BAY AREA WATER SUPPLY AND CONSERVATION AGENCY

BOARD POLICY COMMITTEE MEETING

June 7, 2019

Correspondence and media coverage of interest between May 12, 2019 and June 5, 2019

Media Coverage

Water Supply:

Date: June 5, 2019
Source: Wall Street Journal
Article: Lowville Had Lots of Water. Then String Cheese Came to Town

Date: May 31, 2019
Source: SF Gate
Article: Sierra snowpack is 202 percent of average for this time of year

Date: May 28, 2019
Source: Mercury News
Article: Seeking more water, Silicon Valley eyes Central Valley farmland

Water Infrastructure:

Date: June 3, 2019
Source: Mercury News
Article: Effort to allow electricity from large dams to count as renewable energy in California fails to pass

Date: May 31, 2019
Source: EarthIsland Journal
Article: California's Twin Tunnels Water Project Is Dead. What's Next?

Date: May 12, 2019
Source: California WaterBlog
Article: Some common questions on California water (Part I)

Date: June 2, 2019
Source: California WaterBlog
Article: Some common questions on California water (Part II)

Water Quality:

Date: June 4, 2019
Source: Stanford News
Article: Stanford develops an experimental process to rinse heavy metals from toxic soils

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Lowville Had Lots of Water. Then String Cheese Came to Town.

Kraft Heinz's status as a revered employer in upstate New York was tested when a thirsty new cheese operation put a strain on local lawns

Wall Street Journal | June 5, 2019 | Scott Patterson

LOWVILLE, N.Y.—When the Philadelphia Cream Cheese factory here started making string cheese, too, in the summer of 2017, it brought scores of new jobs to town.

It also boosted the facility's water usage by hundreds of thousands of gallons on some days—eventually bringing its overall demand to more than 80% of the town's typical daily supply. The draw sucked the municipality's reservoir to dangerously low levels. Town officials, caught off guard, banned the village's 3,500 residents from washing cars and watering lawns.

"People can't believe how much water that plant needs," says Lowville Mayor Joseph Beagle.

The incident put the factory, owned by Kraft Heinz Co., at the center of a water clash in one of the most unlikely of places: a farming and cheese-making hamlet in upstate New York that normally gets plenty of rain and snow, and sits just 40 miles from Lake Ontario.

Water is unlike any other commodity. Seen as a natural human right, it is available when we turn on the faucet or slurp from the water fountain at the park. Behind that veneer of plenty, though, companies are waking up to a new, water-constrained future—even in places like Lowville, usually blessed with plenty of it.

A potent mix of population growth, surging industrial demand, pollution and climate change is putting relentless stress on water resources all over the world. It is also pitting companies, used to near-limitless water, against other businesses and nearby residents, who need more of it, too.

During most of the 20th century, just 14% of the global population lived in conditions of scarce water supplies—broadly defined as insufficient water to provide for human needs—according to a 2016 study by a team of water scientists published in the research journal Scientific Reports. Today, that has leapt to nearly 60% of the world's people, a result of surging population growth and dwindling supplies of freshwater.

The situation is especially dire in the developing world. In India, 600 million people face high to extreme water stress. Severe droughts have struck everywhere from East Africa to Central America in recent years, hobbling industry and farmers and forcing cutbacks in personal consumption.

More than half of the world's cities regularly experience water shortages, according to U.S. environment nonprofit The Nature Conservancy. Last year, Cape Town, South Africa, implemented severe restrictions for months to keep from running completely dry.

The Village of Lowville's water supply comes from a reservoir fed by the Crystal Creek. After treatment it is stored in a hilltop tank, where levels reached dangerous lows in recent years

Climate change, too, can heighten water scarcity as rising temperatures dry up available resources. Alternatively, it can increase rainfall and flooding, leading to other challenges corporations must face as weather becomes more unpredictable.

“With population growth, water scarcity will proliferate to new areas across the globe,” a 2017 World Bank report on the causes and effects of water scarcity said. “And with climate change, rainfall will become more fickle, with longer and deeper periods of droughts and deluges.”

Many companies dependent on public water access are just now coming to grips with the new challenges—often only after a crippling supply disruption, or the threat of one.

“A lot of companies talk about water being an important issue” but do little to adapt, said Jason Morrison, chairman of the United Nations’ CEO Water Mandate, which presses executives to assess their company’s water usage across their supply chains and implement policies to make it more sustainable. “Then something happens, and there’s a massive supply-chain hit.”

CDP, a London not-for-profit charity that tracks companies’ environmental-impact disclosures, found that between 2015 and 2018, the number of companies reporting water-reduction targets doubled among firms it polls in an annual survey. Underscoring the challenge, though, nearly 50% more companies during that period reported using more water, not less.

The Lowville factory is among the largest cream cheese manufacturers in the world.

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The new risk is showing up in stock prices, too, according to an analysis by Peter Adriaens, a University of Michigan professor of environmental engineering and finance. Exposure to water risk among energy companies such as oil-and-gas drillers—which use huge amounts of water and are also exposed to production-halting storms—translates to their shares being 23% more volatile than the broader market, his analysis shows. Other sectors, like industrial firms and consumer staples, also show heightened volatility attributed to their need for water.

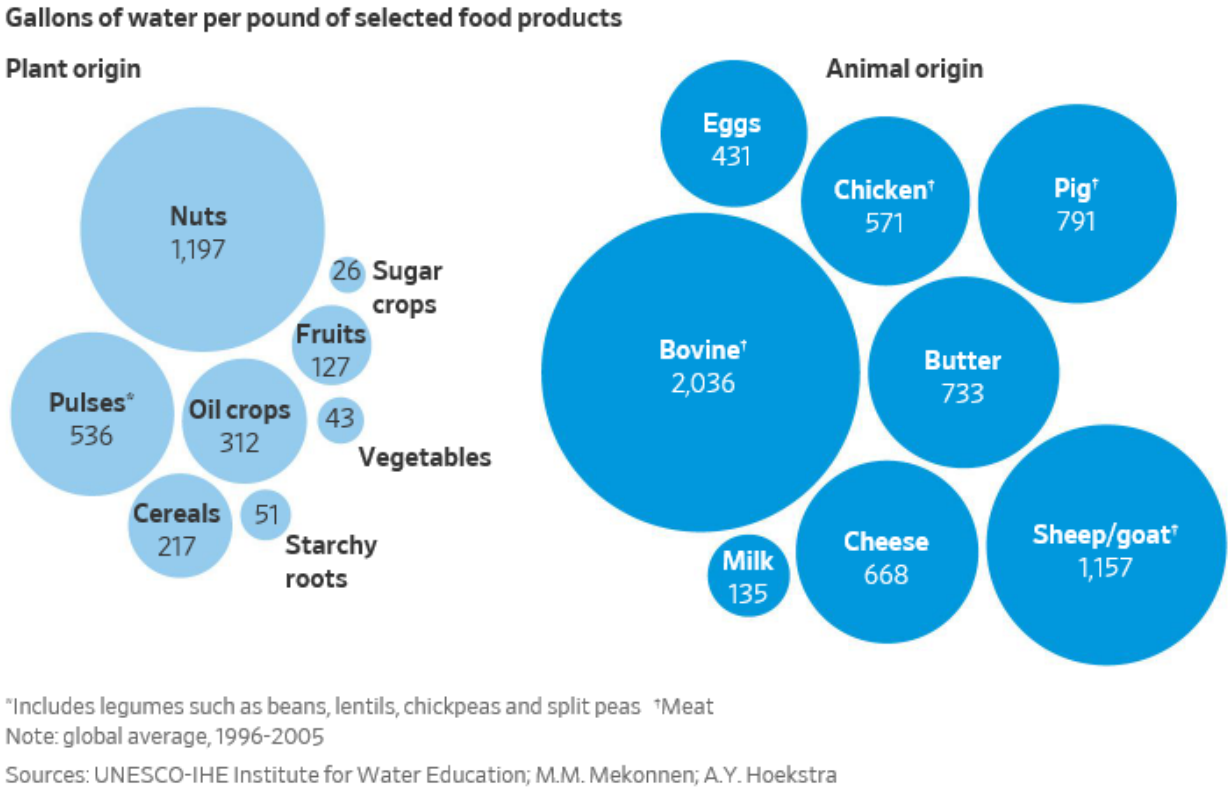
Arjen Hoekstra, a Dutch water scientist, came up in 2002 with the “water footprint,” a measure of how much water goes into products, including all the water used along the way. The metric helps quantify what Prof. Hoekstra describes as “the hidden water use behind the goods and services” people consume. That includes the water used to grow the cotton in a pair of trousers, or to feed the cows that produce a gallon of milk.

