SAN LUIS RESERVOIR
The San Luis Reservoir, one of the largest in California, stores water from the Sacramento-San Joaquin River Delta and sends it by aqueduct to the Bay Area and Southern California. In midsummer, it held about 20 percent capacity.
AFTER THREE HISTORICALLY DRY YEARS, CALIFORNIA’S DROUGHT GROWS MORE CONFOUNDING AND THE FUTURE OF ITS WATER SUPPLY MORE UNCERTAIN.

BY BILL MARKEN, HONORARY ASLA
PHOTOGRAPHY BY PETER BENNETT/GREEN STOCK PHOTOS
To talk about drought in California, you could start with the mid-Holocene period, when a 1,400-year drought lowered Lake Tahoe 20 feet and lasted long enough for conifers to grow three feet thick above the receding waterline before the lake eventually rose back up over them. Or with the 1930s, when farm families escaped the Dust Bowl of Texas and Oklahoma and ran up against a California dry spell nearly as devastating. Or start with 1976–1977, then the driest rainy season recorded, when drastic water-saving measures inspired memorable gallows-humor advice such as, “If it’s yellow, let it mellow; if it’s brown, flush it down.”

But let’s begin with a road trip, 500 miles through the middle of California’s current water crisis, near the end of winter and a rainy season that never came, the third in a row. The driest calendar year in California’s recorded history had recently ended, and the entire 2013–2014 rainy season (measured from July 1 through June 30) was looking bleak, too—measurements at the end would put it among California’s three driest years. The current winter was also the warmest in 119 years of record keeping, adding to threats of wildfires; by this summer, most of the state would be above normal for “significant wildland fire potential,” according to the California Department of Forestry and Fire Protection.

Early in the year, Governor Edmund G. Brown Jr. declared a “drought emergency” and asked for voluntary 20 percent cutbacks in water use. But how this emergency hits different areas depends on where your water comes from, how well your area has prepared for drought, and for what purpose you want the water. One spokesperson for a water agency said, “We’re technically not in a drought”—that agency had enough water. Another agency said, “The district could run out of water by July.” An operator of sled dog teams in the Sierra has gone out of business from a lack of snow, and a Modesto golf course has shut down from a lack of water, but Palm Springs golf courses are as green as ever.

As I drove through the state, it was easy to see that not everyone is affected equitably by the water shortage and the prospect of an even drier future. But the drought’s power plainly showed in the color of the hills, in the levels of lakes and streams, and in the tense faces and sometimes angry, often confused words of everyone who depends on a water supply that is always essential but never predictable or controllable.

The Bay Area

Past the midpoint of the rainy season, it seemed in the San Francisco Bay Area that Uber and out-of-sight real estate prices monopolized more conversations than the almost total lack of winter rain. But there were troubling hints of unusual goings-on. The grassy hills were still brown and would never get enough rain all season to turn into lush green pastures. Cattle ranchers, now mostly long gone from the area, used to say it was a good year for grazing when fall precipitation turned the foothills green by Thanksgiving.

At my neighborhood market in the heart of Silicon Valley, Jim the butcher told me why the price of lamb has skyrocketed—rack of lamb, bones, fat, and all, sells for $29 a pound. He said, “We usually get our lamb from the Central Valley, where the sheep graze on winter grass. There’s nothing to eat this year, so the valley lambs are small, and we have to bring in meat from a lot farther away, like Colorado.” I didn’t want to jeopardize our relationship by telling Jim about Costco’s $10-a-pound lamb from New Zealand.

About the same time, Water in the West, an interdisciplinary program at Stanford, held a panel discussion on the drought. Leon Szeptycki, the program’s executive director, called this drought “the worst drought on record.” The Sierra snowpack, a major source of the Bay Area’s water supply, was at an all-time record low to date, he said. “Nearly 70 percent of California is experiencing extreme or exceptional drought conditions. The challenge is how to get by this year and in the future.”

