

# Mapping Lithium Extraction in the Western United States

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Image courtesy of [KUNR](#).

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# 1. Driving Question and Context



Image courtesy of [San Diego Climate Network](#). Banner reads “Lithium for today, hunger for tomorrow.”

# Driving Question

What are the (potential) direct ramifications of lithium extraction in the Western United States, and how can these effects be mitigated or avoided?

# Why Lithium Matters



Lithium is primarily used in rechargeable batteries.

In the past, lithium has primarily been used in ceramics and glass, along with some other minor usage in other industries. Only around 29-35% was used in batteries.

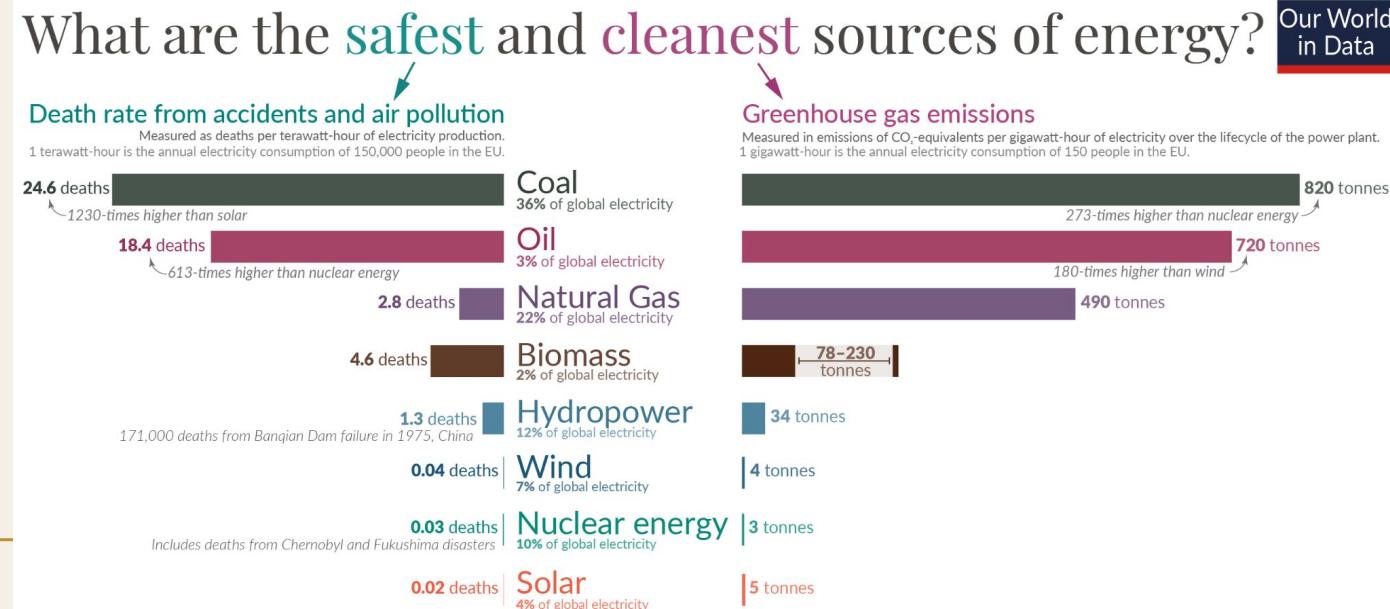
However, electric vehicle (EV) production has skyrocketed. **Lithium batteries are critical for EVs**, so the demand for lithium has increased, and the portion of lithium diverted for batteries has increased to as high as 74%.

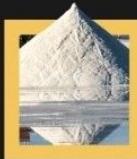
# Where Lithium Matters (Clean Renewable Energy (Wind/Solar))

Wind and solar energy are some of the safest and cleanest energy sources – but they are also very temperamental. Obviously, solar only supplies energy during the day, and wind only supplies energy when wind is blowing.

This issue would make these energy sources unusable. Lithium batteries save the day: solar and wind energy can be used to charge these batteries, allowing customers to receive energy during downtime.

The end result is that  
**lithium is mandatory**  
for most green energy  
initiatives.

