Water

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work. Some of them, I wait until June to start up. Some, it doesn't help."

Fifteen to 20 years ago, Johnson's seven wells would provide 8,000 to 9,000 gallons a minute. Today, they pump a little more than half that, and less by the end of each season, he said.

Like the more than 175,000 other farmers in the West, Johnson and Lyle depend on water produced by the massive natural and man-made waterworks that spans the region.

Their irrigation water comes from the Odessa Aquifer on the federal Columbia Basin Project. When the project first opened to farming in 1948, the plan was to tap the massive Columbia River for water. Use of the aquifer was intended to continue only until the river water was available.

Now, nearly seven decades later, the aquifer is running out.

Johnson and Lyle hope to replace the declining groundwater from their wells with water from the Columbia River. That could happen between 2019 and 2023, "if everything goes right," Johnson said.

Can they wait until then?

"Do I have an option?" Johnson said. "We need it today."

The two farmers raise high-value crops such as conventional and organic potatoes, wheat, canola, corn, barley, seed peas, grass seed and organic onions, spelt, asparagus and mint.

Without the water, Johnson and Lyle said they would likely have to raise dryland wheat every other year on their thousands of acres.

Rivers run through it

Most water reaches the West as rain and snow through the natural water cycle, said Xochitl Rojas-Rocha, science communicator with the U.S. Geological Survey's Western Ecological Research Center.

The rain and spring and summer snowmelt flow into streams and rivers, but before it reaches the ocean, massive networks of dams, canals and pipelines divert a portion of it to cities and farms.

In addition to natural sources of water, a $1 billion desalination plant is being pressed into service near San Diego in Southern California to treat ocean water and provide fresh water to nearby cities.

The problem in much of the West is precipitation — or the lack of it.

"With maybe the exception of the coastal, temperate rainforests, the West, in general, is a desert," Rojas-Rocha said. "Precipitation numbers are much lower here than, say, the Midwest or East Coast."

Most of the West's water supply is from aquifers, such as the Odessa, and from rivers.

Three major rivers — the Columbia, the Snake and the Colorado — provide much of the region's surface water. Combined with the Klamath, Sacramento and other rivers, they supply trillions of gallons of water to the West each year.

For example, the average flow of the Columbia River at The Dalles, Ore., which is downstream from its confluence with the Snake, is about 128 billion gallons — a day.

The average daily flow of the Colorado River is about 15.2 billion gallons at Lee's Ferry, Ariz., upstream from most of the major diversions.

Much of the Columbia's water comes from snowmelt in the mountains of Canada and the Pacific Northwest. Its main headwaters are at Columbia Lake in British Columbia, Rojas-Rocha said. The Snake is the biggest tributary of the Columbia. Its headwaters are just inside Yellowstone National Park, Wyo.

The Colorado River begins at LaPoudre Pass, near Grand Lake in Rocky Mountain National Park, Colo.

More than 60 dams provide flood control, electricity, navigation aid for barges and water for irrigation in the Columbia River watershed. The Snake River has 25 dams, and the Colorado River has 15 dams on its main stem and more on its tributaries.

According to the California Department of Water Resources, roughly 50 to 60 percent of the state's surface water goes to the environment for fish and native vegetation while the remaining 40 to 50 percent goes to urban and agricultural uses.

Water from below

Besides the rivers, groundwater is a major source of water for farmers and cities.

The U.S. Geological Survey does not track the total amount of groundwater available to the West, said spokesman John Clemens. The agency monitors supplies on a regional, county and snapshot basis, but the total amount changes over time and would not have any scientific or technical meaning, he said.

In much of California, now in the fifth year of drought, groundwater has been a godsend. Parched portions of Central California and elsewhere rely on wells for up to 100 percent of the municipal and agricultural water, according to the state's Department of Water Resources. Overall, 38 percent of the state's total water supply comes from groundwater.

In Idaho, an average of 22 inches of precipitation falls on average every year, accounting for more than 75 percent, or roughly 98 million acre-feet, of the state's water supply. Roughly half of that goes to vegetation or is lost to evaporation. The remaining 49 million acre-feet is surface water or goes to recharge aquifers, according to a 2010 report by Idaho Department of Water Resources.

An acre-foot equals 325,851 gallons.

Oregon's average annual precipitation is about 30 inches, but that varies widely, from as much as 200 inches per year at several points along the Oregon Coast Range to less than 8 inches in parts of Eastern Oregon.

Oregon expects roughly 100 million acre-feet of water in an average year to fill lakes and streams and recharge aquifers, according to the Oregon Water Resources Department's Integrated Water Resources Strategy report. That doesn't include water that evaporates or originates outside the state. Only 9 percent is diverted for farms or other uses, according to the report.