A glass of wine takes nearly 30 gallons, if you count the water that goes into growing the grapes, according to his figures. A pair of bluejeans, made from irrigated cotton, can take more than 2,500 gallons. A pound of cheese: 668 gallons of water. Blame hungry cows eating water-intensive grains.

Mr. Hoekstra says a big reason water consumption is expanding around the world is food—primarily, meat and dairy products. As economies grow and wealth increases, more people are eating meat and cheese, which have far bigger water footprints than fruit and vegetables.

Water Bill

Food production is one of the most water-intensive industries.



By this measure, Kraft’s municipal water needs for its Lowville plant are just a small part of its overall water demand in the region. The one million pounds of milk the Lowville dairy cooperative provides Kraft every day takes about 120 million gallons of water to produce, according to Prof. Hoekstra’s data.

In its 2017 corporate social responsibility report, Kraft said it used 5.8 cubic meters, or 205 cubic feet, of water for every metric ton of product it made in 2016—a 1.4% decline from the previous year. The company says it plans to reduce overall its water usage by 15% by 2020 from 2015.

“We’re constantly working to strike the best balance between the water intake needed for sanitary conditions and not being excessive or wasteful in our water use,” said Brian

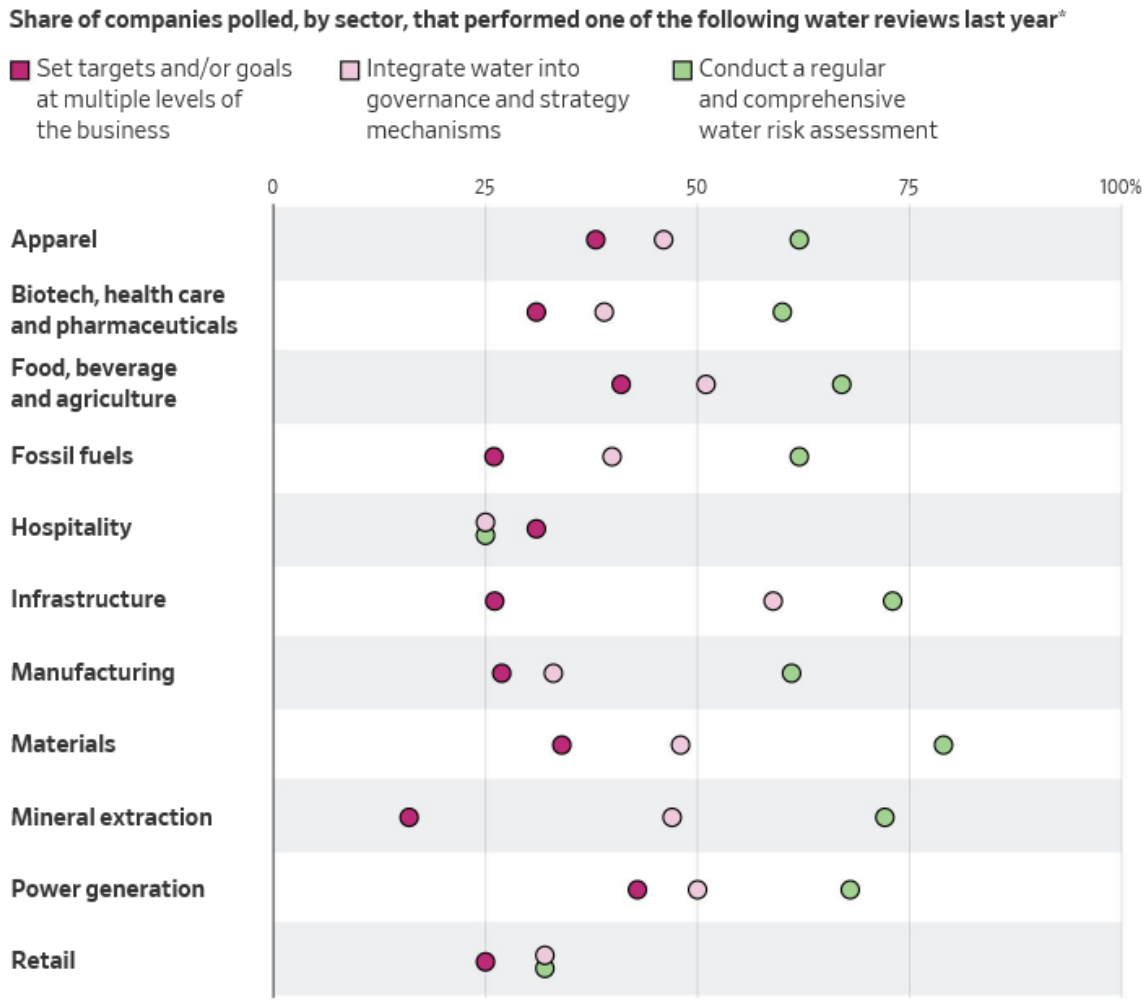
Shuttleworth, Kraft's head operational risk manager for North America. "We're making progress, but this will continue to challenge us."

Some big companies have sought to map out their wider water use and work to reduce it—both burnishing their green credentials and protecting themselves from water-supply shocks. The efforts haven't always led to more secure access to water. Take Coca-Cola Co.'s travails in India.

About a decade ago, Coke turned to Prof. Hoekstra, who estimated a half-liter bottle of Coke had a footprint of anywhere from about 36 liters to 150 liters (9.5 gallons to 40 gallons) of water, mostly due to the water used to grow the sugar in the drink. The range is wide because of variables like climate and the type of sugar used. Sugar cane, for instance, is usually more water intensive than beet sugar.

Liquid Reckoning

Companies have become more aware of their water use and associated risks, but many have refrained from setting specific water-use targets.



*Among the 783 companies that participated out of 1,536 that were asked by their investors to provide water-related information via CDP

Source: CPD Global Water Report, 2018

Sugar cane is what Coke uses in India, one of the most water-stressed countries in the world, thanks to its dry climate, high pollution rate, surging population and large agriculture industry.

In 2004, Indian government officials shut down a Coke bottling plant in the southern state of Kerala, over claims by local residents and Indian activists that it drained and polluted local water supplies. Coke denied the allegations. The beverage behemoth has given up operations or expansions at several other plants that attracted water-related protests since then.

In the past year, a Coke bottler opened a plant in Hoshiarpur in the northern state of Punjab. This time, it implemented a system it says returns more than four times as much water as it consumes through rainwater harvesting and other recovery methods. “It is like a bank,” said Satinder Singh, an executive at Ludhiana Beverages Pvt Ltd., which runs the plant.

The protests came anyway, from local wheat farmers concerned about the plant’s effect on local water supplies.

