per cent agreed, 22.7% disagreed, and 6.3% did not know. Thus, a substantially higher percentage of respondents in 2009 supported the existence of climate change than did respondents in 2013 (when only 57% responded that yes, there is solid evidence that the temperature on Earth has been getting warmer). In 2009, 21.3% of the participants were "very concerned" about climate change, 41.8% were "concerned," 33.3% were "not very concerned", and 3.6% were "not concerned at all", with 225 out of 278 participants responding to this item.

Four factors should be noted in comparing the two surveys. First, the questions were asked in two different ways and with two formats for responding. It may have been more difficult to respond "yes" in this survey compared to the choices of "strongly agree" and "slightly agree" in 2009. Respondents who could only "slightly agree" with the statement in 2009 may have chosen "no" because of the statement asking if there was "solid evidence" that the Earth is getting warmer. Second, none of the 2009 questions asked about reasoning (e.g., due to human activity), so a respondent who said climate change is real did not have to comment on the attribution.

Third, the differences may reflect national trends for the general public between 2009 and 2013 regarding climate change. Although Gallup (2013) reported increasing support for global warming in its most recent poll, the trend from 2008 to 2011 was downward. The trend for SCIPP's assessment appears to be strongly downward from 2009 to 2013. Finally, the respondents for the two surveys were different (though there may have been some overlap) and may not be directly comparable.

In terms of how well informed the respondents felt they were about climate change on a scale of 1 "not at all informed" to 5 "very well informed", the average of the sample was between "somewhat informed" and "well informed" (M = 3.52). The most commonly selected statement was "somewhat informed" (n = 128, 54.0%). To understand whether the respondents' views on climate change had recently altered, we asked them to check one of the statements listed in Table 11. Of the 254 people who responded to the question, 42.1% said their views had changed, whether more or less convinced that humans are influencing the Earth's climate. Of those respondents, more than half of them were *more* convinced.

Table 11: Response to the question, "How has your personal view of climate change altered over the past 5 years?"

Climate Change View	Respondents (%)
It has changed: I am more convinced that humans are influencing the Earth's climate	26.0
It has changed: I am less convinced that humans are influencing the Earth's climate	16.1
It has not changed: I am still convinced that humans are influencing the Earth's climate	28.0
It has not changed: I am still not convinced that humans are influencing the Earth's climate	29.9

Incorporating Climate Change into Hazard Planning

The respondents were asked whether they had ever considered including climate change in the hazard plan for their area of responsibility. Out of the 264 people who answered the question, 30.3% responded "yes," 69.7% "no." To find out the reasoning behind their response, they were asked a question about barriers to incorporating climate change into planning activities. Table 12 shows that a majority of the respondents faced financial constraints (68.0%), higher work priorities (61.0%), lack of community or political interest (56.4%), and staff constraints (55.6%).

Three of these were also among the top four barriers in 2009 but in a different order. The 2009 stated options were simplified for the current survey so caution is necessary when comparing the results of the two iterations. Some useful information can be gleaned from the comparison, however. Overall, fewer respondents selected barriers, which could mean that the barriers are becoming less significant. However, it could also be a product of how the respondents were asked to answer the question. In this survey respondents were simply asked to check whether the barrier existed; in 2009 they were asked to check whether the barrier was a big hurdle, small hurdle, not a barrier, or they did not know. The "big hurdle" or "small hurdle" responses were combined to

produce the 2009 statistics that are displayed in table 12. One of the more substantial changes was regarding "lack of knowledge or expertise", which moved from 2nd to 6th and may indicate that some educational needs are being met. "Lack of community or political interest" moved from 5th to 3rd, which could indicate that the barrier is getting stronger in the region that is served by SCIPP or that it is of the same strength but has not declined as much as some of the other barriers.

Table 12: Reponses to the question, "Whether or not your agency/organization has already taken action to prepare for possible impacts of climate change, which of the following, if any, have been barriers to incorporating climate change into your planning activities? Check all that apply." *The 2009 response options were simplified for 2013 and are not exactly comparable. See explanation in text.

	2013		2009*	
Barrier	**Respondents (%)**	**Rank**	**Respondents (%)**	**Rank**
Limited or no funds available to support climate change planning	68.0%	1	72.9	3
Higher work priorities in other areas	61.0%	2	70.4	4
Lack of community or political interest	56.4%	3	69.8	5
Limited or no staff available to support climate change planning	55.6%	4	78.4	1
Lack of perceived solutions	49.0%	5	57.4	8
Lack of knowledge or expertise	41.5%	6	75.7	2
No legal mandate to take climate change impacts into account	41.1%	7	59.8	7
Scientific evidence too uncertain	38.6%	8	66.8	6
Not enough time to be involved in the process	24.5%	9	n/a	n/a

All of the respondents were asked to indicate their level of agreement with several statements concerning climate change and hazard planning on a scale of 1 "strongly disagree" to 5 "strongly agree". The strongest agreement was for the statement "we should prepare for the most likely scenario based on the best available information (e.g., scientific studies, economic forecasts)" (M = 4.22), followed by "we should prepare for the possibility of stronger or more frequent hazards" (M = 4.14). The respondents rated three statements between "neutral" and "agree": "Other challenges are more important than climate change" (M = 3.40), "we will adjust our plans when we get clear direction from state or federal government" (M = 3.27), and "we don't have enough information about climate change for it to influence our planning" (M = 3.17). "I do not believe climate change will have any significant impacts in my area" was rated 2.59 on average by the respondents, meaning that there was slight disagreement with the statement.

A similar question was asked in 2009 but it was posed as "which of the following best represents your opinion," so the respondents only chose one statement instead of stating their level of agreement with each one. Thus, the results are not directly comparable. The 2009 statement that was by far the most commonly checked was "we should prepare for the most likely scenario based on the best available information" (58.5%; the same statement with which the respondents indicated strongest agreement in this survey). The next closest was "we should wait to make any changes to

current management practices because we don't have enough information to know what to prepare for" at 11.3%.

An interesting finding between coastal and non-coastal respondents surfaced when looking at their level of agreement with the statement, "We don't have enough information about climate change for it to influence our planning." While the two groups did not have a strong opinion either way, non-coastal respondents (M = 3.24) agreed with the statement significantly more than coastal respondents (M = 2.88). Perhaps the national attention given to sea level rise, for example, with coastal decision makers means that climate change information has been lacking for decision makers in interior parts of the country.

Climate Change Concerns

Another question asked the respondents to rate their level of concern with several climate changes that are projected to occur, on a scale of 1 "not at all concerned" to 5 "extremely concerned". (This question was substantially different than the 2009 version; not even a qualitative comparison can be made.) Figure 13 shows that the changes about which the respondents were most concerned included "more intense droughts" (M = 3.82), "more intense floods" (M = 3.74), and "changes to rainfall patterns/timing" (M = 3.66), though the respondents were between "somewhat" and "moderately concerned" about seven of the nine projected changes. These results suggest that the climate scientists' message focused on amplification of the hydrologic system is reaching its intended audience. In addition, the top 3 changes are ones that have been emphasized in presentations by state and regional climatologists and in the National Climate Assessment (Ingram 2013, Ojima 2013).

