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# Transforming Great Salt Lake from Afterthought to Asset

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**Abstract:** In a 36-year period that coincides with my lifetime, Great Salt Lake, one of the world's largest terminal lakes and a critical ecosystem in the Western Hemisphere, went from its largest to its smallest recorded size. In this opinion piece, I argue that the fundamental problem is that we Utahns and other stakeholders have treated Great Salt Lake as an afterthought instead of an asset. I describe the conditions that led to this point, some transformations now taking place, and the new hope that the lake will recover.

**Keywords:** Great Salt Lake; Utah; terminal lake; saline lake; drought; endorheic lake; water use

## 1. Contrasting Conditions

The year I was born, in 1986, Great Salt Lake in Utah, USA, reached its maximum recorded size, topping out at 1283.5 m above sea level and covering 6000 km$^2$ of Utah [1].

In 2022, the lake set a different kind of record, one I hope never gets broken: dropping to 1276.5 m—about 3.0 m below its healthy level—and shrinking to less than 2500 km$^2$, having lost two thirds of its water [2]. Figure 1 shows the contrast.

In the intervening period that exactly covers my lifetime, most of which I have spent in Utah, water demand and water supply in the region have become visibly incompatible. The unintended consequence [3] is a declining lake. Great Salt Lake, like the Colorado River [4], is an environmental gauge, a vital sign of the West's water resources. After years of neglect, the lake is starving not just for water but for attention.

Great Salt Lake is one of the world's largest terminal lakes and a critical ecosystem in the Western Hemisphere. The lake has experienced many natural wet and dry cycles over its 13,000-year history since the last ice age. In modern times, its level has changed from a previous record low in the 1960s to a record high in the 1980s to a record low in 2022 [2]. Consumptive water uses from agriculture, cities, and other uses are what have depleted its inflows during this period [5,6]. The challenges are acute and existential for both the lake and for us. As summarized in a 2023 report led by Brigham Young University [7], the lake has become so small that toxic dust is blowing from the exposed lakebed, so dry that wildlife habitats are vanishing, and so salty that the food web is collapsing. The consequences for human health, ecosystems, and the economy are significant. After observing the lake in the spring of 2023, author Terry Tempest Williams said, "The laws of nature do not negotiate with generations of abusive behavior. Our needs are overtaking the needs of Great Salt Lake at our own peril. We have known this was coming" [8].

The precarious conditions have ignited a burst of efforts in the past few years by local, state, and federal governments; private companies; academic researchers and students; nonprofit groups; and various other stakeholders. I have participated in several of these efforts professionally. Some efforts are "rescue efforts" to shepherd more water to the lake immediately, while others are "planning efforts" to support the lake's long-term health. I describe both below. In early 2023, thanks to record-breaking snowfall, the lake's water levels rose somewhat, but a full recovery is not certain.



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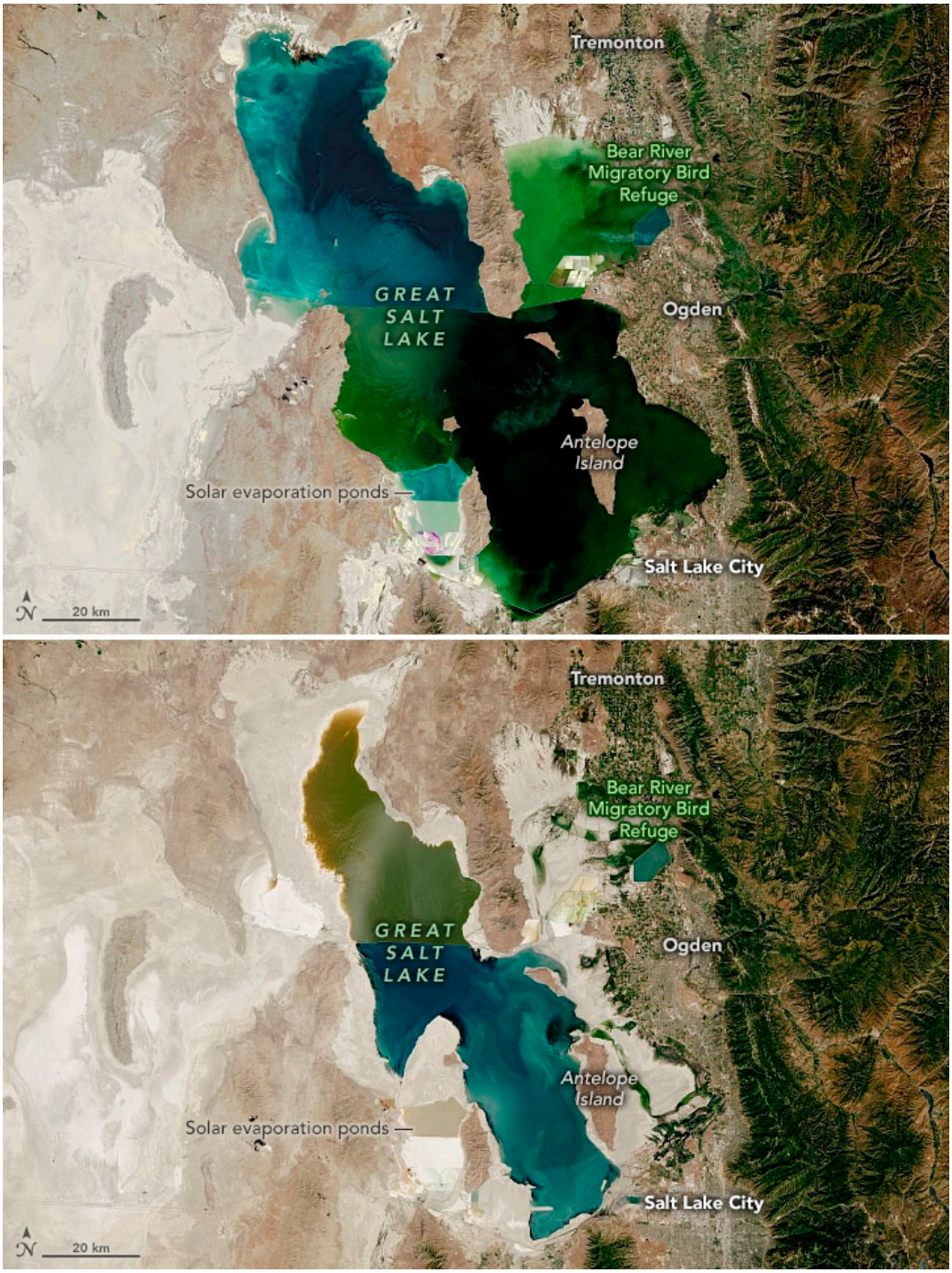


