



## Overcoming barriers during the co-production of climate information for decision-making



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### ABSTRACT

The Great Lakes Integrated Sciences and Assessments program (GLISA) has led the co-development of usable climate information for decision-making in several case study projects. Although each case study is with a unique partnering organization made up of different stakeholders with varying information needs and capabilities, several patterns have emerged that GLISA has identified and overcome to advance the practice of applied climate information. There are three main barriers that GLISA encounters at the onset of many of the case studies: (1) mismatched terminology used by scientists and stakeholders to describe the types of information that are available and needed for problem solving (translation); (2) unrealistic expectations regarding the development of climate information products for problem solving; and (3) disordered integration of when stakeholders want to bring climate information into decision-making processes. Although some or all of these barriers are likely to exist at the onset of any new climate information partnership, GLISA has developed methods for overcoming them more quickly so that the process of co-developing usable climate information is more efficient and effective. In this paper we describe in detail GLISA's experiences that have led to the realization of these barriers and the steps GLISA has taken to overcome them. We also relate these barriers to literature on the "usability gap" between climate science and information use in decision-making as well as uncertainty cascades in climate change adaptation. These experiences demonstrate that climate scientists performing outreach experience similar struggles as the stakeholders they interact with. However, they also reveal the potential for climate-centered boundary organizations to cultivate their own capacities to overcome these challenges in their partnerships.

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### Introduction

Decision makers from a wide variety of professional backgrounds increasingly find that their work intersects with the subject of climate change. The level of scientific expertise required to work on complex climate change adaptation problems is quite high, and most decision makers – such as city planners, resource managers, health officials, and farmers – do not have any background with climate science. When tasked with integrating climate information into their planning processes, decision makers face two main challenges: (1) they find it difficult to know what climate information and data are best

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suit for a particular problem (Tillmann and Siemann, 2012; Barsugli et al., 2013) and (2) they often perceive that climate information and data coming out of the scientific community is not usable in decisions (Lemos and Rood, 2010).

One approach for decision-makers to overcome these challenges is to form direct partnerships with climate scientists to co-produce usable information for decision-making (Lemos and Morehouse, 2005; Dilling and Lemos, 2011). Collaboration between decision makers and climate scientists offers an opportunity to leverage expertise from both parties to better serve problem solving. Highly iterative interactions between decision makers and scientists contribute to greater societal outcomes (Lemos and Morehouse, 2005). However, this type of relationship requires a large investment of time, and the number of decision makers working on climate problems is much greater than the number of available partnering climate scientists (Bidwell et al., 2012).

We argue an equally valid approach to climate change problem solving is the use of boundary organizations to facilitate and extend decision maker-scientist partnerships. Boundary organizations assist interactions (Kirchhoff et al., 2013) and bridge and broker knowledge (Lemos et al., 2014) between science producers and users (decision makers). The Great Lakes Integrated Sciences and Assessments Program (GLISA) is a boundary organization specializing in producing and providing climate information for decision-making in the Great Lakes region. The types of decisions most stakeholders working with GLISA face relate to climate variability and change over the next few decades. The data sources on which climate information is generally built are from historical weather station-based observations (from the past 50 to 100 years depending on the quality of data available) and derivatives of that data as well as model-based projections of future climate conditions. The actual information stakeholders find usable in their problems is a product of working through each of the barriers and is discussed in further detail in their respective sections, but typically some form of synthesis and narrative is required.

To meet these needs, GLISA employs three faculty members and three research associates trained as climate scientists who do direct outreach with other boundary organizations and their stakeholders to support efforts to use climate science in decision-making. When GLISA was formed in 2010 it took on a boundary organization strategy in order to build on the capacities that already existed in the region, enhance the number and diversity of stakeholders (decision makers) GLISA could work with, and reduce the cost of outreach (Lemos et al., 2014; Bidwell et al., 2012).

This paper offers GLISA's climate scientists' reflections on their experiences partnering with other boundary organizations and their stakeholders. The first goal of this paper is to identify barriers that GLISA has encountered while working with other boundary organizations to co-develop usable climate information for decision-making. We position each of these barriers in relation to the existing literature on the "usability gap" between the production of climate science and its application in decision-making (Lemos et al., 2012). What this glimpse reveals is the extent to which information providers experience challenges similar to those stakeholders face. The barriers are (1) mismatched terminology used by scientists and stakeholders to describe the types of information that are available and needed for problem solving (translation); (2) unrealistic expectations that stakeholders have regarding the development of climate information products for their problems (interplay); and (3) disordered integration of when stakeholders want to bring climate information into decision-making processes—stakeholders often assume climate information will reveal their vulnerabilities, but it is more effective to localize climate information around existing known vulnerabilities (information fit). The second goal is to bring attention to these barriers and what GLISA is doing to overcome them so that future boundary organization partnerships can be more effective and efficient in their co-production of climate information.

The next section provides necessary background about research on climate information usability and climate change adaptation. It is followed by another background section that introduces GLISA's approach to addressing these challenges. These two sections provide perspective for the fourth section that describes the barriers of mismatched terms, unrealistic expectations and disordered integration in more detail. We present two case studies in the fifth section in order to show the emergence of these barriers in context and discuss how GLISA has learned to overcome them more quickly over time. Lastly, we conclude with a summary of strategies for overcoming the barriers.

## The usability gap, uncertainty, and climate adaptation

Despite extensive work to further develop climate science, the challenge of moving from the production of information to its use in actual decision-making persists (Bierbaum et al., 2013). This gap has been referred to as a matter of a mismatch between supply and demand (Sarewitz and Pielke, 2007; McNie, 2007), as reliant on the cultivation of certain information characteristics such as salience, credibility and legitimacy (Cash et al., 2006), and as a challenge of using uncertain science that has also become highly politicized (Meyer, 2011; Mearns, 2010).

In an effort to explain the process of moving information towards being usable in stakeholder's decisions, Lemos et al. (2012) developed a model of the process of transitioning information from the production of "useful" information to the realization of "usable" information. This model built off of previous work (Lemos and Rood, 2010) that defined the distinction between these two states as information's potential functionality and desirability for a wide variety of uses (useful) versus being well-suited to a particular application (usable). In an extensive review, Lemos et al. (2012) identified three major factors underlying the usability of information: perception of fit, interplay and interactions. Limitations in any one of these factors represent well-established barriers to the use of information (Lemos et al., 2012).

Information fit encompasses a number of different information characteristics identified in the literature that make people perceive that information adequately applies to a needed purpose. Not surprisingly, people are more likely to use

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