Back in Lowville, officials and residents are struggling to balance their cheese-dependent economy and their own access to water. Nestled near the foothills of the Adirondack Mountains, its closest big-town neighbor, 27 miles away, is Watertown, population 26,000.

A worker tends to a largely automated milking system near Lowville.

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The surrounding countryside is known for its dairy farms, lumber industry, maple syrup and cheese.

In 1895, Lewis County, where Lowville is situated, had 93 commercial cheese operations, according to a history of the region. The Lowville Milk and Cream Co., established in 1900, housed one of the world’s largest cheese cold-storage facilities at the time.

By 1928, it was a part of Kraft-Phenix Cheese Corp., a forebear of today’s Kraft Heinz. Kraft began producing Philadelphia Cream Cheese in Lowville in the early 1970s. One reason: the village sits in one of the biggest milk sheds in the Northeast. Lewis County says it currently has about 27,000 milking cows and 190 dairy farms, making it the sixth biggest milk producer in New York.

Kraft makes the bulk of its U.S. cream cheese here. Last year, it sold $1.2 billion of the stuff, representing over 5% of its total U.S. retail sales, according to Piper Jaffray & Co.

Every summer, Lowville celebrates its ties with Kraft with the annual Cream Cheese Festival, which features a cream cheese eating contest, cream cheese mural painting, cream cheese bingo and a cream cheese race. Contestants roll a bale of hay decorated like a brick of the iconic cheese brand.

That warm relationship was tested when string cheese came to town.

After Kraft's $49 billion merger with Heinz in 2015, Lowville residents were on edge about the fate of the plant. Instead of cutting jobs, though, Kraft decided to move its Polly-O string cheese production from Campbell, N.Y., to Lowville, a move that would bring about 140 new employees to the area.

As preparations for the string-cheese facility progressed, Kraft told Lowville's planning board to expect an increased demand for water. Washing the processing and packaging equipment is especially water intensive.

Then-mayor Donna Smith said board members didn't realize the plant would need so much. They also didn't realize the spikes in demand from Kraft would often take place in the morning over a few hours, when residential use also jumped as people showered and brushed their teeth.

In the summer of 2017, soon after Kraft switched on the new string-cheese line, Lowville's municipal water system was pushed to the brink. Village employees noticed the town's storage tank was nearing critical levels.

Lowville officials were stunned. Ms. Smith says Kraft had told the village the plant would consume at most 900,000 gallons of water a day. Instead, it was at times taking more than one million gallons a day. Water levels at the village's storage tank began to sink below a single day's supply.

Lowville officials contacted Kraft about the problem, but didn't see any appreciable change in withdrawals, Ms. Smith said.

Ms. Smith says Kraft was frequently uncooperative and at times bullying. "Their attitude is, give us what we want or else," she said.

Brian Western, the Kraft plant's operational risk manager, said the factory's "leadership has been in constant conversation" with Lowville officials about its production and cleaning schedules. He said Kraft in 2016 informed Lowville that its average daily usage would be 910,000 gallons, and that peak demand would be "in the morning going into the afternoon."

Lowville's water system operator notified New York State Department of Health officials, who performed field assessments of the plant. Days later, they wrote to then-mayor Ms. Smith, calling the plant's water draw "unsustainable and disruptive" and warned of a potential "public water-system emergency."

The state threatened to fine the village for not adhering to its emergency response plan. It also said Kraft needed to build water storage on site to provide supply. If it failed to do so, the village should restrict its water during peak demand, state officials wrote.

Residents, meanwhile, faced fines if they didn't comply with strict water conservation measures.

"You couldn't water your lawn, it was irritating," said Kathy Morse, owner of Kathy's Barber Shop.

Kraft's dominant position in the local economy in some ways shielded it from criticism and gave it a leg up in negotiations with angry town officials. Still, to appease them, Kraft agreed to fund a $1.5 million water recycling system that is expected to contribute 90,000 to 100,000 gallons a day when it becomes fully operational this summer.

Kraft is working to scale back demand in other ways. It cut back on washing the exterior of milk-delivery trucks and began cleaning its equipment earlier in the day, when most residents are still asleep. It also at times curtailed string-cheese production over the weekends, giving the village a window to recharge its water-storage facilities.

"We tried to assist where we could," said Mr. Western.

Lowville, for its part, has shelled out $1.3 million to add a portable filtration system that can transfer water to the village more quickly, helping it keep up with Kraft's peak periods of demand. It is also looking at drilling a new well to enhance supplies. Residents and other water users, including Kraft, got hit with a 10% rate increase to help pay for the upgrade. It added another 5% increase in May.

Still, Kraft was getting that water at a lower cost than residents, since rates dip as consumption rises: After the first increase, it paid $1.94 per 100 cubic feet of water for most of the water it used, according to Kraft and Lowville officials. That compares with about $2 per 100 cubic feet most other people in Lowville paid.

Then, in the summer of 2018, drought hit. That May was the seventh driest in 100 years. Temperatures topped 90 degrees in July, unusually hot for the northern climate.

With their own wells running dry, dairy farmers turned to Lowville's municipal water system. They filled up water tankers at Lowville's dairy cooperative, drawing from local supplies already under strain from Kraft's new demands, which continued to routinely top one million gallons a day.

This year looks better. Heavy snow and rain have recharged the region's water table. But local farmers worry another hot summer could unwind all that.

"You're not going to ration your animals," says John Peck of Peck Homestead Farm, which own about 60 milk cows. "They've got to drink."

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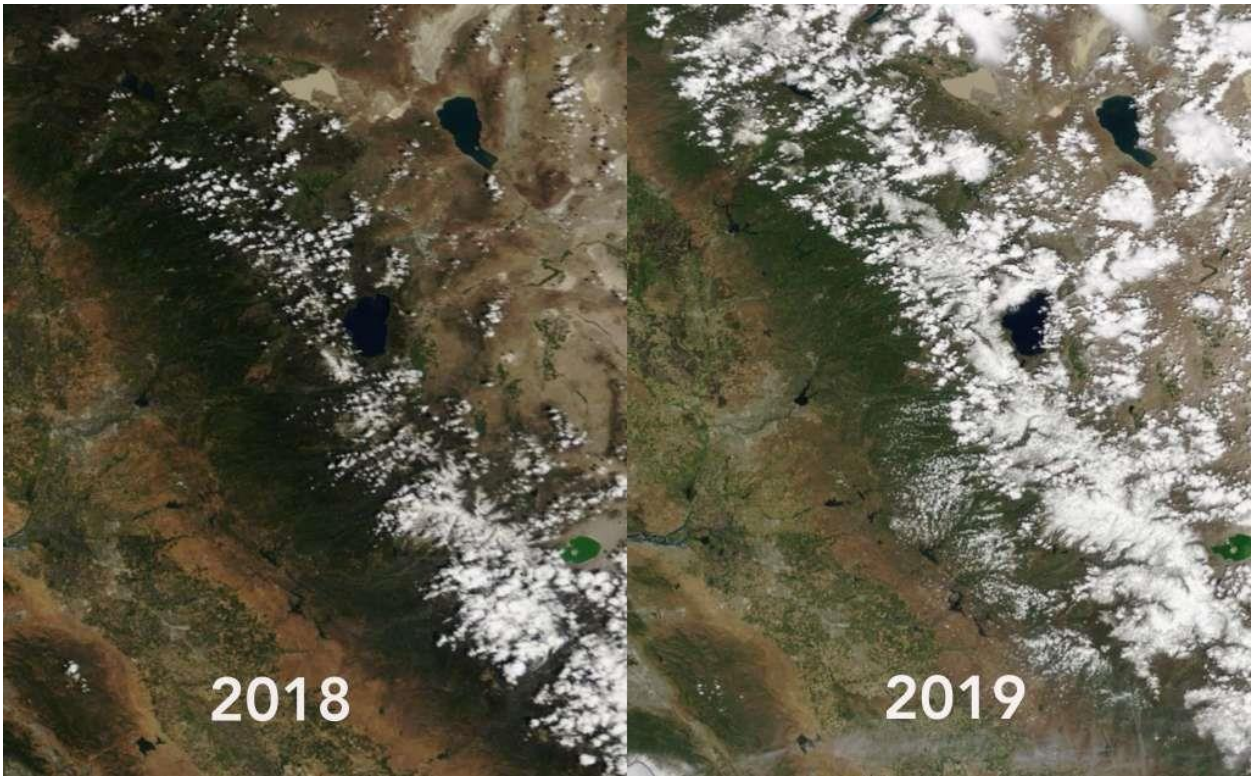
Sierra snowpack is 202 percent of average for this time of year
SFGate | May 31, 2019 | Amy Graff



