As the Great Salt Lake Dries Up, Utah Faces an 'Environmental Nuclear Bomb'

Climate change and rapid population growth are shrinking the lake, creating a bowl of toxic dust that could poison the air around Salt Lake City.

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SALT LAKE CITY — If the Great Salt Lake, which has already shrunk by two-thirds, continues to dry up, here's what's in store:

The lake's flies and brine shrimp would die off — scientists warn it could start as soon as this summer — threatening the 10 million migratory birds that stop at the lake annually to feed on the tiny creatures. Ski conditions at the resorts above Salt Lake City, a vital source of revenue, would deteriorate. The lucrative extraction of magnesium and other minerals from the lake could stop.

Most alarming, the air surrounding Salt Lake City would occasionally turn poisonous. The lake bed contains high levels of arsenic and as more of it becomes exposed, wind storms carry that arsenic into the lungs of nearby residents, who make up three-quarters of Utah's population.

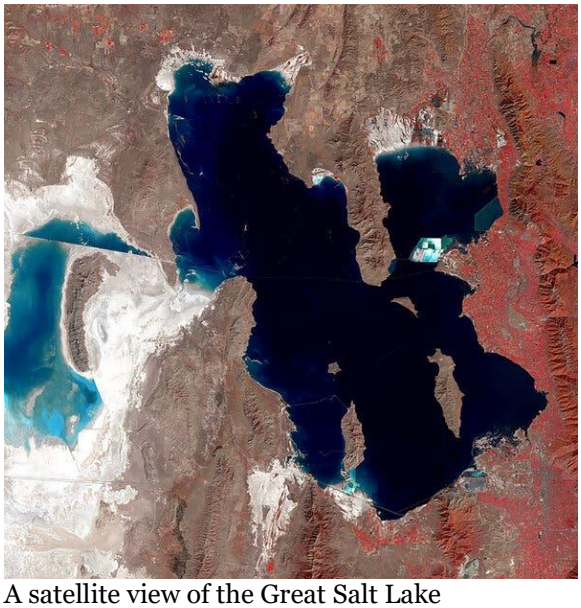
"We have this potential environmental nuclear bomb that's going to go off if we don't take some pretty dramatic action," said Joel Ferry, a Republican state lawmaker and rancher who lives on the north side of the lake.

As climate change continues to cause record-breaking drought, there are no easy solutions. Saving the Great Salt Lake would require letting more snowmelt from the mountains flow to the lake, which means less water for residents and farmers. That would threaten the region's breakneck population growth and high-value agriculture — something state leaders seem reluctant to do.

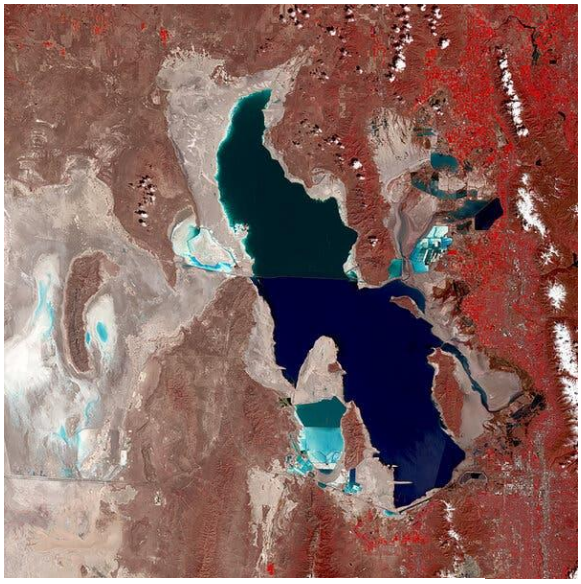
Utah's dilemma raises a core question as the country heats up: How quickly are Americans willing to adapt to the effects of climate change, even as those effects become urgent, obvious, and potentially catastrophic?

The stakes are alarmingly high, according to Timothy D. Hawkes, a Republican lawmaker who wants more aggressive action. Otherwise, he said, the Great Salt Lake risks the same fate as California's Owens Lake, which went dry decades ago, producing the worst levels of dust pollution in the United States and helping to turn the nearby community into a veritable ghost town.

"It's not just fear-mongering," he said of the lake vanishing. "It can actually happen."



A satellite view of the Great Salt Lake captured in September 1987.
Credit...EROS Center, U.S.G.S.



The Great Salt Lake in May 2021.Credit...EROS Center, U.S.G.S.

A modern oasis, under threat

Say you climbed into a car at the edge of the Pacific and started driving east, tracing a line across the middle of the United States. After crossing the Klamath and Cascade mountains in Northern California, green and lush, you would reach the Great Basin Desert of Nevada and western Utah. In one of the driest parts of America, the landscape is a brown so pale, it's almost gray.

