Integrating Science and Policy for the Climate-Water Challenge in California

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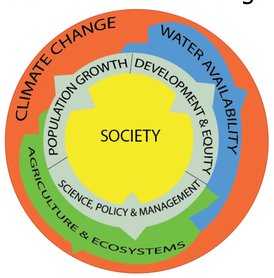
Introduction

California water challenges

Getting water where and when it's needed in California is a constant challenge. Precipitation falls mostly in the north and east during the wet winter, and its storage as snow is critical for meeting demand, which is mostly in the coastal cities and agricultural central valley during the dry summer. A complex network of infrastructure and governance works to address these challenges and meet competing needs for drinking water, irrigation, flood protection, hydropower, and ecosystem support.

However, governance and scientific systems are fragmented, and aquatic ecosystems are in serious decline. Climate change threatens increased water demand, decreased snowpack storage, more severe floods and droughts, and sea-level rise. Significant uncertainties still surround hydrologic responses, so effects on water quantity and quality are largely unknown.



Methods

Building a boundary organization

Boundary organizations serve as interfaces between disparate communities. We sought to use our IGERT as a boundary organization for the science, policy, and water management communities.

We organized a two-day workshop to bring together leading academics and decision makers to identify key research questions, inform scientists what managers and policy-makers need, promote integration of knowledge, and build social ties to enhance communication and cooperation.

Results

Workshop themes and evaluations

Workshop participants included over 100 local and state agency officials, academics, environmental advocates, and policy makers. Panel discussions and roundtable forums facilitated the sharing of strategies and communication of needs and prospects. Additionally, the science-based management focus helped students develop research questions that address decision makers' needs.

This word cloud provides visual representation of major workshop themes, with word size proportional to frequency of use. We generated the word cloud from workshop notes and attendee feedback.

"It's great to get this mix of people together... talking about how do we translate the science into policies that are really going to make a difference in the world. That's why I'm here.

- Benjamin D. Santer

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Percent of workshop participants who "agree" or "strongly agree" that ideas from the workshop relevant to their work...

Discussion

From workshop to research

Management
Modeling reservoir storage and hydropower network system behavior via a disaggregated game-theoretic dynamic analysis will offer needed tools to more effectively adapt to California's variable and changing climate.

Models
Understanding the hydroclimate system requires research at interfaces, through coupled atmospheric and hydrologic models, integrated surface-groundwater models, ensemble approaches, and dynamical downscaling. These process-based modeling efforts will help address complexity within the context of management and policy.

Uncertainty
Physical and social modeling inherently involves uncertainty. Developing and using new techniques to reduce and quantify this uncertainty will advance knowledge and prioritize actions. Further, improved visualization and communication of this uncertainty will facilitate its use in planning.

Human behavior
Human impacts on the hydrologic system are profound, but decision making is poorly represented in models. Representing actors as socially-influenced, boundedly-rational agents has the potential to make hydrologic models more useful for planning.

Integration
The land surface is primarily where human activity occurs and where hydrologic and climatic processes interact. Improved understanding of the interactions between plants and the climate system leads to better model representations of feedbacks between climate change and agriculture.

Conclusions

The workshop identified key needs for science, policy, and management integration.

- Develop research questions in conversation with policy makers and managers.
- Strengthen professional social networks among scientific disciplines and between scientists and decision makers.
- Synthesize scientific information for policy makers and managers, and present key findings with insightful visual representation.

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