

MONO LAKE



Twenty years ago, Los Angeles was forced to give water back to this ecological jewel of the eastern Sierra. Now, drought is raising new questions about its future.

With long, loping strides, geomorphologist Scott Stine zigzags through sagebrush and rabbitbrush to the edge of Mono Lake, whose still, saline waters reflect the forested flanks of California's eastern Sierra. He speeds along the chalky shoreline, stirring

up clouds of alkali flies that congregate along the lake's edge. In the shallows, pale-pink brine shrimp nip at microscopic algae, and in the muck are the tracks of a California gull, which — just minutes ago, perhaps — was sauntering along, beak agape, feasting on the shrimp and the flies.

Soon, we reach the mouth of Lee Vining Creek, one of Mono Lake's freshwater tributaries. In the midst of the worst drought in living memory, the creek fans out in multiple channels like a mini-Mississippi. Lupine and Indian paintbrush daub the banks with color, and crowds of young cottonwoods and willows provide shade for trout and cover for nesting songbirds. "This area has really come back," observes Stine, a professor emeritus at California State University, East Bay. "You can't even walk the stream anymore because of all the vegetation."

Stine stops occasionally to examine treasures: a chunk of pumice, a polished cobble, the feather of a red-tailed hawk. In 1979, when he started doing research here, he was not yet 30. Now, his straw-colored hair is tinged with gray.

It's hard to appreciate today how close Mono Lake and its creeks came to ecological collapse, Stine says, and how catastrophic that would have been. The flow of rain and snowmelt — from the mountains into the creeks, from the creeks into the lake — sustains a mosaic of habitats that are increasingly rare along the western edge of the Great Basin, an arid expanse that stretches from here across Nevada and into Utah. To more than a million eared grebes and tens of thousands of migrating shorebirds, the Mono Basin is arguably the last best place between the Sierra Nevada and the Great Salt Lake.

The existential threat to this high-desert oasis materialized in the 1940s, after the Los Angeles Aqueduct added a 106-mile northern extension, which tapped the waters of Lee

Vining Creek and other feeders of Mono Lake. The aqueduct's first section, completed in 1913, captured the flow of the Owens River and dried up Owens Lake. Mono Lake and its tributaries seemed doomed to a similar fate.

For years, virtually no water flowed down the lower reaches of Lee Vining and the other creeks, causing a mass die-off of cottonwoods and willows. Then, in the 1960s, and again in the 1980s, came a series of extremely wet winters. From spillways and bypass ditches, torrents of water barreled downstream, biting into denuded soils and gravels. As major channels deepened, plummeting water tables threatened the re-establishment of riparian vegetation.

Cut off from its tributaries, the lake contracted, exposing shorelands that had been submerged for centuries. Dust storms filled with fine particles irritated the locals' lungs and obscured their vision. The lake's chemical profile changed, to the point that its waters were becoming too salty and mineral-laden to support even the tough little invertebrates at the base of the food chain. If nothing changed, many feared, recovery in less than thousands of years would be all but impossible.

And that might well have happened, without the reams of data and hours of testimony provided by Stine and others. Instead, in 1994, following a lengthy legal battle and a historic ruling by the California Supreme Court, the State Water Resources Control Board limited the amount of water Los Angeles could take.

It was one of the biggest environmental victories in the history of Western water. It set the stage for a remarkable ecological recovery, and an equally remarkable shift inside the Los Angeles Department of Water and Power. "The Mono Lake decision caused a change of mindset," says Martin Adams, senior assistant general manager for the water system. "It recognized that Los Angeles needed water, but so did the environment." This year, when Mono Lake fell below a pre-determined trigger point, the utility absorbed a big cut in its imports without protest.

What happened here might have been widely copied. It wasn't. Today, Mono Lake remains a rare example of how people

in the arid West can balance their water demands with those of other species. But the recovery remains partial, even tenuous. Once again, the lake is falling, and some of the old threats are resurfacing — this time due to drought instead of diversions.

Long after this dry spell ends, the worries it has awakened will shadow the future. How will Mono Lake fare in a world in which the carbon-loaded climate threatens to become unhinged, raising the specter of droughts more profound than any we've ever experienced? Will it stand as a shining example of how people can use natural resources without destroying them? Or will it be regarded as a lesson in limits, so that the best we can hope for is to keep this strange inland sea in a liminal state, neither optimally full nor desperately empty?

DANIEL SHAW GUNS THE OUTBOARD on his aluminum boat and heads into the lake, which, at its present area of around 66 square miles, is about a third larger than San Francisco. Trailing my fingers through the water, I'm struck by how slippery — soapy, almost — it feels. Mono Lake is a so-called "terminal" lake, meaning that it has no outlet. Over time, its waters evaporate, leaving behind high concentrations of dissolved salts, including the likes of table salt, Epsom salt and the laundry booster borax.

Shaw, an environmental scientist with California State Parks, notes that Mark Twain, who visited Mono Lake in the 1860s, claimed he laundered his clothes by tying them to a boat and towing them a quarter-mile. Twain did not admire Mono Lake. "This solemn, silent, sail-less sea ... is little graced with the picturesque," he wrote. And yet the picturesque is all around us, in the iconic mineral formations known as tufa towers and the eerie islands and islets heaved up by volcanic activity.