NASA satellite imagery shows the difference between the Sierra snowpack in 2018 when snow levels were below average and in 2019 when they were above average. In the left image from May 29, 2018, the snowpack

A nonstop parade of storms barreled across the Sierra Nevada in winter. Then, spring hit and winter weather persisted with unseasonably cold systems piling up snow all the way through Memorial Day weekend.

The marathon stretch of unsettled weather means the reservoirs are brimming, the rivers are rushing, the waterfalls are spectacular, and people are still skiing in fresh powder in Tahoe.

But perhaps the most noteworthy outcome is a remarkably gargantuan snowpack blanketing the mountain range straddling California and Nevada. Right now, it's even bigger than the 2017 snowpack that pulled the state out of a five-year drought.

As of May 30, the snowpack measured 202 percent of average, according to the California Department of Water Resources which compiles data from about 100 stations across the range. At this time last year, it measured 6 percent of average, making this year's 33 times bigger than last year. In 2017, the snowpack measured 190 percent of average.

State officials consider the most important snowpack measurement to be the one taken around April 1 because that's when the sun is at its highest point, temperatures warm, and storm activity subsides.

"That's basically the measurement we look at because that's when the snowpack usually peaks," said Idamis Del Valle, a forecaster with the National Weather Service. "And then after

that the sun's highest position in the sky contributes to rapid melting. This year, that didn't happen and we had late season snow."

This year's April 1 reading put the snowpack at 176 percent of average, making it the fifth-largest on that date, with records going back to 1950.

"I'd say it's not normal," said Chris Orrock, a spokesperson for the California Department of Water Resources. "But it's good for California."

The Sierra snowpack is one of California's most important water sources, with its spring and summer runoff feeding rivers and reservoirs, watering crops, filling bathtubs and water glasses. Mountain snowpack provides about 30 percent of the yearly fresh water supply for California. Orrock says this year's massive snowpack will help with the water supply and also outdoor recreation.

"The good news is there will be plenty of water for fishing, boating, white-water rafting, even skiing, all that stuff."

In the Tahoe Basin, Squaw Valley has seen its third-snowiest season going back to 1970 and the resort plans to stay open until at least July 5. In May alone, the resort recorded 37 inches on the upper mountain above 8,200 feet.

Three feet is impressive for May in California, but it's not the resort's highest-ever May total. "In 2011, we received 56 inches in May," says Squaw spokesperson Alex Spychalsky. "That came at the tail end of our snowiest season on record, 2010-2011, when we received a season snowfall total of 810 inches."

This year, the resort has recorded 719 inches since the start of the season.

To the south in the Central Sierra, Mammoth has also been pummeled with snow and will be running lifts through early July and possibly beyond.

But while the snowpack has benefits, it also presents serious dangers. California officials are preparing for flooding, especially in the more flood-prone and narrow San Joaquin watershed, where rivers such as the Merced that runs through Yosemite swelled in 2017.

"That's where we're mostly concerned about, but there's always concern everywhere," says Orrock. "If you get abnormal warm rain and with these reservoirs being so full, we have to be ready for everything. Each reservoir has their manual and if they have so much water coming in, they have to let so much water out."

And while we may be worrying about the state having too much water this summer, Orrock says soon we could be back in a situation where there's not enough.

"Let's look at the past 10 years and we had the historic drought from 2011 to 2016, and then we had 2107 that was a historic precipitation year, but the snow pack wasn't as much as this year," he said. "Climate change has led to changes. There's such variability in California's climate now, we go from one extreme to another.

"It's not if the next drought is going to come, it's when."

# # #

Seeking more water, Silicon Valley eyes Central Valley farmland

Santa Clara Valley Water District negotiating to buy 5,257-acre ranch in Merced County as groundwater bank

Mercury News | May 28, 2019 | Paul Rogers

The largest water agency in Silicon Valley has been secretly negotiating to purchase a sprawling cattle ranch in Merced County that sits atop billions of gallons of groundwater, a move that could create a promising new water source — or spark a political battle between the Bay Area and Central Valley farmers.

The Santa Clara Valley Water District, based in San Jose, is in talks with the owners of the 4-S Ranch, a 5,257-acre property located about 15 miles northeast of Los Banos, for what would be a multi-million-dollar deal to create a huge underground water reserve.

The plan, however, is likely stir anxieties and controversy from farmers, who for generations in California have been wary of selling or transferring water out of their local areas for fear it could mean the decline of farming, especially if they had to compete with wealthy, more populated urban areas.

The proposed sale appeared on the agenda of the water district's closed session board meeting Tuesday evening, just before the board's public meeting. But only the property's parcel numbers, not the owners or the proposed use, were listed as an item, described as a discussion of "price and terms of payment for acquiring."

Linda LeZotte, chairwoman of the board for the water district, a government agency that provides drinking water and flood control to 2 million residents in Santa Clara County, said Tuesday that she could not discuss specifics, but that the district is looking to buy the property as a possible location for a new groundwater bank.

Groundwater banks are like underground reservoirs. Water agencies put water into them during wet years, and draw water out through wells in dry years.

LeZotte said the district is working to create as many opportunities as it can to boost its water supply, particularly during droughts. She noted that the district was awarded a state grant last year to fund nearly half the cost of a proposed $1 billion new reservoir the district hopes to build near Pacheco Pass, and that it has ongoing projects to boost conservation, recycled water and other water sources.

“We have to look at everything to make sure we have water available in dry years,” LeZotte said.

Buying a Central Valley ranch for its water, however, risks turning into a political minefield. Environmentalists said Tuesday that secrecy is a major issue.

“I’m concerned that the water district, which is a public agency, is doing backroom deals related to water supply that have not been discussed with the public and don’t appear to fit in with anything else that they have said in the past they plan to do,” said Katja Irvin, Conservation Committee co-chair of the Sierra Club’s Loma Prieta Chapter, based in Palo Alto.

A groundwater banking project “might make sense,” Irvin said. “But there’s been no daylight. Nobody knows anything. This isn’t early steps. When you are going into purchase negotiations you are pretty far down the road.”

LeZotte said that a purchase agreement was not going to happen Tuesday. Although board members are discussing potential prices and other details — like how to move the water into Santa Clara County, she said — there will be a public hearing and opportunity for public input before any purchase is finalized, if talks even get that far.

The property already has seen controversy in the past over its water supply.

In 2014, during California’s historic five-year drought, Steve Sloan, the owner of the 4-S Ranch and Stephen Smith, the owner of SHS Ranch, an adjacent property, proposed to sell up to 92,000 acre feet of water — enough for nearly half a million people’s needs for a year — to other farmers for a price estimated at $46 million over a four-year period. Many of those growers were located in neighboring Stanislaus County.

That plan set off a firestorm of protest from other farmers and political leaders in Merced County. They worried that if too much water was pumped out from under the two ranches, it would lower the water table and cause the wells of neighboring farmers to go dry.