Daniel Swain, a Stanford graduate student who runs the blog weatherwest.com, says, “It’s the driest period in San Francisco since at least the Gold Rush.” Swain calls the source of the drought the “Ridiculously Resilient Ridge.” A high-pressure zone over the northeastern Pacific was directing storms to the north instead of allowing them to burst through as in a normal year. This ridge is “part
Home landscapes use as much as 80 percent of residential water supplies.
of the anomalies in the upper atmosphere” that also caused last winter’s severe storms in the Midwest and Northeast.

The East Bay Municipal Utility District (MUD), which serves 1.3 million people, asked its customers to cut back water use voluntarily by 10 percent. Abby Figueroa, a utility spokesperson, says, “The district learned our lesson in past droughts, and we’re in better shape than other areas.” Its reservoirs holding Sierra river water are half full, and this year the district has arranged for Sacramento River water as well.

Since the devastating 1977–1978 drought, the East Bay MUD’s conservation programs have emphasized water-saving landscapes. In 2004, the district published its own 320-page book, Plants and Landscapes for Summer-Dry Climates. The book’s editor and main writer was Nora Harlow, a landscape architect who is now a community affairs representative with the district. Harlow says that area homeowners have learned to cut back, particularly indoors, by retrofitting low-flow toilets and showerheads. “About all that’s left for additional water conservation is the landscape. Irrigation can be done more efficiently.” She expects many lawns to turn brown and advises holding off on major planting: “Wait until we see what winter brings.”

The drought has hit harder just to the south in Santa Clara County. San Jose, which normally receives nearly 15 inches of rain for the season, had just six inches. Now known mostly as Silicon Valley, the area was once called the Valley of Heart’s Delight for all its fruit orchards and spring blossoms. As much as any other part of California, the area has undergone wrenching changes in population, land use, and water supplies in the past 50 years. The county grew from a population of 175,000 in 1940 to 642,000 in 1960 and is approaching two million today.

As I drove south through Silicon Valley I spotted scattered orchards of sweet cherries and apricots blooming early because of the unseasonal warmth. Farms and ranches are mostly gone, supplanted by the tilt-up buildings, parking lots, malls, and subdivisions of the high-tech boom.

In my formerly tiny hometown in the valley, a long-gone local hamburger hangout that was owned by a former deputy sheriff and patronized mostly by cattle ranchers and fruit growers every year displayed a blackboard posting cumulative rainfall. And there was a pool: Put up a dollar and the closest to the season total won. Everyone talked about rainfall. Almost all of the water came from local wells.

Today the area depends on water imported from systems originating far away in Sierra rivers and the Sacramento–San Joaquin River Delta and on local reservoirs built half a century ago that are just a third full this year. The Santa Clara Valley Water District announced a mandatory 20 percent cut in water usage from 2013 levels. Incentives for conservation were boosted: Rebates for converting lawn to “low-water-using landscape” doubled; installing a weather-based irrigation controller is eligible for a rebate of up to $2,000; customers can receive $200 for connecting a clothes washer to a graywater irrigation system.

THE CENTRAL VALLEY

As I drove from the Bay Area into the Central Valley on State Route 152, Pacheco Pass presented a pastoral vision of old California: There were hillsides and arroyos studded with sycamores and valley oaks, and cattle were grazing on the slim pickings of pale green grass that had sprouted after recent showers. The first valley landmark hit like a slap back to reality. The nine-mile-long San Luis Reservoir looks like a bathtub of brownish water, with not a green tree or green blade of grass in sight. San Luis is a major hub for collecting water from the dams and canals of the federal Central Valley Project and the California State Water Project and directing it to valley farmers as well as to the Bay Area and Southern California. The reservoir can hold two million acre-feet of water (an acre-foot is the amount of water covering one acre to a depth of one foot); this winter it was at 33 percent of capacity.

The Central Valley includes about one-sixth of all the irrigated land in the United States. Its water needs are immense, drawing about three-fourths of the state’s water supply. Shielded from the ocean’s weather-moderating influence by the Diablo Range, the 450-mile-long valley is a different world from the Bay Area climatically (much hotter), economically (dependent on agriculture), and politically (far more conservative). The farther south you go, the drier it turns. Redding, at the top of the valley, normally receives almost 35 inches of rain a year; Bakersfield, near the bottom, just six inches—an area with fewer than eight inches a year is considered “arid desert.”

