

Snow may vanish for years at a time in Mountain West with climate warming

Study warns of impending water supply problems due to nearly snowless mountains in about 35 to 60 years

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A new [study](#) provides a glimpse into the future of Western U.S. snow and the picture is far from rosy: In about 35 to 60 years, mountainous states are projected to be nearly snowless for years at a time if greenhouse gas emissions continue unchecked and climate change does not slow.

Due to rising temperatures, the region has already lost 20 percent of its snowpack since the 1950s. That's enough water to fill Lake Mead, the nation's largest human-made reservoir. It stands to lose another half, and possibly more, later this century, from the Rockies to the Sierra Nevada and into the Cascades of the Pacific Northwest, according to a literature synthesis conducted in the study leveraging dozens of peer-reviewed climate model projections.

The current snow situation in the West offers a preview of what the future may hold. Snow water equivalent, or the liquid water from snowpack, [is much lower than normal](#) in much of the Western United States. Snow cover across the nation [is only at 6 percent](#) — the lowest since records began in 2003.

Decades ahead, the “potential for persistent low-to-no snow to disrupt the [Western U.S.] water system is substantial, potentially even catastrophic,” the study's authors write.

Published in *Nature Reviews Earth and Environment* in October, the paper provides an overview of how Western snowpack has changed and what it will look like over the course of this century.

In addition to the 20 percent loss, snowpack is peaking and melting off earlier in the year and is expected to continue on that track. Atmospheric rivers are also warming and dropping more rain than snow, which increases [flood risk](#).

The demands of a warmer atmosphere are already translating into water stress. Although this past year was not a “low snow” year for California, much less snowmelt made it to reservoirs because of an unusually warm spring.

“California's climate is transitioning to a warmer setting in which historical relationships among temperature, precipitation, and runoff are changing,” according to a California Department of Water Resources [report](#) on the 2021 water year.

Snow loss was also apparent during June's extreme Pacific Northwest heat wave.

“When that heat wave occurred, there was a sharp ablation of the snowpack ... that water was ‘lost’ to dry soils and/or the atmosphere rather than feeding streams and rivers,” said Alan Rhoades, a hydroclimate research scientist at Lawrence Berkeley National Laboratory and a co-lead author of the study.

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western states have only had a taste of what is to come. For example, 2015 was an example of an extremely low snow year in the Sierra Nevada, when peak snowpack was only 5 percent of normal.

Such years are projected to become chronic and persistent, occurring for prolonged periods of five to 10 years at a time. By the end of the century, the majority of years (78 to 94 percent) could be nearly snowless in much of the Western United States, according to one model projection in the study.

The Sierra Nevada could see its first near-snowless 10-year period in the 2050s.

“We don’t have any historical analogues of this persistent snowpack loss,” said Erica Siirila-Woodburn, a research scientist at Lawrence Berkeley National Laboratory and a co-lead author of the study. “That, hydrologically, is a totally different beast.”

While the outlooks are grim, there are steps that can be taken now that could make a difference. In fact, the authors see the paper as a “call to action” for scientists, water managers and policymakers, given the high confidence that snowpack will continue to shrink.

According to James Eklund, a Western water expert and former director of the Colorado Water Conservation Board, not all water managers are approaching the issue with the urgency it requires.

“They are all aware things could be bad, but they haven’t planned for things to be this bad,” he said. “This is an existential threat to the West and our water managers stand on the front lines of our response.”

Water managers are already dealing with increasingly volatile precipitation, swinging from drought and heat this summer to extreme rain and flooding.

“Municipalities and water districts are going to have to accept that the new climate-changed reality will not be cheap or easy,” he said. “Senior water rights holders need to be paid to conserve water and leave it in the river to buy time while they get recycled water systems in place.”

The study ends on an optimistic note, and it lays out numerous adaptation strategies and possible paths forward.

“Banking” unused water in reservoirs, and storing excess water in vast groundwater aquifers during wet years, could help to offset the loss of snowpack storage.

Improved seasonal forecasts can also help reservoir operators decide when to hold or release water, avoiding unnecessary releases if outlooks favor dry spells, or helping with flood control if an extremely wet episode is expected.

“The good news is that we can do this, but we’ve got to act with much greater urgency,” Eklund, the Colorado water expert, said. “All the aphorisms apply here: Hope is not a strategy. Failure is not an option.”

