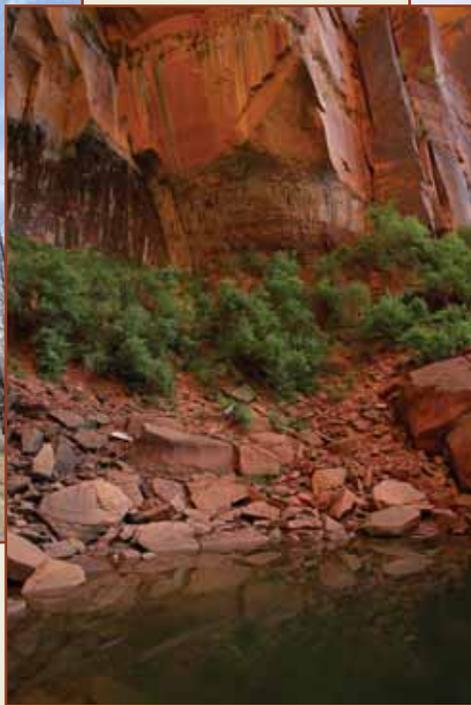


Keep the West Vibrant with a Strong Climate Change Policy

Jonathan Overpeck – The University of Arizona



Dear Mr. President and Members of Congress,

The evidence for global climate change—especially warming—is now unequivocal, and humans clearly are the principal cause. The impacts of climate change, however, will be distinctly regional and local. The heavily populated coastal regions of the eastern United States will have to deal with rapid sea level rise, possibly made worse by more intense large hurricanes. Other regions will have their own distinct climate change challenges. In the western United States, the primary climate change concern will be having less water: Can we maintain supplies needed for continued economic growth and avoid drying out the West to the point that makes vegetation mortality and wildfire much more the norm?

Forecast for West: Hotter, Drier

The most troubling news for the West is the consistency of evidence. Climate models project that the West should warm faster than the global average, and this is indeed what is happening. Temperature increases should drive a reduction in spring snowpack along with a corresponding decrease in river flows such as in the Colorado River: both are already taking place. Models predict that the tropics should expand, driving springtime rain- and snow-laden storms northward, and once again, this appears to already be underway, apparently at a rate even faster than predicted by the climate models.

Ensuring the water supply needed for residential, industrial, energy, recreation,

biological conservation, and other uses will be our biggest challenge in the West, but water, or more precisely soil moisture, is also a prerequisite for healthy landscapes, whether they are forests, woodlands, deserts, or something else. Already, we are seeing elevated temperatures, reduced spring snowpack, and lower soil moisture drive significant increases in wildfire at many locations around the West. Perhaps more disturbing, we are also seeing warming temperatures combine with drought to cause widespread tree mortality. The management of western landscapes, and all that depend on them—including urban water supplies—is going to become more difficult as a result of continued climate change.

For all the consistency between climate model projections and recent observed climate change in the West, major uncertainties remain. To what extent are the recent observed changes, and their surprising rapidity in particular, due to natural climate variability versus the anthropogenic trends on which this variability is superimposed? How large, ultimately, will the warming and drying be? Some models predict double the warming of others. Climate theory and models also point to more future drought and, paradoxically, floods as well. Could we be in for decades-long “mega-droughts” like those that had profound

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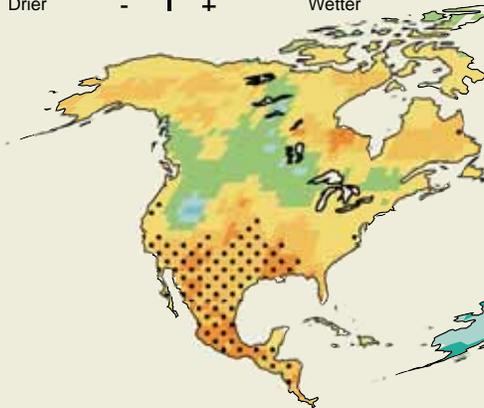
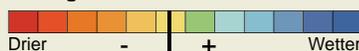
human impacts in the Southwest during medieval times, only much hotter this time around? What will the summer monsoon do in the future? Might more summer rainfall include the mixed blessing of more frequent flooding? What climate surprises may lurk in our future?