**Figure 1.** Great Salt Lake is shown at top in June 1985, just before its maximum level in 1986, and at bottom in July 2022, just before its minimum level in November 2022. (NASA Earth Observatory/Landsat, public domain.).

In all this, I have asked myself, "How did this happen?" I have explored possible answers over the past couple years as I have discussed the issues with policy leaders, water managers, and the public. Everyone seems to have an opinion, pointing a finger at farmers, developers, politicians, the climate, or the neighbor with the perpetually soggy lawn. But fundamentally, I believe it comes down to this:

We have treated Great Salt Lake as an afterthought instead of an asset.

## 2. The Afterthought

When it comes to water, Great Salt Lake gets the leftovers. It's the big dead-end of the West, a huge tub that does not drain anywhere. Water starts in the mountains and has a long way to go through thirsty farmlands, growing cities, and hot desert air before it reaches the lake. It's the end of the hydrologic line, the last stop in nature's liquid $H_2O$ supply chain. Historically, that hasn't been a problem for the lake's water balance, but lately the leftovers have been meager and the lake has been forced into a crash diet.

While water infrastructure has been developed to support growing communities around the lake, less has been done to support water flows to the lake itself. Most irrigation use is unmetered. Canal systems leak. Some waterways to the lake are overgrown with invasive plant species or are otherwise obstructed. Wetlands surrounding the lake (Figure 2) lack the means to monitor water flows.

**Figure 2.** American avocets take flight in a cloud of brine flies at the Bear River Migratory Bird Refuge on Great Salt Lake. (U.S. Fish and Wildlife Service, public domain.).

Besides getting the physical leftovers, the lake also gets the legal leftovers. Under Utah law, Great Salt Lake has had no water rights, legal standing, or representation of its own until recently. The lake wasn't just last in line; it didn't even have an invitation: any water conserved upstream might just be snatched by the next water-right holder downstream. "If we believe in the Western water doctrine of 'first in time, first in rights"', said ecologist Ben Abbott, then Great Salt Lake is a rightful owner [8]. Even if the lake had an invitation, it would need to make up for decades of missing the party.

In the minds of the public, too, I believe the lake's health has been in the background until now. One hardly pauses to think how water actually arrives at and sustains this rich ecosystem. The lake is just there, full of water, until it isn't. If Great Salt Lake is known as a notable natural feature, it is because of its name, its extreme saltiness, or how a swimmer can float better in it than in freshwater—quality over quantity. But the quantity of water directly affects the quality, and both are tied to the lake's overall health. We Utahns seem to appreciate the hydrology of our mountains more than that of our dead-end lake. It is

admirable that we use words like "snowpack" and "runoff" so easily in everyday speech, but "brine flies" and "salinity" are not so common.

## 3. The Transformation

Besides prompting scrutiny of past water management practices, Great Salt Lake's decline has launched new efforts and caused existing ones to accelerate.

