



# Unpacking the ‘information barrier’: Comparing perspectives on information as a barrier to climate change adaptation in the interior mountain West



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## ABSTRACT

Inadequate information has been repeatedly identified as a barrier to climate change adaptation planning and implementation. However less is known about how information functions as a barrier, and to what degree it prevents adaptation compared to other perceived barriers. In addition, the role of institutional context in mediating the demand for information in the context of adaptation has been less well studied. This paper helps to clarify the role that information plays in adaptation planning for two sectors of public employees working at similar scales, in similar locations, with similar challenges. We conducted surveys and semi-structured interviews to investigate the demand for information in support of adaptation implementation and planning from US federal public lands managers and municipal officials in the US interior West. We found that federal managers and municipal officials both consulted information frequently for decision making, and while both groups indicated that lack of information at relevant scales was a barrier to adaptation planning, this was seen as a much stronger barrier for federal managers than for communities. Uncertainty of information was raised as an issue, but results were mixed on whether or not this acted as a strong barrier. While peer-reviewed publications were seen as the “best available science,” and correlated with adaptation planning, they were not accessed directly as frequently as other sources of information, including colleagues, the internet and reports. The strong connection between communities and adjacent federal lands may provide an opportunity for networking that could facilitate the flow of information relevant for adaptation.

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## 1. Introduction

Gaps in information have been repeatedly identified as barriers to climate change adaptation planning and implementation (Crabbé and Robin, 2006; Mukheibir and Ziervogel, 2007; Tribbia and Moser, 2008; GAO, 2009; Lowe et al., 2009; Metz and Below, 2009; Carter and Culp, 2010; ICCATF, 2010; NRC, 2010; Foster et al., 2011; Measham et al., 2011; Archie et al., 2012). Recent studies of US federal agencies by the Government Accountability

Office (GAO) and the Interagency Climate Change Adaptation Task Force (ICCATF) identify lack of relevant data as one of the major challenges associated with adaptation (GAO, 2007; GAO, 2009; ICCATF, 2010). In addition, California coastal managers participating in surveys and interviews have identified multiple types of information that would be useful to them in planning for adaptation (Tribbia and Moser, 2008). Relevant information is an extremely valuable resource and institutions that have access to site-specific information have reportedly been successful in both planning for adaptation and implementing such plans (Cruce, 2007; GAO, 2009). In fact, a 2009 report by the Center for Clean Air Policy identified leadership, organizational structure, collaboration and networking, stakeholder engagement and access to scale relevant information as common characteristics of places that have been successful in planning for adaptation (Lowe et al., 2009).

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In addition, the 2011 Progress Report of the ICCATF, listed “improving accessibility and coordination of science for decision making” as one of the five key areas where federal adaptation progress has been made (ICCATF, 2011). Given all of these reports of success in the area of providing information, we can infer that at least some useful information is available.

## 2. Supply and demand of information

In instances where lack of information is identified as a barrier to adaptation planning it is not always obvious whether the necessary information does not exist or is just not easily accessible (Archie et al., 2012). Furthermore, even if ostensibly relevant information is available, the question arises of whether that information is usable for decision making, and if not, why not. One recent critique has suggested there is a disconnect between the supply and demand of scientific information where supply consists of knowledge and information provided by scientists and demand is determined by use of this information in achieving societal goals (Sarewitz and Pielke, 2007; Dilling, 2007; Dilling and Lemos, 2011). Effectively addressing opportunities to reconcile supply and demand could result in science that is “more likely to advance desired societal outcomes” (Sarewitz and Pielke, 2007, p.6). Often the response to the disconnect between supply and demand has been to merely increase the supply of science before confirming that what is produced is usable to decision makers, leading to a glut of information that is not necessarily usable (Lahsen and Nobre, 2007; Sarewitz and Pielke, 2007; McNie, 2007). We consider usable science to be that which “contributes directly to the design of policy or the solution of a problem” (Dilling and Lemos, 2011, p.681). The US Global Change Research Program (USGCRP) and other major scientific programs have prioritized production of adaptation science, but whether that information will be usable for decision makers remains to be seen (USGCRP, 2009).