But keep going east, and just shy of Wyoming you would find a modern oasis: a narrow strip of green, stretching some 100 miles from north to south, home to an uninterrupted metropolis beneath snow-capped mountains, sheltered under maple and pear trees. At the edge of that oasis, between the city and the desert, is the Great Salt Lake.

Utahns call that metropolis the Wasatch Front, after the 12,000-foot Wasatch Range above it. Extending roughly from Provo in the south to Brigham City in the north, with Salt Lake City at its center, it's one of the fastest-growing urban areas in America — home to 2.5 million people, drawn by the natural beauty and relatively modest cost of living.

That megacity is possible because of a minor hydrological miracle. Snow that falls in the mountains just east of Salt Lake City feeds three rivers — the Jordan, Weber, and Bear — which provide water for the cities and towns of the Wasatch Front, as well as the rich cropland nearby, before flowing into the Great Salt Lake.

Until recently, that hydrological system existed in a delicate balance. In summer, evaporation would cause the lake to drop about two feet; in spring, as the snowpack melted, the rivers would replenish it.

Joel Ferry, a state lawmaker whose ranch is on the north side of the Great Salt Lake. “We have this potential environmental nuclear bomb that’s going to go off if we don’t take some pretty dramatic action.”

The parched Bear River canal system, which irrigates farmland by diverting water that would otherwise reach the Great Salt Lake.

Now two changes are throwing that system out of balance. One is explosive population growth, diverting more water from those rivers before they reach the lake.

The other shift is climate change, according to Robert Gillies, a professor at Utah State University and Utah's state climatologist. Higher temperatures cause more snowpack to transform to water vapor, which then escapes into the atmosphere, rather than turning to liquid and running into rivers. More heat also means greater demand for water for lawns or crops, further reducing the amount that reaches the lake.

And a shrinking lake means less snow. As storms pass over the Great Salt Lake, they absorb some of its moisture, which then falls as snow in the mountains. A vanishing lake endangers that pattern.

"If you don't have water," Dr. Gillies said, "you don't have industry, you don't have agriculture, you don't have life."

'At the precipice'

Last summer, the water level in the Great Salt Lake reached its lowest point on record, and it's likely to fall further this year. The lake's surface area, which covered about 3,300 square miles in the late 1980s, has since shrunk to less than 1,000, according to the U.S. Geological Survey.

The salt content in the part of the lake closest to Salt Lake City used to fluctuate between 9 percent and 12 percent, according to Bonnie Baxter, a biology professor at Westminster College. But as the water in the lake drops, its salt content has increased. If it reaches 17 percent — something Dr. Baxter says will happen this summer — the algae in the water will struggle, threatening the brine shrimp that consume it.

While the ecosystem hasn't collapsed yet, Dr. Baxter said, "we're at the precipice. It's terrifying."

Kevin Perry, a professor of atmospheric sciences at the University of Utah, on land that used to be submerged by the Great Salt Lake.


Dr. Perry held dead brine shrimp on the shoreline.

The long term risks are even worse. One morning in March, Kevin Perry, a professor of atmospheric sciences at the University of Utah, walked out onto land that used to be underwater. He picked at the earth, the color of dried mud, like a beach whose tide went out and never came back.

The soil contains arsenic, antimony, copper, zirconium and other dangerous heavy metals, much of it residue from mining activity in the region. Most of the exposed soil is still protected by a hard crust. But as wind erodes the crust over time, those contaminants become airborne.

Clouds of dust also make it difficult for people to breathe, particularly those with asthma or other respiratory ailments. Dr. Perry pointed to shards of crust that had come apart, lying on the sand like broken china.

“This is a disaster,” Dr. Perry said. “And the consequences for the ecosystem are absolutely, insanely bad.”

Running out of water, but growing fast

In theory, the fix is simple: Let more water from melting snowpack reach the lake, by sending less toward homes, businesses and farms.

But metropolitan Salt Lake City has barely enough water to support its current population. And it is expected to grow almost 50 percent by 2060.

Laura Briefer, director of Salt Lake City’s public utilities department, said the city can increase its water supply in three ways: Divert more water from rivers and streams, recycle more wastewater, or draw more groundwater from wells. Each of those

strategies reduces the amount of water that reaches the lake. But without those steps, demand for water in Salt Lake City would exceed supply around 2040, Ms. Briefer said.

The city is trying to conserve water. Last December, it stopped issuing permits for businesses that require significant water, such as data centers or bottling plants.

Water pipes and construction intended for a new development near Salt Lake City.

Laura Briefer, director of Salt Lake City's public utilities department, said that without diverting more water from the Great Salt Lake, the city's supply of water will fall below demand by 2040.


The shrinking lake seen from Antelope Island State Park. As the water recedes, the island has become a peninsula.

But city leaders have shied away from another potentially powerful tool: higher prices.