As I headed south on Interstate 5, the signs of the drought were everywhere. Interstate 5, the monotonous freeway favored by truck drivers, slices north to south down the west side of the valley. That’s the drier side, lightly populated
and heavy with agriculture. About halfway between San Francisco and Los Angeles, Coalinga (population 13,000, main industries: agriculture, oil, and incarceration) receives just eight inches of rainfall a year. This area boomed around a system of canals and aqueducts, and it has become a bountiful center for heat-loving, water-demanding crops such as melons, tomatoes, cotton, and fruit and nut trees.

On a late winter day, this side of the valley was khaki in color. There was hardly any grazing livestock. Fields lay fallow owing to water shortage. One agricultural industry source estimates that at least 500,000 acres of farmland will not be planted this year because of the water crisis.

But for what seems like 50 miles or more, there was a notable exception. Almond trees in full white pale pink bloom lined the highway. California now has 800,000 acres of almonds—a response to global demand, especially in Asia—nearly double the 1995 acreage, and they bring profits second only to those of grapes. They come with a price paid in water. Almond trees take five or more years to become productive, and they need much more water than the row crops they have replaced. And almond growers can't afford to reduce irrigation or let their orchards go fallow during a dry year as with tomatoes, for instance.

Along the highway, angry, hand-lettered signs appeared with the frequency of old Burma-Shave ads to protest a “man-made drought” or to claim that “Congress Created DUST BOWL.” The signs refer to federal regulations that limit the delivery of water to protect the flow of rivers diminished by the drought. The complications of water rights (who gets what, and at what price) lead to oversimplifications. “Twenty to 30 percent of our water is gone because of a little fish,” says a farmer west of Fresno who is going to leave his fields fallow. An environmentalist counters by saying that the “little fish” (smelt) is a scapegoat that plays a key part in maintaining the health of a complex ecosystem.

The plight of smaller-scale growers is particularly problematic. “Drought hits small farmers the hardest,” says Lance Walheim, who grows 17 acres of mixed citrus varieties east of Visalia on the east side of the valley. He has seen growers with small acreages of citrus pulling out drought-stricken trees while a large-scale grower with access to groundwater is planting 200 acres of almonds. With water prices on their way to tripling or more, Walheim is pondering whether to pay the cost of a deeper well. He notes that large growers have more access to deep wells or stronger water rights.

Everyone in the valley is affected by the polarizing subject of groundwater, a major source of irrigation and drinking water. Groundwater generally makes up 40 percent of the state's water supply and rises to 60 percent or so during drought. In California the pumping of groundwater has been unregulated for the most part, which means that owners of private wells usually can pump as much as water as desired. Some local water districts have allowed aquifers to decline precipitously.

At Stanford's Water in the West, the research analyst Janny Choy says, “Groundwater is getting us through the drought. Imagine if the groundwater weren't there.” Choy says that groundwater levels have dropped in nearly all parts of the state, and in many areas of the San Joaquin Valley, levels are more than 100 feet below historical lows. She adds, “How long will the groundwater last? No one knows. The situation is already dire for many communities. If we want groundwater to be there for us, we need to put water back into our aquifers and manage it for droughts to come.”

Groundwater is more than an agricultural business problem. Visalia, one valley town that gets all its residential water from groundwater, put into effect a “water emergency” that limits homeowners to irrigating no more than three times a week, for 20 minutes maximum.

Governor Brown and other state officials have emphasized protection of groundwater supplies, and lawmakers have introduced a controversial bill that would impose new management plans overseeing groundwater managed by local agencies. As the spring and summer wore on, state legislators debated new groundwater regulations, and various state and federal drought-relief measures were proposed.