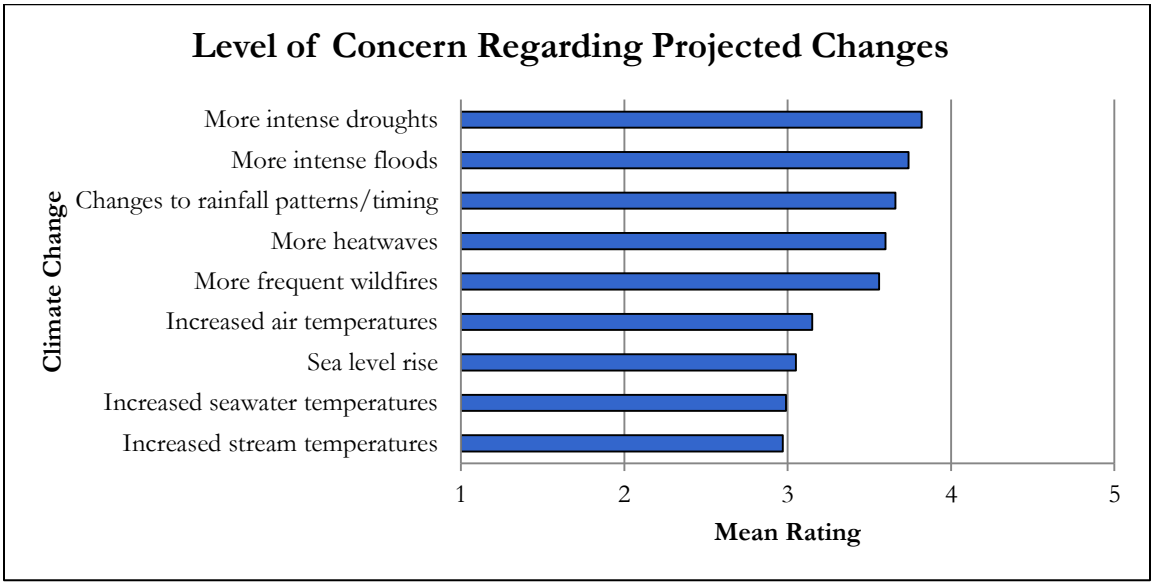


Figure 13: Respondents' level of concern regarding nine projected climate changes. A rating of 1 corresponds to "not at all concerned", 2 "slightly concerned", 3 "somewhat concerned", 4 "moderately concerned", and 5 "extremely concerned".

Concerns by State. Looking at level of concern by state, it is not surprising that respondents in different states were concerned about different projected changes. Table 13 shows that for example, Texas respondents ranked "more frequent wildfires" 2nd (M = 3.76) whereas Louisiana respondents ranked it 8th (M = 2.83). "More intense droughts" were the top concern for Arkansas, Oklahoma and Texas respondents whereas "more intense floods" were the top concern for Louisiana, Mississippi and Tennessee respondents. Surprisingly, sea level rise ranked last for Texas respondents. This may, again, be due to the fact that the vast majority of Texas respondents were not located along the coast.

Overall, the concern about all the projected changes was highest among Oklahoma respondents (M = 3.77) and lowest among Tennessee respondents (M = 3.09). Oklahoma scientists have been actively engaging the public on climate change for several years, which may contribute to the higher level of concern.

Table 13: Respondents' mean level of concern regarding climate changes that are projected to occur. The scale ranged from 1 "not at all concerned" to 5 "extremely concerned".

	Mean Level of Concern (Rank)					
Projected Change	**Arkansas**	**Louisiana**	**Mississippi**	**Oklahoma**	**Tennessee**	**Texas**
More intense droughts	4.24 (1)	3.25 (5)	3.58 (2)	4.47 (1)	3.37 (3)	3.9 (1)
More intense floods	4.00 (2)	3.85 (1)	3.71 (1)	3.95 (5)	3.53 (1)	3.49 (5)
Changes to rainfall patterns/timing	3.79 (3)	3.42 (3)	3.55 (3)	4.22 (3)	3.18 (5)	3.62 (3)
More heat waves	3.72 (4)	3.28 (4)	3.17 (5)	4.14 (4)	3.39 (2)	3.6 (4)
More frequent wildfires	3.71 (5)	2.83 (8)	3.1 (6)	4.38 (2)	3.21 (4)	3.76 (2)
Increased air temperatures	3.44 (6)	3.00 (7)	2.94 (9)	3.66 (6)	2.71 (9)	3.03 (6)
Sea level rise	3.08 (9)	3.49 (2)	3.26 (4)	2.98 (8)	2.74 (7)	2.83 (9)
Increased seawater temperatures	3.12 (8)	3.21 (6)	3.03 (7)	2.93 (9)	2.74 (7)	2.95 (7)
Increased stream temperatures	3.29 (7)	2.66 (9)	2.97 (8)	3.24 (7)	2.92 (6)	2.87 (8)
Concern for all Changes (Mean)	**3.60**	**3.22**	**3.26**	**3.77**	**3.09**	**3.34**

Concerns by Coastal and Non-Coastal. Similar to how the respondents rated the importance of planning for existing hazards, the coastal respondents were more concerned about the projected climate changes that are most relevant to the coast including sea level rise and increased seawater temperatures. There was a significant difference between the coastal and non-coastal respondents for these two changes. In fact, there were significant differences in how the two groups rated their concern for five of the eight changes. The complete results are shown in table 14.

Table 14: Coastal and non-coastal respondents' level of concern regarding projected climate changes. The scale ranged from 1 "not at all concerned" to 5 "extremely concerned".

	Coastal		Non-Coastal	
Projected Change	**Rank**	**Mean Rating**	**Rank**	**Mean Rating**
More intense floods	1	3.88	3	3.71
Sea level rise	2	3.71**	8	2.88**
Increased seawater temperatures	3	3.48**	9	2.87**
Changes to rainfall patterns/timing	3	3.48	3	3.71
More intense droughts	5	3.31**	1	3.95**
More heat waves	6	3.27*	5	3.68*
Increased air temperatures	7	3.12	6	3.15
Increased stream temperatures	8	2.87	7	3.00
More frequent wildfires	9	2.86**	2	3.74**

* two-tailed $p < .05$; **two-tailed $p < .01$

Climate Change Planning Needs

An important function of SCIPP is to provide relevant and useful climate products and services for decision makers such as hazard planners. To provide insight for our work, we asked about the most critical needs for including climate change in hazard planning. Table 15 shows that the three needs that were most commonly selected in 2009 were also selected in this survey: "More climate information that is applicable to my particular area", "information pertaining to future anticipated climate hazards", and "instruction on where to find trustworthy climate information". In two cases, fewer respondents selected them. This could indicate that these top needs are now being met for some decision makers.

Table 15: Responses to the statement, "Please identify the most critical needs for including climate change in the hazard plan(s) relevant to your area of responsibility. Check all that apply."