Of major U.S. cities, Salt Lake has among the lowest per-gallon water rates, according to a 2017 federal report. It also consumes more water for residential use than other desert cities — 96 gallons per person per day last year, compared with 78 in Tucson and 77 in Los Angeles.

Charge more for water and people use less, said Zachary Frankel, executive director of the Utah Rivers Council. “Pricing drives consumption,” he said.

Through a spokesman, Mayor Erin Mendenhall, elected in 2019 on a pledge to address climate change and air quality, declined an interview. In a statement, she said the city will consider pricing as a way “to send a stronger conservation signal.”

Homes around Salt Lake boast lush, forest-green lawns, despite the drought. And not always by choice.

In the suburb of Bluffdale, when Elie El kessrwany stopped watering his lawn in response to the drought, his homeowners’ association threatened to fine him. “I was trying to do the right thing for my community,” he said.

Dormant green lawns, seen before spring began, in Saratoga Springs, near the southern end of the Wasatch Front.

Elie El kessrwany stopped watering his lawn during the drought, and was threatened with a fine. “I was trying to do the right thing,” he said.

Robert Spendlove, a Republican state representative, introduced a bill this year that would have blocked communities from requiring homeowners to maintain lawns. He said local governments lobbied against the bill, which failed.

In the state legislative session that ended in March, lawmakers approved other measures that start to address the crisis. They funded a study of water needs, made it easier to buy and sell water rights, and required cities and towns to include water in their long-term planning. But lawmakers rejected proposals that would have had an immediate impact, such as requiring water-efficient sinks and showers in new homes or increasing the price of water.

What the Future May Hold

Keeler, Calif., once a thriving community on the shore of Owens Lake, emptied out after the lake disappeared. Only about 50 residents remain.

The worst-case scenario for the Great Salt Lake is neither hypothetical nor abstract. Rather, it's on display 600 miles southwest, in a narrow valley at the edge of California, where what used to be a lake is now a barely contained disaster.

In the early 1900s, Los Angeles, growing fast and running out of water, bought land along either side of the Owens River, then built an aqueduct diverting the river's water 230 miles south to Los Angeles.

The river had been the main source of water for what was once Owens Lake, which covered more than 100 square miles. The lake dried up, and then for much of the 20th century it was the worst source of dust pollution in America, according to a 2020 study by the National Academies of Sciences, Engineering, and Medicine.

When wind storms hit the dried lake bed, they kick up PM10 — particulate matter 10 micrometers or smaller, which can lodge in the lungs when inhaled and has been linked to worsened asthma, heart attacks and premature death. The amount of PM10 in the air around Owens Lake has been as much as 138 times higher than deemed safe by the U.S. Environmental Protection Agency.

Local officials successfully sued Los Angeles, arguing it had violated the rights of nearby communities to clean air. A judge ordered Los Angeles to reduce the dust. That was 25 years ago. Since then, Los Angeles has spent $2.5 billion trying to keep wind from blowing dust off the lake bed.

The city has tried different strategies: Covering the lake bed in gravel. Spraying just enough water on the dust to hold it in place. Constantly tilling the dry earth, creating low ridges to catch restive dust particles before they can become airborne.

Los Angeles has tried a range of strategies to stop dust flying off the dried bed of Owens Lake, including sprinklers and vegetation.

Jim Macey moved to Keeler in 1980. He called that period, before officials spent billions trying to control the dried-out lake bed, “the time of dust.”


Gravel spread across a portion of Owens Lake, another effort to prevent dust from becoming airborne.

The result is a mix between an industrial site and a science experiment. On a recent morning, workers scurried across the vast area, checking valves and sprinklers that continually get plugged with sand. Nearby, inside a complex that resembles a bunker, walls of screens monitored data to alert the operation's 70-person staff if something goes wrong. If the carefully calibrated flow of sprinklers is disrupted, for example, dust could quickly start to fly off again.

Dust levels near the lake still sometimes exceed federal safety rules. Among Utah's coterie of nervous advocates for the Great Salt Lake, Owens Lake has become shorthand for the risks of failing to act quickly enough and the grave damage if the lake dries up, the contents of its bed spinning into the air.

On what used to be the shore of what used to be Owens Lake is what's left of the town of Keeler. When the lake still existed, Keeler was a boom town. Today it consists of an abandoned school, an abandoned train station, a long-closed general store, a post office that's open from 10 a.m. to noon, and about 50 remaining residents who value their space, and have lots of it.

"Cheap land," said Jim Macey, when asked why he moved to Keeler in 1980. He described that period, before Los Angeles began trying to hold down the lake bed, as "the time of dust." He recalled watching entire houses vanish from sight when the wind blew in.

"We called it the Keeler Death Cloud," Mr. Macey said.

Christopher Flavelle focuses on how people, governments and industries try to cope with the effects of global warming. He received a 2018 National Press Foundation award for coverage of the federal government's struggles to deal with flooding. @cflav