# Utah’s Dust Hotspots:

# How Oxidated Dust from Great Salt Lake Threatens Air, Health, and Justice

In the 1930s, the United States faced one of its greatest environmental disasters—the Dust Bowl. Massive dust storms swept across the Great Plains, darkening skies, burying homes, and wreaking havoc on human health. Residents frequently experienced severe respiratory distress, developing conditions such as “dust pneumonia,” where fine particulate matter embedded deeply into lungs, causing inflammation and, in severe cases, death (Earle et al., 1935, p. 1381). The dust that swept across the Central Plains held microbial pathogens and transmitted measles, influenza, and the fungus Coccidioides immitis. This resulted in increased hospitalization and increased infant mortality (Alexander et al., 2018). Today, Utah faces its own version of this environmental tragedy, linked directly to the disappearance of North America’s largest saline lake, Great Salt Lake.

Utah's Great Salt Lake has shrunk dramatically by nearly 73% since its high in the1980s, largely driven by human water diversion practices and exacerbated by climate change (Thompson, 2024). As a terminal lake with no natural outlet, Great Salt Lake collects dissolved minerals, salts, pollutants, and sediments from rivers and streams. These materials settle into lakebed sediments, becoming concentrated over time. However, the grain size distribution and proportion of mineralogical sediments varies spatially across the lakebed (Zamora et al., 2024, p. 5). As the lake recedes, playas emerge—dry, flat expanses of exposed lakebed sediment, rich in accumulated minerals, salts, and contaminants. When left barren, these playas are highly susceptible to wind erosion, with loose sediments easily carried by wind to surrounding regions. This erosion process transforms playas into “dust hotspots”—areas generating notably high concentrations of airborne dust, significantly affecting air quality.

Dust hotspots form through several interrelated processes. Initially, drying lakebeds expose fine-grained sediment previously submerged underwater. These sediments, devoid of vegetation or crustal protection, quickly dry out, becoming vulnerable to wind erosion. Wind speeds across these playas often exceed the threshold required to lift and transport particles, creating frequent and intense dust storms. Though its salt crust can delay dust release, Great Salt Lake is still a particularly apt environment for dust hotspots to form; it has little vegetation to begin with as the lake's high salinity level only allows few organisms to thrive and is consistently shallow. The healthy average elevation of the lake is approximately 4,200 feet, making the lake 75 miles long by 35 miles wide with a maximum depth of 33 feet (Davis et al., 2022). Great Salt Lake changes in area significantly through the seasons and being a closed-basin lake occupying a very flat lakebed. Currently, the lake has an approximate maximum elevation of 4,191 feet (Utah DWR, 2025). In a public information series from Utah Geological Survey, the response of a frequently asked question about the size of Great Salt Lake includes, "For every one-foot increase of decrease in lake level, about 70 square miles of lakebed is inundated or exposed" (Davis et al., 2022). One of the most qualifying factors for hotspot likelihood is due to the lake's minimum overall depth. Loss of water from Great Salt Lake increasingly grows its drying lakebed with the trajectory to becoming dust hotspots.

Effective monitoring of dust hotspots involves detailed air-quality measurements, particularly of particulate matter (PM2.5 and PM10). These measurements are crucial for understanding exposure levels and guiding appropriate responses. In Utah, air-quality stations have increased significantly in recent years, specifically around Great Salt Lake, providing critical data on dust composition and concentration (Utah DEQ, 2025). A significant gap remains in understanding the full scope of the health impacts of particulate matter from these dust hotspots. The current data on the composition and frequency of particulate matter remains insufficient, limiting the ability of scientists to accurately predict the long-term health costs associated with exposure. However, as of June 2025, a $1 million investment was approved for the upcoming fiscal year, allowing the Utah Division of Air Quality to deploy a statewide network of monitors. Some of these monitors allow for real-time data measurement of PM2.5 and PM10 levels, others will be filter-based to collect dust samples for later testing and identification. This testing will be essential for distinguishing the places of origin of the dust and its exact composition. Pollutants that have been detected in Great Salt Lake sediment include arsenic, cadmium, mercury, nickel, chromium, lead, copper, selenium, organic contaminants, and cyanotoxins (Abbott et al., 2023). Most of the monitors will be placed along the Wasatch Front; others will be placed by known dust hotspots such as Farmington Bay and Bear River Bay (Hawkins, 2025). Utah governor Spencer J. Cox references decisions made by California to save their own shrinking lake, the Salton Sea, and hopes to learn from them, “We’re trying to understand better so that we can engineer the right types of solutions for the space” (Cox, 2025, 1:02).