	2013 (N = 243)		2009 (N = 196)	
Climate Change Planning Need	**Respondents (%)**	**Rank**	**Respondents (%)**	**Rank**
More climate information that is applicable to my particular area	59.3	1	63.3	1
Information pertaining to future anticipated climate hazards	53.9	2	53.1	2
Instruction on where to find trustworthy climate information	45.3	3	52.6	3
Improved fine-scale (regional) climate projections	45.3	3	41.3	7
Education on the basics of climate and climate science	44.9	5	50.0	4
Increased collaboration between different hazard planning groups	44.0	6	45.4	6
Increased engagement between decision makers and scientists	42.8	7	39.3	8
Training on how to interpret various climate information products	41.6	8	48.0	5
I don't think climate change needs to be included in hazard planning	14.4	n/a	22.4	n/a

Looking at the needs by state revealed some interesting distinctions. Mississippi had many more respondents (52.6%) say that "education on the basics of climate and climate science" is needed than any other state, which ranged from 26.5% to 40.9%. Furthermore, only 3% of Oklahoma respondents said "climate change does not need to be included in hazard planning", compared to at least 11% for the other five states. "Increased engagement between decision makers and scientists" increased overall, and was highest in Mississippi (44.7%) and lowest in Arkansas (26.5%). The increase in the need could be a result of inadequate engagement or a stronger realization among decision makers that engagement with scientists is needed.

Actions to Take

Understanding how the climate is projected to change and the impacts those changes could have on agency planning and operations are important steps toward climate change adaptation. However, another step is to take action to reduce risk(s) to a particular hazard. We asked survey respondents what water or flood management-, land management-, or disaster preparedness-related actions they would take, assuming they had all the information they needed about climate change. Table 16 displays the results. Note that the same actions were listed in the 2009 survey but were associated with a question about what actions they *could* or *did* take, and in conjunction with different categories (e.g., "update flood risk maps" was associated with informational tools as opposed a water or flood management action). The percentages of the two datasets should not be compared, but it is appropriate to compare the relative popularity of each action.

Water or Flood Management. Two-thirds of the respondents (n = 230, 67.3%) selected at least one water or flood management-related action in 2013. "Update flood risk maps" was the most commonly selected action (2013, 72.6%; 2009, 51.5%) in both samples. At least half of the respondents said they would "update water quality and supply management plans" (58.7%) and/or "change flood zone restrictions" (51.3%). Those options were also the 2nd and 3rd most popular in 2009.

Land Management. The most common land management action respondents said they would take was "change land use planning requirements" (62.1%). This was the second most common action selected in 2009 (16.5%), but the top action was "change building codes" (17.3%). "Change building codes" (49.3%) and "change zoning regulations" (46.9%) were the 2nd and 3rd most commonly selected actions in 2013.

Disaster Preparedness. In terms of disaster preparedness actions, 79.1% of respondents said they would "provide additional information/education materials to public, homeowners". It was also the top action in 2009. Over half of respondents said they would "join other communities in regional collaboration or hazard planning" (67.2%) and "update emergency evacuation plans" (61.3%).

Table 16: Water or flood management-, land management-, or disaster preparedness-related actions the respondents would take, assuming they had all the information they needed about climate change. The 2009 question was "Because of new information/data that is available in conjunction with climate change, what, if any, changes can (or did) you make to your current [action category] in your hazard plan?" and the percentages should not be compared to 2013. *The same actions were listed in this survey as 2009, but organization was different. Therefore, "other" cannot be computed for 2009.

Water or Flood Management Action	2013 (%)	2009 (%)
Update flood risk maps	72.6	51.5
Update water quality and supply management plans	58.7	18.0
Change flood zone restrictions	51.3	28.2
Change water dependent use restrictions	40.9	11.9
Join the National Flood Insurance Program	13.5	15.2
Other	4.8	*
Land Management Action	**2013 (%)**	**2009 (%)**
Change land use planning requirements	62.1	16.5
Change building codes	49.3	17.3
Change zoning regulations	46.9	16.0
Change disclosure requirements (e.g., on flooding or erosion risks)	45.0	12.3
Improve species and/or habitat protection plans	41.7	6.8
Strengthen shoreline protection policies and regulations	35.1	5.4
Other	5.7	*
Disaster Preparedness Action	**2013 (%)**	**2009 (%)**
Provide additional information/educational materials to public, homeowners	79.1	38.2
Join other communities in regional collaboration or hazard planning	67.2	28.3
Update emergency evacuation plans	61.3	37.9
Install or alter warning system(s)	42.6	23.5
Other	3.4	*

INFORMATION USE AND APPLICATIONS

Information Use

To understand the kinds of information decision makers use to carry out hazard planning, we asked them to check which of seven types of community or environmental information and 11 types of weather, climate, or geological information they consult regularly. The results are displayed in table 17. The same categories were listed in 2009 but by way of four questions instead of two. Thus, the sample sizes are provided for each category for an accurate interpretation of the results.

Table 17: Responses to the question, "In order for you to carry out hazard planning, what information do you consult regularly? Check all that apply." Note that percentages may be sensitive to the small sample size in some of the least-cited choices.

	2013		2009	
Community or Environmental Information	**n**	**%**	**n**	**%**
Location of critical facilities	199	82.9	167	86.1
Population data	177	73.8	157	80.9
Land use plans and surveys	156	65.0	141	87.0
Information on use of recreation areas	84	35.0	69	35.6
Habitat maps or species	75	31.3	54	33.3
Property tax information	52	21.7	81	41.8
Endangered species maps or studies	37	15.4	33	20.4
Other	6	2.5	n/a	n/a
Weather, Climate, or Geological Information	**n**	**%**	**n**	**%**
Weather information	222	91.4	180	92.8
Flood risk maps	182	74.9	157	80.9
Return periods of past extreme events	142	58.4	99	51.0
Climate model precipitation projections	95	39.1	80	41.2
Climate model temperature projections	86	35.4	74	38.1
Water supply and budget forecasts	85	35.0	61	31.4
Water quality information	85	35.0	57	29.4
Erosion rates or studies	62	25.5	51	57.3
Coastal geology maps and reports	40	16.5	38	42.7
Sea-level rise projections	34	14.0	22	11.3
Sediment budgets	23	9.5	17	19.1
Other	3	1.2	n/a	n/a

In terms of community or environmental information, the vast majority of respondents in both surveys said they use three kinds: location of critical facilities (2013, 82.9%; 2009, 86.1%), population data (2013, 73.8%; 2009, 80.9%), and land use plans and surveys (2013, 65.0%; 2009: 87.0%). For weather, climate or geological information, weather information (2013, 91.4%; 2009, 92.8%) and flood risk maps (2013, 74.9%; 2009, 80.9%) were by far the most commonly consulted. Over half of the respondents in both surveys also said they consult return periods of past extreme events (2013, 58.4%; 2009, 51.0%).

Information Applications

Decision makers are more likely to use climate information if it is analyzed and displayed in a way that is relevant to the spatial and temporal scale(s) at which they operate and plan. In two previous studies involving 85 interviews with Oklahoma (Riley et al. 2012) and Gulf Coast decision makers

(Needham and Carter 2012), SCIPP discovered that a majority of them did not plan beyond 15 years. This was an important finding since a lot of climate change information is provided on a scale that projects 50 to 100 years in the future. To see whether the planning trend held true for a larger sample, we added four questions to this survey. We asked the respondents about their maximum planning timescale, most common planning timescale, the spatial scale at which climate projection information would be most useful, and their preference for how data should be represented (changes in average trends, frequency of extremes, or distribution of a variable). We wanted to get a broad snapshot although one should keep in mind that needs may vary across sectors and/or particular lines of work.

