5. Preparations for Climate Change Impacts

Analysis

During the past century, global surface temperatures have reportedly increased at a rate near 1.1ºF. The rate of temperature increase has been three times larger since 1976, with some of the largest temperature increases occurring in the high latitudes. Average temperatures in the West have reportedly risen 2-5ºF during the 20th century—greater than in other regions of the contiguous United States. As the West has warmed, snowfall and snowpack have diminished in major portions of the West, and an increasing fraction of winter precipitation is falling as rain, rather than snow. Additionally, Western snowpacks are melting earlier with peak runoff coming 10 to 30 days earlier in many cases. The region has generally had increases in precipitation, with significant increases in some areas. However, other areas have become drier and experienced more droughts. Wildfire in the West has increased, particularly in the last two decades. Of the major mountain ranges in the West—the Cascades, the Sierra Nevada, and the Rockies—trends are more pronounced in the Cascades and the Sierra Nevada and less so in the Central and Northern Rockies, due in large part to the temperatures at the affected snowline altitudes in the Sierra Nevada and Cascades being closer to 32ºF to begin with.

Although the research on projections for climate change in the future does not have nearly the same degree of certainty as the observed climate change to date, it does suggest that rising global surface temperatures and associated climate changes may continue over the next several decades and beyond. According to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), global surface temperatures are projected to rise by 3-10ºF by the end of the 21st Century. Precipitation predictions show a greater range of possibilities, thus they are considered more uncertain. The American West could heat up more than the worldwide average, with regional climate models suggesting temperature increases in the West could be 4-13ºF. Projected impacts that could accompany this warming in the West include the following:

- **Smaller snowpacks**—winter precipitation could fall as rain instead of snow; periods of snowpack accumulation could be shorter; and snowpacks could be smaller, which has serious implications for reservoir storage.
- **Earlier snowmelt**—warming earlier in the year could melt snowpacks sooner further increasing the length of time between peak water flows and the summertime peak water needs of cities, farmers, utilities, etc. requiring more reservoir storage to capture the earlier runoff.
- **Flood-control releases**—water managers may be forced to make changes in reservoir operations and rule curves.
- **More extreme flood events**—extreme events could be more common causing more frequent and larger floods. In some cases, existing flood control 'rule curves' should be reformulated.
- **Receding glaciers**—some have suggested Glacier National Park could be void of glaciers by 2030 as a result of warming.
- **More evaporation and dryness**—higher temperatures could increase evaporation from streams and reservoirs, soil dryness, and the needs of crops and other plants for supplemental water.
- **Less groundwater**—less availability of surface water supplies may lead to increased pumping from groundwater aquifers further stressing groundwater supplies and hydraulically-connected surface water supplies.

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- **More droughts**—more intense, frequent, and longer-lasting droughts could result.

- **More wildfires**—there could be an increase in number and severity of wildfires and an extended wildfire season.

- **Water quality challenges**—diminished streamflows during drought could result in less dilution of discharges; sediment loading from storm events that follow wildfires, saltwater intrusion along the coast resulting from rising sea levels, and warmer lake temperatures leading to algae blooms could follow.

- **Hydroelectric generation**—climate changes that alter overall water availability and timing could reduce the productivity of hydropower facilities; changes in the timing of hydroelectric generation can affect the value of the energy produced.

- **Water-borne shipping**—decreases in river flows could reduce the periods when navigation is possible; increase transportation costs; and increase conflicts over water allocated for other purposes.

- **Ecosystems**—natural ecosystems have limited ability to adapt or cope with climate changes that occur over a relatively short time frame, which could lead to irreversible impacts, such as additional species extinctions.

- **Recreation impacts**—due to lower lake and stream flow levels, recreation opportunities and economies could be significantly reduced.

Notwithstanding the seriousness of these potential impacts, it is nevertheless not currently possible to predict if and how they will affect a particular area within the region at any particular time, given the existence of a number of variables. According to the National Assessment Synthesis Team, which is a part of the US Global Change Research Program, climate is not static. Assumptions about the probability, frequency, and magnitude of extreme events should be considered accordingly.

Nonetheless, it must be recognized that there is already substantial stress on the water sector today even in the absence of climate change. There are many watersheds that are already over-appropriated, and new stresses are coming from population growth, land use changes, and water needs for instream uses, including those necessary to meet federal laws like the Endangered Species Act and the Clean Water Act. In some areas, the new demands may cause major shifts in water supply and water rights. Climate change may pose additional stresses and could result in thresholds being reached earlier than currently anticipated.

Because many of the impacts of climate change are not predictable, more flexible institutional arrangements are needed in order to adapt to changing conditions including not only climate change, but other existing stresses as well. Supply-side options are more familiar to most water managers, but demand-side options are becoming increasingly prevalent.

Recommendations:

While recognizing the uncertainties inherent in climate prediction, efforts should be made to focus on vulnerabilities and building increased resiliency to climatic extremes.

