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## Slideshow: Future of Water: Technology to help California farms stretch every drop | 89.3 KPCC

*Southern California Public Radio*

To find out how that could be in a world of more frequent drought, I went to Madera County to meet almond farmer Tom Rogers. In many ways, his 175-acre orchard smack in the center of the San Joaquin Valley is the farm of the future — a future where, like it or not, almonds are almost certain to be the state's number one crop.

"These were some of the first almond trees that were planted in this area," Rogers said, pointing to row after row of almond trees. "This has been a good crop for us."

In the 1970s, Roger's father made a prescient decision. He ditched the cotton, corn and alfalfa his father grew and planted almonds. Thanks largely to strong demand in Asia, they've become a very lucrative crop. The downside is the trees require year-round watering.

"It's a scary time," said Rogers. "We're very concerned about

what's going on.”

So this year, Rogers made perhaps his own prescient decision. He not only installed a drip irrigation system, but one that's as much digital gadgets as it is pipes and tubes. Conserving water has become especially important because Rogers now relies solely on groundwater.

"By comparison, in other years, groundwater amounted to maybe 10 to 25 percent of our annual water usage," Rogers said. "I have no clue how long the water will last.”

His high-tech irrigation system lets him stretch what little water he has as much as possible. In the middle of a row of almond trees, Rogers pulls a soil moisture probe out of the ground.

“On top is the rain gauge and wind speed indicator," Rogers said. "A panel up there measures the amount of sunlight.”





***Caption:*** *Two soil moisture sensors are at each weather station at Dan and Tom Rogers' farm in Madera, Calif. Tom Rogers can now program his drip irrigation system from his computer.*

This is one of the data stations in the orchard where sensors record measurements about the exact conditions on Rogers' ranch – temperature, humidity, the amount of soil moisture. All the information gets uploaded to the Internet every 15 minutes, which allows Rogers to make decisions about exactly how much water the trees need.

"I usually spend an hour looking at it every night," Rogers said. "I can read it on the smartphone, but I prefer looking at it on my computer. I guess I'm getting old so I want a bigger screen."

Instead of getting soaked by sprinklers once a week, his roughly 15,000 trees get tiny doses every day.

"In essence, they're spoon feeding the tree," said [Heather Cooley](#), co-director of the Pacific Institute's Water Program.

She said drip irrigation isn't new, but for a long time it was seen as a niche method for high yield crops because it's pricey, sometimes

costing \$1 million to install. But Cooley said the drought is changing the equation for farmers.

"They're shifting because it allows them to use water more efficiently," she said.

But there's a paradox to all this efficiency: The more water Rogers and other farmers save with drip irrigation, the more incentive they have to use that saved water to plant more crops — particularly water-intensive crops like almonds.

"The irrigation technology we're using today is much more efficient than we used 20 years ago," said Larry Yee, president of The Food Commons, a group working to reform how food is grown and distributed. "But if we plant crops that take a lot more water, then overall we could have greater water demand than we have now."

So, while farms of the future will probably be more efficient with water, they won't necessarily be using less of it.

Another thing about the farms of the future: there will be many fewer of them, said Jay Lund, who studies agriculture at the University of California, Davis.

"Some of the agricultural land will be urbanized," said Lund. "A few thousand acres are becoming too salient because of drainage problems."

He said by 2040, we could easily see as much as two million acres of farmland taken out of production — that's an area roughly half the size of Los Angeles County. Most of that will be lost to subdivisions and shopping malls for California's growing population. But a lot of that land will be permanently fallowed because of a lack of reliable water, which is already devastating farms in the Tulare Basin.

"They are basically dependent on imported water," said Lund. "I think those towns will have to find another source of economic activity."

But even though there will be fewer farms, the agricultural industry will likely continue reaping record revenues well into the future — because of a shift toward more valuable, but permanent crops.

"Today about one-third of California's irrigated agriculture is in permanent crops — vines, almonds, fruits and nut crops," said Lund. "We'll see a continued shift that way."

Even during the last four years of drought, the acreage of thirsty fruit and nut trees has increased by 8 percent. California agriculture saw record revenue in 2014 — \$54.9 billion according to the U.S. Department of Agriculture. But at the same time, farmers saw record expenses — \$40.8 billion. The California Farm Bureau Federation says profit margins are shrinking largely because of drought-related costs like pumping groundwater.

Still, when Lund and his team of UC Davis researchers used computer modeling to see what would happen if there was a 72-year mega drought, they were surprised how minor the overall impacts would be.

“One of the things I think that study points out is that California, particularly with its very large infrastructure system that can move water around compared to other states, can accommodate some pretty big water shocks, even permanent water shocks,” Lund said.



***Caption:*** Dan and Tom Rogers' farm has three weather stations throughout their 175-acre almond farm. This temperature sensor sends back information to a centralized computer that Tom Rogers can then access from his personal computer. (Photo by Maya

*Sugarman/ KPCC)*

About 50 miles west from Tom Rogers' farm of the future is Bowles Farming Company, an 11,000-acre family-farm located in Los Banos, that counts alfalfa, cotton, and tomatoes among its crops.

Despite alfalfa's rap as a low-value commodity that needs more water than any other crop, Phillip Bowles, the farm's chairman, says he still plans to grow it, even though he didn't plant any this year because his water allotment was cut back by 55 percent.

"If we were to stop growing alfalfa in California, we wouldn't have a dairy industry anymore," Bowles said.

Still, he does plan to switch his alfalfa fields to drip irrigation.

Bowles represents the fifth generation of his family to harvest this land. His great, great grandfather built a dam upstream from here in the 1800s — which means Bowles has very senior water rights.

"Water is a big expense for us," Bowles said. "We don't want to use anymore than we have to. We don't want to use less than we need because it hurts the crop. But we don't get a kick out of it. We don't drink the water."

Bowles doesn't expect his farm to operate much differently in the next 25 years than it has in the past 159. And he doesn't think other California farms will change much either.

Bottom line: he thinks people are making much too big a deal out of the drought.

*The chart above shows which crops need the most water to grow. Data from 2010. Source: California Department of Water Resources.*

“The system that we have can be adapted,” Bowles said. “It doesn’t have to [be] blown up. It doesn’t have to be abandoned. There’s still a lot of water in this state, and people overlook that.”

That’s not to say farms of the future won’t face big challenges. More frequent droughts will likely mean less reliable water supplies, and under new rules, California farms won't be able to continue drawing unchecked amounts of groundwater.

That said, California's status as the produce aisle of America will probably remain firmly rooted for decades to come.