The phenomenon of shrinking lakebeds becoming dust hotspots is not isolated. Globally, bodies of water such as the Aral Sea in Central Asia and California's Salton Sea and Owens Lake have similarly dried, becoming sources of toxic dust storms severely impacting public health (Shukman, 2004; Kornei, 2025). In the case of the Aral Sea, up to 80% of cancer victims in the region suffer from cancer of the esophagus. A study from the National Geographic Society examined DNA samples from the local population and found there to be widespread genetic damage and theorizes the dust blown from Aral's lakebed to be connected to the proportion of esophageal cancer (Shukman, 2004). Like the respiratory impacts of a drying Aral Sea, children living near California's Salton Sea suffer from asthma at nearly twice the national rate (Farzan et al., 2019). California's Owens Lake completely dried by 1926 after its water was diverted to the growing Los Angeles area. Since 2000, the state government has poured $2.5 billion into dust mitigation efforts. Dust storms from Owens Lake are the largest human-caused source of dust in the continent. This lake's dust has carcinogenic concentrations more than 100 times more than the EPA's healthy limits. These examples serve as warnings, especially that of Owens Lake, to some of the consequences that follow a dried lake. Great Salt Lake is fifteen times the size of Owens Lake and has 625 times the size of the surrounding population (Grow the Flow, n.d.).

The dust originating from Great Salt Lake has attracted scientific scrutiny due to its potentially toxic composition, exhibiting high oxidative potential. Recent studies show that inhaling dust from Great Salt Lake's playa may trigger inflammation, exacerbating respiratory illnesses, heart conditions, and other serious health problems (Cowley et al., 2025). Mental health is also affected, with research indicating increased depression rates in communities regularly exposed to high levels of dust (Neelam et al., 2025). This is not to mention the possibility of recreational activities being hindered by dust storms/high dust levels, indirectly having a similar effect on people that rely on such activities for their health.

These profound social and health impacts disproportionately burden communities of color, notably Hispanic and Pacific Islander populations. Research indicates specific vulnerability in these racial and ethnic minority communities, making the Great Salt Lake crisis a pressing environmental justice issue. People of color in the United States are disproportionately impacted by deleterious environment health condition compared to their White and higher socioeconomic standing counterparts (Grineski et al., 2024). Based on contemporary residential patterns of the Salt Lake Valley, minorities are disproportionately exposed to waste sites and dumping, industrial pollution, and various sources of air pollution, locations of which are typically located to the West of the Salt Lake valley and closer to the lake. Additionally, Utah's state prison is located five miles west of the international airport SLC and is considerably closer to the drying southern arm of the lake compared to other valley residents. Since inmates in the facility are not at liberty to choose their living situations or facilitate their own relocation, inmates and correctional officers are exposed to pollutants to the degree that the previously discussed communities are. To an added degree, the mosquito population skyrockets near Great Salt Lake, especially in summer months, as the shallow standing water of the lake and the Jordan River creates ideal breeding grounds (Mosquito Forecast, n.d.). Mosquitos in Utah have been found to sometimes carry the West Nile Virus, and previous mosquito testing within the prison area has detected the virus in the mosquitos (Utah DOC, 2023). Race and ethnicity, socio-economic standing, and correctional facility minorities located near Great Salt Lake show a disparity that highlights broader ethical questions: What responsibilities do we hold toward marginalized communities disproportionately affected by ecological crises, such as the shrinking lake, and how should society ensure fair and equitable protection?

In terms of health, the stability and well-being of Great Salt Lake's ecosystem is dire. Great Salt Lake is renowned for its unique biodiversity, supporting millions of migratory birds, brine shrimp, and a complex regional ecosystem (Abbott et al., 2023). The lake is an essential link in the Pacific Flyway between North and South America. Millions of birds of hundreds of species rely on the lake to rest, eat and breed during times of migration each year (Reading the West, 2024). As Great Salt Lake shrinks, its salinity levels grow, currently at approximately 19% salinity. This level makes it not possible for brine flies and brine shrimp to maintain their populations. These invertebrates are the only creatures able to thrive within the lake, essential for feeding migratory birds and supporting industries on the lake. Great Salt Lake supports an ecosystem for millions, protecting air quality, removing water pollution, and moderating local weather. The ongoing desiccation threatens wildlife and exacerbates climate change. Exposed lakebed sediments emit substantial amounts of greenhouse gases, contributing directly to global warming (Cobo et al., 2024). Additionally, dust deposits on snowpack darken snow and accelerate melting, endangering essential water supplies across the region.

