Communities and Climate:
The Intersection of Science, Policy, and Citizens Collaboration

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Presented by:

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Welcome! I'd like to offer a special thanks to our project partners from the Netherlands, France, and Boston. I'd like to extend my personal thanks to Herman Karl and our U.S. team for their leadership in advancing this partnership and project.

During my nearly 8-year tenure at the U.S. Department of the Interior, perhaps no challenge was more complex than climate change and its effects on people and places. Those effects cut a broad swathe across the landscape. Those gathered here today are acutely aware of that medley of potential effects—sea level rise, changes in precipitation patterns, increased frequency of high-intensity rainfall events, impacts on flora and fauna, and so many other potential changes to our environment. I will not enumerate these effects in detail, as we are all familiar with them.

At the Interior Department, I chaired its Climate Change Task Force. The Task Force examined how climate effects might unfold across 500 million acres of Interior-managed lands and impact management at 2,400 locations with some 165,000 facilities. We explored adaptation and mitigation options for addressing climate change and its effects. Those deliberations situated at the confluence of science, technology, management and policy.

There is a passage in the children's book, *Alice in Wonderland*, by Lewis Carroll, in which the heroine Alice stands at a fork in the road and looks up to see the Cheshire Cat pondering at her. Alice asks the Cat, "Tell me, please, which way ought I to go from here." The Cat grins and replies: "That depends a good deal on where you want to get to."

For communities grappling with a changing climate and its effects, perhaps the response to the Cheshire Cat might be that they are striving for risk reduction and sustainability (however defined). The challenge is, of course, how? Where? What?

This joint project rather uniquely blends research, collaboration, and action. Many communities have launched climate action plans. There is also much outstanding scientific research underway to better understand climate change effects. Many collaborative efforts are also emerging to understand better these effects and develop options for addressing risks to communities associated with these effects.

Our project is looking at this intersection of science, collaboration, and action. We are examining different interactive forums in relationship to planning and policy processes and decisions. We are exploring knowledge flows and adaptive learning models. We are looking at institutional structures and practices and how they shape goals, options, the generation and use of information, and decision legitimacy.

I'd like to offer a few thoughts to set the stage for this workshop and project. I offer thoughts from the vantage point of a policymaker. Through that lens, I'll highlight four features of the climate change tableau that complicate decision making and affect how we think about institutions, information, and actions.

These four features include: 1) the multiple spatial and temporal scales of the climate change problem set; 2) the high levels of uncertainty about effects, particularly regionally and locally; 3) the interconnected complexity of the changes underway; and 4) the highly dynamic nature of climate effects changes.

The first feature of climate change and its related effects is the context in which changes are occurring at multiple spatial and temporal scales. Many climate effects transcend jurisdictional boundaries of political institutions. Sea level rise, for example, along the Gulf of Mexico, affects multiple communities, even multiple states. Our Dutch colleagues have described the intersection of sea level rise and river flows and their impact on multiple communities.[1]

Climate effects transcend boundaries and span different time horizons. Some effects are significant and near-term, such as we see with sea ice melting in the Arctic region. Others are long-term, iterative, and ongoing, as, for example, we see with the responses of some wildlife to climate change.

What are the implications of this first feature for policymakers? I suggest that we will need institutions and decision processes that facilitate coordination across jurisdictional boundaries. We will need both horizontal

and vertical interaction among multiple governing units. Such interaction is not new. Indeed, in the United States, the entire governing framework is one of federalism, which implies some sharing of public decision making and a vertical distribution of governing roles and responsibilities. Also, in the United States and elsewhere, we have many examples of regional governance.[2]

But these governing forms of federalism and regional decision making may require a different character to respond effectively to the challenges presented by a changing climate. Kirk Emerson describes "collaborative federalism," with joint decision making among multiple governing units. The model she describes is one of "shared governance", not divided and distributed decision making.[3] The concept of shared or collaborative governance may be applicable at the regional scale among local, interacting jurisdictions striving to coordinate policy and action where responding to climate effects requires cross-jurisdictional action.

But collaborative federalism presents challenges. How might one convene and motivate a cross-jurisdictional polity? And policy makers face practical challenges associated with limits on their authorities to expend funds outside jurisdictional boundaries. Yet such expenditures may be important. Consider source water protection in which relevant lands may lie outside a city's boundaries. Or consider the need to sustain cool instream water temperatures along an entire watershed. Or consider beach replenishment along coasts, in which sediment deposition may be required outside a city's boundaries to secure the desired protections.

I want to mention two central challenges of multi-jurisdictional governance. Fundamentally, policy makers face the challenge of how to achieve a decision scale "big enough to surround the problem, but small enough to tailor the solution."[4] Second, policy makers face a challenge of how to share both goal-setting and financing across governing units.

