

**Greenhouse Gas Town Hall Information Briefing  
for the California Assembly  
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**Testimony of  
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in Development, Environment, and Security<sup>1</sup>**

**California's Water Future: Understanding and Reducing the Risks of  
Climate Change**

Honorable members of the legislature and of the public, thank you for the opportunity to offer this briefing today. I am a scientist by training and direct the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California. The Pacific Institute is an independent, non-partisan research center looking at a wide range of national and international water issues. I have served on many boards and committees, including the Public Advisory Forum of the American Water Works Association, the International Water Resources Association, scientific panels of the American Geophysical Union, the American Association for the Advancement of Science, and others. I am currently a member of the National Academy of Science's Water Science and Technology Board, and an Academician of the International Water Academy of Oslo, Norway. I serve on the editorial boards of the journals Climatic Change and Water Policy. I am a MacArthur Foundation Fellow. A resume is attached.

The Institute works extensively on California water policy issues and provides analysis and policy recommendations to State, Federal, and local policymakers. The Institute was a participant in the recent California Water Plan effort of the state DWR, which concluded that climate change would have significant, and inadequately addressed, impacts on the state's water resources. I served as co-chair and lead author of the National Assessment Water Sector report looking at the implications of climate change for the nation's water resources, and have done research for nearly two decades into the effects of climate change for California and the western United States.

**Summary Testimony**

My testimony today addresses **the risks of climate change for California, with a focus on the State's water resources**. In the short time available, let me provide a summary overview. **I have submitted more detailed supplementary materials for your information.**

Climate change is a real problem. We already see evidence of climate change, and the state, country, and world are committed to more. California is especially vulnerable to these changes. Among the most significant risks we face are:

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1. Threats to coastal communities and infrastructure from rising sea level and changing storm patterns.
2. Threats to agricultural production from water problems, rising temperatures, and pests.
3. Threats to human health from higher temperatures, new disease vectors, and existing vectors that do not currently pose much risk to residents.
4. Threats to our diverse ecosystems from rising temperatures, changing rainfall and snowfall patterns, and
5. Threats to our water resources and our water infrastructure, as detailed below.

Let me focus the rest of my talk on water issues, which touch on all aspects of California's economy and environment.

The risks to the State's water are real; and the State and Federal agencies looking at our water problems need to do a better job of addressing them. Climate change is a complicated and difficult issue, but not nearly as complicated as some think. Let me offer you a summary of the major concerns for California's water resources:

- There is a long history of research and analysis on climate change and water, especially for California.
- Some climate change is now unavoidable.
- The evidence is accumulating and convincing that the climate is already changing.
- There are close and complex connections between California's water system and our climate.
- California's water resources and some of the infrastructure already in place are especially vulnerable to climate changes.
- There are likely to be serious negative impacts for the state's water resources; there are also likely to be positive impacts and some reductions in the severity of negative ones we already experience. There are also many remaining uncertainties, including the nature of changes in extreme events, precipitation patterns, and the details of regional effects.

There are things we should be doing right now. California water planners have not adequately addressed this issue, at the federal, state, or local levels.

### **Nature of Climate Impacts for California Water: What Can We Expect?**

- A hotter world.
- There will be very important effects on water availability.
  - Significant changes in the **timing of runoff** from the Sierra Nevada;
  - **Less snow, more rain**, more late winter and early spring runoff;
  - **Less late spring and early summer runoff**;
  - **Less summer soil moisture** (more need for irrigation water)
- Everyone worries about droughts, but the **risks of flooding** for Californians may be as great or greater. Worse, we may see increases in the risks of both.

- **Water quality will also be affected:** salt water may penetrate farther into the Sacramento/San Joaquin Delta to where the pumps for our water supplies take freshwater for Bay Area and Southern California.
- The Colorado River will also be directly affected.
- There is an **increased risk of contamination of coastal groundwater** due to rising sea level.
- Some sectoral impacts can be severe: **the ski industry could be devastated** over the coming decades. Under all scenarios, the ski season dramatically shortens. Under some, it disappears by the end of the century.
- There are **indirect effects of concern:** climate and water-related diseases; energy connections with water; effects on agricultural production. We understand little about these impacts.

***Some Climate Change is Unavoidable; and Impacts are Already Occurring.***

Some climate change is unavoidable. There is nothing we can do to prevent at least some change from occurring. Indeed, the National Assessment water sector report and other research presents compelling evidence that changes are already occurring.

- Warming is happening.

*“The evidence that humans are changing the water cycle of the United States is increasingly compelling.” (National Assessment Water Report, 2000)*

- Changes in timing of runoff are being observed (See Figure 1).
- Changes in snowpack and snow “water content” are being observed. By the middle of the next century, much of the Sierra snowpack may be completely gone. (See Figure 2).
- Sea levels are rising.
- Continued reliance solely on engineering approaches may lead to incorrect, expensive, and dangerous, decisions.

***But This Doesn’t Mean There is Nothing to Be Done.***

- Efforts to reduce greenhouse gas emissions must accelerate.
- Research on climate change must not only continue, it must accelerate, just as greenhouse gas emissions are accelerating. (This is primarily a federal and international responsibility.)
- Research on climate impacts must greatly expand. What we **don’t** know seriously outweighs what we **do** know. (This is both a federal and state responsibility; State research on issues of concern in California is needed.)
- Water managers (and coastal planners, and the agricultural community, and natural resource experts, and more) should begin a systematic re-examination of their areas

and incorporate what we know about future climatic changes. For water managers, this includes re-evaluating engineering designs, operating rules, contingency plans, and water allocation policies.