The shrinking of Great Salt Lake also represents a looming economic crisis. As lake levels drop and dust storms become more frequent, the economic effects will ripple further. Tourism revenues, historically supported by birdwatching, boating, duck hunting, and sightseeing are declining (Reading the West, 2024). Growing levels of salinity that endanger a suitable habitat for brine shrimp has a negative effect on the brine shrimp harvest industry that typically harvests 30 million pounds of raw brine shrimp from the lake a year. Depending on the quality and quantity of the harvest, the industry can be valued up to $67 million (May, 2023). The Utah Division of Wildlife Resources regulates the harvest and ensures a viable shrimp population, but as the threshold of harvesting declines, so will the industry's revenue. Agricultural harvests face heightened vulnerability from diminished snowpack accelerated by dust, reducing irrigation water availability and harming crop yields (Utah DWR, n.d.). Approximately 63% of water diverted from the lake goes towards agricultural purposes (Utah

State University, n.d.). Agriculture in the Great Salt Lake Basin contributes billions of dollars to the economy, an essential piece of Utah relying on another, endangered piece of Utah. Thousands of jobs that depend on the health of Great Salt Lake could be lost, specifically in the mineral extraction industry. Great Salt Lake provides the country nearly all of its magnesium and the world with about 14% of its supply, a loss that could cost more than 5,300 jobs and $1.3 billion annually. Other harvested compounds include mineral sulfate of potash and lithium, both of which are big players in Utah's economy (Benincasa, 2023).

Despite increased monitoring and growing scientific consensus about the risks, state-level responses have been criticized as insufficient. Although Utah has pledged nearly $1 billion in investments aimed at addressing the crisis, substantial and enforceable policy measures have lagged far behind symbolic commitments. Water-use laws remain primarily advisory rather than mandatory, limiting their effectiveness in reversing lake shrinkage or curbing dust emission (Utah DEQ, 2025). There are several volunteer organizations supporting the rehabilitation of Great Salt Lake like Grow the Flow and Friends of Great Salt Lake, that fundraise, organize events, and lobby at the Utah Capitol to grow awareness for the lake. Multiple teams of subject matter experts have been assembled such as the Great Salt Lake Strike Team to conduct and synthesize research to present to the legislature with hopes of informing their priorities and decisions on the topic of Great Salt Lake and the consequences of its disappearance. News outlets have likely provided the most awareness to the issue, as articles and broadcasts are continuing to be made on the subject. This is likely how most of the people concerned about the lake came to be worried about the oxidative potential of the dust from its playa. Alarming headlines are often, and effectively, used to capture the public's attention such as an article from

*Smithsonian Magazine* titled "Drying Great Salt Lake Could Expose Millions to Toxic Arsenic-Laced Dust." While some may write things like this off and consider it to be public fearmongering, the topic of a dying Great Salt Lake has shown to truly be as urgent and worrisome as some headlines suggest.

To address this multifaceted crisis, comprehensive and integrated responses are essential. Effective strategies include enforcing strict water-level regulations, employing advanced dust-suppression methods such as establishing saline crusts or promoting vegetation growth on exposed playas, and significantly increasing resources for community health interventions. A comprehensive outline of approaches to solutions is detailed in the Great Salt Lake Basin Integrated Plan. Completed in late 2024, the plan synthesizes information and data across the watershed related to water quantity and quality, water use, water demand, and water diversions. With the objective to ensure an ongoing and resilient water supply within the Great Salt Lake Basin, the integrated plan collaboratively explores conservation options and assess the costs and benefits of meeting different water resource related goals (Utah DWR, n.d.). To the benefit of the lake, there are thousands of individuals who care and actively engage in spreading awareness, conducting research, or volunteering for conservation efforts. It is not an issue that has gone unnoticed, but it is an issue that demands more attention and action.

Restoring Great Salt Lake and protecting its surrounding communities is not merely an ecological imperative but a profound moral responsibility. Successful action in Utah could provide a global model, aiding efforts in other environmentally vulnerable areas. Conversely, continued inaction risks irreversible ecological and social consequences, challenging our collective capacity to act responsibly and sustainably. The Dust Bowl from nearly a century ago disproportionately affected minorities unable to adapt and protect themselves, but it was not just an issue for the marginalized. The Dust Bowl had profound negative effects on millions of people and consequences that followed for years, and even lifetimes afterwards. A similar fate awaits residents of Great Salt Lake Valley and beyond if marathon-level effort isn't made in the name of rehabilitation and conservation for Great Salt Lake. Ultimately, the fate of the Great Salt Lake is a test of our commitment to justice and environmental stewardship. As one local advocate succinctly stated, "If we save the lake, we save ourselves" (Abbott et al., 2023).

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