California Drought: San Joaquin Valley sinking as farmers race to tap aquifer

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Posted: MercuryNews.com

PIXLEY – So wet was the San Joaquin Valley of Steve Arthur's childhood that a single 240-foot-deep well could quench the thirst of an arid farm.

Now his massive rig, bucking and belching, must drill 1,200 feet deep in search of ever-more-elusive water to sustain this wheat farm north of Bakersfield. As he drills, his phone rings with three new appeals for help.

"Everybody is starting to panic," said Arthur, whose Fresno-based well-drilling company just bought its ninth rig, off the Wyoming oil fields. "Without water, this valley can't survive."

When water doesn't fall from the sky or flow from reservoirs, there's only one place to find it: underground. So, three years into a devastating drought, thirsty Californians are draining the precious aquifer beneath the nation's most productive farmland like never before, pitting neighbor against neighbor in a perverse race to the bottom.

The rush to drill is driven not just by historically dry conditions, but by a host of other factors that promote short-term consumption over long-term survival -- new, more moisture-demanding crops; improved drilling technologies; and a surge of corporate investors seeking profits for agricultural ventures.

Now those forces are renewing an age-old problem of environmental degradation: Decades ago, overpumping sunk half of the entire San Joaquin Valley, in one area as much as 28 feet. Today new areas are subsiding, some almost a foot each year, damaging bridges and vital canals.

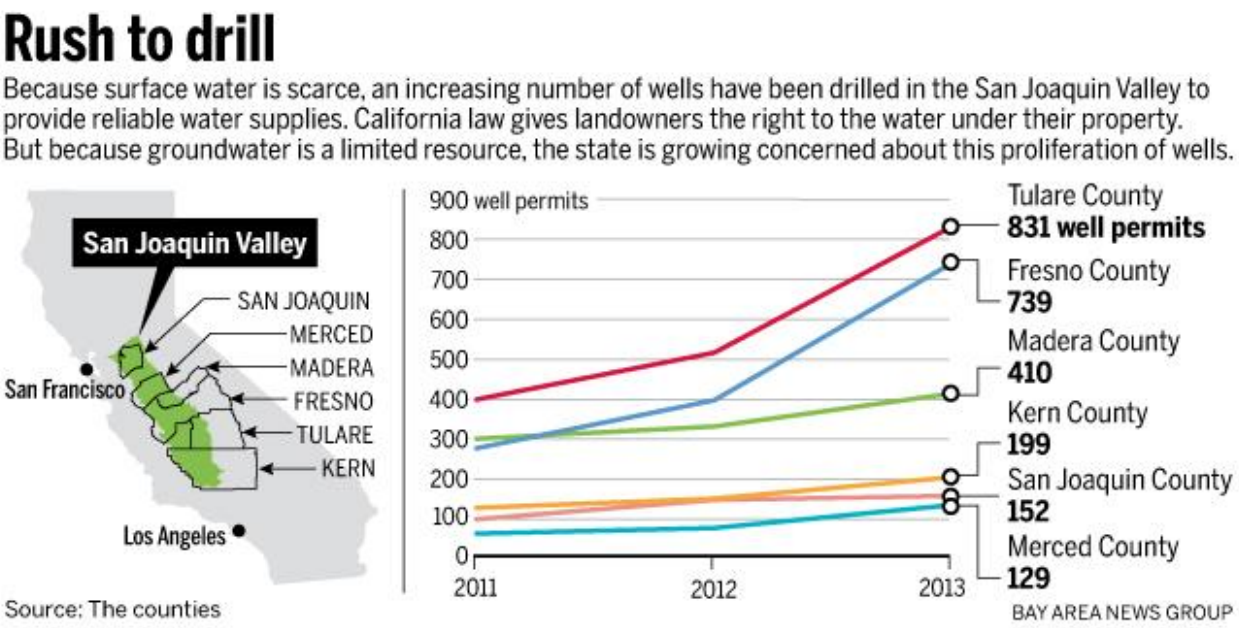
Yet in California, one of the few states that doesn't regulate how much water can be pumped from underground, even this hasn't been enough to create a consensus to stop.

"It's our savings account, and we're draining it," said Phil Isenberg of the Public Policy Institute of California, a former Sacramento mayor and assemblyman. "At some point, there will be none left."

'Hitting bottom' before long?

The trends are alarming, the politics complex, but the science is rather simple: The Central Valley -- from Redding to Bakersfield -- is consuming twice as much groundwater as nature is returning through rain and snow.

The rate of water loss over the past two years is the largest since the University of California started using NASA satellites to measure underground water reserves in 2003. The Central Valley's reserves are shrinking by 800 billion gallons a year -- enough to supply every resident of California with water for seven months, according to Jay Famiglietti, director of the



University of California Center for Hydrologic Modeling.