Planning Timescales. Figure 14 shows that 62.1% of respondents' maximum planning timescale was 5 years or less. Only 4.7% planned for greater than 50 years in the future.

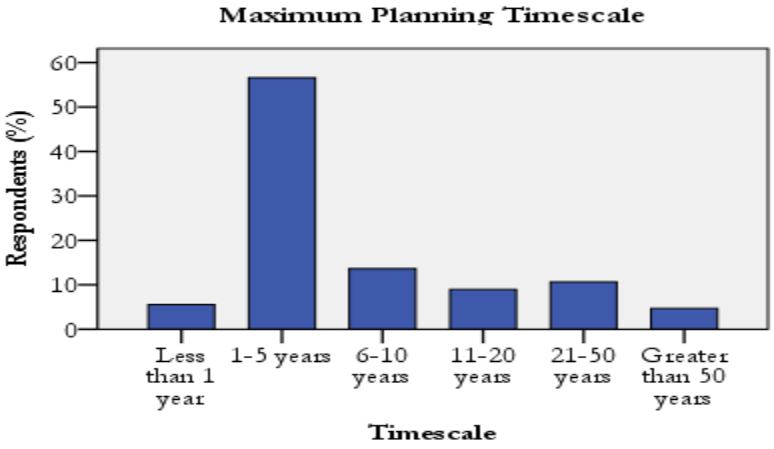


Figure 14: Respondent's maximum planning timescale.

Even more respondents most commonly planned on a short timescale. In fact, 83.8% of respondents most commonly planned out 5 years or less (Figure 15). Only 1.3% commonly planned on a timescale greater than 50 years. This and the above result indicate that while climate change projections on a 20-100 year timescale are useful for some decision makers, information on five year timescales would serve a majority of decision makers.

Breaking the data down by the top five most common respondent occupations of emergency manager, planner, extension agent, administrator, and environmental specialist, the pattern was similar to the overall pattern: The maximum planning occurred most commonly on the 1-5 year timescale. The same pattern was evident for the most common planning timescale among those occupations as well. A larger sample size may reveal more variation.

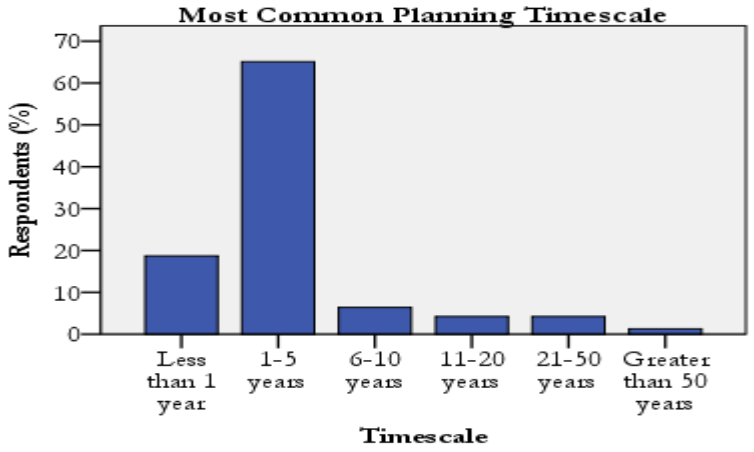


Figure 15: Respondents' most common planning timescale.

Spatial Scale of Interest. In addition to temporal scales, it is important to understand the spatial scale(s) at which climate information is relevant to decision makers. We provided respondents with a list of six different spatial scales and asked them to select the scale at which climate projection information would be most useful to their planning activities. The most common scale of interest was "regional within a state" (34.4%) followed by "county scale" (22.4%). Figure 16 shows the full distribution of responses.

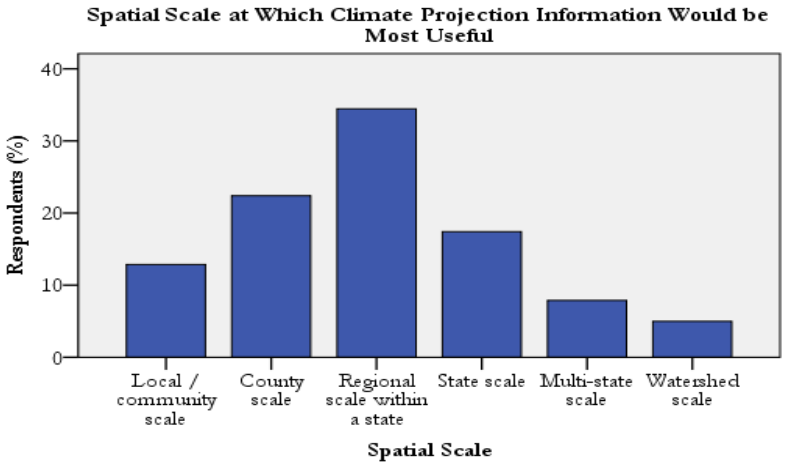


Figure 16: The spatial scale at which climate projection information would be most useful to respondents.

Preferred Representation of Data. Another important component of climate change data is how it is analyzed and displayed. Graphs depicting climate change typically show a trend over a particular time period. However, extremes often have the most impact on decision makers and the infrastructure they manage. We asked the respondents whether information about changes in average trends, the frequency of extremes, or the distribution of a variable would be most useful to their planning activities. "Changes in extremes" was selected by 51.5% of respondents, but "changes in average trends" was a close second; 49.1% of respondents selected it. This result indicates that the respondents need information about projected changes in extremes and averages. Only 22.8% of

respondents chose "changes in the distribution of a variable". The low percentage could be a valid measure of a lack of interest in that type of data or it could indicate that respondents did not understand the answer choice, given its technical nature.

Engagement Opportunities. In order to best serve decision makers in the SCIPP region, we were interested in the types of engagement opportunities that are most useful to them. The respondents were provided with a list of six opportunities and asked to rate how useful each would be on a scale of 1 "not at all useful" to 5 "extremely useful". Figure 17 shows that all opportunities were rated between 3 "somewhat useful" and 4 "moderately useful". Respondents rated "hands-on training on how to use information and/or tools in real-life settings" as the most useful (M = 3.96), followed by "routine workshops where presenters illustrate the use of information and tools in real-life settings" (M = 3.81) and "online tutorials on how to use information tools and products" (M = 3.63). These three opportunities were ranked in the same order in 2009 but the mean ratings cannot be compared due to a change in the labeling scheme. The three top rated opportunities are similar in that they involve active, in-person (in two cases) engagement as opposed to passive engagement, an indication of the broader type of engagement for which decision makers are looking.