“Growers throughout Merced County are scrambling for water and we have to protect what we have here,” Bob Weimer, who grows sweet potatoes, peaches, walnuts and almonds in Merced County told the Merced Sun-Star in 2014.

In the end, a smaller sale for 26,000 acre feet of water over a two-year period — roughly the amount that the Lexington Reservoir near Los Gatos holds when full — went through.

But the incident caused the Merced County Board of Supervisors to pass a local ordinance that requires a county permit for most future transfers of groundwater outside the county. Sloan, the 4-S Ranch owner, could not be reached for comment Tuesday.

On Tuesday, farm leaders in Merced County said they were just becoming aware of a possible sale of the ranch and its implications for their water supply.

“We will remain watchful as the conversations on this particular purchase continues,” said Breanne Ramos, executive director of the Merced County Farm Bureau.

LeZotte said that she hopes an agreement can be worked out that all sides find acceptable. One option would be for the Santa Clara Valley Water District to agree to take out no more water than it puts into the groundwater aquifers, she said, so it doesn't draw down the water table.

"I would not want to participate in something to the detriment of another region," she said. "I wouldn't be comfortable participating in that."

Complicating matters, the Merced County groundwater basin is classified by the state Department of Water Resources as one of 21 "critically over-drafted" groundwater areas in California, and one of 48 basins considered "high priority" for recharging and restoring.

For generations, farmers all across California have been wary of selling their water outside their home areas, said Jay Lund, a professor of civil and environmental engineering at UC Davis. The concern dates back to the 1920s, when Los Angeles water officials formed fake cattle companies, bought up water land in the Owens Valley on the California-Nevada border, and shipped the water to Los Angeles.

"It's one of those eternal things," Lund said. "If you are one of the neighbors of the people selling the land, you are worried they are selling water you need for a drought. And if you are the county supervisors, you are probably worried that if they sell their water they might fallow land, and that means less tax revenue coming in, and less employment opportunity, especially in these rural counties."

But, Lund said, a compromise potentially could be worked out in which the Santa Clara Valley Water District helps restore the groundwater in the area as part of a deal.

"Depending on how you do it," he said, "you could cause a lot of trouble or you could cause a lot of good."

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Effort to allow electricity from large dams to count as renewable energy in California fails to pass

SB 386 split Democratic lawmakers in Sacramento and failed to get a vote in the state Senate

Mercury News | June 3, 2019 | Paul Rogers

The powerhouse at Don Pedro Reservoir generates 200 megawatts of electricity. (Courtesy of Turlock Irrigation District)

A controversial effort to broaden California's definition of renewable energy has fizzled out. The proposal would have allowed electricity from a large dam in the Central Valley to count the same as solar and wind.

Under a law signed last year by former Gov. Jerry Brown aimed at reducing smog and greenhouse gas emissions, utilities in California are required to produce 60 percent of their electricity from renewable sources by 2030.

Large dams aren't allowed to count toward that total, however. That rule dates back nearly 20 years, when state lawmakers wanted to increase investment in solar and wind projects, and did not want to increase demand for construction of big new dams on rivers, which kill salmon and have other environmental impacts.

But State Sen. Anna Caballero, D-Salinas, introduced the bill earlier this year to allow two utilities, the Modesto and Turlock irrigation districts, to count the electricity generated by turbines at Don Pedro Reservoir, which they jointly own, toward their 60 percent mandate.

Caballero, whose district includes eastern Santa Clara County and much of Stanislaus, San Benito, Fresno and Merced counties, said she was trying to keep electricity costs low for low-income residents of the Central Valley by not requiring the two utilities to buy solar and wind power when they already have clean electricity from the Don Pedro Reservoir, which is visible to motorists driving to Yosemite National Park along Highway 120 west of Groveland.

“California’s renewable energy goals are laudable, but they should take into account the different ways in which our most disadvantaged communities are affected,” she said late last week.

The bill passed an early vote in a committee. But it failed to gain enough support for Caballero to bring it up for a vote in the full Senate, where it needed 21 of 40 votes. Instead the bill was reassigned to the rules committee, and branded as a two-year bill, which gives Caballero the option of bringing it up again next year.

The bill drew stiff opposition from environmental and health groups, from the Sierra Club to the American Lung Association. They argued that if Don Pedro’s electricity was counted as renewable, then the owners of dozens of other large dams would want the same treatment. That would mean that demand for solar and wind power could falter.

“California needs to double down and do even more on ramping up renewable energy,” said Fran Pavley, a former state senator who wrote California’s landmark cap-and-trade law in 2006, and who opposed Caballero’s bill. “The sense of urgency is real.”

Pavley noted that under current law, hydropower from large dams will count as renewable after 2045, when state law requires 100 percent of California’s electricity to come from renewable or “carbon-free” sources. And, she added, there is a provision in existing law that lets utilities appeal to the state Public Utilities Commission for a waiver if they can prove unfair rate hikes on customers.

# # #

California's Twin Tunnels Water Project Is Dead. What's Next?

Environmental advocates are cautiously optimistic about plans to downscale the controversial WaterFix project.

EarthIsland Journal | May 31, 2019 | Cindy Xin

This past February, Governor Gavin Newsom announced his decision to downscale California's Delta tunnels project from two tunnels to one. In May, the Department of Water Resources withdrew the permit application it had previously submitted to the State Water Resources Control Board, officially killing the project, and gave notice that it would start planning for a single tunnel. The decisions were generally welcomed within the environmental community.

The Sacramento-San Joaquin Delta has long been shaped by agriculture, channelization, and water diversions. California is wrestling with how to upgrade the aging water infrastructure in the Delta while minimizing harm to local habitat. Photo by IBM Research / Flickr.

The configuration of the Delta tunnels has long been controversial. First proposed more than a decade ago, former Governor Jerry Brown had initially considered building a single tunnel to divert water from the Sacramento-San Joaquin Delta to other thirsty parts of the state. Ultimately, however, he proposed a twin tunnel project, known as WaterFix, which centered upon the installment of two 40-foot wide and 35-mile long tunnels that would divert water from the Sacramento-San Joaquin Delta to an existing network of canals, and ultimately on to the San Francisco Bay Area, Central Valley, and Southern California.

The tunnel plan was meant to address a long-standing issue in California: most of the state's water resources lie in the North, but more water is needed in urban areas in Southern California, as well as agricultural areas in the Central Valley. The Delta is already the hub of the state's water system — some 4.5 million acre-feet of water are withdrawn on average every year. WaterFix was meant to stabilize the aging system, and moderately increase water diversions.

This plan, however, was unpopular in many quarters, particularly among local Delta farmers who have been struggling with salinization due to the long history of water diversion from the region, and among environmental groups concerned that a two-tunnel project would remove too much water from the Delta, negatively impacting the environment there.

Part of the concern has been around the capacity of the tunnels. Though the state insisted that it would only increase diversions to an average of 4.9 million acre-feet a year, the twin tunnels would have the capacity to remove much more water from the Delta system. Environmental advocates have insisted that preservation of the Delta ecosystem depends of extracting less water, not more.

In particular, environmentalists have pointed to the impact the project would likely have on native fish species like the endangered Delta Smelt and winter-run Chinook salmon, both of which are protected under the US Endangered Species Act . The fish are already stressed by local agricultural runoff as well as by the existing water pumps in the Delta, which at times result in reverse flows of local rivers and channels, pushing fish towards predators and even into the pumps themselves. The twin Delta tunnels, John McManus, executive director of The Golden Gate Salmon Association says, could increase the risk of overdrawing water from the Delta and therefore disrupt their existence further.

Because the tunnels would be funded in large part by water companies in Southern California, Delta advocates were particularly concerned that remote water demands would be prioritized over local needs and environmental interests.

