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Your Science is a Multi-Tool

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Sep 3, 2014 | **Policy Tips**, **Reflections**

Science plays many roles in the policymaking process. Describing those roles is often harder than I expect. While attending the North American Congress of Conservation Biology (NACCB) in July, I was introduced to a new—and helpful—description of those roles, during a talk by Stephen Posner. Stephen is a PhD candidate at the Gund Institute at the University of Vermont. Like COMPASS, the Gund Institute works at the boundary between new knowledge and emerging solutions to pressing environmental challenges. Much of their work takes place through the lens of "ecosystem services", a way of thinking about how people's

needs, desires, and actions relate to the natural world upon which we all depend. Stephen investigates how knowledge and understanding of ecosystem services is actually used in policymaking.

I often talk to scientists who are trying to understand this process. They want to know where their "piece" of the science fits into the policy "cycle". Until now, I've struggled to give a simple and useful answer. Models of "the policymaking cycle" abound (eg, the Library of Congress's legislative process diagram). Each of these models are useful for understanding (in general) the sequence of events that leads to a law or regulation. However, like all models they work in broad strokes and don't capture the complex reality. They're a lot like food web diagrams—they show who (in general) eats who, but they can't tell you for any particular fish, what (or who) they will eat, or the exact source of their demise (Disease? Predation?).

Similarly, the policy "cycle" is made of complicated interactions between individuals, each with their own knowledge, perspective, and network. The process stops and starts, doubles back on itself, and gets stuck in iterative loops that appear to defy progress. The role science plays is equally complex. Stephen introduced me to a helpful way to think about this. He and his colleagues describe three ways that science can interact with the policy process: instrumentally (information to shape a particular action), strategically (a tool of influence), and conceptually (to shape the nature of a discussion or process). Each of these roles is critical to help bring all of the insights and knowledge of the science community to bear on the many challenges society faces. Understanding how these uses fit together, and their implications for you as a scientist, can help you navigate a sometimes-obscure landscape.

The issue of ocean acidification provides a nice illustration of how these concepts play out in the real world. Science has contributed to the policy discussion in all of the modes, both discretely and now interactively. A decade ago, ocean acidification began to move from a few obscure studies to an issue of public importance. In 2006, most policymakers hadn't even heard of ocean acidification. Scott Doney's article in Scientific American brought it out of the scientific journals and into the public discourse, and positioned it as an issue worthy of attention. Scott and his scientific colleagues spent months talking with members of Congress, agency officials, and their staff. In the press and during meetings the scientists used detailed descriptions of scientific findings sparingly, because these conversations were largely conceptual: laying out the topic and what it might mean for various communities and ocean users.

Working **at the conceptual level** can mean a large investment of time. While the payoff can be huge (bringing a new issue onto the public agenda in this case, or shaping a whole new way of doing business), it can be a long-time coming. Scientists working on ocean acidification were engaged in ongoing conceptual conversations for nearly a year before any legislative action was taken. Policy

agendas can be fickle and are often radically altered by circumstances outside of your control, including politics.

In the case of ocean acidification, the conceptual conversations impelled members of Congress to take action. But individuals in Congress are not able to make much progress alone, so those who supported action began employing the ocean acidification science in a strategic role: using the science to bolster their arguments as they worked to garner the support of their colleagues for legislative action. At then-Congressman Jay Inslee's request, COMPASS organized Dr. Joan Kleypas and Dr. Ken Caldeira to brief him and five of his colleagues, all of whom walked away from the meeting convinced that action was warranted. Similarly, interest groups used the science to convince an increasing number of members of Congress to take the issue of ocean acidification seriously.

The strategic use of science is fundamentally political; it involves using science as a tool of influence. This can include setting policy priorities, steering the debate in a particular direction, or garnering support for a particular choice. This includes (but is not limited to) advocating for particular policies, so being clear about your relationship with advocacy is essential.

The instrumental use of science is what springs to mind for many scientists and managers when asked about connecting science to policy. These include using science and scientific understanding to make on-the-ground decisions, such as setting a water quality criterion, or drawing the boundaries of a particular management area. Science has a more clear-cut, and less political, role in these discussions. They also tend to be focused on incremental changes, rather than re-thinking the entire management approach. There are often clear and discrete ways for scientists to get involved in these decisions, e.g. science advisory committees, or technical working groups. The political risks here are often low(er). While the payoffs may not be as dramatic, they can be crucial to the people and ecosystems involved, and they are generally more certain to come.

For ocean acidification scientists, instrumental use of the science came later. The Whiskey Creek Hatchery in Oregon experienced dramatic losses in their oyster operations. The hatchery managers engaged scientists to help them understand what was going on. By 2009 they understood that acidification was the culprit. In an instrumental use of science, they began to adjust their operations to avoid pumping the water into their tanks when it was most acidified. This solved their problem (in the short term). It also led to their entire industry seeing acidification as a threat, and one for which they sought help from the federal government. The science that was originally used to make decisions about hatchery operations (instrumental) now became a prime tool of persuasion (strategic). The owners of Whiskey Creek Hatchery brought their story, and the science behind it, to Congress. The owners and other interested parties continue to use the science to

frame the problem (conceptual) and garner further support for action by government (strategic).

These three modes of engagement interact with one another, and as with any model of the real world, the lines between them can be fuzzy. Considering these three modes in terms of your time, interests, and comfort level can help you be thoughtful about what role you play, the risks you take on and the payoffs you expect. Politics, advocacy, and timing are important to understand no matter how you get involved, so do your homework or find a trusted guide.

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