Numerous papers analyze the information disconnect from the supply side, evaluating research agendas and science policy, but less research has been done on the demand side (McNie, 2007). Here we consider demand for climate change adaptation information from the perspective of federal land managers and municipal officials in the interior US West, a region of potentially rapid climate change and where we have limited knowledge about the role of information in adapting to climate change. We consider adaptation in the same manner as the Intergovernmental Panel on Climate Change (IPCC), which defines climate change adaptation as “adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects (IPCC, 2007).”

There are a number of documented issues related to the dissemination of climate related information. For example, literature suggests there is a lack of cross-disciplinary interaction and understanding by scientists, which leads to a constricted flow of information and makes “decision support” and communication difficult (Ingram and Bradley, 2006; Feldman and Ingram, 2009). The term “decision support” has been used to describe research activities that center around the needs of decision makers rather than those that stem from the pursuit of scientific knowledge alone (Dilling and Romsdahl, 2013). Of utmost importance are issues relating to the transmission and relevance of climate information such as the non-linear pathways that information must travel from scientist to practitioner and the differences between the “decision space” of a researcher and a decision maker (Feldman and Ingram, 2009). Issues of trust, accessibility, relevance, and timeliness are additional reasons why certain information may not be included in the decision process (Dilling and Lemos, 2011). Of similar importance when considering the effective use of science in decision

making are the “tightly coupled” issues of salience, credibility, and legitimacy (Cash et al., 2003; Cash et al. 2006). Cash et al. (2003) make the case that effective information needs to be not only relevant to the needs of users but also scientifically adequate, and unbiased in relation to the potentially divergent views of stakeholders. Cash and others also point out four functions characteristic of institutions that work effectively at the science–policy interface to better link scientific knowledge to decision making (2006). These functions include convening, translation, collaboration and mediation. The translational function can be understood as both literal translation across different languages or sets of terminology, and metaphorical translation where boundary organizations must work to reconcile different sets of assumptions, causal explanations, or expectations of knowledge across the boundary between knowledge providers and users (Cash, 2001). While examining how boundary organizations can improve the linkage between science and decision making is beyond the scope of this paper, we aim to illuminate the perceived information gaps and how they function as barriers to adaptation in two types of governmental organizations as a first step toward understanding how such gaps can be remedied.

In response to Executive Order 13,514 issued by President Obama in 2009, federal agencies are required to begin the process of adaptation to climate change. Though research has shown that federal public lands agencies have indeed begun to incorporate adaptation into decision making (Cruce and Holsinger, 2010; Archie et al., 2012), few efforts have made it to the implementation stage (Amundsen et al., 2010; Moser and Eckstrom, 2010; Berrang-Ford et al., 2011; Archie et al., 2012; Dilling and Failey, 2013). Similarly, adaptation planning has begun to take place in many municipalities across the US, but research on the state of adaptation planning and implementation in Colorado mountain communities shows only a small degree of progress in implementation of such plans (Archie, 2013).

Understanding the specific information demands for these groups could help to bridge the gap between adaptation science and adaptation planning and implementation on federal public lands and in municipalities. This is the first step in reconciling the demand for adaptation information with the supply of adaptation science. Literature suggests a variety of strategies that could assist in adaptation planning (Measham et al., 2011; Romsdahl, 2011), but we focus here on the role of information. This paper helps to clarify the role that information plays in adaptation planning for two different types of public employees working at the in the same region, with similar challenges. Our approach is novel in its ability to compare the responses of these two sectors and in its inclusion of questions related to both adaptation planning and implementation. Prior work in this area has suggested that decision makers often desire additional information, but that information barriers were not necessarily as important as other barriers in preventing adaptation progress (Jantarasami et al., 2010). Furthermore, we were interested in differences in information demand for those having both a mandate to use information and directives to pursue adaptation, and for those who had neither.

To address these issues, we conducted separate surveys of western federal public lands managers and municipal government employees in Colorado mountain communities, which were supplemented with several interviews. Here we analyze the results, and discuss the reported barriers to adaptation planning, the types of information decision makers currently use, and where they get this information. We present interesting similarities and differences among the types of climate related information that federal land managers and mountain community municipal employees find useful, the scale of information that is considered most useful,

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