Cross-boundary governance options include both structural and non-structural tools.[5] Structural tools include the creation of dedicated agencies, districts, and institutions. Nonstructural tools include service agreements, partnerships, joint programs, and other informal coordinating arrangements. Both may be relevant in the context of climate problem-solving, depending on the particular issue and community circumstances.

Our Dutch partners offer us a useful example of multi-tiered governance in their paper.[6] In the United States, we see many emergent models. In southeastern Wisconsin, 28 municipalities with separate stormwater management authorities have joined in a public-private partnership to create a trust to coordinate stormwater management in an area

encompassing six watersheds.[7] In the Tualatin Basin, water managers combined four wastewater permits and one stormwater permit into a single cluster and partnered with the farmers in the county and the U.S. Department of Agriculture to plant trees within the watershed to reduce water temperatures. Both of these partnerships are issue specific. Very few U.S. examples present models of multi-purpose, cross-jurisdictional government.

Let us turn now to the second feature of climate effects: the high level of uncertainty regarding these effects, particularly at regional and local scales. For policy making, this characteristic makes ongoing learning imperative. It also highlights the significance of adaptive management and what some analysts have referred to as a "deliberation with analysis" model of decision making.[8]

Adaptive management in the context of resource management refers to a decision making model in which goals are set, action options are developed and intentionally designed as experiments to evaluate scientific assumptions and action effectiveness, ongoing monitoring is undertaken, results are reviewed, and adjustments to management practices are based on the monitored results and analysis.

In a review of adaptive management, the National Academy of Sciences reports that experience to date indicates limits to adaptive management. Specifically, this approach may be most feasible where four conditions are met.[9] It may be most effective when:

- Temporal and spatial scales are relatively small;
- Dimensions of uncertainty are bounded so that option experiments can yield clear results;
- Costs, benefits, and risks of experimentation are acceptable and course corrections are tolerated; and
- Institutional support exists for flexibility and adjustments.

Since these features may not apply to many climate effects issues and contexts, some analysts suggest a "deliberation with analysis" model may be more relevant. This model refers to the iterative formulation of a problem, identification of interests and values relevant to addressing the problem, development of a shared understanding of risks, and crafting of responses using this shared knowledge.[10]

Depending on the particular climate issue, different decision models may be appropriate. However, high uncertainty characterizes most climate change effects at the regional and local scale and over long time horizons, underscoring the need for flexibility, resilience, iteration, and adaptive responses in decision tools and action options. High uncertainty also

underscores the central role of science and technical expertise in decision making about whether, when, and how to respond to the effects of a changing climate.

This centrality of science and technical expertise raises another conundrum—what some have referred to as the "technocracy versus democracy" quandary.[11] Climate change issues are highly technical and complex but policies and adaptation decisions may significantly affect people and involve trade offs. These differential effects on people heighten the relevance of participatory democracy and collaboration and present a fundamental question. How is it possible to increase public involvement in decision making when the scientific and technical issues associated with some climate effects challenges are so complex? What are the roles of scientists and technical experts?

The role of science in decision making is fluid and varying. The relationship of scientists to decision making unfolds along a continuum of low engagement to high engagement. That continuum may be described as clustering into five potential roles for scientists.[12] At the end of the spectrum with minimal engagement is a reporting role in which scientists report or provide their research to decision making. A slightly more active engagement includes reporting and interpretation of scientific information. Third is a role in which scientists report, interpret, and then integrate their scientific information and analysis into a set of policy or management options. Beyond this integration, some scientists may actually advocate particular options. At the far end of the spectrum are circumstances in which scientists actually participate in making policy choices.

What is the appropriate role of scientists? How can relevant science information inform policy and management decisions?

I am intrigued by the joint fact-finding model described and used by the U.S. Geological Survey and others. Under that model, scientists, decision makers, and citizens collaborate in the scoping, conduct, and employment of technical and scientific studies to improve decision making.[13] Studies on knowledge utilization show that mechanisms (such as joint fact finding) that link researchers to users, include information dissemination efforts, and provide for adaptive research outputs are keys to good information flows and uses of knowledge; the user context also can significantly affect whether and how scientific and technical information are used.[14] Note that substantial research indicates that mere reception of knowledge by users does not imply use.[15] Lack of interaction between researchers and intended audiences can present a significant problem that limits relevance and perceived credibility of certain research intended to inform public policy decisions.