Though the twin tunnel project is dead, WaterFix is not. Officials in Newsom's administration have said that a single tunnel will help secure water resources in Delta region, provide water to other places that need it, and take less time to build than the former twin tunnel plan.

"I'd like to see a more modest proposal, but I'm not going to walk away," Newsom said this winter. "Doing nothing is not an option…. The status quo is not helping salmon."

Though Southern California water companies are not entirely happy about the shift, environmental groups are generally encouraged, and hope for a larger emphasis on environmental interests this time around. Doug Obegi, director of California River Restoration and Water Division with the Natural Resource Defense Council, hopes that the planning process is more inclusive of Delta farmers and environmental advocates this time around. "I want to see the administration engage with more local groups," he says.

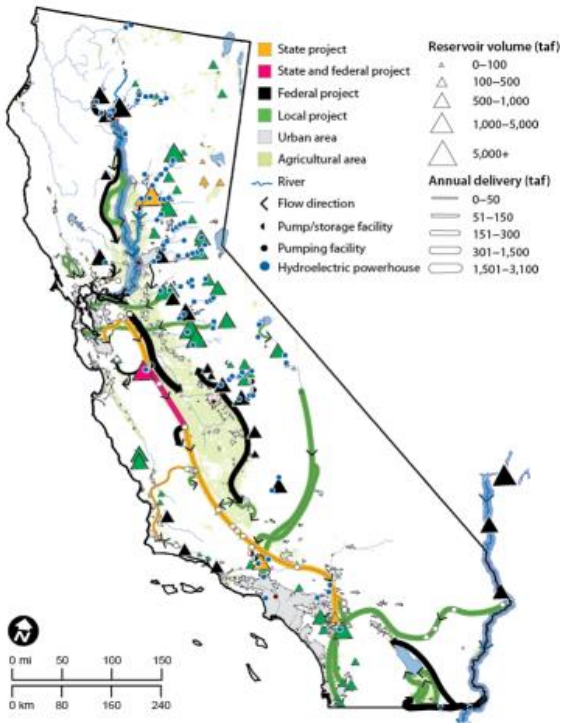
"If [Southern California water companies are] disappointed then it's a sign that Governor Newsom would be moving towards the right direction," adds McManus.

Still, McManus says, it's too soon to celebrate the single-tunnel idea. Having a single tunnel is not a definitive indicator that less water will be transported South, or that the natural ecosystem will be less damaged than it would have been with two-tunnels. Until the Department of Water Resources conducts its environmental analysis of the new plan — which could take some time — the effects of implementing a single tunnel remain unknown. As McManus puts it, "The devil is in the details."

# # #

Some common questions on California water (Part I)
California WaterBlog | May 12, 2019 | Jay Lund

People are interested in California water problems, and they ask reasonable questions. Here is a first installment of short science-based answers to some reasonable questions often heard at public and private discussions of water in California. (Longer answers are possible, of course.)



1. Why doesn't California just build desalination plants to end water shortages and leave more water in streams for the environment?

Desalting ocean water is expensive, about $2,000-$3,000/acre-ft. This cost is too high to be economical for almost any crop in California. This cost is also over $1,000/acre-ft more than other sources available to California's cities (including wastewater reuse, conservation, and buying water from farmers). Providing only 20% of California's urban water use by desalinating sea water (1.4 maf/year) would cost households at least $3.5 billion/year (about $300/household per year). The environment would benefit more from other expenditures of such money.

https://news.bloombergenvironment.com/environment-and-energy/california-touts-desalination-but-take-it-with-a-grain-of-salt

2. How much water do we lose from evaporation? Wouldn't reducing evaporation from reservoirs be cheaper than building new reservoirs?

Evaporation is the second largest flow of water in California, following precipitation. Average California precipitation is roughly 200 million acre-ft/year, with roughly 70 maf/year of river runoff, meaning that most precipitation (~130 maf/yr) evaporates quickly back to the atmosphere. Additional evaporation of runoff occurs from agricultural fields, reservoirs, and urban landscapes (evapotranspiration is roughly 26 maf/yr from crops, 2 maf/yr from cities, and 2 maf/yr from reservoirs and canals). Evaporation in all its forms is most of the water that falls on California.

Retaining and reducing evaporation is usually difficult, because it is so widely distributed and driven by the sun, which we all enjoy in California. Farmers often manage irrigation to reduce unproductive evaporation from bare soil. Water system operators sometimes shift water among reservoirs to reduce evaporation. Since the 1950s, researchers have experimented with adding covers and thin layers of floating chemicals to reduce evaporation from reservoirs, but these are rarely economical or environmentally friendly.

https://water.ca.gov/Library/Modeling-and-Analysis/Statewide-models-and-tools/Economic-Modeling-and-Analysis-Tools

3. If we are short of water, why don't we just build new reservoirs?

Just as a refrigerator stores food, but does not make it, reservoirs don't make water, but only shift it in time. For reservoirs to supply water, they must first fill with water from an earlier wetter

time. Even the largest reservoir cannot reliably supply more than its river's average annual inflow.

Reservoirs are important and attractive because of California's seasonally variable streamflows and wet and dry years. They can reliably store water from California's wet winters for the following dry summer, because modest amounts of storage can refill every year. Larger reservoirs become less efficient for storing water from wetter years for dry years, when a reservoir might need several years (or longer) to refill. Large reservoirs for over-year drought storage often refill infrequently, but re-paying for their construction occurs every year.

Increasingly large reservoirs become more expensive and refill less frequently, providing less water per unit of storage expansion and cost. The additional water supplied from larger reservoirs can become very expensive. In addition to these limitations of physics and economics, environmental objections and concerns often arise for new and expanded reservoirs.

https://californiawaterblog.com/2011/09/13/water-storage-in-california-2/

4. On California's coast, why don't we gather fog water?

California's coast is often foggy and some of its coastal ecosystems receive a sizable share of their water from summer fog. But for humans, the costs of gathering fog water will almost always greatly exceed the costs of alternative water sources or the value of the water use they would supply.

https://californiawaterblog.com/2015/01/26/demystifying-mist-as-a-source-of-water-supply/

5. Why doesn't California import water from the Pacific Northwest, the Great Lakes, or the Mississippi River? They seem to have extra water.

The Pacific Northwest, Great Lakes, and Mississippi River all have relatively abundant water supplies. These water sources also are all far from California, with mountain ranges in between. Constructing and operating aqueducts, tankers, or railcars to move water great distances is expensive, and moving water (which is heavy) over mountains is very energy-intensive. The cost of moving water these great distances typically exceeds the value of the additional water uses in California (Perrier and Fuji water might be exceptions). Environmental, political, and legal opposition also would likely be barriers to California importing large amounts of water.

Some Larger lessons

Some broader lessons arise from this first set of common questions on California water. First, there are many ways to get water in California, which vary tremendously in cost, availability, environmental impact, and practicality. Second, because so many potential water sources are available in California, it is sometimes said, "There is rarely a shortage of water, but more often a shortage of cheap water." California is often a dry place, and the relative costs and benefits of different water supplies and demands typically drive the use, rejection, and research for water management options.

# # #

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Some common questions on California water (Part II)
California WaterBlog | June 2, 2019 | Jay Lund and Josué Medellín-Azuara

This is the second installment of answers to some common questions regarding water problems in California. Part I examined some common questions on water supplies (questions 1-5). Part II looks more at common questions on water uses and demands.

6. Wouldn't more agricultural water use efficiency end California's water problems?

Irrigated crops are about 80% of human water use in California, so it is an obvious target for conservation attention. This irrigation supports about $50 billion/year in agricultural production, about 4% of the state's economy, with a much larger share for many poorer counties.

