Strengthening Adaptive Capacity and Community Preparedness for Adverse Climate Events, Variability and Changes

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OUTLINE

1. Introduction

Mr. Chairman and members of the Committee, thank you for the invitation to appear before you today and to provide testimony regarding my views on adaptation to climate variability and change. Specifically, I would like to first summarize how investing in adaptive capacity can reduce the possible magnitude and extent of adverse consequences, and then provide some examples that characterize some of the strategies, opportunities and options available to governments and communities. In appearing before you today, I am representing my own individual views, and not those of any current or past employer, organization, or association. My views have been informed by nearly two decades of research on climate change economics, impacts and adaptation, with a primary focus on agricultural and water resources. For example, during my current faculty appointment for the past ten years with New Mexico State University, I have had the opportunity to study and research water, agricultural, and economic systems in New Mexico, and across the Southwest including both the Rio Grande and Colorado River watersheds.

2. Key Ingredients for Successful Climate Change Adaptation

We are all well aware of many instances and anecdotes that raise our concern about the nature and power of climate and of extreme weather events. Even in the most recent past we are reminded of the power of intense storms including hurricanes, tornadoes, snow and ice storms, of the human and economic losses from extended periods of both high and low temperatures, wildfires and persistent droughts and floods. The chronicle of weather and climate is ever present in our consciousness such that we constantly observe, track, sometimes name and often recollect these phenomena. “How is the weather?” we ask. Answers and stories abound. “Fine.” “Gloomy”. “Worst in decades.” “Not since records have been kept.” Permit me to give a quick anecdote from my experience this past winter. Late January and early February saw temperatures lower and for longer periods than ever seen before in southern New Mexico, Far West Texas, and Chihuahua, Mexico. In my ten years I had never seen single digits let alone sub-zero temperatures in the deserts near Las Cruces, New Mexico. The mercury hit a low of -6 degrees Fahrenheit, and never rose above freezing for four consecutive days.

Perhaps most surprising was the incapacity of the electrical system to cope with the event. For a week residents dealt with rolling blackouts, closed schools, universities, and businesses, broken pipes and pumps, and flooded rooms. Crop losses are widespread and homeowners and businesses across the region are just now beginning to confront damages and to replace damaged landscape plants and trees. Not to mention the recent heat wave and record high temperatures in March and April that have set west Texas ablaze. Some might begin to ask questions about this region's capacity to adapt and the capability of utilities, residents and businesses to cope with such climatic extremes. It is difficult to know, and to assign blame, to so-called 'acts of god.' And of course there are limits to what even the best-prepared and well-adapted community can hope to withstand. But that really is not the point. Rather the point should be focused on future preparedness, and what might be done to lessen the losses and damages in the future.

Climate extremes, I think we can generally agree, present challenges to vulnerable communities -- whether or not these extreme events are attributable to 'normal' variability or to climate changes induced by rising greenhouse gas concentrations. How well communities anticipate and assess the likelihood of climate extremes, and how well they choose to prepare for them depends to a large extent on four key ingredients:

- Quality and accessibility of climate change scenarios and information including frameworks to use and transform them into relevant forms for decision makers.

- Understanding and assessment of vulnerable environmental and economic systems and impacts, including sensitivity to climate, degree of exposure, and capacity to adapt.

- Capacity to identify trends and and render plausible scenarios not only of changes in climate and climate extremes, but of demographic and economic conditions, relevant institutions and policies, and environmental stresses and conditions.

- State of institutional preparedness, leadership and support for integrating climate science into relevant and appropriate programs, procedures and policies.

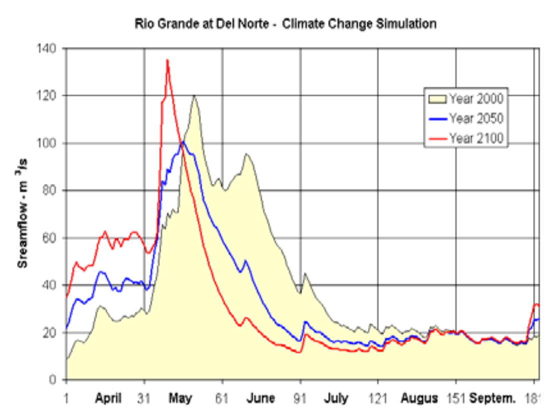
Time does not permit addressing each ingredient but I will draw attention to the second component, namely that of assessing vulnerability. I will quickly illustrate some key issues using water resources as an example, looking first at the impacts and then at the potential for adaptation.