Water conservation is the immediate answer. Because consumptive water use is the culprit [5,6], we need strategies to reduce consumptive water use upstream—ideally without losing the intended benefits—and leave more water available for the lake. One prime candidate is residential landscape irrigation, which recent studies show can be done far more efficiently even without changing the landscapes [9,10]; another is agricultural irrigation, where Utah has a well-funded program for water optimization [11,12]. Utah has had water conservation goals since 2000, and a 2019 update revised them to capture new technologies, policies, and regionally specific opportunities [13]. Water conservation is the only action that can happen quickly, with relatively little cost, and accumulate gains over time.

Recognizing that aquatic ecosystems are water users as legitimate as any other, the Utah legislature passed a 2022 law that allows state agencies to acquire water rights for in-stream flows and similar purposes on sovereign lands [14]. This is a major legal step that enables Great Salt Lake and other water bodies to have water rights, temporary or permanent, without losing priority by being the last to receive an invitation. But it doesn't help to cut in line if there's not much on the table, hence the need for physical water conservation as well as a legal claim to the water. The Great Salt Lake Watershed Enhancement Trust, administered by nonprofit organizations, was set up to facilitate water donations from outside parties [15]. In 2023 in particular—with record snowpack and runoff—irrigators and others donated sizable amounts of water.

In 2022, researchers from Utah universities and leaders from state agencies formed the Great Salt Lake Strike Team to provide rapid, data-driven answers to key questions. They soon produced a report on policy options [16]. Among the top recommendations were committing conserved water to the lake, optimizing agricultural water use, adjusting municipal water pricing, and expanding water banking.

The legislature passed the Utah Water Banking Act in 2020, authorizing water markets to facilitate voluntary, temporary, win–win exchanges of water [17]. Pilot markets have been tested and strategies have been developed to scale them up. The dire condition of Great Salt Lake has boosted interest in water banking as a solution to the longstanding water right problem of forfeiture for nonuse, also known as "use it or lose it".

The cooperation the lake has inspired for conservation, research, and water banking also extends to media coverage. News agencies that compete to scoop each other on other stories have recognized the lake as a central issue around which they can organize quality journalism to make a positive impact. Accordingly, they are working together to engage the public through the Great Salt Lake Collaborative [18].

Perhaps as a result of so much media attention on the lake, the drought, and the record snowpack all in a single year, it seems that public interest in water issues is aroused now more than ever. Even though I have been working in the Utah water industry for over 10 years now, only in the past few months have I started receiving correspondence from strangers who have ideas to help Great Salt Lake. Some ideas are bright and some ideas are dull, but the point is that people are thinking about it now. The crisis has brought this strange, wonderful, salty lake into the foreground.

Until recently, Great Salt Lake had no central authority: different state agencies have jurisdiction over its land, water, and wildlife. In 2010, the Great Salt Lake Advisory Council, appointed by the governor, was formed, and since then, it has been overseeing lake research, management, and policy [19]. In 2023, a Great Salt Lake Commissioner was appointed by the governor as a central executive authority over the lake [20]. The position will provide much-needed leadership for the lake's recovery and ongoing health.

All these efforts will culminate in the Great Salt Lake Basin Integrated Plan, a collaborative effort that will "enhance existing water resource management tools from across the basin to complete a state-of-the-art water supply and demand study . . . to help to ensure a resilient water supply for Great Salt Lake and its watershed" [21]. The three-year project is underway now.

I can't possibly describe all the work that passionate people have put in to rescuing Great Salt Lake. Marcelle Shoop, the saline lakes program director for the National Audubon Society, said, "It's really unprecedented the amount of money and the amount of attention that is going toward the lake and saline lakes in the region" [22]. I have described just a few of the more visible projects here in the hope that other communities may learn from them.

To be clear, the progress has not been perfect. Complete solutions are uncertain, conserved water is very difficult to track, one-time water donations are too small, and the legislature failed to establish an official minimum healthy elevation for the lake. But the momentum is increasing.

## 4. The Asset

To support Utah communities, we divert water that would otherwise go to Great Salt Lake. Humans worldwide do the same for any type of water resource. Is that selfish? It certainly makes us part of the problem. But we should also be part of the solution.

While we can't wish away our past mistakes, we can acknowledge them and commit to a path that leads to health and stability, or even restoration, for the environment and for ourselves. As environmental advocate George Handley said, "Human design of the environment is inevitable, but it is not inevitably unethical or unsustainable" [23].

Facing an environmental crisis, we are compelled to rethink our relationship with Great Salt Lake, to treat it like the precious asset it is rather than a casual afterthought. It's a lesson we should have learned with the loss of the Aral Sea in Central Asia [24], Lake Urmia in Iran [25], and other saline lakes around the world [4,26]. But we are learning it now. In Utah, Great Salt Lake is becoming a political, technical, and economic priority.

As I ponder Great Salt Lake's past, present, and future, I wonder what else in our environmental stewardship is an afterthought.

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