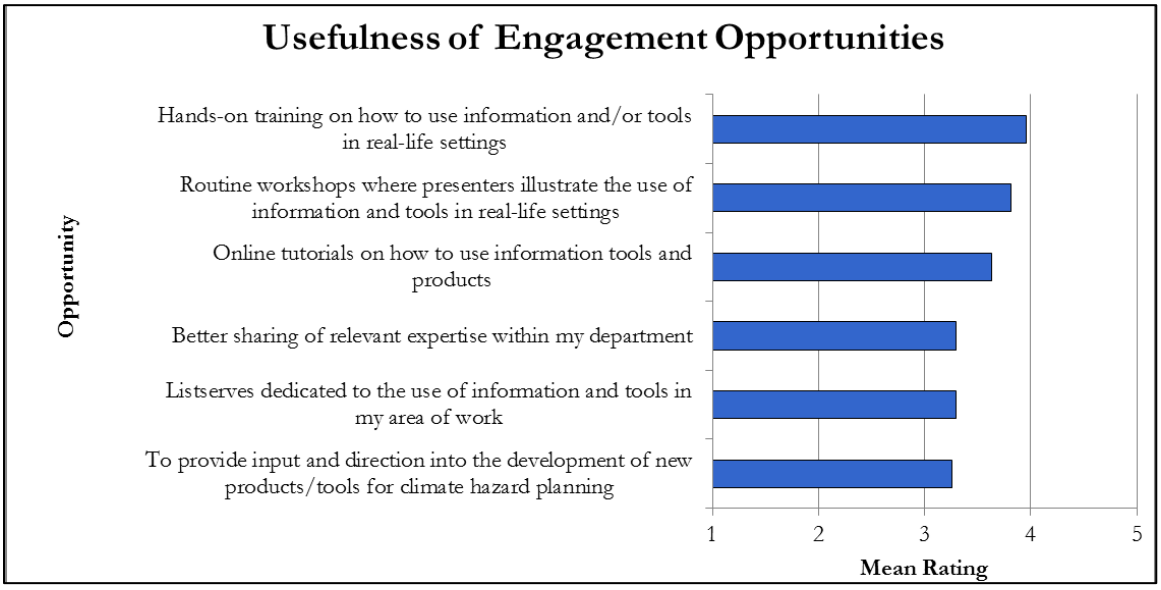


Figure 17: Mean rating response to the question, "In order for you to make the most effective use of information, how useful would the following opportunities be?" Answer choices included 1 "not at all useful", 2 "slightly useful", 3 "somewhat useful", 4 "moderately useful", and 5 "extremely useful".

DISCUSSION

Understanding hazard planning practices and the issues that are important across the region is essential to the work of SCIPP. Knowing how needs and concerns change over time provides us

with direction for how best to utilize our resources and serve our stakeholders. Below is a discussion on comparing the results of the two surveys and the implications of the results for SCIPP.

Comparison of the Two Surveys

One goal of this study was to compare and contrast how hazard planning concerns and processes have changed over the period between 2009 and 2013. Some noteworthy findings are described below.

First, the average number of staff who shared hazard planning responsibilities in a department increased slightly over the four year period from 3.13 to 3.32. About 77% of 2009 respondents cited three or fewer staff; only 71.1% of the 2013 cited three or fewer staff. Second, the ranking order of the hazard planning challenges and limitations stayed the same for the two surveys, which means that the staffing and funding limitations, in addition to other areas of their work taking precedence, remained the top 3 challenges for decision makers.

In terms of the personnel involved in hazard planning, it was clear in both surveys that although emergency managers and city planners are likely to be involved, a variety of people from other agencies and organizations are involved as well. Furthermore, the decision makers continued to most commonly interact with at least the same four local, state and federal groups to carry out their hazard planning responsibilities.

Tornadoes and floods remained the top two hazards about which the respondents were concerned, although their rankings did an about-face and the respondents said it was slightly more important to plan for floods in this survey. Planning for drought rated much higher in this survey, which was probably a result of much of the SCIPP region experiencing exceptional drought over the past two to three years. When looking at the concerns by state it is interesting to note that lightning and hail were ranked in the top five in four states in 2009 but only in one state's top five in 2013 (and even then, just lightning).

The climate change section was substantially redesigned after 2009 so it is difficult to make a direct comparison between the two surveys. However, the most prominent three needs for incorporating climate change into planning activities stayed the same over the four year period. In addition, the barriers to incorporating climate change shifted, which means that some are becoming less prominent, perhaps due to the work of SCIPP and other organizations. In 2013 the top four climate change barriers were the same for the regular hazard planning barriers, which may be a product of general constraints as opposed to climate change-specific constraints.

Implications for SCIPP

Another goal of this study was to inform SCIPP for how to be relevant to decision makers involved in hazard planning. The ratings for how important the respondents think it is to plan for particular hazards provides direction for the hazards on which to spend our time engaging with decision makers. Furthermore, the groups with whom hazard planners most commonly interacted were the

same for both iterations, which gives us direction for other agencies and organizations with which to collaborate on hazard planning initiatives.

Understanding the challenges to hazard planning such as limited staffing and funding is important because in some instances we may be able to help alleviate those challenges. We can also help fill the knowledge and expertise gap that exists among some of those involved in hazard planning. The results also highlight the need for continued improvement in engagement between decision makers and scientists, a relevant message to all climate service providers across the region.

In terms of climate change, it is clear that quite a bit of uncertainty exists among decision makers on the topic. It is also clear that much more needs to be done to establish its relevance to the many decision makers whose planning horizon is typically five years or less. Therefore, continuing to provide clear and accurate information on climate change, when given the opportunity, is a good use of our time. Additionally, we can work to meet the top needs identified to encourage respondents to incorporate climate change in their planning initiatives.

ACKNOWLEDGEMENTS

The authors thank the survey respondents for taking time to participate in this study. Your input is invaluable. Second, we thank Katy Strnad for producing the map of survey respondents. This work was supported by the Southern Climate Impacts Planning Program (SCIPP) as authorized by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration Co-operative Agreement, NA08OAR4320886.

REFERENCES

Burby, R. J., 2005: Have state comprehensive planning mandates reduced insured losses from natural disasters? *Natural Hazards Review*, **6**: 67-81.

Gallup, cited 2013: Americans' concerns about global warning on the rise. [Available online at http://www.gallup.com/poll/161645/americans-concerns-global-warming-rise.aspx.]

Hocker, J. E., and L. M. Carter, 2010: Southern U.S. Regional Hazards and Climate Change Planning Assessment. A summary report based on a regional survey conducted by the Southern Climate Impacts Planning Program (SCIPP). [Available online at: http://www.southernclimate.org/publications/SCIPP_Hazards_Survey_Report_Final.pdf.]

Ingram, K., 2013: *Climate of the Southeast United States: Variability, Change, Impacts, and Vulnerability*. Island Press, 224 pp.

Kohut, A., C. Doherty, M. Dimock, and S. Keeter, 2010: Increasing partisan divide on energy policies: Little change in opinions about global warming. The Pew Research Center, 18 pp.

National Institute of Building Sciences, 2005: Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities, Volume 1 – Findings, Conclusions, and Recommendations. [Available online at http://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/MMC/hms_vol1.pdf]

Needham, H. F., and L. Carter, 2012: Gulf Coast Climate Information Needs Assessment. Southern Climate Impacts Planning Program, 20 pp. [Available online at: http://www.southernclimate.org/publications/Gulf_Coast_Assessment_Final.pdf.]

Ojima, D., 2013: *Great Plains Regional Technical Input Report*. Island Press, 224 pp.