3. Can Adaptation Reduce Economic and Environmental Consequences?

Essentially one of the goals of most water supply systems and institutions, especially in the West, is to help communities cope with a moderate range of climate and water supply variability. With few exceptions, most water system and utility managers agree that U.S. communities, industries and water users are generally prepared and well adapted to manage successfully within ‘normal’ fluctuations, often including occasional extremes (such as events that typically occur once every decade or two). However, problems begin to arise when relatively rare or unexpected events occur and re-occur with unusual frequency (such as flooding along the Red River of the North where historic floods once thought to be rarer than once in 100 years are occurring in surprising rapid succession). If, as the accumulated science indicates, climate changes can result from rising greenhouse gas concentrations and emissions, and if these changes contribute to greater climate uncertainty and extreme events, then it might be reasonable and prudent to expect more severe and/or frequent extreme events. Such events can quickly become a significant economic and environmental concern, pushing beyond the prevailing capacities of water users to cope, and indicating the need for additional adaptive capacity. Adaptation as such can be viewed as a complement to climate change mitigation activities within a comprehensive and coordinated climate strategy.

To determine if and how adaptations can reduce economic and environmental consequences, we need to first identify and estimate vulnerabilities and specific impacts. A general approach would begin with an examination of the physical and environmental systems that support economic and environmental health. For water resources this begins with the question, “What if climate changes and it brings about changes in streamflows, water storage, and water availability?” which draws upon the expertise of climate and hydrology scientists. The result is a scenario analysis which could include a projection of how a river’s hydrograph could be expected to change (an example is shown in Exhibit 1).

Exhibit 1: Rio Grande Hydrograph and the Possible Effects of Climate Change



Source: Rango, A. (2008)

Then economic and environmental scientists can proceed to ask: “What might these changes in streamflows imply for …”

- Water storage and distribution systems
- Urban and rural water users

- Water quality
- Hydropower
- Recreational and cultural functions
- Riparian ecosystems and migratory patterns
- Local employment, jobs, and income?

A quick summary of key climate change impacts estimated for the Rio Grande by Hurd and Coonrod (2007) indicate the likelihood of:

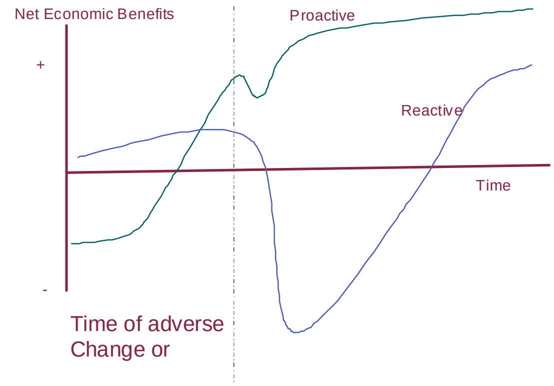
- Earlier snowmelt and peak runoff, greater evaporation losses, and reduced streamflows even if total annual precipitation should increase, and if precipitation should fall, runoff could be reduced by as much as 1/3.
- Rising populations and lower water supplies will raise pressure to tighten and fine tune water management systems. Systems with limited storage capacities are most vulnerable.
- Projected annual economic losses than range from $13 million to $115 million by 2030, and from $21 million to as much as $300 million by 2080.
- Traditional agricultural systems and rural communities are most at risk, and may need transitional assistance.
- Losses to New Mexico's residents, tourists, and wildlife could go well beyond such market-derived figures, including losses to the environment, water quality, and quality of life.

It is during the process of assessing vulnerability that the question of adaptation begins to arise. For example, with their primary focus on the physical systems, the earliest climate change impact assessments often neglected expected natural responses from affected people, such as farmers, once they had realized that a change occurred. After all, a great evolutionary strength of humans is their capacity to observe and recognize changing conditions and to react accordingly (although it might take some time to realize, confirm and learn that the observed changes are likely to persist).

