Can We Operate the Colorado River Differently Amid Climate Change?

It will be challenging to adapt to changing precipitation and snowmelt patterns in the vital Colorado River watershed. Jack Schmidt at Utah State University is launching a project that may provide some answers.

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Jack Schmidt on the Colorado River.*Photo courtesy University of Utah*

The Colorado River watershed faces increasing challenges from chronic water shortage. And it appears increasingly likely this is a new permanent condition, not an episodic drought.

As a result, the many reservoirs built in the watershed – large and small – may have to be operated differently to optimize new precipitation patterns

and snowmelt routines. That is a complicated problem, because they are all operated by different entities, with different water demands and unique environmental and flood-control concerns.

But if the 40 million people who depend on the Colorado River are to continue thriving, something's got to be done. Jack Schmidt, a professor of watershed sciences at Utah State University, is about to start a large new research project to explore reservoir operations in the watershed. The goal is to explore new ways to manage the river that will work better amid climate change.

It's an ambitious project, but Schmidt is no stranger to this turf: In 2016 he led a study exploring the controversial proposal to "Fill Mead First" – which is another way of saying "drain Lake Powell," so that Lake Mead becomes the primary storage point on the river.

Schmidt answered a few questions for Water Deeply this week about the new research project.

Water Deeply: Tell me about the new research you're planning on Colorado River reservoirs. What does it involve?

Jack Schmidt: We have two primary objectives in our work:

- To use existing modeling platforms, such as the Colorado River Simulation System (CRSS), to evaluate alternative strategies to manage the Colorado River for the joint objectives of meeting water supply needs and river ecosystem needs.
- To develop algorithms by which we can predict changes to the primary drivers of river ecosystems: streamflow, water temperature, sediment mass balance and (perhaps) nutrients.

Our team includes experts in river and water supply modeling, experts in

hydrology and experts in river ecosystems. We intend to collaborate with federal research scientists on river ecosystem topics, and collaborate with Bureau of Reclamation engineers on how to augment CRSS to consider ecosystem issues. We intend to run workshops to bring together stakeholders who traditionally have not had access to tools with which to explore the feasibility of their management suggestions.

Water Deeply: What is the goal of this research?

Schmidt: Our large-scale goal is to encourage innovative approaches to managing the Colorado River that enhance both water supply and river ecosystems.

Water Deeply: How could this research be used by water managers to improve the watershed and water supplies?

Schmidt: We intend to evaluate many scenarios of how to manage water supply to meet objectives of water supply reliability and security. We plan to evaluate management options that are within the present “Law of the River” framework, and also options that are presently outside that framework. We hope to encourage a wide-ranging discussion about how to manage the Colorado River system.

Water Deeply: To what extent does climate change figure into the work?

Schmidt: In many ways, this project is entirely about climate change, and how society adapts to a warming world in which runoff in the Colorado River basin decreases. Our premise is that the major impacts to the mainstem Colorado River and its major headwater tributaries will be indirectly determined by how society adapts to a changing climate … not by warmer air

temperatures per se.

Udall and Overpeck (2017) predicted that watershed runoff is likely to decrease by 17 percent by 2050 and by 25–35 percent by 2100. These decreases in runoff will force the Colorado River basin states and Mexico to negotiate alternative strategies for allocating water among themselves, and these strategies will necessitate decisions about where and how much water to store in reservoirs.

Relatively full reservoirs release cold water and relatively empty reservoirs release warm water. Because water temperature is one of the primary drivers of ecosystem processes, the temperature of reservoir releases has the potential to completely change the present ecosystems of the Colorado River.

There are other ways that reservoir water storage and releases change downstream sediment mass balance and channel geomorphology, nutrients and other ecosystem processes. The premise of our project is that decisions about how to address water supply in a world of decreasing runoff also have the potential to profoundly affect river ecosystems. We assert that it is best to evaluate water supply and river ecosystem issues as a joint problem, rather than address water supply issues first and then decide how to minimize adverse impacts to river ecosystems as a secondary issue.

Water Deeply: Who is funding this research?

Schmidt: Private foundations, including the Walton Family Foundation and the Catena Foundation, and individual donors. We are working collaboratively with Reclamation, the USGS-Grand Canyon Monitoring and Research Center and others. Representatives of NGOs, tribes, agencies and lobbying groups participate in our advisory council.

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