"We may only be a few decades away from hitting bottom," said Famiglietti, considered one of the leading experts on state water policy.

However, little is being done to control it. States such as Kansas and even Texas prevent unlimited pumping of groundwater. But California has failed to regulate how much groundwater is pumped, leaving it up to the courts to settle disputes over excessive use, according to Barton H. "Buzz" Thompson Jr., professor of natural resources law at Stanford University.

Overpumping not only lowers the water table and collapses land at the surface, but it also lowers water quality and requires more power to pump. River flows are lower, and shallow wells are exhausted.

Farmers have long relied on the government's engineering marvel of aqueducts to bring surface water from giant reservoirs in the north to the south. However, the federally run Central Valley Project allotted farmers only 20 percent of their share last year -- and none this year. Officials who manage the State Water Project, California's other major water system, have also said that they will not be releasing any water for farmers, a first in the system's 54-year history.

So with the drought cutting off their deliveries, farmers say they must rely on the only source left. Those who can afford the $200,000 to $600,000 price tag are digging deeper and deeper to tap into a once-unreachable aquifer. Many are taking out loans, betting on crop yields to break even.

"I've got some of the best land in the nation -- 50 feet of topsoil -- that is sitting vacant if I can't get water," said Thomas Kaljian, of Los Banos, who owns almond orchards on the San Joaquin Valley's west side. "This is the breadbasket of the nation, and we're strangling it."

The signs of the valley's relentless thirst are everywhere. An analysis by this newspaper shows a dramatic jump in well construction in seven San Joaquin Valley counties in 2013, with an even sharper increase this year as Gov. Jerry Brown declared a drought emergency:

• In the first month and a half of this year, Fresno County issued 124 new well permits, and Tulare County approved 182 -- a pace that is triple and double, respectively, the previous year.

• In Kern County, cotton king J.C. Boswell Farms drilled five ultra-deep 2,500-foot wells last year. Each one is as deep as two Empire State Buildings, stacked underground.

• A Chowchilla-based farm in Madera County has ordered 25 new wells for construction this year; a drill rig is likely to stay on that property all year.

• Stanislaus County issued nearly 150 drilling permits, with 100 for large wells, in fall 2013 -- compared with 35 well permits issued in fall 2012, with four large wells.

• Demand for drilling is so hot that the average wait to get an agricultural well is 10 to 12 months, according to a survey by the Fresno County Department of Environmental Health.

Even those at odds over whether Central Valley farmers need more water or more restraint are finding room for agreement on one point: Too much is at stake to ignore the problem.

Feeding the nation

The Central Valley, home to the world's largest swath of ultra-fertile Class 1 soil, is the backbone of California's $36.9 billion a year, high-tech agricultural industry. Its 6.3 million acres of farmland produce more 350 crops, from fruits and vegetables to nuts and cotton, representing 25 percent of the food on the nation's table.

The rise of the valley's agricultural might is intimately tied to its access to the water. Nature blessed the area with rich soil, but its water supplies have always been unreliable, despite the best efforts of generations of entrepreneurs and visionaries armed with better drilling technology and an audacious system of reservoirs and canals.

Generations ago, agriculture was at the mercy of Mother Nature.

"What you got out of the sky was what predicated what your crops would be," said Pat Hillman, 86, whose grandfather Jefferson Davis Heiskell moved to Tulare in 1886 to start a grain warehouse to store the area's wheat, barley and sorghum.

Eventually, farmers dug crude canals to channel water to their fields from Tulare Lake, once larger than Lake Tahoe, and from the abundant shallow artesian wells that flourished during wet seasons. But by 1898, the lake was drained dry, and the only sign left of the shallow wells is a slab of granite set by the Pixley Women's Club in an abandoned cattle trough to commemorate the area's long-gone natural fountains.

Decades of demand

New technologies soon made it possible to tap into the deep underground water basin. Improvement of drilling techniques and gasoline-powered pumps, then the invention of the deep well turbine pump in 1930, drove wells down more than 300 feet.

More intensely irrigated row crops followed, with acreage made feasible by mechanical harvesting and refrigerated railroad transportation. The federal system of aqueducts, pumps, canals and dams -- the largest water development project in the United States, completed in 1949 -- spurred more agricultural growth.

Soon, every acre was valuable, and thirsty -- especially when it didn't rain, and the demand for groundwater grew.

"Now you don't see any piece of dirt that don't have something on it anymore," Arthur said. "Before, you used to just grow in the winter. Now, to make any money, you better have crops all year round."

In the past, during dry years, farmers routinely would fallow their fields, either not planting or letting crops such as alfalfa go dormant.