**LOS ANGELES**

At the south end of the valley, I-5 climbs steeply over Tejon Pass through the Tehachapi Mountains, where there are peaks higher than 8,000 feet. From the highway, you glimpse the California Aqueduct, part of the 700-mile-long State Water Project, which pumps its water 2,000 feet high over and through the mountains to Castaic Lake reservoir, just miles from the northern edge of the greater metropolitan Los Angeles area, which has a population of more than 18 million.
ABOVE
Although beautiful in bloom, almonds demand much more water than the row crops they have replaced in the last decade.
In Los Angeles, the total rainfall for 2013–2014 was about six inches, less than half the normal 14 inches. But in late winter there hardly seemed to be a sense of panic, controversy, or worry about a dry future. Television weather reporters spoke at one point of a “threat” of rain and possible mudslides. In Pasadena, I couldn’t help but notice new sod around the convention center, laid in time for thousands of dog groomers and kennel keepers attending an expo. One scary headline did say, “Brace yourself for the driest winter in 500 years.” An even scarier newspaper story said that Lady Gaga had become “California’s new drought spokeswoman.”

Downtown, in the halls of the Metropolitan Water District (MWD) of Southern California, the country’s largest supplier of treated water, spokesman Bob Muir said, “These are unprecedented conditions for Southern California. Each drought becomes more complicated with new twists. We are reaching an era of limits.” But, he noted that the district entered the current drought with “highest reserves” even though its two main sources of water are “challenged” this year: The State Water Project cut back its allocation of water to Southern California to just 5 percent of its normal delivery, the lowest since 1991; and the Colorado River aqueduct, built during the Depression, is delivering an adequate supply despite a 12-year drought in the river’s watershed. Muir credits the district’s reserves to lessons learned from the droughts of the 1970s and 1980s. Correcting an overdependence on water from the Colorado River and Northern California, in the 1990s MWD built 810,000-acre-foot Diamond Valley Lake, 90 miles east of L.A. This summer, the reservoir was two-thirds full.

Last February MWD declared a “Water Supply Alert” to support the governor’s 20 percent reduction target. The alert encourages conservation, particularly outdoors where 60 percent of the area’s water use takes place. The district’s incentive for reducing turfgrass doubled from $1 to $2 a square foot. Muir said that since 2009, 11 million square feet of turf lawn have been replaced with landscape that uses less water.
A hundred or so miles east of downtown Los Angeles, the Coachella Valley, including Palm Springs, lies in the rain shadow of the San Jacinto Mountains, which rise nearly 11,000 feet over the desert floor. This is real, dictionary-defined desert, with normal annual rainfall of about six inches—and just two inches this year. The native vegetation consists of creosote bush, cholla cactus, yucca, paloverde trees, and smoke trees; native fan palms still grow in spring-fed oases in canyons of the foothills. The area began to turn green in 1949 when a canal connected to the Colorado River system brought in the first imported water and ignited a boom in vacation living and agriculture (grapes, citrus, dates, vegetables).

This past winter season was business as usual. Golf courses were fully green, the fountains sparkling. Resorts were decked out with masses of annual flowers timed to bloom for the arrival of people escaping the cold of the Midwest and East Coast.

Early in the year, the Coachella water district stepped up its conservation incentives for homeowners (80 percent of their water goes to outdoor use). There are rebates for converting lawns to low-water landscape and for smart controllers. As a guide for homeowners, the district published a 160-page book on water-efficient landscaping, Lush & Efficient; the book in its entirety can be viewed online. Tiered water rates begun in 2009 have encouraged conservation, but the cost of Coachella water is startlingly low. The average residential bill is $28 a month. A young homeowner told me that her monthly bill, for a small patch of

Mia Lehrer, FASLA, who is active in Los Angeles water circles, is a big believer in lawn rebates. She says that decades of water conservation have sunk in to a certain degree: The city uses less water now with a larger population than 20 years ago. She credits public agencies for creating a sense of urgency about the current drought but adds that “homeowners don’t know what to put in place of a grass lawn.” She said she would like to see more hands-on instruction—even what she calls “a lawn therapy truck” going around the city equipped with plants and a designer.