Though much more might be said of this science-policy interface, let me turn now to the third feature of the climate change problem set—the interconnectedness of climate change effects. Consider the case described by our Dutch colleagues of sea level rise and river flows. In their Room for the River project, they indicate that, on the one hand, they need to plan for higher river flows through improved drainage. On the other hand, sea level rise interferes with water drainage. Improved flood protection and water management, therefore, require considering both river flows and sea level. One issue cannot be addressed independently of the other.

This interconnectedness raises challenges of agency silos in which responsibilities for sectors or issues are fractured and divided. It also raises challenges for metrics: how might managers develop cross-issue indicators to measure outcomes on an integrated basis?

Let us now turn to the last feature of climate change effects: dynamism. Climate effects are highly dynamic, with the pace of change sometimes dramatic (as in current trends with Artic sea ice melting). Like the characteristic of uncertainty, the highly dynamic nature of climate change effects implies the need for adaptation. It may also heighten the need for policy options centered on resilience, or, more specifically, management options that provide functionality across a broad range of conditions.

Consider water infrastructure, water management, and flood protection. In the case of coastal protection, traditional flood and storm surge protection has relied on "gray", engineered infrastructure such as dikes and levees. This infrastructure may perform reasonably well under certain conditions. Increasing performance to withstand more frequent and more intense storms may be exorbitantly expensive relative to a mix of "gray" and "green" infrastructure that supplements existing gray infrastructure with beach nourishment, wetlands restoration, and sea marsh protections. The latter mix of gray and green infrastructure may provide greater functionality, thus more resilience, across a broader range of conditions than traditional infrastructure.

Or consider reservoirs, which, traditionally, have been built for dual purposes of water storage and flood control. With increased frequency of high-intensity rainfall events or prolonged droughts, revising reservoir operations to maximize water storage capacity in combination with restoring flood plains to serve the flood protection role may offer communities greater resilience than simply building ever-larger reservoirs that continue to operate as dual-purpose systems.

I offer no answers to the governance and information challenges presented by issues of climate adaptation. But I suggest that risk reduction

and sustainability will result from a confluence of science, collaboration, and new forms of governance. These three dimensions of problem-solving are important for effectiveness, accountability, and legitimacy of decisions.

Twenty-first century governance, as the Lincoln Institute in Cambridge has pointed out, may reveal a new lexicon of collaboration, shared power, networks, consensus, and iteration.[16] All these features, for policy makers, make decisions provisional, and they diffuse responsibilities. This sort of diffuse, provisional decision making is difficult to reconcile with traditional notions of accountability.[17]

Our project is pioneering in its focus on how to integrate science, collaboration, governance, and actions, with the action itself nested in a research context to examine the effectiveness of the actions as well as the effectiveness of the institutional and decision making structures for shaping, generating, and using relevant information.

One of my favorite philosophers, Yogi Berra, once opined that "the future ain't what it used to be," a fitting phrase for the world we face.

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[1] *Dutch Programs: Delta Program and Room for the River*, University of Amsterdam and Netherlands Environmental Assessment Agency, presentation at Communities and Climate Workshop, January 21-22, 2010, Boston, Massachusetts.
[2] *Regionalism on Purpose*, Kathryn A. Foster, Lincoln Institute of Land Policy, Cambridge, MA, 2001.
[3] "Collaborative Public Management and Climate Change: Managing Climate Change in a Multi-level Governance System," draft chapter, January 2010, for *Climate Change and Federalism*, forthcoming.
[4] *Regionalism on Purpose,* op. cit., p. 4.
[5] Ibid., p. 8.
[6] *Dutch Programs: Delta Program and Room for the River*, op.cit.
[7] "Green, Clean, and Dollar Smart: Ecosystem Restoration in Cities and Countryside," Lynn Scarlett, forthcoming, Environmental Defense Fund, Washington, D.C.
[8] *Informing Decisions in a Changing Climate***,** National Academy of Sciences, Washington, D.C., 2009. p. 79.
[9] Ibid., p. 77.
[10] Ibid., 79.
[11] "Advocacy and Credibility of Ecological Scientists in Resource Decisionmaking: A Regional Study," Denise Lach, Peter List, Brent Steel, and Bruce Shindler, in *BioScience*, February 2003, p. 171.
[12] "Advocacy and Credibility of Ecological Scientists," op. cit., pp. 173-174.
[13] See, for example, USGS Seminar on Joint Fact Finding: Integrating Science, Public Engagement, and Agency Decision Making in Ecosystem and Resource Management Decisions, Seminar Description, Sept. 29-30, 2004.
[14] "Utilization of social science research knowledge in Canada," Rejean Landry, Nabil Amara, Moktar Lamari, in *Research Policy* 30, 2001, p. 343.
[15] Ibid.
[16] *Regionalism on Purpose,* p. 2.
[17] Ibid.