Riley, R., K. Monroe, J. Hocker, M. Boone, and M. Shafer, 2012: An Assessment of the Climate-Related Needs of Oklahoma Decision Makers. Southern Climate Impacts Planning Program, 47 pp. [Available online at http://www.southernclimate.org/publications/OK_Climate_Needs_Assessment_Report_Final.pdf]

Sheehan, K. B., 2001: E-mail survey response rates: A review. *Journal of Computer-Mediated Communication*, **6**(2): 0.

APPENDIX – SURVEY QUESTIONS

South Central U.S. Hazard Planning Survey

1. PROJECT CONSENT

University of Oklahoma Institutional Review Board Information Sheet to Participate in a Research Study

Project Title: South Central U.S. Hazard Planning Survey
Principal Investigator: Mark Shafer
Department: Oklahoma Climatological Survey

You are being asked to volunteer for a research study. This study is being conducted by the Southern Climate Impacts Planning Program (SCIPP; www.southernclimate.org) to evaluate climate hazard preparedness across the south central U.S. (OK, TX, AR, LA, TN and MS). We conducted a survey in 2009 and are doing so again to determine whether changes in perceptions and/or needs have occurred across the region. SCIPP is a National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments (RISA) team that provides stakeholder-driven climate products and services across the south central U.S. You were selected as a possible participant because you may participate in hazard planning activities or have previously had contact with SCIPP.

Please read this information sheet. You may contact me if you have any questions before participating in this study.

Purpose of the Research Study
The purpose is to evaluate state and local hazard planning currently in place across the south central U.S. and to learn more about information sources, planning challenges, data needs, and communication. This survey also focuses on climate change perceptions and how climate change may affect hazard planning in your area.

Number of Participants
About 1500 people will take part in this study.

Procedures
If you agree to be in this study, you will be asked to participate in an online survey.

Length of Participation
30 minutes.

Risks and Benefits
There are no risks and no benefits from being in this study.

Compensation
You will not be reimbursed for your time and participation in this study.

Confidentiality
In published reports, there will be no information included that will make it possible to identify you. Research records will be stored securely and only approved researchers will have access to the records. There are organizations that may inspect and/or copy your research records for quality assurance and data analysis. These organizations include the OU Institutional Review Board.

Voluntary Nature of the Study
Participation in this study is voluntary. If you withdraw or decline participation, you will not be penalized or lose benefits or services unrelated to the study. If you decide to participate, you may decline to answer any question and may choose to withdraw at any time.

South Central U.S. Hazard Planning Survey

Contacts and Questions

If you have concerns or complaints about the research, the researcher(s) conducting this study can be contacted at 405-325-3044 or mshafer@ou.edu. Contact the researcher(s) if you have questions or if you have experienced a research related injury. If you have any questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than individuals on the research team or if you cannot reach the research team, you may contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu.

Please print this information sheet for your records. By clicking Next at the bottom you are agreeing to participate in this study.

Survey Development Team:
Margret Boone, University of Oklahoma
Lynne Carter, Louisiana State University
Renee Edwards, Louisiana State University
James Hocker, University of Oklahoma
Barry Keim, Louisiana State University
Rachel Riley, University of Oklahoma
Mark Shafer, University of Oklahoma

This study has been approved by the University of Oklahoma, Norman Campus IRB. IRB Number: 415960. Approval date: 12/12/12.

2. SECTION 1: YOUR WORK AND OTHER INFORMATION

To start off, we would like to ask some basic demographic questions and about your work.

3. SECTION 1: YOUR WORK AND OTHER INFORMATION

1. What is your gender?

- ○ Female
- ○ Male

2. What year were you born?

[▾]

3. Please select the highest level of education you have completed.

[▾]

4. Which of the following best describes you?

- ○ Caucasian / White
- ○ African American / Black
- ○ Hispanic
- ○ Other (please specify)
- ○ Native Hawaiian / Pacific Islander
- ○ Asian
- ○ American Indian / Alaskan Native

South Central U.S. Hazard Planning Survey

5. What type is your organization or agency?

- ○ Federal Government
- ○ State Government
- ○ Local Government
- ○ Tribal Government
- ○ Non-Profit Organization
- ○ For-Profit Organization

6. Please indicate what position you hold in your organization or agency.

- ○ City Manager
- ○ Consultant
- ○ Developer
- ○ Education
- ○ Emergency Manager
- ○ Engineer
- ○ Other (please specify)
- ○ Environmental Specialist
- ○ Elected Official (e.g., Mayor, Commissioner, City Council Member)
- ○ Extension Agent
- ○ Planner
- ○ Police or Fire Department

7. Have you been formally involved with hazard planning within your organization or agency?

- ○ Yes
- ○ No

4. SECTION 1: YOUR WORK AND OTHER INFORMATION

8. Please indicate the level at which you are involved with hazard planning:

- ○ City/Community level
- ○ County/Parish level
- ○ Multi-County/Parish level
- ○ Tribal level
- ○ Other (please specify)
- ○ State level
- ○ Federal level
- ○ Multi-State level
- ○ I am not involved in hazard planning

South Central U.S. Hazard Planning Survey

9. In an average week, approximately what percentage of your work deals with hazard planning issues?

- None
- Under 20% [up to 1 day/wk]
- 20-50% [approx. 1-2.5 days/wk]
- 50-75% [approx. 2.5-4 days/wk]
- Over 75% [more than 4 days/wk]

10. How many staff members in your department (including yourself) share hazard planning responsibilities for your area?

5. SECTION 2: LOCAL LEVEL HAZARD PLANNING

In this section, we are interested in information about your community, county/parish, or state, the types of hazards your area faces, existing hazard plans that are used to manage these risks, and the information sources used to develop these plans.

6. SECTION 2: LOCAL LEVEL HAZARD PLANNING

11. What is the approximate population of your area of responsibility?

- Less than 1,000
- 1,000-9,999
- 10,000 - 49,999
- 50,000 - 99,999
- 100,000 - 499,999
- 500,000 - 999,999
- > 1,000,000

12. Please enter your state.

- Arkansas
- Louisiana
- Mississippi
- Oklahoma
- Tennessee
- Texas
- Other (please specify)

13. Please enter your zip code.

7. SECTION 2: LOCAL LEVEL HAZARD PLANNING

South Central U.S. Hazard Planning Survey

14. Please rate how important planning is for the following climate hazards, as they currently affect your area of responsibility.

	Critically Important	Very Important	Important	Not Very Important	Not Important at All	N/A
Drought	○	○	○	○	○	○
Dust Storm	○	○	○	○	○	○
Extreme Cold	○	○	○	○	○	○
Flood (from rain or rivers)	○	○	○	○	○	○
Hail	○	○	○	○	○	○
Heat Wave	○	○	○	○	○	○
Hurricane	○	○	○	○	○	○

15. Please rate how important planning is for the following climate hazards, as they currently affect your area of responsibility.

