Here's what's causing the Great Salt Lake to shrink, according to study

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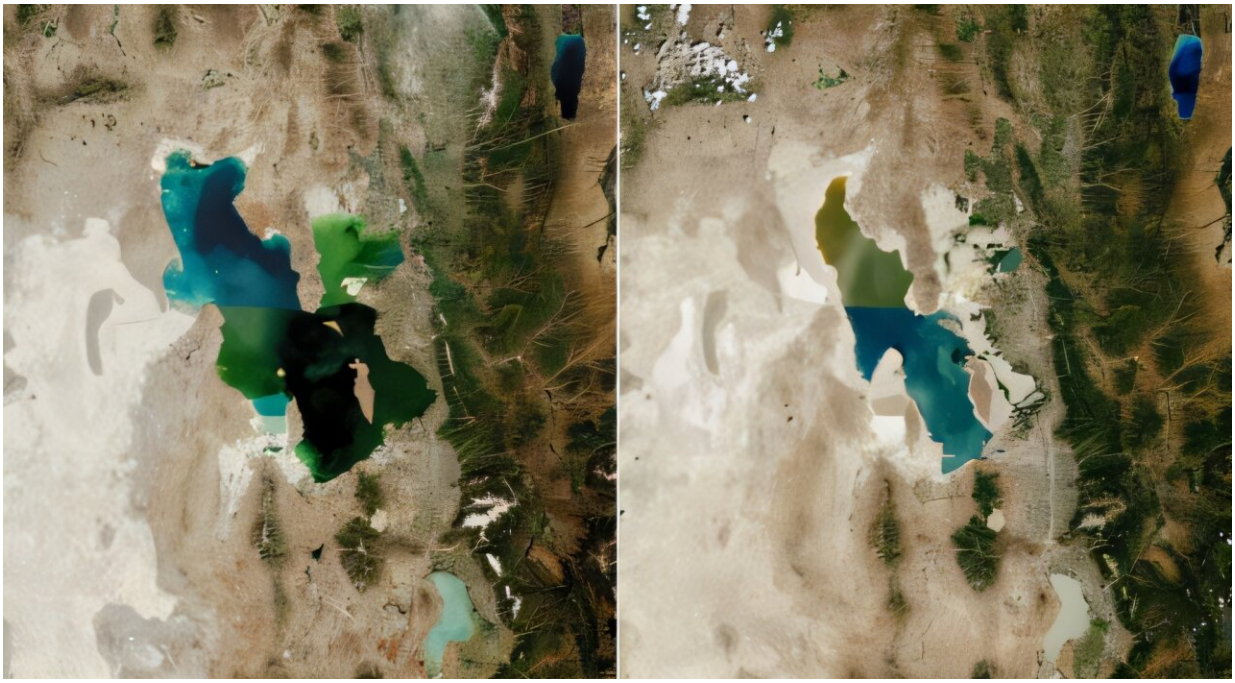

The Great Salt Lake in 1985, left, and in 2022 when it reached historic low levels. New research from Portland State is believed to be the first peer-reviewed study that quantifies the contributing factors to the record low water volume levels. Credit: NASA Earth Observatory images

The Great Salt Lake, the largest saltwater lake in the Western Hemisphere, reached historic low levels in 2022, raising economic, ecological and public health concerns for Utah.

New research from Portland State is believed to be the first peer-reviewed study that quantifies the contributing factors to the record low water volume levels, which the researchers say is important for anticipating and managing future lake changes. The findings were published in the journal *Geophysical Research Letters*.

"The lake has a lot of social and economic relevance for the region and Utah," said Siiri Bigalke, the lead author and a Ph.D. candidate in PSU's Earth, Environment and Society program who built on research she started while a master's student at Utah State University.

"It provides over $1.9 billion in annual economic revenue, serves as a vital feeding ground for millions of migratory birds and enhances snowfall over the Wasatch Mountain Range"—home to 11 world-class ski resorts, which are a big reason why the 2034 Winter Olympics are returning to Salt Lake City.

Bigalke and co-authors Paul Loikith, an associate professor of geography and director of PSU's Climate Science Lab, and Nick Siler, an associate professor in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University, developed and applied a model that simulates lake volume change year over year from water inputs primarily from streamflow into the lake and precipitation onto the lake and output from water evaporating off the lake.

"We developed a model that created alternate scenarios where only one of the input or output variables changed as observed in order to isolate the relative contributions of streamflow, precipitation and evaporation to the record low volume in 2022," Bigalke said.

The decline in lake levels leading up to 2022 has been widely attributed to low stream flows from the lake's three major tributaries, likely due to some combination of drought, water diversions, and climate change.

However, the present study found that lower streamflows only accounted for about two-thirds of the total decline in lake volume. The rest primarily came from an increase in lake evaporation due to warmer temperatures, which will only get worse as temperatures continue to rise.

"As the climate is warming, evaporation off the lake increases, so the contribution from warming to the evaporation is significant," Loikith said. "Without the warming trend, 2022 wouldn't have been a record low. Even though streamflow is dominant, the increase in evaporation was necessary to reach the record low."

The researchers said that the findings suggest that increased streamflow can lead to rapid volume recovery in the short term, but under continued warming, evaporation is expected to lead to additional long-term water loss.

In addition to ecological and economic loss, the shrinking lake also poses health risks as a source of toxic dust for the 1.2 million people in the Salt Lake City metro region.

"As the lake shrinks, it's exposing this dry lakebed that could possibly increase dust events into the metropolitan area, affecting the air quality for nearby residents," Bigalke said.

The authors suggest further research into determining the degree to which local increasing evaporation, precipitation changes and/or human-caused diversions is affecting streamflow into the lake.

More information: Siiri Bigalke et al, Explaining the 2022 Record Low Great Salt Lake Volume, *Geophysical Research Letters* (2025). DOI: 10.1029/2024GL112154

Provided by Portland State University