East of Los Angeles, in Orange County, Amy McNulty, the water efficiency manager of the Irvine Ranch Water District, said that their area is “technically not in a drought” because their supplier MWD (which provides 22 percent of Irvine Ranch’s water) has adequate water, and the district’s wells and recycled water systems are adequately stocked. Irvine Ranch’s reliance on groundwater and recycled water is unusual in Southern California. The area was developed more recently (in the 1970s and later) than much of Southern California, and pipes for recycling water went in at the same time as the subdivisions. Recycled water (treated wastewater) provides 25 percent of the district’s water. McNulty also commends the conservation record of its 80,000 residential customers: Water use has fallen from 170 gallons per day in 1991 to 86 gallons in 2014. A major incentive has been a rate structure put in place in 1991: Every customer is given a water base, depending on the number of people in a residence and the evapotranspiration rate of the particular location. If a customer goes over the base, the water bill goes up.
lawn and mostly desert plants, runs between $12 and $15 (my monthly Silicon Valley water bill reached $200 this summer).

In the longer run, Coachella Valley faces the same groundwater dilemma as the rest of the state. Engel says that “the groundwater supply is not infinite.” The area’s natural groundwater supply of 39 million acre-feet “is in overdraft”—drawn down by about 5 million acre-feet. Groundwater is usually replenished with imported water, but not much replenishment can take place this year, with only a 5 percent allocation from the State Water Project.

While I was driving back from the desert, several Coachella images kept popping into my mind. In the lobby of the historic La Quinta Resort, black-and-white photos show what the area looked like when the resort was built in the 1920s, decades before water was imported. The resort now is one of those lush golf-and-geranium winter paradises. Then it was stark as a western movie set, its adobe buildings framing views into a wide-open, nearly bare plain dramatically backdropped by steep mountains.

Near the resort today, Bear Creek Trail skirts golf fairways and subdivisions and gives a glimpse of the beauty of the natural landscape, marked by sculptural smoke trees and paloverde trees. It was heartening to see how many of the nearby La Quinta homeowners on their own have created desert-style landscapes instead of lawns—whether motivated by a quest for authenticity, sustainability, or lower water bills.

The drive home back through the Central Valley, much of it technically desert, revealed—in fast-forward summary—how the land was transformed by massive irrigation projects. In the 18th century, Spanish padres and settlers built missions, towns, and forts, and planted what they knew from home in a climate that seemed familiar. They grew olives and figs, created plazas of packed earth, and watered sparingly. Nineteenth-century Anglos came, and then their engineering solutions delivered water from far away. The state greened up.

Droughts in California are a fact of life, as, now, are battles over how the state’s water will be divvied up. Under discussion are ways to make better use of existing water supplies and to ameliorate the risks of drought. There are marketing or political solutions—tiered price structures for water, the selling or trading of water rights, tighter oversight of groundwater, mandatory rationing. There are technical solutions—greater use of recycled water, increased storage in groundwater aquifers, deployment of smart controllers and meters, and other ways to make irrigation more efficient for farmers and homeowners. And there are the solutions that date back to the state’s earlier days—building more dams and canals.

On their November ballot, California voters will have a chance to decide on a bond measure to overhaul the state’s water system. Still being refined in midsummer, the measure will be loaded with controversial projects, such as groundwater management, dam building, and environmental restoration.

Many predictions point to a future of more extremes, owing to climate change: a warmer, drier state with diminished snowpack and more flooding as rain falls rather than snow. Of more immediate concern to most Californians is the upcoming rainy season, which usually begins in October or November. As of midsummer, the U.S. Climate Prediction Center predicts a weak to moderate El Niño effect for the next rainy season, leaving the prospects of a drought breaker up in the air. California rainfall records show great variations from one year to the next, with erratic periods of dry and wet years, and actually more wet years than dry years. The drought of 1987–1992 was broken by an El Niño-driven season that was the wettest in at least 119 years.

Lance Walheim, the citrus grower, says, “One more dry summer next year will be devastating.”

Bob Muir, of the Metropolitan Water District of Southern California, says if 2014–2015 is another dry year, “Expect to see the specter of allocations and mandatory conservation.”

In East of Eden, John Steinbeck, who grew up in the agriculturally rich Salinas Valley, had this to say: “And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way.”

ABOVE
With just two inches of rain this year, Palm Springs golf courses are under close watch.