- The risks of climate change must be incorporated into all water planning, including the design and operation of Federal and State water facilities, CalFed, and the California Water Plan. (See the sidebar below for an example for Folsom Dam and the American River.)
- We must begin now, and should have begun a decade ago, to evaluate policies for adapting to and mitigating the worst threats. (This is a federal, state, local, agency, and individual responsibility.)

The IPCC<sup>2</sup> concluded: "water demand management and institutional adaptation are the primary components for increasing system flexibility to meet uncertainties of climate change."

<p><b>Sidebar</b></p> <p><b>Impacts of Climate Change for Lake Folsom and the American River</b></p> <p>Georgia Tech completed a series of studies for the National Assessment on the response of Lake Folsom on the American River to potential climate and management scenarios. Folsom’s main water uses are flood control, energy generation, water supply, and maintenance of low flows for environmental quality. One of the climate scenarios suggests that Central California will experience wetter and more variable climate under a CO<sub>2</sub> increase. When this new climate was put into the Lake Folsom system, the climate changes cause Folsom’s energy generation and revenues to increase by 24%, spillage (defined as water released above turbine capacity) to increase by 80%, and potential flood damage to increase. What is most interesting is that the results are critically dependent on how the system is operated. If we operate Folsom the way it is operated today, this climate scenario leads to flood damages over a 30-year period of \$4.3 <b>billion</b>. Using a more sophisticated method of system operation, not currently used by Folsom, could reduce flood damages to \$220 <b>million</b> – 1/20<sup>th</sup> of the damages. (Source: National Assessment Water Report, 2000)</p>
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- The ultimate impacts will depend on our ability to foresee major changes, adapt to such changes, be flexible in the face of probable surprises, and be innovative.

Thank you for the opportunity to speak before you today. I will be happy to answer any questions you might have.

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<sup>2</sup> Intergovernmental Panel on Climate Change – the leading international scientific review of the issues. [www.ipcc.ch](http://www.ipcc.ch).

Figure 1. Spring snowmelt is decreasing in California, indicating a change in the timing of runoff. California DWR and researchers believe this is an indication of climate change. (Source. CDWR)

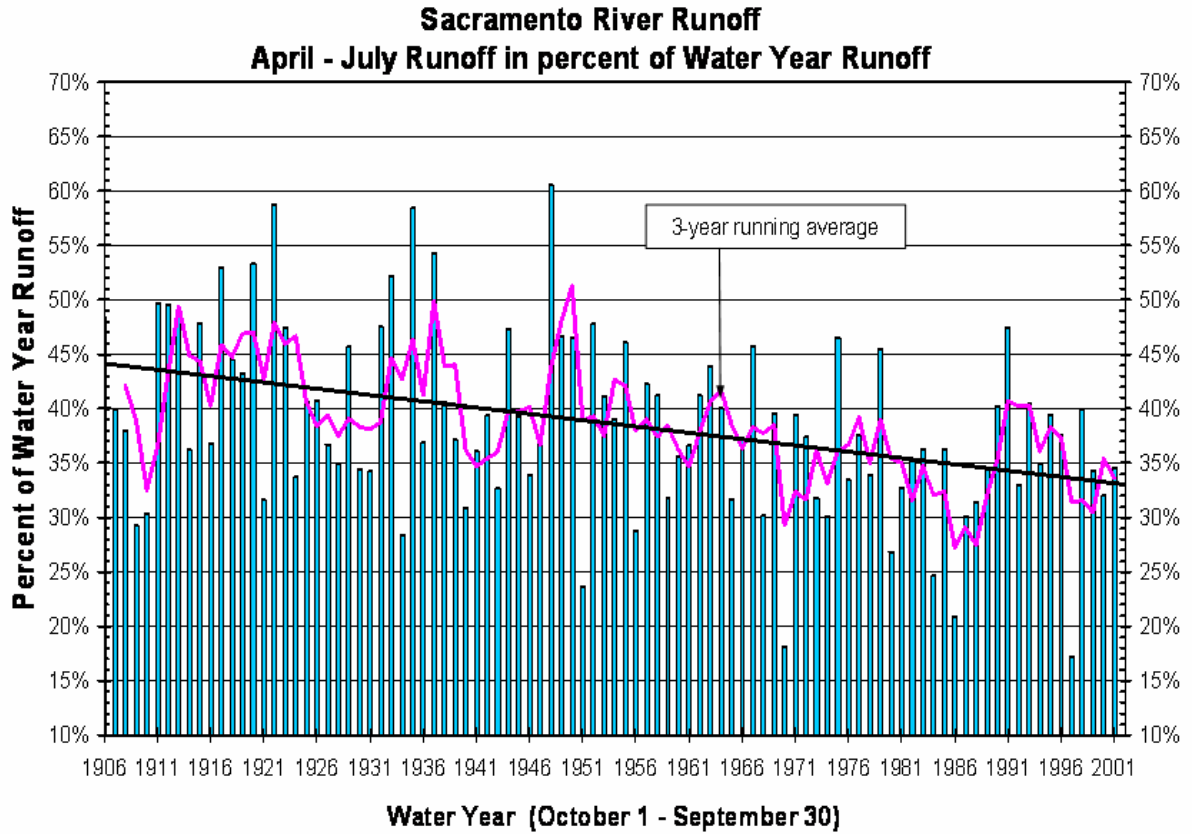


Figure 2. The loss of California snowpack under two climate scenarios by mid- and late-century. Even under optimistic scenarios of climate change, more than 70 percent of California's snowpack will be lost due to warming. (Source: Proceedings of the National Academy of Sciences. 2004).