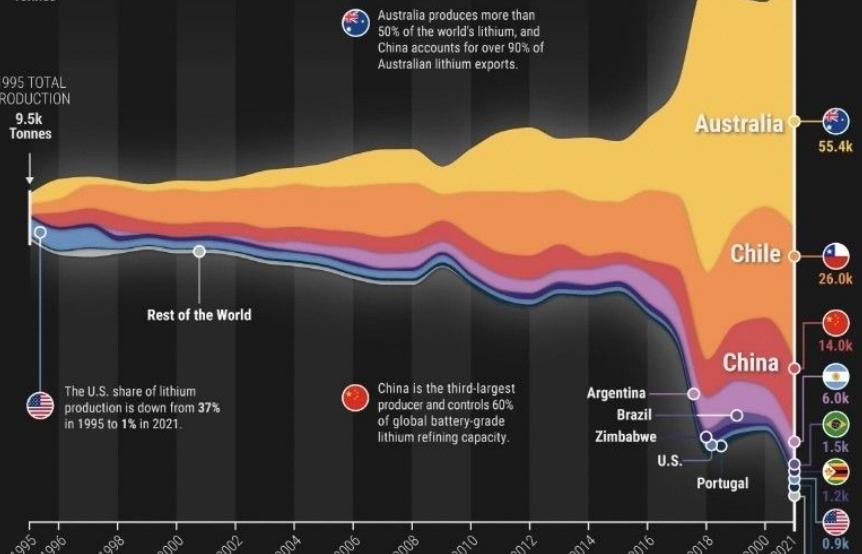




## 25 YEARS OF LITHIUM PRODUCTION

Global lithium production has quadrupled since 2010.  
Which countries produce the most lithium,  
and how have they changed over time?

Mine Production of Lithium 1995-2021  
Tonnes



Lithium Consumption  
by End-use 2021



Source: BP Statistical Review of World Energy 2022, Statista

ELEMENTS.VISUALCAPITALIST.COM

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# Where does lithium come from?

## Main Producers: Australia, South America, China

"Roughly 90% of lithium extraction [takes] place in Australia, Chile and China, and almost 100% of its processing [occurs] in China, Chile and Argentina". "Most other countries in the world are completely dependent on lithium imports".

However, huge untapped lithium reserves exist worldwide, mostly in the Americas.

Notably, 12 million tons of lithium resources have been identified in the US (currently, we produce around 1 thousand tons per year).

UC San Diego

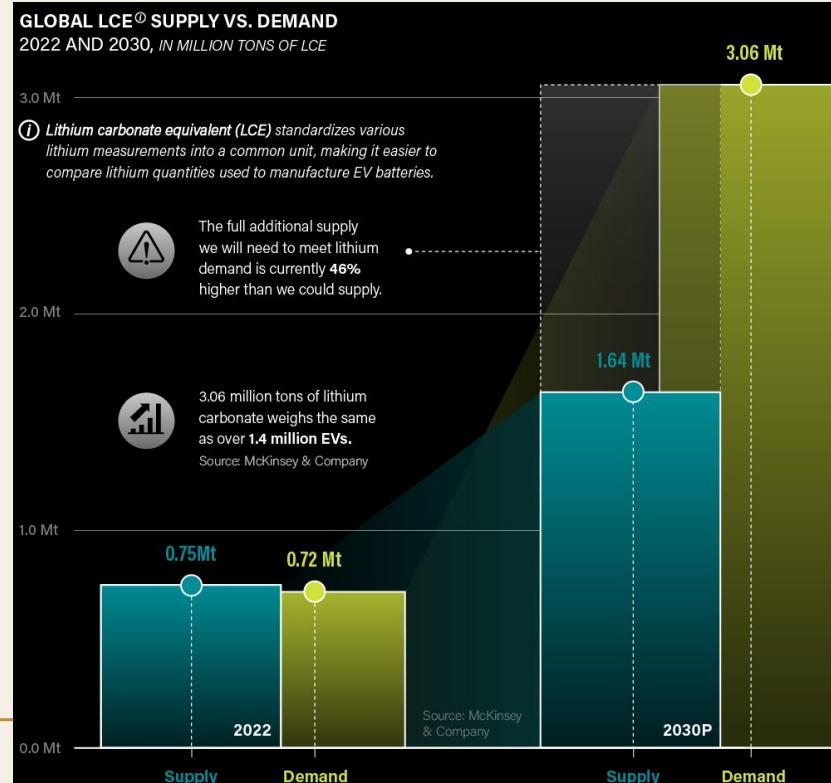
# Do we have enough lithium?