Water applied to crops for irrigation evapotranspires from the crop to the atmosphere, or runs off to nearby streams, or infiltrates to groundwater. (A tiny amount of water is harvested with the crop's biomass.) The percent of irrigation water evapotranspired by the crop is often called irrigation efficiency. Irrigation efficiency can increase with more expensive irrigation technology, such as drip irrigation, which require less water application and often improves crop yields and quality.

For most of California, increasing surface water irrigation efficiency mostly comes from reducing infiltration to groundwater needed to support agriculture and rural residents during drought. Much of current recharge in California's Central Valley comes from irrigation. Increasing irrigation efficiency also often leads farmers to expand irrigated acreage with the "saved" water, leaving to greater losses of water to the atmosphere, and less water for downstream users and aquifer recharge. Most promising irrigation efficiency improvement is reduces non-beneficial evaporation from soil and non-recoverable return flows.

Because improving irrigation efficiency mostly comes from reducing the amount of water available for recharge or other uses, saving real water in agriculture mostly means reducing agricultural production (crop evapotranspiration), which has real and sometimes inevitable costs to rural areas.

Grafton, R. Q. et al. (2018), "The paradox of irrigation efficiency," Science, 24 Aug 2018.

Lund, J., E. Hanak, R. Howitt, A. Dinar, B. Gray, J. Mount, P. Moyle, B. Thompson (2011), "Taking agricultural conservation seriously," CaliforniaWaterBlog.com, 15 March 2011.

7. Wouldn't ending water subsidies for farmers save a lot of water?

The short answer is no. Water subsidies in California are remarkably rare today. Historically, the biggest water subsidies in California were for construction of federal (USBR and Army Corps of Engineers) reservoirs and canals. These largely ended decades ago. Farmers benefited from these projects with cheaper and more reliable water supplies, which increased the economic value of their lands. Most original farmers have since sold their lands to other farmers, pocketing most of the federal subsidies in the sale price of their farmlands. Federal expenditures today for agricultural water supplies in California are now much diminished.

State water project deliveries are now, and have almost always been, entirely funded by the project's water users. Some local water agencies, urban and agricultural, have benefited from

state water bonds funding some of their capital projects. It is sometimes argued that these projects would often be built anyway by local and regional water agencies.

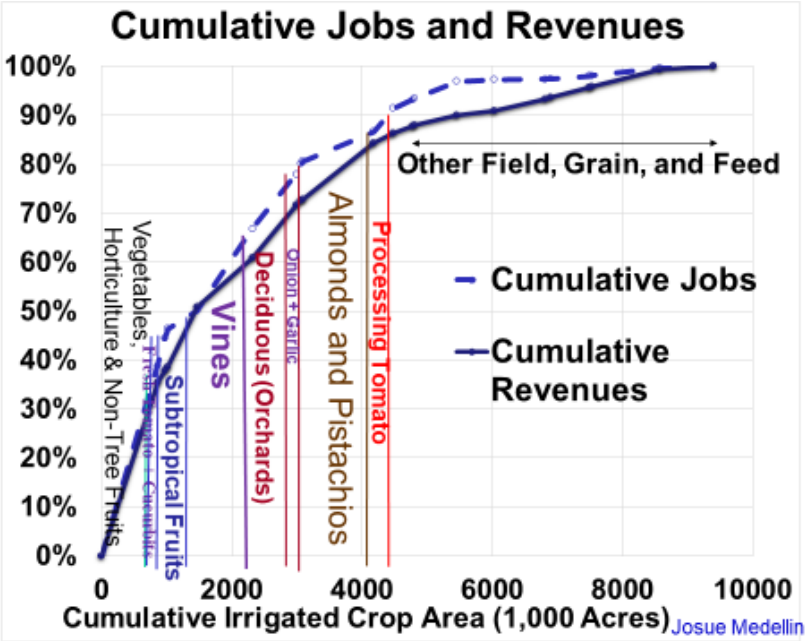
Perhaps the biggest water subsidies are the mutual subsidies that come from the economies of scale for larger water supplies and coordinated projects. When people work together in water, costs are lower, even without external subsidies.

A similar question is, "Would ending federal farm subsidies reduce agriculture and save water in California?" Our suspicion is that California's agriculture is profitable enough that ending crop subsidies might change the mix of crops, but would not greatly increase agricultural land fallowing that would reduce actual net water use. (Also, most of the more profitable fruit, vegetable, and tree nut crops in California do not receive federal subsidies.)

Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, and B. Thompson (2011), Managing California's Water: From Conflict to Reconciliation, Public Policy Institute of California, San Francisco, CA.

Hanak, E., B. Gray, J. Lund, D. Mitchell, C. Chappelle, A. Fahlund, K. Jessoe, J. Medellín-Azuara, D. Misczynski, and J. Nachbaur, Paying for Water in California, Public Policy Institute of California, San Francisco, CA, March 2014

8. Would we save a lot of water if we stopped allowing water use for exported crops?



If crops were not allowed to be exported, farmers, as businesses, would be forced to grow less profitable crops that could be sold in the US or California. Because most irrigated crops use similar amounts of water per acre, eliminating crop exports would not save much water.

Economically, a disproportionate amount of revenue and jobs in California's agriculture comes from exported crops (almonds) and crop-derived products (wine). Banning crop exports would reduce the price of almonds for Californians, while greatly reducing rural employment and revenues and increasing rural poverty.

Medellin-Azuara J., J. Lund, R. Howitt. 2015. Jobs per drop irrigating California crops, CaliforniaWaterBlog, April 28, 2015.

9. If everyone dried their lawns, wouldn't that end our water problems?

Roughly, urban water use is about 20% of human water use in California and 10% of total water supplies in California. Landscape irrigation is about 50% of urban water use, statewide. So, drying up all urban landscaping in California (reducing urban water use by 50%), would only make 5% more water available in California. This would easily be enough water to support expansion of many wetlands in California, supporting waterfowl and some fishes. Or, if reallocated to farms, drying all urban landscaping might allow expansion of agriculture by about 12% or about enough to end groundwater overdraft in the Central Valley. It would help, but is no panacea.

Drying all urban lawns and landscaping would not nearly be enough to end all water shortages among environmental, agricultural, and other urban water users.

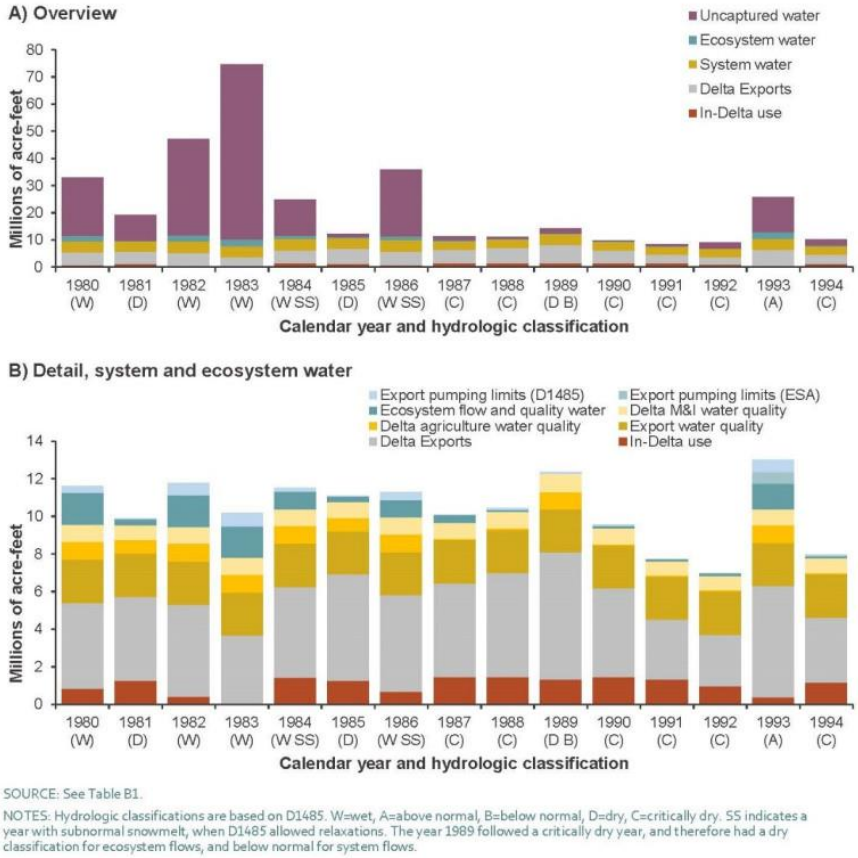
Drying lawns every year would also eliminate the easiest drought response available to cities.