Washington doesn't measure its flow of water, since there's no purpose for the information, said Brook Beeler, communications director for the state Department of Ecology in Spokane. Instead, Ecology determines if water is available at a given time at a given location for various needs, such as people, farms and fish.

For fish, the department determines the minimum instream flows needed to protect habitat, which varies by season, Beeler said.

"In relationship to surface water we have flow data for many priority river systems, but we have more than 70,000 miles of streams and rivers — not all of these are monitored or measured," Beeler said.

Future of water

"Like always, we could do a lot of stuff better, use water more efficiently, more cooperatively, but I think all in all, we live in a pretty good place," said Aaron Wolf, professor of geography at Oregon State University's College of Earth, Ocean and Atmospheric Sciences.

He believes the Columbia-Snake River System is a "terrific" example of water being shared across nations, states and economic sectors.

"It unites five states, a Canadian province, ranchers and environmentalists, ecosystems and tribes," he said.

Michael Campana, professor of hydrogeology and water resources at OSU, specializes in sub-surface water and teaches classes on water management.

"It's not like it used to be, but I think overall, given the tenor of the times and the fact global warming paints an uncertain future for us, farmers are in fairly good shape," Campana said.

But forecasts call for warmer, wetter weather, which means more rain and less snow, Campana said. The snow that does fall will melt sooner, which requires more man-made storage for summer use.

Campana expects junior water right holders and farmers growing low-value crops to be impacted most.

"The days of 'I can take all of the water out of the stream I want' are long gone, and they're not coming back," he said.

"The farmers are real easy targets, so when people talk about drought and cutting water use 25 percent, (they) look right away at the farmers," Campana said. "Sure, we need to cut out water use in the cities and tear out the green lawns and everything. If we don't like agriculture using a lot of water, we have a lot of decisions as stakeholders — who's going to replace the food that is taken out of production, do we want to have to pay higher prices, do we want to truck or ship in food from the Southeast, which is wetter?"

The future

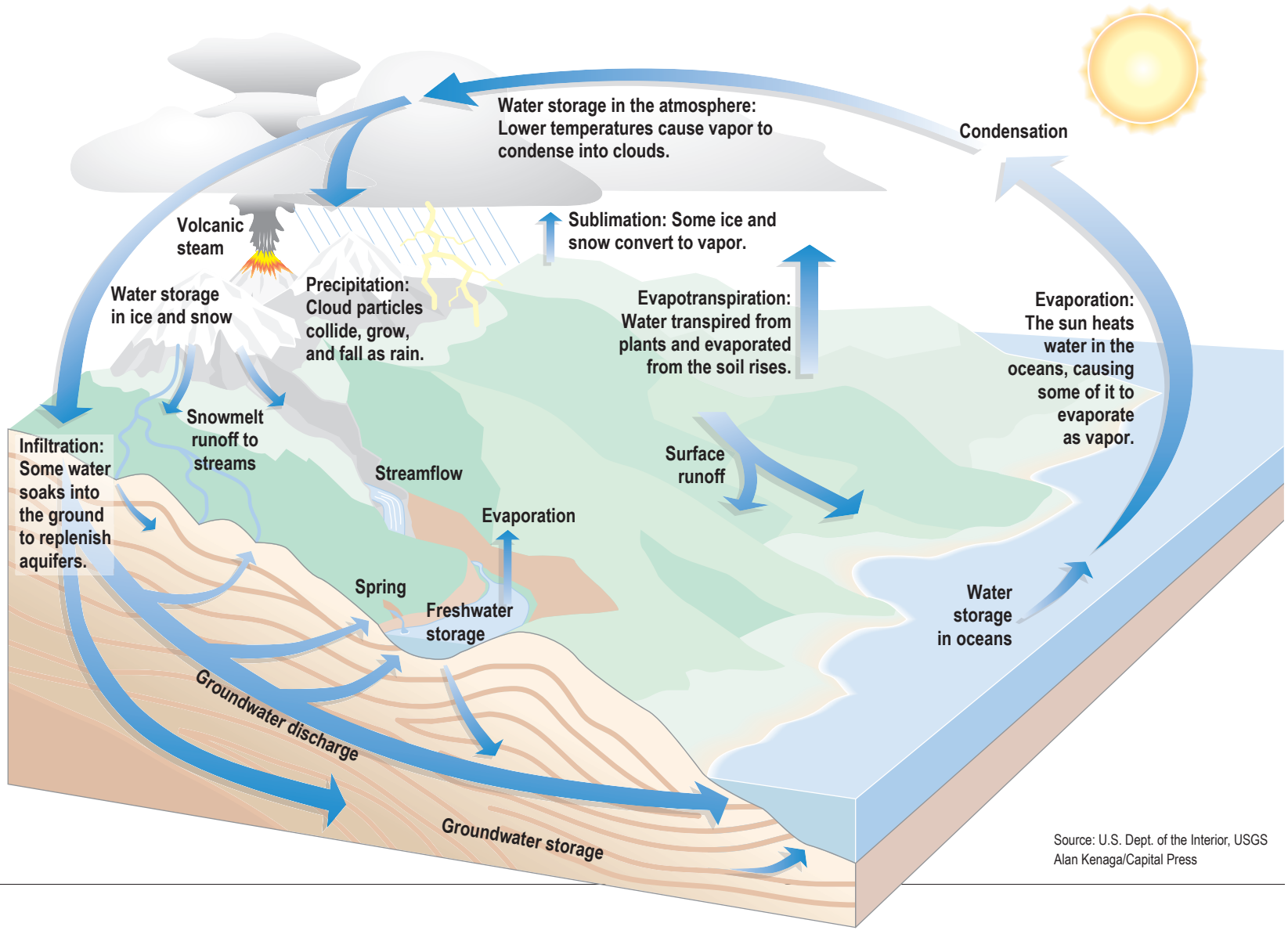
Johnson, Lyle and their neighboring Washington state farmers anticipate getting water from the Columbia River via the East Columbia Basin Irrigation District's planned pipeline.

