Sierra Nevada Snow Won’t End California’s Thirst

Henry Fountain, New York Times, 4-11-16

YOSEMITE NATIONAL PARK, Calif. — Thanks in part to El Niño, snowpack in the Sierra Nevada is greater than it has been in years. With the winter snowfall season winding down, California officials said that the pack peaked two weeks ago at 87 percent of the long-term average.

That’s far better than last year, when it was just 5 percent of normal and Gov. Jerry Brown announced restrictions on water use after four years of severe drought. But the drought is still far from over, especially in Southern California, where El Niño did not bring many major storms.

Despite the better news this year, there are plenty of worrying signs about the Sierra snowpack, which provides about 30 percent of the water Californians use after it melts and flows into rivers and reservoirs, according to the state Department of Water Resources.

Many of those concerns stem from the effects of climate change and the structure of Sierra forests, which can influence how the snowpack accumulates and melts. Because the snow, in effect, serves as a reservoir that is released over time, any changes can affect how much water is available for people, industry and agriculture, and when.

“We’ll be getting more rain and less snow here,” said Roger C. Bales, a professor at the University of California, Merced, and a principal investigator with the Southern Sierra Critical Zone Observatory, which studies snowpack and other water-related issues. “That means less snowpack storage and faster runoff.”

Dr. Bales was standing on a snowy slope in Yosemite last Thursday, at about 7,000 feet elevation, just off a 19th-century wagon road that is used by hikers and snowshoers. Nearby, amid car-size granite boulders and close to a soaring Ponderosa pine, were instruments that he and his fellow researchers use to obtain detailed information about the snowpack in several spots throughout the southern Sierra. The effects of warmer temperatures can already be seen here, Dr. Bales said.

“Historically, this has been the reliable snow zone, where it accumulates till late March or early April and then melts,” he said. But now the snowpack here is more like that at lower elevations, “where it will accumulate, melt, accumulate, melt,” he said.

Proof was close at hand, as well. Until the last quarter-mile of a two-mile hike here from 6,300 feet, snowshoes were not needed. What snow remained was in small patches.

Similar effects of climate change have been seen throughout the Sierra, including at the Central Sierra Snow Laboratory, which is operated by the University of California at Berkeley near the Donner Pass, about 120 miles to the north. Researchers there still make some measurements the way they have since the lab started in the 1940s, by inserting special metal tubes into the snow.

“We are seeing an ever-increasing percentage of annual and winter precipitation in liquid rather than solid form,” said Randall Osterhuber, who spends winters at the lab. The altitude above which snow accumulates is becoming higher as temperatures warm. “That change in elevation means a lot less terrain is covered in snow.”

Climate change is also expected to increase precipitation in some areas, because warmer air can hold more moisture. But it is not yet clear if that will be the case in the Sierra Nevada.

Snowpack is measured in “snow water equivalent,” or how much water would result if the snow were melted. When snow first falls in the Sierra, it is usually dry and powdery, with about 10 to 12 percent moisture by volume, but as it accumulates and compresses, the moisture content rises to about 40 percent. So 30 inches of snow on March 30 would be equivalent to about 12 inches of water.

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The data from Dr. Bales’s instruments will not be downloaded until later in the spring, but just up the slope, other instruments set up by the Department of Water Resources send data continuously to state offices in Sacramento. Last Thursday, they recorded a water equivalent of 18.36 inches. With warm spring temperatures, the snowpack here was past its peak, with the water equivalent declining by more than three inches in less than two weeks.

The Department of Water Resources instruments are set up in a relatively open part of the forest. The observatory’s instruments, by contrast, are near the Ponderosa pine, and there are three of them: one next to the trunk, one a little farther away where water drips from the tips of the branches, and one in the open, about 20 feet away. Other sensors, which are buried, detect how much water is in the ground.

The goal is to gather a complete picture of the snowpack, which is far from a uniform blanket of white. A tree, for example can affect snow cover in several ways, Dr. Bales said. Some snow is caught by the branches and turns directly to vapor. Other flakes melt and the water drips to the ground. The tree trunk itself absorbs sunlight and re-emits it as heat, melting the snow around it. Boulders do the same thing. Even the tiniest pieces of forest litter — needles or bits of pine cones — can heat up in the sunlight and cause melting.