Rising temperatures challenge Salt Lake City's water supply

November 1 2013

In an example of the challenges water-strapped Western cities will face in a warming world, new research shows that every degree Fahrenheit of warming in the Salt Lake City region could mean a 1.8 to 6.5 percent drop in the annual flow of streams that provide water to the city.

By midcentury, warming Western temperatures may mean that some of the creeks and streams that help slake Salt Lake City's thirst will dry up several weeks earlier in the summer and fall, according to the new paper, published today in the journal *Earth Interactions*. The findings may help regional planners make choices about long-term investments, including water storage and even land-protection policies.

"Many Western water suppliers are aware that climate change will have impacts, but they don't have detailed information that can help them plan for the future," said lead author Tim Bardsley, with NOAA's Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado Boulder. "Because our research team included hydrologists, climate scientists and water utility experts, we could dig into the issues that mattered most to the operators responsible for making sure clean water flows through taps and sprinklers without interruption."

Bardsley works for the CIRES Western Water Assessment, from the NOAA Colorado Basin River Forecast Center in Salt Lake City. For the new paper, he worked closely with colleagues from the city's water utility, the National Center for Atmospheric Research (NCAR),

NOAA's Earth System Research Laboratory and the University of Utah.

The team relied on climate model projections of temperature and precipitation in the area, historical data analysis and a detailed understanding of the region from which the city utility obtains water. The study also used NOAA streamflow forecasting models that provide information for Salt Lake City's current water operations and management.

The picture that emerged was similar, in some ways, to previous research on the water in the Interior West: Warmer temperatures alone will cause more of the region's precipitation to fall as rain than snow, leading to earlier runoff and less water in creeks and streams in the late summer and fall.

"Many snow-dependent regions follow a consistent pattern in responding to warming, but it's important to drill down further to understand the sensitivity of watersheds that matter for individual water supply systems," said NCAR's Andy Wood, a co-author.

The specifics in the new analysis—which creeks are likely to be impacted most and soonest, how water sources on the nearby western flank of the Wasatch Mountains and the more distant eastern flank will fare—are critical to water managers with Salt Lake City.

"We are using the findings of this sensitivity analysis to better understand the range of impacts we might experience under climate change scenarios," said co-author Laura Briefer, water resources manager at the Salt Lake City Department of Public Utilities. "This is the kind of tool we need to help us adapt to a changing climate, anticipate future changes and make sound water-resource decisions."

"Water emanating from our local Wasatch Mountains is the lifeblood of

the Salt Lake Valley, and is vulnerable to the projected changes in climate," said Salt Lake City Mayor Ralph Becker. "This study, along with other climate adaptation work Salt Lake City is doing, helps us plan to be a more resilient community in a time of climate change."

Among the details in the new assessment:

- Temperatures are already rising in northern Utah, about 2 degrees Fahrenheit in the last century, and continue to climb. Summer temperatures have increased especially steeply and are expected to continue to do so. Increasing temperatures during the summer irrigation season may increase water demand.
- Every increase in a degree Fahrenheit means an average decrease of 3.8 percent in annual water flow from watersheds used by Salt Lake City. This means less water available from Salt Lake City's watersheds in the future.
- Lower-elevation streams are more sensitive to increasing temperatures, especially from May through September, and city water experts may need to rely on less-sensitive, higher-elevation sources in late summer, or more water storage.
- Models tell an uncertain story about total future precipitation in the region, primarily because Utah is on the boundary of the Southwest (projected to dry) and the U.S. northern tier states (projected to get wetter).
- Overall, models suggest increased winter flows, when water demand is lower, and decreased summer flows when water demand peaks.
- Annual precipitation would need to increase by about 10 percent to counteract the stream-drying effect of a 5-degree increase in temperature.
- A 5-degree temperature increase would also mean that peak water flow in the western Wasatch creeks would occur two to four weeks earlier in the summer than it does today. This earlier

stream runoff will make it more difficult to meet water demand as the summer irrigation season progresses.

More information: "Planning for an Uncertain Future: Climate Change Sensitivity Assessment Toward Adaptation Planning for Public Water Supply," *Earth Interactions*.

Provided by University of Colorado at Boulder