	Critically Important	Very Important	Important	Not Very Important	Not Important at All	N/A
Inundation (from sea-level rise or land subsidence)	○	○	○	○	○	○
Lightning	○	○	○	○	○	○
Severe Winter Storm	○	○	○	○	○	○
Storm Surge	○	○	○	○	○	○
Tornado	○	○	○	○	○	○
Wildfire	○	○	○	○	○	○
Windstorm	○	○	○	○	○	○

8. SECTION 2: LOCAL LEVEL HAZARD PLANNING

16. What types of hazard plans does your agency/organization have? Please check all that apply. (Note that we will ask about the specific hazards for which you plan in the next question)

- ☐ Multi-Hazard/All Hazards Plan
- ☐ Comprehensive Water Plan (Quanity or Quality)
- ☐ Stormwater Plan
- ☐ Response Plan
- ☐ Mitigation Plan
- ☐ Land Use Plan
- ☐ Sediment/Beach Management Plan
- ☐ Species and/or Habitat Protection Plan
- ☐ Emergency Evacuation Plan

Other (please specify)

South Central U.S. Hazard Planning Survey

17. Please identify the hazard(s) for which your agency/organization has developed a mitigation plan (before the hazard; to reduce vulnerability) or a response plan (after the event; for recovery).

	Mitigation plan	Response plan
Drought	☐	☐
Dust Storm	☐	☐
Extreme Cold	☐	☐
Flood (from rain or rivers)	☐	☐
Hail	☐	☐
Heat Wave	☐	☐
Hurricane	☐	☐

18. Please identify the hazard(s) for which your agency/organization has developed a mitigation plan (before the hazard; to reduce vulnerability) or a response plan (after the event; for recovery).

	Mitigation plan	Response plan
Inundation (from sea-level rise/land subsidence)	☐	☐
Lightning	☐	☐
Severe Winter Storm	☐	☐
Storm Surge	☐	☐
Tornado	☐	☐
Wildfire	☐	☐
Windstorm	☐	☐

9. SECTION 2: LOCAL LEVEL HAZARD PLANNING

South Central U.S. Hazard Planning Survey

19. What local groups do you interact with in connection with hazard planning? Check all that apply.

- ☐ Association of City / Council of Governments
- ☐ Chamber of Commerce
- ☐ Citizen Groups (e.g. Environmental)
- ☐ Consultant(s)
- ☐ County / Parish Commissioners or Township Officials
- ☐ Developers or Realtors
- ☐ Economic Development Coalition or Agency
- ☐ Homeowner Associations
- ☐ Local Businesses or Industries
- ☐ Local Environmental Planning Committee (LEPC)
- ☐ Local Land Trust(s)
- ☐ Rural Development
- ☐ Public Works
- ☐ Public Safety Agencies
- ☐ Scientists/Engineers
- ☐ Other (please specify)

20. What regional or state groups do you interact with in connection with hazard planning? Check all that apply.

- ☐ Council of Governments
- ☐ Floodplain Managers
- ☐ Farm Service Agency
- ☐ Natural Resources Conservation Service
- ☐ State Climate Office / Regional Climate Center
- ☐ State Conservation Commission
- ☐ State Corporation Commission
- ☐ State Department of Agriculture
- ☐ State Department of Emergency Management
- ☐ State Department of Environmental Quality
- ☐ State Department of Health
- ☐ State Department of Wildlife Conservation
- ☐ State Municipal League
- ☐ State Water Board
- ☐ Tribal Governments
- ☐ University Extension Services (e.g. Agriculture, Sea Grant, RISA)
- ☐ Other (please specify)

South Central U.S. Hazard Planning Survey

21. What federal groups do you interact with in connection with hazard planning? Check all that apply.

- ☐ Federal Emergency Management Agency (FEMA)
- ☐ National Weather Service (NWS)
- ☐ National Oceanic and Atmospheric Administration (NOAA)
- ☐ Small Business Administration (SBA)
- ☐ U.S. Army Corps of Engineers (USACE)
- ☐ U.S. Bureau of Reclamation (USBR)
- ☐ U.S. Department of Agriculture (USDA)
- ☐ U.S. Department of Defense (DOD)
- ☐ U.S. Department of Health and Human Services (HHS)
- ☐ U.S. Department of Fish and Wildlife Service (FWS)
- ☐ U.S. Department of Housing and Urban Development (HUD)
- ☐ U.S. Environmental Protection Agency (EPA)
- ☐ U.S. Geological Survey (USGS)
- ☐ Other (please specify)

22. What non-governmental groups do you interact with in connection with hazard planning? Check all that apply.

- ☐ American Red Cross
- ☐ National Wildlife Federation
- ☐ Salvation Army
- ☐ The Nature Conservancy
- ☐ Other Environmentally-Based Organizations
- ☐ Other Faith-Based Organizations (e.g. Catholic Charities, Southern Baptist Convention)
- ☐ Other (please specify)

10. SECTION 2: LOCAL LEVEL HAZARD PLANNING

South Central U.S. Hazard Planning Survey

23. What challenges and limitations do you experience in developing hazard plans for your area of responsibility? Check all that apply.

- ☐ Higher work priorities in other areas
- ☐ Not enough time to be involved in the process
- ☐ Lack of community or political interest
- ☐ Lack of knowledge or expertise
- ☐ Limited or no funds available to support hazard planning
- ☐ Limited or no staff available to support hazard planning
- ☐ Too much time required to periodically refresh / renew plans (e.g., every 5 years)
- ☐ Other (please specify)

24. What adjustments have you made in your operations/practices in anticipation of these challenges, if any?

11. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

In this next section, we are interested in your thoughts about climate change and how it may affect hazard planning in your area of responsibility.

12. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

25. From what you have read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades?

- ○ Yes
- ○ No
- ○ Don't know

13. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

South Central U.S. Hazard Planning Survey

26. If the earth is getting warmer, is it

- Mostly because of human activity such as burning fossil fuels
- Mostly because of natural patterns in the earth's environment
- Don't know

27. In your view, is climate change

- A very serious problem
- Somewhat serious
- Not too serious
- Not a problem

14. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

28. How well informed are you about climate change?

- Very well informed
- Well informed
- Somewhat informed
- Not well informed
- Not at all informed

29. How has your personal view of climate change altered over the past 5 years?

- It has changed: I am more convinced that humans are influencing the earth's climate
- It has changed: I am less convinced that humans are influencing the earth's climate
- It has not changed: I am still convinced that humans are influencing the earth's climate
- It has not changed: I am still not convinced that humans are influencing the earth's climate

30. Have you ever included or considered including climate change in the hazard plan for your area of responsibility?

- Yes
- No

If so, what have you included? If not, why not?

15. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

South Central U.S. Hazard Planning Survey

31. Please indicate your level of agreement with the following statements about climate change and hazard planning for your area of responsibility.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
We should prepare for the possibility of stronger or more frequent hazards	○	○	○	○	○
We should prepare for the most likely scenario based on the best available information (e.g., scientific studies, economic forecasts)	○	○	○	○	○
We don't have enough information about climate change for it to influence our planning	○	○	○	○	○
We will adjust our plans when we get clear direction from state or federal government	○	○	○	○	○
Other challenges are more important than climate change	○	○	○	○	○
I do not believe that climate change will have any significant impacts in my area	○	○	○	○	○

32. Climate models project the following changes to occur in the future. What is your level of concern with these changes?

	Not At All Concerned	Slightly Concerned	Somewhat Concerned	Moderately Concerned	Extremely Concerned
Increased air temperatures	○	○	○	○	○
Increased seawater temperatures	○	○	○	○	○
Increased stream temperatures	○	○	○	○	○
Changes to rainfall patterns/timing	○	○	○	○	○
More intense droughts	○	○	○	○	○
More intense floods	○	○	○	○	○
More heatwaves	○	○	○	○	○
More frequent wildfires	○	○	○	○	○
Sea level rise	○	○	○	○	○

16. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

South Central U.S. Hazard Planning Survey

33. If you had all of the information that you needed about climate change, what water or flood management-related actions, if any, would you take? Check all that apply.