5.A. Data Collection

The federal agencies must continue and expand funding for data collection networks and activities necessary for monitoring, assessing, and predicting future water supplies as addressed earlier herein by the Water Needs and Strategies group recommendation (2A).

5.B. Improved Prediction, Modeling, and Impact Assessment

Climate change could result in an extended fire season.

The Western Governors should urge Congress and the Administration through the Climate Change Science Program (CCSP) to fund research for improving the predictive capabilities for climate change, and assessment and mitigation of its impacts. Additionally, given the complex climatology in the West, it is important that climate change modeling be conducted at a much finer resolution, e.g. watersheds and subwatersheds. It is also important that the federal government implement research funding recommendations associated with Goals 4 and 5 of the 2003 CCSP Strategic Plan, including the area of increased partnerships with existing user support institutions, such as state climatologists, regional climate centers, agricultural extension services, resource management agencies, and state and local governments.

5.C. State Planning

1) The Governor of each state should direct their state climatologist, relevant water and environmental agencies, and universities to assess historical, current, and projected climate trends for their particular state and relate these to potential changes in water supply and water quality, in order to prepare for and mitigate the impacts from climate change and climate variability. Such assessments should include an inventory of data sources available for each state, with analysis appropriate to watershed-level management. The Governors should seek necessary funding to support these activities.

2) States should maintain various water-related plans, including state water plans, watershed plans, state drought plans, reservoir management plans, flood plans, etc. These plans should be expanded or enhanced accordingly to include climate change scenarios. Particular emphasis should be placed on climate change within the context of watershed planning. States, similarly, should expand or enhance other state plans that include water-related concerns—such as forest management, energy, and economic development plans—to include the impact of climate-change scenarios.

3) States should coordinate with and include local governments in their climate change planning efforts. Local governments are an ever-increasing player in water issues, for example, through land use policies, as the developer of new water supplies, water transfers, and in implementing water restrictions and water use efficiency programs.

4) States should evaluate and revise as necessary the legal framework for water management to the extent allowable to ensure sufficient flexibility exists to anticipate and respond to climate change.

5.D. Ongoing Coordination & Information Sharing Between Scientists, Policy-Makers, and Water Users

The Governors should convene ongoing, broad stakeholder meetings between state water managers, local water supply managers, scientists, federal agencies, universities, and others to make sure water managers understand what the science is saying about climate change and what new tools exist, and, conversely so that scientists understand the data and research needs of water managers and users.

"States should evaluate and revise as necessary the legal framework for water management to the extent allowable to ensure sufficient flexibility exists to anticipate and respond to change."

6. Coordination and Cooperation in Protecting Aquatic Species under the Endangered Species Act

Analysis

Conflicts have arisen since the enactment of the Endangered Species Act (Act) in 1973 between development and management of state water systems for traditional purposes and protection of endangered aquatic species that are dependent on rivers, streams and wetlands. From the Tellico Dam snail darter to the Rio Grande silvery minnow, balancing water-related economic and environmental needs has been challenging. In 1982, recognizing the need for greater coordination, the Congress incorporated a policy statement in the Act directing federal agencies to "cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." (ESA Section 2(c)(2)). Further, ESA section 6(a) requires that ". . . the Secretary shall cooperate to the maximum extent practicable with the States . . . . [and consult] with the States concerned before acquiring any land or water, or interest therein . . . ."

Despite these Congressional pronouncements, conflicts have continued to occur between management and use of water and the needs of endangered and threatened species in the West. Greater cooperation and coordination between federal and state water and fish and wildlife agencies is necessary to improve the prospects for aquatic species conservation and recovery and to assure the continued economic vitality of the West. Congress did not address this reality in its last significant amendments to the Endangered Species Act (1988).

As stated in a 1997 Senate report accompanying proposed legislation (S. 1180); "the respective relationship of the States and the Federal Government over the use or allocation of water has never been precisely fixed. Consequently, the boundaries between State and Federal responsibility have been the subject of much discussion and debate for many decades in a variety of contexts . . . . It was ultimately determined that a delineation of the boundaries between the States and the Federal Government over the use or allocation of water was not possible in . . . the [context of] reauthorization of the Act. A position of neutrality on this issue is reflected in this bill." S. 1180 did not pass. None of the bills pending before the current Congress move away from this position of neutrality in that they do not deal with the above-described boundaries between states and the federal government over water allocation and use.

Administrative steps have been taken in the past to accommodate some landowner and state resource agency concerns. More needs to be done at both the federal and state level to expand the use of administrative and management mechanisms. Policy directives are needed to implement the Congressional pronouncement of ESA Section 2(c)(2) that Federal agencies "cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." Further, given their primary role in water allocation and protection, states should enhance their ability to avoid conflicts under state water law.

"Greater cooperation and coordination between federal and state water and fish and wildlife agencies is necessary to improve the prospects for aquatic species conservation and recovery and to assure the continued economic vitality of the West."