

COMMENTARY:

Fostering knowledge networks for climate adaptation

David Bidwell, Thomas Dietz and Donald Scavia

We must forge network connections among rapidly changing communities of decision-makers and researchers to foster the social learning necessary for effective adaptation to climate risks.

We are still learning how to cope with the potential impacts of a changing climate. Although climate models offer plausible futures, they cannot provide a precise forecast for the coming decades. Uncertainties abound in the amount of climate forcing that will occur over the next few decades, in how the climate system will respond to that forcing and in how both human and natural systems will change in response. Even if we had a high degree of certainty with regard to these complex issues, there is still uncertainty in how climate-related policies and programmes will interact with other social and environmental policies.

Recognizing these uncertainties, however, should not lead to paralysis. It doesn't in other domains, such as economic policy, geopolitics, or medicine. The logical way to proceed is through adaptive risk management (ARM)¹. In ARM, one takes action based on available information, monitors what happens, learns from the experience and adjusts future actions based on what has been learnt. In the academic literature, ARM is widely advocated as a path forward for making climate-sensitive decisions; however, much of the decision-making community struggles to move towards a risk-management framework²⁻⁴. Instead, many continue to emphasize the need to reduce uncertainty in climate projections, rather than move towards decision techniques that accommodate that uncertainty². Even if decision-makers accept ARM strategies, they often do not have access to useable information on risks and management options. The available science can be hard to translate into language that makes sense to decision-makers, scientists are often not aware of the needs of decision-makers and neither side has a sufficient history of trust with the other.

To resolve the gap between producers and potential users of climate information, some

have suggested sustained interaction between scientists and decision-makers^{3,4}. This is a model that has long been used effectively by the Land Grant and Sea Grant programmes in the United States, where science is linked to decision-making through organizational partnerships stretching over decades. Developing effective relationships, however, is time consuming and difficult. It may not be realistic to expect climate scientists to develop continuing relationships with a broad, diverse and changing community of decision-makers, particularly under conditions of limited resources and poor institutional support on both sides. Even if climate scientists had that capacity, decision-makers rarely focus on climate alone because it is only one of a number of stresses driving their decisions⁵.

Moreover, a direct, two-way model of communication between producers and users of climate information is probably overly simplistic. Sharing information among scientists and decision-makers has been described as a complex, continuous web of interactions rather than a simple linear exchange⁴. Thus, these interactions might be better characterized as knowledge networks³, and this framing has important implications for how we encourage ARM.

To promote ARM, especially as more sectors of society are affected by climate change, the climate-adaptation community needs to foster social learning, "the process by which agents adopt cognitions and behaviours from their social environment"⁶. Social learning is the movement of information and practices through knowledge networks, whose structures influence both the pace and qualities of learning as the networks themselves evolve^{7,8}.

In climate adaptation, knowledge about the values and political calculations of policymakers can be as important as that about physical and ecological processes². Fortunately, social learning can encompass

content about both physical and ecological processes (for example, how key weather patterns have changed) and what decision-makers value (such as methods to improve justice in the decision process). Summaries of climate impacts are probably most useful when they are communicated through networks of scientists, decision-makers and those who are experienced in communicating science to decision-makers. These networks can be effective not only for transmitting information but also for guidance on how best to use it. For example, rules of thumb and best practices — such as the appropriate use of downscaled projections in making decisions — are likely to have more impact when learnt from a trusted peer rather than read on a website or in a publication.

If we accept that networks can facilitate the social learning needed for ARM, we must ask what can be done to encourage the evolution of networks that are effective in deploying scientific information. Network science emphasizes the importance of 'bridgers' who span gaps in network structure. Individuals, boundary organizations (such as extension services), activities (for example, assessments) and objects (such as downscaled projections) that bridge network gaps have long been recognized as an essential feature of making science useful and useable for decision-making^{3,9-11}. Bridgers link disparate communities, facilitate communication among them and provide mechanisms for mediating disputes. In doing so, they encourage the coproduction of credible, salient and legitimate science, along with effective policies or practices. When effective bridgers are in place, science becomes more relevant and decision-making more effective¹¹.