California Department of Water Resources (2014). California Water Plan Update 2013. Volume 3: Resource Management Strategies. Department of Water Resources, Sacramento, California.

10. Wouldn't giving up on Delta smelt free enough water for agriculture and ending groundwater overdraft?

The restrictions on Delta water exports and operations that solely support Delta smelt have only a small effect on Delta exports, even during drought years. (The restrictions reduce water exports more in wetter years.) Uncaptured water, and Delta outflows needed to maintain in-Delta and water export water quality is generally much higher. Two studies came this conclusion, independently. Most water flowing into the Delta in wetter periods flows out because it is not captured from lack of infrastructure (which is costly to expand), rather than environmental regulations.

FIGURE B3
Where Delta water went, 1980–1994



SOURCE: See Table B1.

NOTES: Hydrologic classifications are based on D1485. W=wet, A=above normal, B=below normal, D=dry, C=critically dry. SS indicates a year with subnormal snowmelt, when D1485 allowed relaxations. The year 1989 followed a critically dry year, and therefore had a dry classification for ecosystem flows, and below normal for system flows.

Gartrell G, Mount J, Hanak E, Gray B. 2017. A new approach to accounting for environmental water: insights from the Sacramento–San Joaquin Delta. Public Policy Institute of California. San Francisco, CA

Reis, G. J, Howard, J. K, & Rosenfield, J. A. (2019). “Clarifying Effects of Environmental Protections on Freshwater Flows to—and Water Exports from—the San Francisco Bay Estuary”. San Francisco Estuary and Watershed Science, 17(1)

Some larger lessons

California is often a dry place with many water users and uses, and there will be disputes over who should get how much water when. In such an environment it is easy and popular to call for others to conserve water. Sometimes water conservation does not make more water available, but only shifts water from one user to another or away from groundwater recharge. Still, careful and thoughtful water conservation in all water use categories is important and will likely be increasingly useful in the future, despite its costs.

# # #

Jay Lund is a Professor of Civil and Environmental Engineering at the University of California, Davis. Josué Medellín-Azuara is an Acting Associate Professor of Civil and Environmental Engineering at the University of California, Merced.

Stanford develops an experimental process to rinse heavy metals from toxic soils

Poisonous heavy metals contaminating thousands of sites nationwide threaten to enter the food chain, and there's been no easy way to remove them. An experimental chemical bath and electrochemical filter could now extract heavy metals from the soil and leave fields safe.

Stanford News | June 4, 2019 | Tom Abate

When poisonous heavy metals like lead and cadmium escape from factories or mines, they can pollute the nearby soil. With no easy ways to remove these contaminants, fields must be cordoned off to prevent these toxins from entering the food chain where they threaten human and animal health.

An experimental process to remove heavy metal contaminants from soil may help to keep these toxic substances from entering the food chain. (Image credit: Reuters/Mica Rosenberg)

According to the Environmental Protection Agency, heavy metals have been found at thousands of locations nationwide. While some have been cleaned up through a combination of federal, state and private efforts, the need remains for new technologies to address heavy metal contamination.

Now a research team led by Stanford materials scientist Yi Cui has invented a way to wash heavy metals from contaminated soils using a chemical process that's a bit like brewing coffee.

As they describe June 4 in Nature Communications, the researchers started by rinsing contaminated soil with a mixture of water and a chemical that attracts heavy metals. When that mixture percolates through the soil, the chemical pulls heavy metals loose. The team members then collected this toxic brew and ran it through an electrochemical filter that captured the heavy metals out of the water. In this way they cleansed the soil of heavy metals and recycled the water and chemical mixture to percolate through more contaminated ground.

"This is a new approach to soil cleanup," said Cui, who is a professor of materials science and engineering and photon science. "Our next step is a pilot test to make sure that what works in the lab is practical in the field, and to figure out how much this process will cost."

So far, his team has cleansed soils contaminated with lead and cadmium, two prevalent and dangerous toxins, as well as with copper, which is only dangerous in high concentrations. Cui believes this process of chemical cleansing and electrochemical filtering will work with other dangerous heavy metals like mercury and chromium, but further lab experiments are needed to demonstrate that.

No more sacrificial plants

Cui said the project began two years ago when he and graduate student Jinwei Xu brainstormed about how to solve the basic problem: Heavy metals bind to the soil and become virtually inextricable. Today, Cui said, cleanup may involve digging up contaminated soils and sequestering them somewhere. Agricultural researchers have also developed phytoremediation techniques – growing sacrificial plants in contaminated soil to absorb heavy metals, then harvesting these crops and taking them to an extraction and disposal facility. But phytoremediation can take many years of repeated harvests.

Seeking a quick, cost-effective way to extract heavy metals from contaminated fields, the researchers tried washing toxic soil samples with plain water. They soon realized that plain

water couldn't break the chemical bond between the heavy metals and the soil. They needed some additive to pry the contaminants loose. They found the answer in a common chemical known by its initials: EDTA.

In retrospect, EDTA was the obvious choice because this same chemical is used to treat patients poisoned with lead or mercury. Negatively charged EDTA bonds so strongly to positively charged heavy metal particles that it pulls the lead or mercury from the patient's tissues. The researchers reasoned that, when dissolved in water, EDTA's negative hooks would rip heavy metals loose from soils. Experiments bore this out. When EDTA-treated water percolated through contaminated soil, it carried the heavy metals away.

But the team's job was only half done. The soil was clean, but the treated water was still toxic. They needed a way to separate the EDTA from the heavy metals in the rinse water and capture those toxins once and for all.

Isolating heavy metals

The scientists knew that EDTA remained strongly negative even after it captured a positively charged metal particle. So, the researchers built a sieve with the electrical and chemical properties to pull the negatively charged EDTA and positively charged heavy metals apart. The result was isolated heavy metals and a mixture of water and EDTA ready to purify more soil.

In addition to lead and cadmium, the researchers tested the process on copper, which is only dangerous in high concentrations. Next Cui would like to run the experiment on other heavy metals like mercury, which are so toxic they require special handling to protect the researchers. But he thinks the chemistry is so sound that he is confident of success in the lab. The bigger question is whether the process can be scaled up to treat tons of contaminated soil. The researchers have sought to patent the process through the Stanford Office of Technology Licensing and would like to find an opportunity to run a pilot project in a contaminated field.

"We really have no good remediation technology for heavy metals," Cui said. "If this proves practical on a large scale it will be a significant advance."

# # #

Yi Cui is also a senior fellow of the Precourt Institute for Energy and a member of Stanford Bio-X and the Wu Tsai Neurosciences Institute. Other Stanford authors include Tong Wu, Jing Tang and Kai Liu, postdoctoral scholars in materials science and engineering. Former Stanford researchers Chong Liu, Po-Chun Hsu and Jie Zhao also contributed to this research.

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