In the meantime, they wonder if their luck will continue. If they have an electrical interruption in June, there's a chance they may not be able to prime their well pumps again, Johnson said.

"Every day we're concerned about how much water we've got the next day," Johnson said. "Every day when (we) go to sleep, we don't know if there's going to be a well shut off."

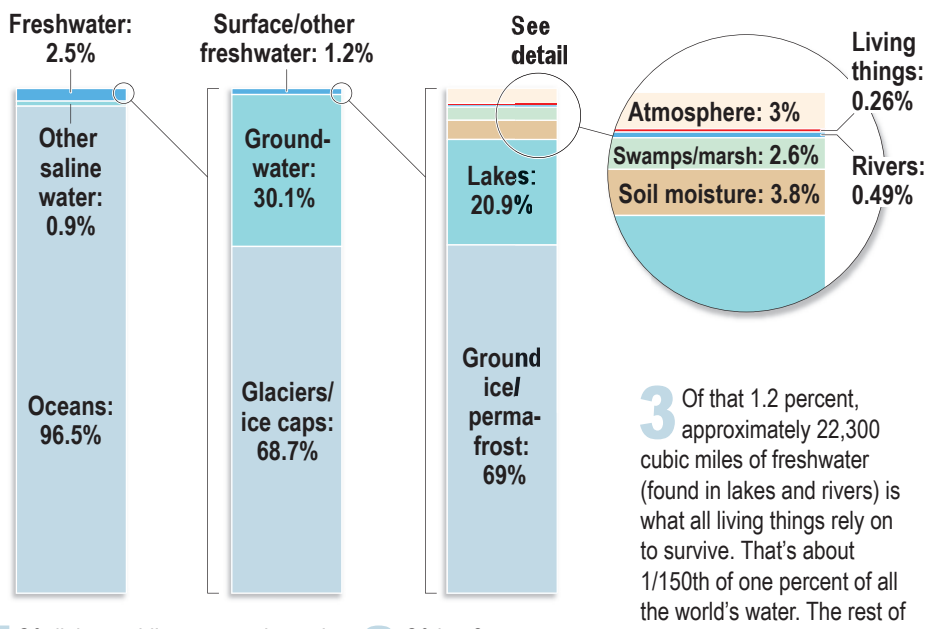
The Water Cycle

The Earth's water is in constant motion, changing states between liquid, vapor and ice above, on and below ground. Known as the water cycle, this repetitive process has been happening for millions of years.



Source: U.S. Dept. of the Interior, USGS
Alan Kenaga/Capital Press

All the world's water: Where it's found



1 Of all the world's water, estimated at 332.5 million cubic miles, More than 97 percent is saline. Only 2.5 percent is freshwater.

2 Of that 2.5 percent, only 1.2 percent is accessible on the surface or in the air.

3 Of that 1.2 percent, approximately 22,300 cubic miles of freshwater (found in lakes and rivers) is what all living things rely on to survive. That's about 1/150th of one percent of all the world's water. The rest of the freshwater is trapped in permafrost or contained in swamps, marshes, soil and the atmosphere.