But now, despite the historic drought, many farmers are opening new acreage to more intensive cultivation -- converting row crops to orchards, such as almonds and grapes, that command a higher profit but demand water to survive year-round. When it's dry, that water has to come from the ground.

"We're mining water that is thousands of years old to produce crops that might last a decade or two," said retired U.S. Geological Survey hydrologist Vance Kennedy, 91, who has witnessed wide expanses of grasslands in the foothills of the Sierra converted into large orchards.

It takes slightly more than a gallon of water to produce one almond, three-quarters of a gallon to grow a single pistachio and 4.9 gallons to grow a single walnut.

But the profit from a single acre of almonds can deliver $3,510 a year, according to David Doll, a University of California Cooperative Extension farm adviser for Merced County. From 2000 to 2010, the price per pound jumped from 97 cents to $1.67, and the number of acres planted in almonds increases by 20,000 to 30,000 acres every year, according to the Almond Board of California.

Two-thirds of California's almonds go overseas, fueled by the tastes of China's growing middle class.

Investors, sensing the opportunity for profit, have accelerated the shift toward more water-intensive crops:

• John Hancock Agricultural Investment Group in 2010 bought the 12,000-acre Triangle T

Ranch of Los Banos, a ranch known for prize-winning Hereford beef cattle, cotton and alfalfa, and converted it to almonds.

• The Livermore-based Wine Group, the world's third-largest wine producer, in 2012 bought a Chowchilla ranch from W.P. Roduner Cattle Co. and converted it to grapes.

• Trinitas Partners, a Silicon Valley-based private equity firm, is turning 6,500 acres of rugged eastern Stanislaus County land from grazing to almonds.

• Paramount Farms, the world's largest pistachio and almond grower and processor, recently converted 15,000 acres of row-cropland in Madera County.

Experts say the shift in crops creates an inflexible need for water called "demand hardening."

"Groundwater has always been a resource to fall back on when things are tight. But that's not what is going on now," said UC's Doll. "Operations have become more reliant on it."

What's been lost, experts say, is farmers' ability to roll with nature's hydrologic punches. This year has delivered that kind of punch.

'A dog-eat-dog world'

A ringing phone jangles Tulare County farmer Mark Watte's nerves. His well pumps are drawing up more sand, so they wear out more quickly. "Every morning I get a call from one of my irrigators, and I just cringe with fear that there will be a report of a well failure," said Watte, who farms a variety of crops, from cotton to tomatoes. "This is my land. This is my livelihood."

To ensure they can support their crops, farms are "ordering wells faster than we can put them in," said Arthur, of Arthur & Orum Well Drilling.

Driller Ron Bradley, of Del Rey, south of Fresno, is busy replacing or deepening dry domestic wells. "Without the groundwater being replaced, they're not adequate anymore."

It's akin to an arms race, said hydrologist Kennedy. Newly deepened wells drain the water below existing wells -- forcing neighbors to drill ever deeper or risk going dry.

"People don't know, or don't care, that they are also pulling water from thousands of feet around them," he said. "If their neighbor suffers? Well, it's a dog-eat-dog world."

In the Modesto area, the water table has dropped 100 feet; in Tulare Basin, it's dropped 500 feet, according to the U.S. Geological Survey.

Changes on the horizon?

Regulations are anathema to most of California's farmers and developers, who consider well-drilling a private property right -- and blame environmental laws such as the protection of endangered fish and the government's unreliable water shipments for their desperate situation. To reduce groundwater use, they say, more dams are needed to store water to help

them get through dry years.

However, change is creeping over the political horizon. An increasing number of farmers concede that local, regional or state pressure might be the only way to preserve groundwater. This summer, the state will issue a draft plan to manage groundwater. Because it supports local management with state oversight, experts say it may succeed where previous plans have failed.

Possible groundwater management tools could include monitoring, reporting and setting a price on water withdrawals, and even restrictions on pumping.

Sixth-generation Los Banos farmer Cannon Michael, whose great-grandfather Henry Miller was California's largest cattle rancher in the late 19th century, is no fan of regulation. But he is angered by the overpumping, and sinking land, that is damaging the irrigation pipes that deliver water to his farm.

"We need reasonable use of a shared resource," he said. "It affects other folks, creating long-term impact."

This year's drought won't be the last one, or even the worst, scientists say. Climate change is expected to further stress the state's naturally dry environment. Snowmelt runoff will decrease. Reservoir levels will fall as heat evaporates more water. Heat-stressed crops and population growth will build even more demand.

During future droughts, experts fear, groundwater may not be there to patch us through.

In the Pixley wheat field, Arthur's newly deepened $200,000 well is spurting gallons of fresh water -- a sign that there will be a harvest this year. But how long before a deeper well is needed?

"The one thing I can't determine is how much water it is going to produce," Arthur said.

"We were a desert before. We could be a desert again."