- [ ] Update flood risk maps
- [ ] Update water quality and supply management plans
- [ ] Change flood zone restrictions
- [ ] Change water dependent use restrictions
- [ ] Join the National Flood Insurance Program
- [ ] Other (please specify)

34. If you had all of the information that you needed about climate change, what land management-related actions, if any, would you take? Check all that apply.

- [ ] Change disclosure requirements (e.g., on flooding or erosion risks)
- [ ] Change land use planning requirements
- [ ] Change zoning regulations
- [ ] Change building codes
- [ ] Improve species and/or habitat protection plans
- [ ] Strengthen shoreline protection policies and regulations
- [ ] Other (please specify)

35. If you had all of the information that you needed about climate change, what disaster preparedness-related actions, if any, would you take? Check all that apply.

- [ ] Provide additional information/educational materials to public, homeowners
- [ ] Install or alter warning system(s)
- [ ] Update emergency evacuation plans
- [ ] Join other communities in regional collaboration or hazard planning
- [ ] Other (please specify)

17. SECTION 3: CLIMATE CHANGE AND HAZARD PLANNING

South Central U.S. Hazard Planning Survey

36. Whether or not your agency/organization has already taken action to prepare for possible impacts of climate change, which of the following, if any, have been barriers to incorporating climate change into your planning activities? Check all that apply.

- ☐ Higher work priorities in other areas
- ☐ Lack of community or political interest
- ☐ Lack of knowledge or expertise
- ☐ Lack of perceived solutions
- ☐ Limited or no funds available to support climate change planning
- ☐ Limited or no staff available to support climate change planning
- ☐ No legal mandate to take climate change impacts into account
- ☐ Not enough time to be involved in the process
- ☐ Scientific evidence is too uncertain

Other (please specify)

37. Please identify the most critical needs for including climate change in the hazard plan (s) relevant to your area of responsibility. Check all that apply.

- ☐ More climate information that is applicable to my particular area
- ☐ Instruction on where to find trustworthy climate information
- ☐ Training on how to interpret various climate information products
- ☐ Education on the basics of climate and climate science
- ☐ Improved fine-scale (regional) climate projections
- ☐ Information pertaining to future anticipated climate hazards
- ☐ Increased engagement between decision makers and scientists
- ☐ Increased collaboration between different hazard planning groups
- ☐ I don't think climate change needs to be included in hazard planning

18. SECTION 4: INFORMATION USE & NEEDS FOR EFFECTIVE HAZARD PLANNING

In this final section we are interested in the information you currently use or would like to have available to effectively carry out your job responsibilities in hazard planning.

19. SECTION 4: INFORMATION USE & NEEDS FOR EFFECTIVE HAZARD PLANNING

South Central U.S. Hazard Planning Survey

38. In order for you to carry out hazard planning, what community or environmental information do you consult regularly? Check all that apply.

- [ ] Population data
- [ ] Property tax information
- [ ] Information on use of recreation areas (types of activities, types of visitors, frequency or intensity of use, etc.)
- [ ] Location of critical facilities (e.g. utilities)
- [ ] Habitat maps or studies
- [ ] Endangered species maps or studies
- [ ] Land use plans and surveys
- [ ] Other (please specify)

39. In order for you to carry out hazard planning, what weather, climate, or geological information do you consult regularly? Check all that apply.

- [ ] Weather information (i.e., temperature, rainfall, winds, etc.)
- [ ] Return periods of past extreme events (droughts, floods, storms, hurricanes, etc.)
- [ ] Flood risk maps
- [ ] Water supply and budget forecasts
- [ ] Water quality information
- [ ] Sea-level rise projections
- [ ] Climate model temperature projections
- [ ] Climate model precipitation projections
- [ ] Coastal geology maps and reports
- [ ] Sediment budgets
- [ ] Erosion rates or studies
- [ ] Other (please specify)

20. SECTION 4: INFORMATION USE & NEEDS FOR EFFECTIVE HAZARD PLANNING

South Central U.S. Hazard Planning Survey

40. What is your maximum planning timescale?

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-20 years
- 21-50 years
- Greater than 50 years

41. What is your most common planning timescale?

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-20 years
- 21-50 years
- Greater than 50 years

42. What is the spatial scale at which climate projection information would be most useful in your planning activities?

- Local / community scale
- County scale
- Regional scale within a state
- State scale
- Multi-state scale
- Watershed scale

43. In terms of climate projections, would information about changes in average trends, the frequency of extremes, or the distribution of a variable (e.g., temperature, precipitation) be most useful to your planning activities? Check all the apply.

- [ ] Changes in average trends
- [ ] Changes in the frequency of extremes
- [ ] Changes in the distribution of a variable

44. In order for you to make the most effective use of information, how useful would the following opportunities be?

	Extremely Useful	Moderately Useful	Somewhat Useful	Slightly Useful	Not at All Useful
To provide input and direction into the development of new products/tools for climate hazard planning	○	○	○	○	○
Hands-on training on how to use information and/or tools in real-life settings	○	○	○	○	○
Online tutorials on how to use information tools and products	○	○	○	○	○
Routine workshops where presenters illustrate the use of information and tools in real-life settings	○	○	○	○	○
Listserves dedicated to the use of information and tools in my area of work	○	○	○	○	○
Better sharing of relevant expertise within my department	○	○	○	○	○

21. SECTION 5: FINAL REMARKS

South Central U.S. Hazard Planning Survey

45. Aside from this survey, have you ever worked with SCIPP before?

- ○ Yes
- ○ No

46. If Yes, how have you been involved with SCIPP? Check all that apply.

- ☐ Participated in or attended a webinar
- ☐ Participated in or attended an in-person workshop or meeting
- ☐ Used information or tool on SCIPP website
- ☐ Collaborated on a project
- ☐ Consulted with SCIPP for information
- ☐ Invited a SCIPP team member to present at a meeting

Other (please specify)

47. If you have worked with or attended a meeting or webinar that was hosted by SCIPP, please mark how the information you obtained was used. Check all that apply.

- ☐ Background information on a topic
- ☐ Used specific products or resources
- ☐ Used a figure or material from a presentation or report
- ☐ Changed my perspective on an issue
- ☐ Raised awareness of an issue for myself and/or a colleague
- ☐ Changed agency operations or policies

Other (please specify)

48. If there is anything we have not covered regarding hazard planning, climate change, or challenges/needs you may have in association with those, please use the following space to comment as needed.

South Central U.S. Hazard Planning Survey

22. THANK YOU!

Thank you very much for your time. We greatly appreciate it! By clicking "Done" below you have completed the survey.

If you are interested in the results of this study and/or would like to get involved with SCIPP, please provide your contact information after clicking "Done" below which will route you to an entry page on the SCIPP website.

This publication is issued by the Southern Climate Impacts Planning Program (SCIPP) as authorized by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration Co-operative Agreement, NA08OAR4320886. Copies have not been printed but are available through the SCIPP website.