Clearly, action is needed, but what form should it take? The longer we wait to act, the more carbon dioxide will remain in the atmosphere for decades, centuries, and longer, and the more future warming and drying will become inevitable for the West.

Mitigation and Adaptation are Key

Two broad—and interconnected—types of action are urgently required: mitigation and adaptation. First, we must leave no technological stone unturned (see table) as we work to limit greenhouse gas emissions to levels that will preclude dangerous future climate-change impacts. Many climate scientists and climate policy experts alike favor a goal of reducing greenhouse gas emissions by 2050 so that they are at least 80 percent below those of 1990. This goal is more

Change in Soil Moisture

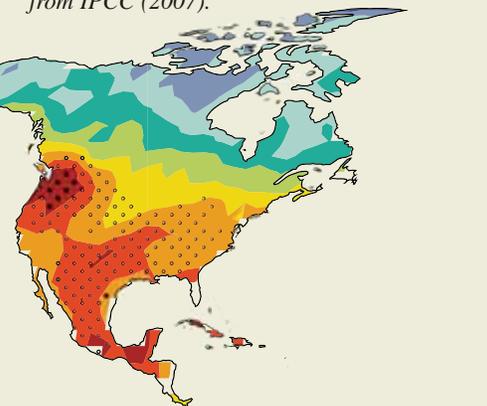


ambitious than what emerged during the recent presidential campaign or has been suggested by Congress, but conversely, even this goal could ultimately be insufficient to forestall major impacts like polar ice-sheet melting, major sea-level rise, or a level of desertification that threatens sustained economic growth and quality of life in parts of the West.

The most important point is that the United States—and the world—has to quickly set some aggressive greenhouse-gas emission-reduction targets and then implement policy to ensure the targets are met. Changes can be made in the future as the ultimate course of global and regional climate change becomes clearer.

Second, we must figure out how to adapt to the climate change that will happen no matter what we do; indeed, climate change due to greenhouse gases *already* in the atmosphere could drive change that is double what we’ve already seen take place. Mitigation alone, no matter how aggressive, will not be enough. Too much change is already in the pipeline because of past and ongoing emissions. Moreover, few mitigation options can be implemented without considering the possible adaptation trade-offs that could be involved. For example, all forms of energy production require water that might be needed for other uses in adapting to climate change, and these energy requirements must be factored into efforts to ensure the water supply. Many forms of future energy production (especially solar, wind, and bioenergy) could also compete for land that could be used for other purposes,

Changes in annual soil moisture (left) and maximum number of consecutive dry days (below) projected to occur by the late 21st century, based on the average of many global climate models. Stippling denotes areas of greater model agreement. Together these projections indicate that much of the West, and particularly the Southwest, will likely become drier and more drought-prone as global climate change continues, a tendency that will be exacerbated by continued warming in the region. Figures adapted from IPCC (2007).



Dry Days



such as urban growth, food generation, biological conservation, and recreation.

Stakeholder/Academic Partnerships

To be successful—and most cost-effective—climate change mitigation and adaptation must be coupled at the regional to local scales where they really happen, and must ultimately be driven by the regional to local stakeholders who are central to bringing about change. Public

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Energy technologies that can reduce carbon emissions to the atmosphere

Reduction in energy need:

- enhanced energy efficiency
- enhanced conservation of energy

Low-carbon energy generated by:

- wind
- solar
- hydropower
- hydrocarbon with carbon capture
- bioenergy
- nuclear

Transportation energy generated from:

- biofuels
- electricity generated with the above low-carbon technologies
- hydrogen generated with the above low-carbon technologies

A Critical Need, continued from page 19
Alamos-type” centralized research effort to assist water utilities. And a consortium of eight major entities (UCAR, 2008) released a list of specific actions needed to respond adequately to climate change, including the need to “evaluate approaches to ensure that investments are done in the best interest of the nation.” These actions, which will underpin the national water plan, include:

- Fully fund our ground- and satellite-based observing systems;
- Greatly increase computer power for research;
- Support fundamental and applied research in weather, climate, and their impacts;

Climate Change, continued from page 25
universities have the most successful track record in working with diverse groups of stakeholders in their regions, and also in forming successful working partnerships with all the other key players: local, state, and federal agencies; the private sector; nongovernmental players; tribes; and relevant international partners.