Shaw, a large, talkative man who studies osprey, gives me an up-close view of the lake in its present state. With water levels at their lowest in 19 years, it bustles with birds. In pre-diversion days, he says, many tufa towers were concealed by some 40 feet of water. Today, they serve as avian habitat. Atop one, we see a female osprey on her nest, shading her chicks with

outstretched wings. Typically, osprey build nests out of twigs and branches. Here, they also use bones. "There's a whole stack of dead seagulls up there!" Shaw exclaims.

Since the 1970s, when DDT was banned, osprey have expanded their range. The first nesting pair arrived at Mono Lake in 1985. This year, Shaw and his colleagues counted 12 nests and 18 chicks. The osprey's diet centers on rainbow and brown trout introduced to the area many decades ago. The osprey and their non-native prey are reminders of how this human-altered landscape retains a surprising degree of biological function.

Shaw idles the boat to get a better look at the volcanic islands. Negit, a black, brooding presence in the middle of the lake, was the California gulls' favored nesting area until the late 1970s. Then, falling water levels caused by diversions exposed a land bridge that allowed coyotes to cross from the mainland and gobble up eggs and chicks. With few exceptions, the gulls have avoided Negit ever since, nesting on smaller islets nearby.

Had the lake not fallen so low, the gulls' resurgence would seem an unequivocal success. The population, now some 50,000 strong, is higher than it's been in 10 years, says Kristie Nelson, who heads up the Mono Lake California Gull Project for Point Blue Conservation Science. This summer, Nelson and her colleagues counted a higher-than-average number of chicks. But if the drought persists, the land bridge could resurface, putting the Negit islets in tempting proximity to hungry coyotes. From the boat, we can see the land bridge, beneath just a few feet of water.

There are invisible dangers as well, from rising salt concentrations to a lake-encircling "nick point" — geologist-speak for a steepening in slope that greatly increases the erosive force of water flowing downhill. Should the lake ever drop below this nick point, Stine warned the Water Board, thousands of ephemeral rills would start cutting into exposed sediments, setting in motion an inexorable process that would transform the lake's skirt of lagoons and marshes into deeply incised badlands. At summer's end, the lake plateaued at a good 10 feet above the danger zone.

California gulls in flight over Mono Lake, with Negit Island in the background.



Grant Lake reservoir, where the spillway will be re-engineered to allow more water to flow into Rush Creek, Mono Lake's largest tributary.

what we're asking them to do," says Geoffrey McQuilken, who joined the Mono Lake Committee as a fifth-grader in Pasadena, and is currently its executive director.

The gravity-fed system designed to take water from the lake's feeder creeks and send it to Los Angeles is now required to put water back in. That has entailed re-engineering: A \$20 million retrofit of the spillway for the Grant Lake reservoir above lower Rush Creek, the largest tributary, is on the department's to-do list. When complete, it will allow the utility to dial up the springtime flows needed to restore the creek more fully. Stream scientists have specified how high these flows must be to perform ecologically important work, like scouring deep pools that provide hiding places for trout.

McQuilken and I stand for a while along the edge of the creek, savoring the sound of water rushing from the reservoir, the central collection point for the aqueduct. The reservoir itself is barely a quarter full. High above us, mere traces of snow linger on Mount Lyell, the highest point in Yosemite National Park. At winter's end, California's snowpack was just 5 percent of normal.

It wasn't supposed to be this way. By now, it was hoped, Mono Lake would have risen to 6,392 feet, the Water Board's objective. From then on, the twin goals of providing water for both people and the environment might be stably managed. Had the climate cooperated, Los Angeles could today be drawing in excess of 30,000 acre-feet of water, many times its present allotment.

Fortunately, the L.A. Department of Water and Power has come a long way in the last 20 years. For a time, says McQuilken, managers balked at the idea that conservation and recycling could replace the Mono Basin losses. But since then, the utility has become one of the country's most progressive. Take water conservation. Simple measures like encouraging customers to rip out lawns and install low-flow toilets have made a stunning difference. Despite the addition of a million residents, Los Angeles uses less water today than it did nearly half a century ago.

By 2025, Los Angeles hopes to drive water use still lower, saving an additional 60,000 acre-feet each year. It's planning to expand the use of non-potable water for purposes such as irrigation, and to recapture water from winter storms. Even more ambitious is its plan to clean up the San Fernando Valley's polluted aquifer and recharge it with purified recycled water. The goal: To make the city much less dependent on the resource that fueled its early growth — water imported from afar.

Los Angeles proves that transformation is possible, says Martha Davis, manager of policy development at Southern California's Inland Empire Utilities Agency. It's what she dreamed of in the 1980s and 1990s, when, as McQuilken's predecessor, she helped lead the Mono Lake Committee through court battles and Water Board hearings. As she puts it, "Anyone who has watched water gushing down the street from someone's overactive sprinkler system knows we can do better — *must* do better — if the price tag is the extinction of a species or of an entire ecosystem."

