

# How farmers are trying a new kind of flooding to save California's agriculture

*Even as scientists say the Golden State's agricultural sector must inevitably shrink, farmers are testing a way to stanch the loss of their most precious resource: groundwater.*

**Pete Spotts, Christian Science Monitor, 2-19-16**

FRESNO — El Niño's winter rains couldn't have come soon enough for George Goshgarian and his family's orchards.

It's not that his crops are failing. Far from it. Instead, he's looking to the future. The storms are providing an opportunity for Mr. Goshgarian and a handful of other growers in California's San Joaquin Valley to test a new approach to stanching the loss of their most precious resource: groundwater.

Groundwater is the reservoir of last resort in a drought, after rivers and surface reservoirs run low or regulators limit access to them for environmental reasons. But groundwater is vanishing at an alarming rate in the Central Valley, particularly in the San Joaquin.

This relentless loss threatens the future of agriculture in the region and the communities that support it – even as the state's population continues to grow. And while the valley is no stranger to drought, the regional effects of global warming are anticipated to increase drought frequency and intensity.

The approach that a handful of growers are testing involves flooding fields during the rainy season, when orchards and vineyards are dormant. In principle, the water soaks into the ground, eventually recharging groundwater supplies; and the dormant crops are none the worse for the flooding.

Agricultural researchers say the approach holds the potential to store significant amounts of water. But the devil is in the details.

“There are a lot of ducks that need to be in a row in order for this to become a sustainable practice,” cautions Ken Shackel, a plant biologist at the University of California at Davis who is taking part in the research.

The stakes are high.

“In the next 50 to 100 years, acreage will decrease.... There's no doubt about it,” says Helen Dahlke, a hydrologist at UC Davis who also is working on the project.

The question: By how much? Banking water underground during the wet season could play an important role in determining the answer, researchers suggest.

## **Staying nimble**

For Goshgarian, whose family fled the massacres of Armenians and has farmed in the valley for more than 100 years, keeping the operation afloat means staying nimble.

Where almond trees now grow in tidy rows, grapes once thrived. The Goshgarians made the switch in 2008

because wineries found they preferred grapes grown in mountain foothills that ring the valley. The demand for grapes from the valley floor plunged, Goshgarian explains.

### **Not everyone is adroit.**

“There are fewer and fewer family farms every year,” says Goshgarian's son, also George. “It's becoming harder and harder to compete at our scale versus the larger-scale guys. That's just the nature of the beast.”

“The last few years have been good,” says the younger Goshgarian, the fourth generation to farm the family's acres. “Prior to that it wasn't so good.”

Now comes the prospect that severe droughts like the current one not only will reoccur, but are also likely to appear more often.

“Drought in this area is nothing new,” the elder Goshgarian adds. But during really wet years, the region lacks enough surface storage to hold the extra water. It merely flows into the Pacific Ocean. The state is unlikely to build more reservoirs, he adds. Groundwater storage gives the best chance of capturing rainy-season runoff.

So along with a handful of other growers in the San Joaquin, Goshgarian is experimenting with a new way to stabilize the heavily depleted aquifers deep beneath his orchards. It involves a new twist on flood irrigation.

Prior to the adoption of more-efficient drip irrigation, growers irrigated fields by periodically flooding them during the spring and summer growing season, when the crops' demand for water is heaviest. Now, they aim to flood fields during the fall-winter rainy season, when plants least demand the water.

For the past few decades, water districts in the valley have excavated recharge basins to catch water. The earthen basins capture water and allow it to percolate into aquifers. But there are too few of these basins, researchers say; they are expensive to build, and they tie up, for occasional use, land that otherwise might have year-round value.

Flooding dormant orchards won't work everywhere. Much depends on the nature of the soil beneath the fields. But farmland along the eastern half of the Central Valley – a large area that includes Goshgarian's acreage – has some of the highest potential for recharging groundwater, researchers say.

That potential is significant, according to a study for the California Water Foundation in Sacramento. For a broad swath of the southern San Joaquin, groundwater is being depleted at an average rate of 250,000 acre-feet a year – a rate faster than it can be replenished. But winter runoff flows, on average, could supply roughly one-third to one-half of that total and could be diverted to fields without spending for new canals or diversion structures, the study estimates.

So far, more-efficient use of water has allowed farmers to keep profits relatively high. Revenue from three key groups of crops in 2014 hit its second-highest total on record, according to an analysis by the Pacific Institute, a water-policy think tank in Oakland, Calif.

### **Water at Goshgarian's orchard**

Goshgarian's orchard illustrates the trend. Drip irrigation provides water and fertilizer to plants with almost surgical precision, reducing waste and the potential for polluting groundwater. Weather stations at various locations track temperature, humidity, and the moisture that the soil and trees return to the atmosphere as evapotranspiration. Other sensors track solar radiation, as well as soil moisture to depths of several feet.

Ironically, however, these water-saving methods might jeopardize long-term groundwater levels.

Drip irrigation uses water more efficiently because it delivers the water to the base of each tree, where sensors track moisture in and around the root zone. Once that zone is saturated, the water cuts off. In effect, there are no leftovers. But with flood irrigation, water that trees didn't use – and that didn't evaporate – percolated down to the aquifer.

Goshgarian has a strong hunch that the new approach to water storage will work. Even before scientific studies were made, he and his son gave the flood-the-field approach a try. When the irrigation district had extra water to allocate six years ago, Goshgarian used it to flood the field where he'd switched from grapes to almonds.

“It worked pretty well,” he says. “We could see a pretty good rise in our water table. But it wasn't a scientific study.”

The scientific studies began in 2011, when researchers conducted a formal experiment in western Fresno County. Between January and August, the team flooded the plots while the crops were dormant and estimated that the water seeped up to 118 feet below the surface. But the main aquifer in the area is between 150 and 200 feet below the surface. The experiment didn't track the flow sufficiently to see if it reached the water table.

Researchers are now exploring the prospects for flooding other fields, including almonds. Almond orchards account for more than 1 million acres in the Central Valley, notes Dr. Dahlke.

“A lot of questions need to be answered,” she says. For instance, it's unclear how much flooding the trees can tolerate without damage or drops in yield. The same holds true for other crops whose fields might serve as soaking grounds.

“Almonds are known to be relatively sensitive to flooding,” adds Dr. Shackel.

Understanding the physical mechanisms responsible for difference in flood tolerance will help ensure that when fields are flooded, the water isn't putting the crops at risk.

Even with new approaches, the valley's agriculture sector is likely to contract, water-policy specialists in the state reiterate.

Cities, where most of the population lives and virtually all the state's future growth is expected to occur, tend to take water from agriculture when they get desperate, says Jonas Minton, water-policy adviser to the Planning and Conservation League, an environmental group in Sacramento.

For now, investors are still flocking to agricultural opportunities, particularly for almonds and wine grapes, even on marginal land. But those booms and busts come and go. Goshgarian's goal is to find a more sustainable future – for the industry and his family.

Farming in the valley has undergone a paradigm shift, Goshgarian says. At one time, water directly underneath a grower's field was considered that grower's water. But the current drought has led growers to accelerate the loss, leaving some communities in the valley with well pipes that no longer reach groundwater. Either people drive for miles to fill water containers, or water is trucked in to replace what wells no longer deliver.

Indeed, in 2014, the state enacted the Sustainable Groundwater Management Act, becoming the last state in

the Union to actively manage its groundwater resources. With a few strokes of Democratic Gov. Jerry Brown's pen, groundwater became a public commodity to be managed for the public good.

“The only constant is change,” Goshgarian says. “You have to adapt.”