

GSA members on climate change: Where, what, and ways forward?

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Climate change is one of the most pressing environmental, economic, and societal issues of the twenty-first century. Addressing climate change issues is difficult partly due to the disconnect between the scientific community and the public's understanding and perception of climate change issues. A number of studies have examined the views of the public and suggest that basic knowledge about climate change is limited and that many believe there is still no agreement in the scientific community about the possible causes and impacts (Hamilton, 2011; Whitmarsh, 2009). Fewer studies have looked at the broad scientific community, but those that have report that climate scientists who understand the climate process generally accept that anthropogenic climate change exists and agree that human activity has had a profound impact on Earth's climate (Doran, 2009; Oreskes, 2004). However, in order for vital information to be passed on to policy makers and voters, the scientists must put forth the effort to inform. *Included in that effort is the need to communicate the agreement scientists share on climate change factors.* Studies indicate that only 47% of the American public believes that there is scientific consensus on climate change (Doran, 2009); this belief needs to be addressed if scientists' views are to be accepted by the public. Here we look at the perceptions of Geological Society of America (GSA) scientists on climate change to understand (1) what are their biggest concerns; (2) what regions of the USA will be most impacted; and (3) how we bridge the gap between scientists and the public.

Surveys were collected in the exhibit halls of the GSA Annual Meetings in 2009 and 2011. GSA has more than 20,000 members, and each annual meeting attracts nearly 6,000 geoscientists (www.geosociety.org). We collected 181 surveys. Forty-nine percent of participants were female, and ages ranged from 19 to 70 years. The brief two-page survey varied slightly between the two years but both asked participants to indicate on a map where they believe climate change will have the most impact. They were then asked to answer questions (Table 1) about the region they indicated.

The most common response to the open-ended question about the impact of climate change was **sea-level rise** (32%), followed by **more severe weather** (22%) and **water resource issues** (20%). These responses make sense because people generally show the most concern for "salient, palatable" risks (Seacrest et al., 2000).

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Table 1. Survey questions

Question	Response Type
Shade in one region on the map below that you feel has been or will be impacted by climate change.	Shading/circling
This region has been or will be severely impacted by climate change.	Likert scale
I believe the general public is sufficiently informed about the impacts of climate change in this region.	Likert scale
Describe the climate change impact(s) that the region you shaded has or will experience.	Open-ended
Explain what you believe would be the most effective way to increase public understanding of climate change.	Open-ended

The remaining responses were varied and specific, with the next most common being agricultural shifts, both spatially and temporally (6%). Geographically specific impacts included pine-beetle expansion and loss of the maple-syrup industry. Of all 181 surveys, there were only two "climate change skeptics" who clearly stated they do not believe anything will occur because climate change is not happening.

Circled regions from the surveys were digitized into ESRI ArcGIS to visualize the overall regions of concern. Figure 1 represents the overall density of regions circled across all participants. The focus on coasts is consistent with the impacts given on the open-ended portion of the survey, including sea-level rise and increase in hurricanes. Water resource issues are also reflected in the focus on the southwestern United States. There were minor differences between years, based on the location of the meeting (more focus on the Northwest in 2009 and the northern Midwest in 2011). These signals, however, were relatively insignificant compared to the concern over the coasts.

Survey results indicate that 89% of the respondents believe that climate change presents a significant risk to the public, whereas only about half the general population is concerned. This difference in perceived risk may be influenced by a number of potentially mitigating factors shared by both the respondents and the public. These include personal experiences with climate change (Whitmarsh, 2009) as well as social and demographic factors (Leiserowitz, 2006). Perhaps the difference is rooted in the scientists' understanding and acceptance of the evidence, which may be immune to influences by informational sources available



Figure 1. Regions of most climate change concerns among GSA respondents. Darker orange areas mark where more respondents shaded.

to the public. Although recent studies have demonstrated varying beliefs in climate change by Americans (Hamilton, 2011; Whitmarsh, 2009), substantial doubt and lower perceived risk of climate change still remain among the population.

As the public's trusted source, what do these scientists think of the current state of the public's awareness of climate change? Most respondents (84%) believe the public is not adequately informed on the potential climate change impacts in the United States. This position is reflected by recent studies that indicate the American public is not well informed on climate change issues (Malka et al., 2009). Although potentially alarming, the geoscientists were forthcoming with possible solutions to increasing public awareness.

The majority of survey respondents (52%) believe the public is best informed through educational means, varying from formal K–12 education to specific public outreach programs delivered through a variety of methods to enable the greatest coverage. The remainder of responses varied in the delivery mechanism of climate information to the public. Some believed in a pure source of information derived from the scientific community, while others felt the government should take a role in disseminating the information in an understandable public format. Interestingly, 6% of the respondents indicated that an actual climate-related disaster would serve best to wake up the public to the risk associated with climate change in their respective regions. Although drastic in comparison with more reasonable alternatives, the impact of disasters and the national attention focused on these events have the tendency to grip the public's scrutiny in an immediate and urgent manner.

The link between scientists and the public thirst for knowledge is an opportunity for the geoscience community. The public generally relies on the media to navigate science-based issues, ranging from local weather to complex information about geohappenings, including climate change. Since scientists usually generate this information, a more direct connection between the media and scientists, or perhaps alternative methods of providing for the interaction between scientists and the public would be beneficial. Malka et al. (2009) show that nearly three-quarters of the public relies on scientists for information because the complexity and number of issues is too much to fully grasp without conducting research oneself.

Survey data demonstrate that climate change concerns among geoscientists are consistent and aligned with current climate

science (Bray and von Storch, 2010). This community has great potential to influence public awareness and understanding of climate issues by acting in unison (Anderegg et al., 2010) and reinforcing the public's trust (Hamilton, 2011; Whitmarsh, 2009). GSA's official position statement on climate change (www.geosociety.org/positions/position10.htm) highlights the opportunities available to members in order to help this cause. These include participating in professional education, engaging in public education activities, collaborating with stakeholders, working with other science and policy societies, and utilizing the most up-to-date sources of climate science (GSA, 2010). The impacts of climate change range from local communities to the global population. With overwhelming consensus, and armed with the best science, each member of the geoscience community can find his or her niche in moving the public toward better understanding of the risks and solutions for the changing climate.

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