TRACES OF CLIMATES PAST weave through the landscape here, disquieting reminders of how far our planet can stray from what we consider normal. Hundreds of feet above my head

stretches a long scar that marks Mono Lake's Pleistocene shoreline, when glacial meltwater surged into its creeks. But in the context of the present, the most evocative of all these traces are the stumps that mark two droughts of mind-bending duration — "megadroughts," as they're sometimes called.

Geomorphologist Stine found the stumps more than three decades ago, still rooted in place along shorelands exposed by the diversions. He found more relicts in the Walker River and Yosemite's Tenaya Lake. By dating the wood, Stine was able to assign ages to the stumps and, thus, to the dry spells that forced the lake to recede, allowing woody vegetation to take root and flourish. The later of the dry spells ended in the 14th century after lasting nearly 200 years.

Stine bends over what looks like a log. Encrusted with tufa, it's all that remains of a tree that grew in medieval times, when the lake fell as low as 6,368 feet. In 1982, the lake came within four feet of that point; had Los Angeles' diversions continued unchecked, it would have plunged well past it. "All the chips are in place legally to protect Mono Lake," Stine reflects. "The problem is, Mother Nature is no longer Mother Nature. You know, it's amazing to consider all the damage we humans have done to the planet, but only recently have we upset the underpinnings of the whole thing. That's where we are with the climate."

As greenhouse-gas driven warming accelerates, many scientists, including Stine, fear that the climate system could switch to a very different state, one in which droughts of punishing duration become more likely. They need not last for 100 years to put excruciating pressure on ecosystems. At the very least, rising temperatures will accelerate water losses from plants, soils and reservoirs, intensifying even short dry spells. In Mono Lake and its creeks, higher temperatures alone are sure to stress everything from brine shrimp to trout adapted to cooler waters.

But deeper droughts are not the only possibility. Periods of extreme precipitation have also become more likely. That's because the warmer the atmosphere, the more moisture the air can hold. Stir in an unsettled zone of low pressure and unprecedented warmth in the ocean, and you get the powerful storms that have hit Southern California recently, triggering landslides and floods. This spring and summer, Lee Vining, on the edge of Mono Lake, received nearly three times more precipitation than average. If the turn to wet persists — most of California's snow and rain falls between October and March — the lake could soon rise.

Sharp climate swings are nothing new here. Between the medieval megadroughts, for example, came a five-decade wet period during which Mono Lake rose to 6,433 feet — more than 50 feet above its current level. There have



Scott Stine, geomorphologist and paleoclimatologist, near some of the iconic tufa formations exposed when water was diverted from Mono Lake.

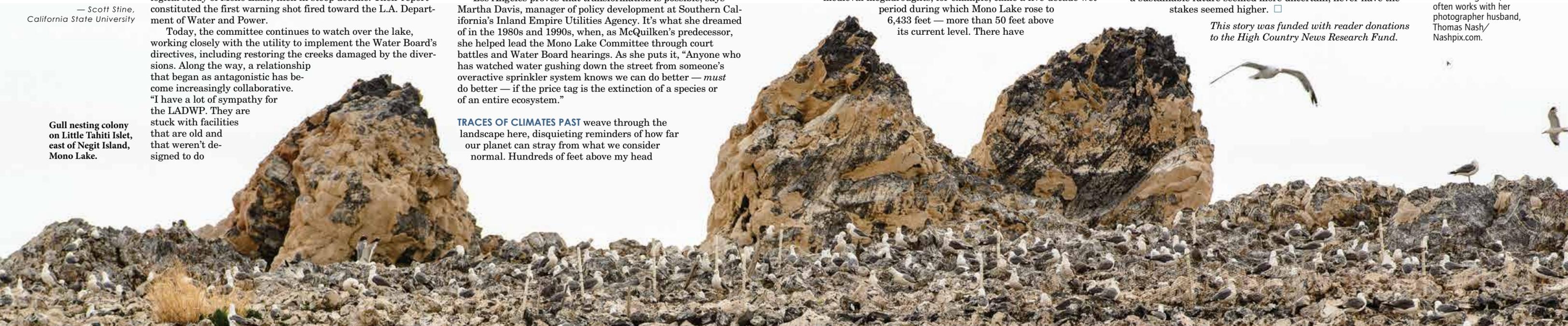
been shorter-term swings as well. As recently as the 1990s — thanks, in part, to a powerful El Niño — Mono Lake rose more than 10 feet. Now another El Niño is tantalizing Californians with the prospect of winter storms.

The Mono Lake Committee's McQuilken, for one, remains optimistic that the lake will eventually reach the level the Water Board envisioned. "It will just take longer," he says. In the midst of drought, maybe it's too easy to become pessimistic. Outside McQuilken's office hangs a framed passage from John Steinbeck's *East of Eden*: "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." Before leaving, I cast a last, lingering look at the lake, which gleams like molten nickel under darkening skies. Lightning sizzles in the distance. Never has the path to a sustainable future seemed more uncertain; never have the stakes seemed higher. □

This story was funded with reader donations to the High Country News Research Fund.



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Gull nesting colony on Little Tahiti Islet, east of Negit Island, Mono Lake.