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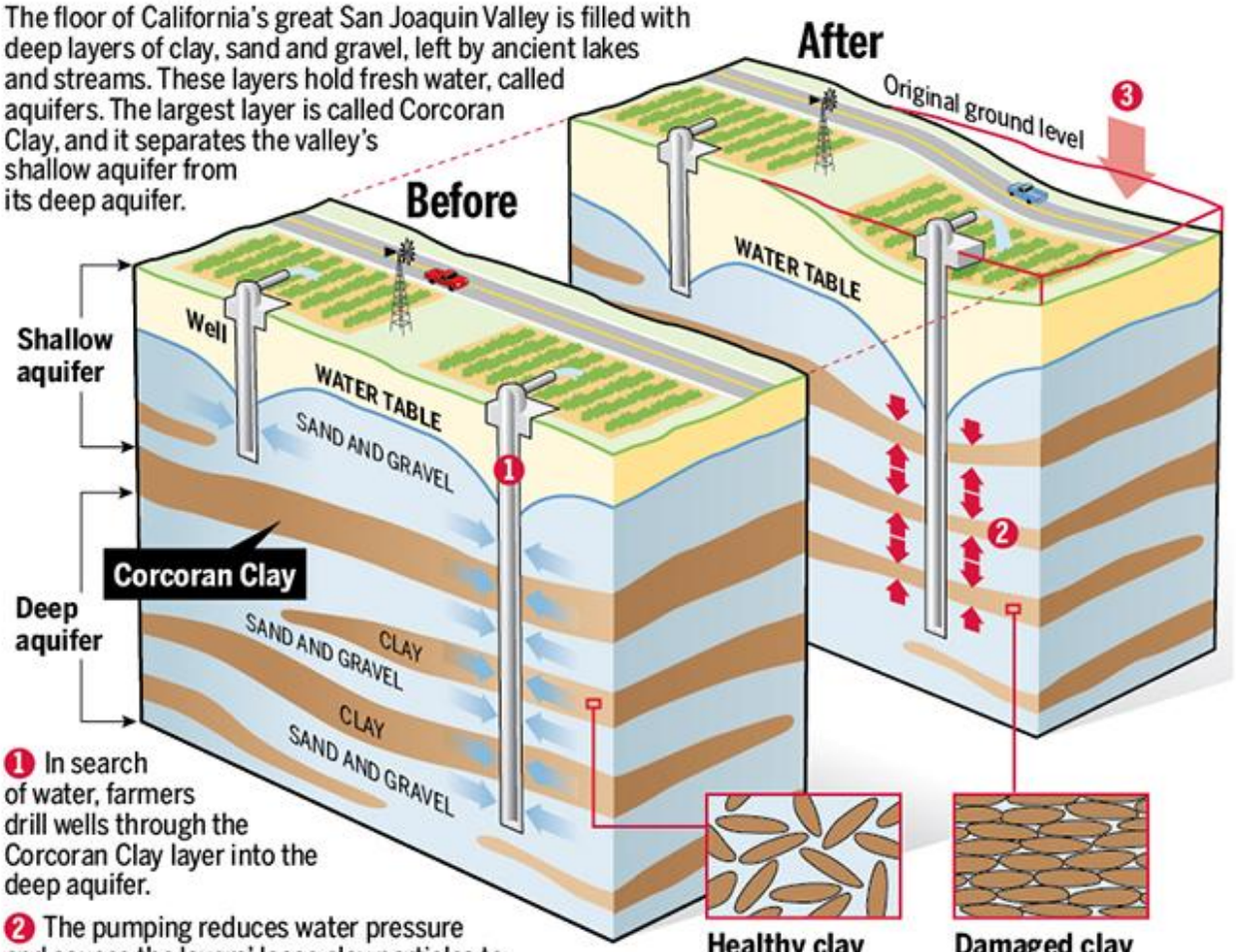
Sinking ground

The floor of California's great San Joaquin Valley is filled with deep layers of clay, sand and gravel, left by ancient lakes and streams. These layers hold fresh water, called aquifers. The largest layer is called Corcoran Clay, and it separates the valley's shallow aquifer from its deep aquifer.



1 In search of water, farmers drill wells through the Corcoran Clay layer into the deep aquifer.

2 The pumping reduces water pressure and causes the layers' loose clay particles to compact, stacking like pancakes. The sand and gravel layers are undisturbed.

3 The heavy ground above them collapses.

Healthy clay
The granular structure of heathy clay is filled with water.

Damaged clay
Once the clay compacts, it can never be repaired, permanently limiting future water storage.

Latest example

Extensive pumping of groundwater from the San Joaquin Valley has caused widespread land subsidence. The newest area of concern is 1,200 square miles centered near the town of El Nido, where USGS satellite-based radar