Stakeholders and their university partners should also be front and center in any integrated climate change adaptation and mitigation program for three other very important reasons. First, the successful program must be designed to learn and shift strategies on the go, and only at universities do we have the disciplinary and interdisciplinary critical mass, as well as a sufficiently broad workforce, to make large routine shifts in focus. Second, rapid innovation will be needed

Short Term, continued from previous page
groundwater conservation districts, and in Arizona legislation was enacted in 2007 to establish a local water district in the San Pedro River watershed.

Even while federal, state, and local policymakers and water managers work on long-term visions for 2020, 2030, and beyond, short-term and comparatively lower-cost actions can yield beneficial results while enhancing—not impeding—the success of those longer-term projects and programs. Fully recognizing the need

- Support education and training of water managers in using and understanding research tools, data, and models; and
- Implement effective leadership, management, and evaluation of the entire U.S. research effort on climate change.

Energy and Water Are Unique

It is clear that water and energy are *the* critical problems of climate change. Just as we need a national energy plan to minimize greenhouse gases emitted from every sector of our economy, we also need a national water plan to coordinate our responses to the water-related impacts of climate change that will affect all sectors of our economy. Only through the

to speed up research and application—a challenge that requires both the cutting-edge research capabilities and stakeholder partnerships at which universities excel. Lastly, successful climate change adaptation and mitigation will need a rapid build-out of a next-generation workforce, and this can only happen in large stakeholder-oriented universities.

The advantages of an aggressive U.S. climate change adaptation and mitigation program go beyond saving our own skin. The *technologies* and *knowledge systems* required for successful adaptation and mitigation will be in demand worldwide, and thus aggressive action could propel the United States—and those regions of the United States most threatened by climate change—to be global market leaders in this rapidly expanding sector of an increasingly intertwined global

for and supporting the importance of long-range planning, policy makers and water managers in the West should review available short-term actions and implement as many as possible. Federal policymakers can undertake or assist with a number of these short-term actions, especially with regard to interstate initiatives, the development of additional information resources, and participation in water rights adjudications. Even where policy changes are initiated at the state and local level, there is a vital role for federal agencies and policymakers in cooperating with

development, funding, and follow-through of such a plan will the nation be able to meet the challenge of preparing for the water-related impacts of climate change.

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University Corporation for Atmospheric Research (UCAR), and others, 2008. Advice to the new Administration and Congress: Actions to make our nation resilient to severe weather and climate change, www.ucar.edu/td/.

economy. Opportunities realized could be just as important as the threats that are diminished, and the former could quite possibly pay for the latter. Failure to act quickly and aggressively on climate change could cede economic opportunity just as it could cripple prospects for sustained economic growth and a vibrant quality of life in the West.

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and supporting those changes. The task is large and the time short, but progress and success are clearly within reach.

These recommendations are based on a 2007 NWRI White Paper, “Water 2010: A ‘Near-Sighted’ Program of Water Resource Management Improvements for the Western United States,” by William A. Blomquist. Blomquist is a professor of political science and dean of the School of Liberal Arts at Indiana University-Purdue University Indianapolis. Contact him at blomquis@iupui.edu. Jeffrey J. Mosher is executive director of the National Water Research Institute (NWRI), a 501(c)(3) organization that sponsors projects and programs to manage water resources, address water quality and water scarcity, and protect public health and the environment. Contact him at jmosher@nwri-usa.org.