Source: USGS NOTE: Totals may not equal 100 due to rounding. Alan Kenaga/Capital Press

Dam

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The governors and Jewell were joined in the morning ceremony by Pacific Power President and CEO Stefan Bird, National Oceanic and Atmospheric Administration chief Kathryn Sullivan, Yurok Tribe Chairman Thomas O'Rourke, Karuk Tribe Chairman Russell Attebery and representatives of nongovernmental and water users' groups.

The ceremony was to sign off on a final version of the 133-page agreement announced Feb. 2 by PacifiCorp, the states of Oregon and California and the federal Departments of the Interior and Commerce. The new agreement was reached after Congress failed to authorize the original 2010 Klamath Basin water-sharing pacts by the end of 2015.

The officials stood near the mouth of the Klamath River and signed the agreements atop a fish-cleaning table. The event was streamed online by the Yurok Tribe.

The amended Klamath Hydroelectric Settlement Agreement will maintain the timeline for dam removal in 2020 and use the same funding as before — $200 million from PacifiCorp ratepayers and $250 million from California's Proposition 1 water bond, which voters passed in 2014.

The separate agreement — called the 2016 Klamath Power and Facilities Agreement — aims to help Klamath Basin irrigators avoid any adverse impacts from the return of fish runs to the Upper Klamath Basin after dam removal, proponents said.

Removing dam removal from the equation could make it more politically palatable for lawmakers to support other aspects of the agreements. In December, Rep. Greg Walden, R-Ore., introduced a bill to move forward on other aspects of the agreements.

Another bill by Sen. Ron Wyden, D-Ore., has so far languished in the upper chamber's Energy and Natural Resources Committee.

Most of the 42 original signatories have been working for the past two months to iron out details of the new pact, and the parties held a public meeting March 16 in Sacramento to gather input. The process has drawn criticism from dam removal opponents, who in recent weeks have accused proponents of meeting in secret and claimed the private entity created under the new plan would still need congressional approval.

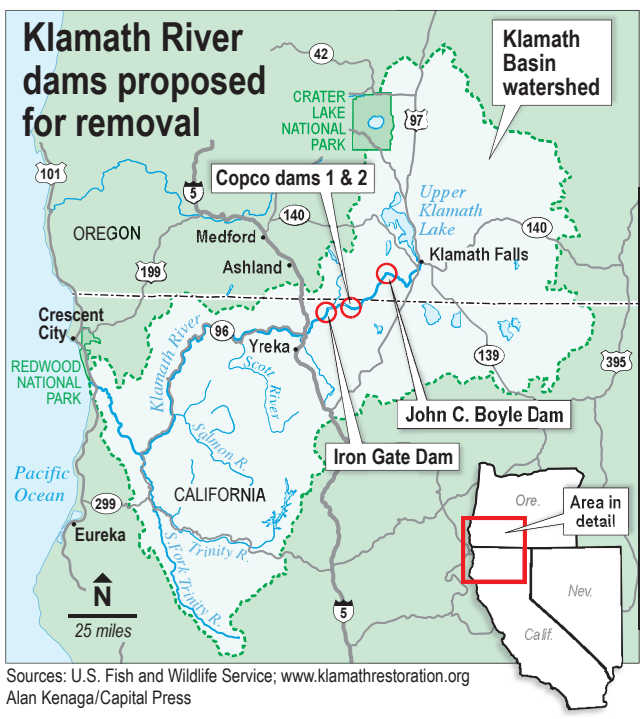
One of the most vocal critics has been Lawrence Kogan, a New York-based water-rights attorney hired by the Klamath Irrigation District. Kogan alleges the government agencies are violating the original agreements by not giving the district enough time to study the new proposal and failing to disclose key elements of the pact, including an economic impact study he said Oregon and California utilities regulators will rely on in considering dam-removal permits.

Kogan sent an email April 4 urging Klamath Basin Coordinating Council facilitator Ed Sheets to postpone the signing ceremony until the irrigation district's questions are resolved. He said he didn't receive a response.

"We are objecting to the process that they violated and continue to violate," Kogan told the Capital Press, adding that the district may sue to block the agreement.

At the ceremony, Jewell said the district's meet-and-confer request has put the Upper Basin agreement into question, but "we are as committed" to the agreement "as we were on the day we first signed."

The Karuk Tribe's Tucker said in an interview the tribes and environmental groups were going to push for the dams' removal to save beleaguered salmon runs regardless of whether an agreement was in place. He said it would be better for Klamath Basin irrigators if a water-rights settlement could be put in place.



Sources: U.S. Fish and Wildlife Service; www.klamathrestoration.org
Alan Kenaga/Capital Press