Previous models of bridging organizations, such as the Land Grant and Sea Grant extension services, assume

relatively stable scientific organizations with long-term links to communities of decision-makers. But, as mentioned above, the communities both of climate researchers and of decision-makers who must cope with climate change are evolving rapidly. If more and more kinds of decision-makers need to be informed and they need expanded sets of science, then a traditional bridging organization would have to grow dramatically. We submit that, at least in the short term, this is not a viable model for informing decisions about climate change. More flexible, adaptable and innovative approaches are needed.

We propose that an effective way to link science to decision-making is by forging network connections among rapidly changing communities of decision-makers and researchers. The traditional model of a bridger centrally located in the network, with communication flowing through the organization, is not likely to be able to keep up with the growing supply of and demand for science. Furthermore, there is a risk that such networks can become narrowly focused or stale and insular, reinforcing myths and misinformation among its members. We suggest instead that the best investment is in the facilitation of extended networks among local bridging organizations, each with direct links within their community of researchers and decision-makers. In many cases, these organizations have already established long-term trust relationships with decision-makers and other stakeholders, thus raising the chances of producing and sharing information that is more salient, timely and legitimate^{3,11}.

At the Great Lakes Integrated Sciences and Assessments Center, one of eleven

Regional Integrated Sciences and Assessments centres funded by the US National Oceanographic and Atmospheric Administration, we are experimenting with this model. Rather than acting as a centralized bridging organization, we are supporting other organizations that are themselves forming bridges. We are actively monitoring the flow of communication among communities of researchers and decision-makers and evaluating alternative ways to build connections to find the best ways to create effective network structures¹². Our goal is to foster greater social learning within the networks⁶ with the expectation that these networks will, to a substantial degree, become self-sustaining, requiring only modest periodic efforts to ease new groups of researchers and new communities of decision-makers into existing networks. Such efforts may be needed to overcome homophily — the tendency to associate with those who are similar to you and avoid those who are not. Although some homophily is essential for trusted and informed communication, too much can make a network impervious to new participants and ideas and thus threaten the learning needed for ARM.

In addition to our newest approach of supporting other formal bridging organizations, we support more traditional applied research projects in which researchers and decision-makers are linked by iterated analysis and deliberation¹³. We also undertake targeted activities such as collaborative development of assessment reports or regional plans. Some are continuing processes of information sharing such as web-based problem-solving environments or simply regular gatherings

for discussion. We don't know which of these will be most effective, let alone the contexts that make one approach more effective than another. That is why we view the process as experimental — it is part of the social learning process we must engage to cope with climate change and ensure the transfer of critical information throughout knowledge networks. □

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Acknowledgements

Our work was supported by the National Oceanic and Atmospheric Administration's Climate Program Office through grant NA10OAR4310213 with the Great Lakes Integrated Sciences and Assessments programme at Michigan State University and the University of Michigan.

COMMENTARY:

Mitigation win-win

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Win-win messages regarding climate change mitigation policies in agriculture tend to oversimplify farmer motivation. Contributions from psychology, cultural evolution and behavioural economics should help to design more effective policy.

In relation to climate change mitigation, 'win-win' measures are those that reduce greenhouse gas emissions and save costs. They are frequently highlighted in marginal abatement cost curves (MACCs), which rank the relative cost-effectiveness of measure

implementation and help policymakers to identify the amount of mitigation that is worthwhile pursuing in each sector of the economy. MACC exercises conducted in several countries have highlighted the availability of win-win measures in a range of

sectors including energy and transport. For example, the installation of home insulation can lower bills and reduce emissions. Such messages are attractive and politically expedient. But win-wins present a policy challenge because they are often not adopted.