This capacity to <u>recognize and react</u> to changing conditions confers economic advantage and success. However, and this is KEY, even greater advantage and long-run economic success follows from the ability to observe patterns and trends, and to combine these with knowledge and understanding of our economic and environmental systems in <u>anticipation</u> of likely outcomes and consequences. It is worth taking a moment to more clearly illustrate the essential difference between <u>reactive</u> and <u>anticipatory</u> (or proactive) adaptation strategies. This illustration also highlights the importance of investment timing in the effort to build adaptive capacity.

Imagine that we can illustrate these differences using a timeline over which net economic performance is measured (call it something like ‘gross domestic happiness’ to distinguish from the flawed concept of ‘gross domestic product’ - which most often shows a boost to economic production after a disaster). Also imagine that a significant climate catastrophe occurs at a given point in the timeline (see Exhibit 2).

Exhibit 2 - Illustrating reactive and anticipatory adaptation



Source: Hurd (2008)

Consider the case of reactive adaptation, and note that it can result from either of two situations. The first is when little or no consideration is given at all to evolving trends and future conditions or events. In this case any adaptation that occurs is after-the-fact and in response to events and conditions after they have occurred. The second way that results in a reactive response is when investment decisions are delayed or postponed, either rationally and deliberately because of inherent uncertainties and costs, or inadvertently because of indecision. In either of these cases the outcomes are similar, net economic benefits are positive and continue to grow until the adverse event or change. A significant adverse event then occurs, significant economic losses ensue, and the path to recovery is protracted and costly. After recovery and the economy is reestablished, which now may even perform better than before because degraded and depreciated infrastructure has been replaced (like with the Marshall Plan). But maybe the redevelopment occurs without any change for future defenses, production of economic and environmental services continues - until the next adverse event. Several questions then arise, “Could we have done better?” “Were events and changes foreseeable?” And, “Would better preparations, designs and policies have lessened the damages and speeded recovery?”

Now consider a well planned and executed proactive adaptation strategy, one that tries to anticipate changing conditions and to prepare for them in advance. In this manner, prior and/or continuing investment to build and strengthen adaptive capacity will undoubtedly redirect resources away from current consumption, resulting in lower net economic rewards relative to no- or postponed-investment, but only for the duration until the adverse event occurs. Generally, if the adverse event is not a question of ‘if’ but rather ‘when’, then anticipatory adaptation strategies share many similar aspects to a prudent and effective risk management or insurance-type strategies. In this case, when the adverse event occurs there is also the potential for significant economic loss and disruption but with effective preparation it may only be a fraction of what it would have been. In addition, with proactive adaptation the path and duration of economic recovery may be much shorter, resulting in greater net economic performance in the long-run.

4. Strategies, Opportunities and Options to Strengthen Adaptive Capacity

Many adaptation strategies and opportunities fall within four broad categories.

1. **Improve science and technical information including development, integration, education, and dissemination.**

   There is a need for continued development of climate, environmental, and resource management sciences and their integration. For example, there has been progress in development of assessment methods but uncertainties which compound and cascade throughout the process result in often broad and otherwise not-well defined scenarios that are not very useful for local scale planning. By facilitating partnerships and strategic alliances between Federal and State agencies, National Laboratories, local governments, universities, and NGOs cross-organization capacities can be better harnessed and focused.

2. **Develop appropriate risk management institutions and policies.**

   Risk management institutions, policies and insurance programs are often at odds, resulting in inappropriate development in high risk areas, and then promoting rebuilding without appropriate regard to risks. It might be prudent to develop programs and policies with greater 'risk sharing' and stakeholder awareness rather than 'blanket protection' from climate-related risks.

3. **Increase the use of resource markets and incentive-based policy designs.**

   The goal is to create a context in which communities, organization, and individuals can make smarter decisions and wiser choices. Institutions and policies that establish and use decentralized approaches help to provide appropriate economic signals to decision makers and generally improve compliance and voluntary solutions. For example, water-use efficiency could be promoted, resulting in more flexibility and responsiveness to climate changes if water-rights were better defined and right-holders could be compensated or could lease the value of 'saved' water. In a similar fashion to electricity cogeneration and buy-back.

4. **Add flexibility and safety to infrastructure design and construction, and incorporate climate factors in land-use planning and building codes**

   Especially with long-lived infrastructure, the added costs may provide good value in providing both additional services and reliability. Risk-appropriate zoning and building codes also may add to short-run costs but provide better long-run protection. An example of this is the LEED (Leadership for Energy and Environmental Design) certification program for energy efficiency in building design.