**The answer is a resounding No.**

It is expected that, by 2030, we will have sold 350 million EVs (significant even compared to the 1.47 billion vehicles, total, that are in use today). Because of this, lithium demand is expected to increase fourfold by 2030, and continue to skyrocket for decades after.

Today, we barely produce enough lithium to meet the demand. Current technologies and current growth rates show that production will approximately double by 2030 – only half of what we will need.

The CEO of a lithium extraction company put it well: "If we don't unlock lithium supplies... all the EV targets announced by auto makers are dead-on-arrival."



## 2. Current Issues

Image courtesy of [Las Vegas Review-Journal](#).

# The Big Problem

**Lithium extraction by conventional means either disrupts habitats in salt flats and lakes, or creates intensive mining operations.**

The aforementioned mining operations tend to be in the desert near the West Coast – where they would destroy or disrupt rare natural habitats (like sagebrush) and greatly impact indigenous people in the area (if the operations wouldn't be on their land outright). Also, existing technologies are very wasteful, consuming a lot of water either directly or through pollution of groundwater.

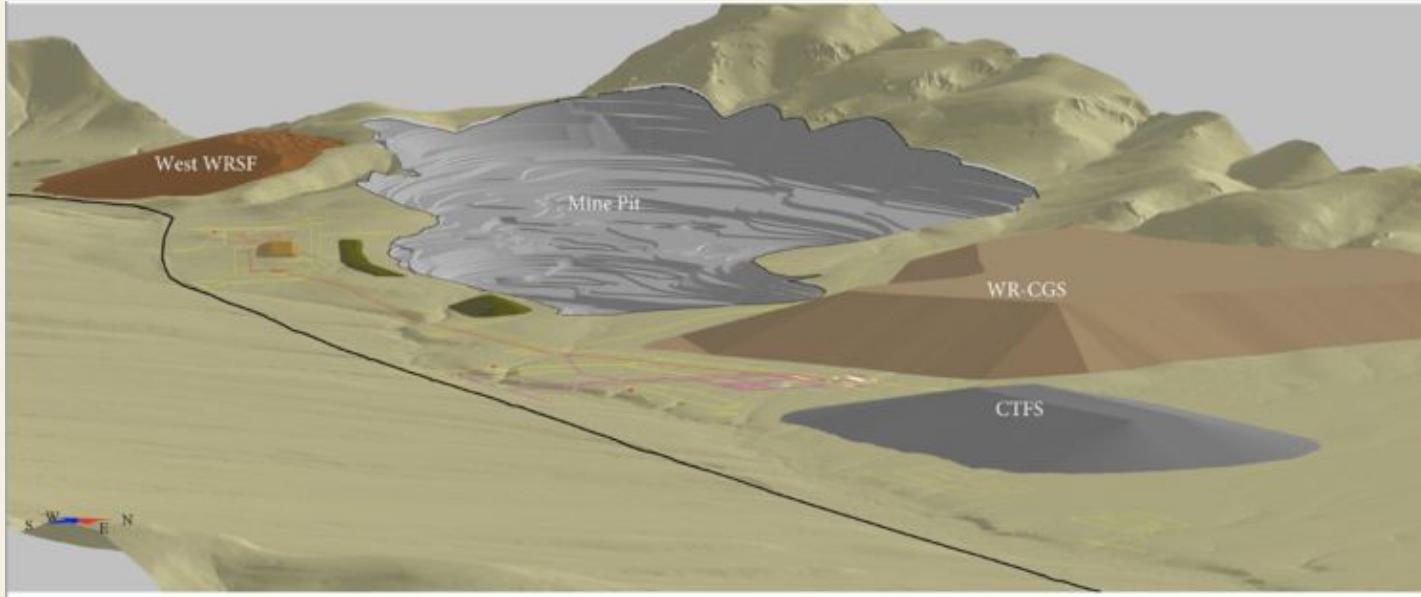
(Operations away from the West Coast tend to suffer as well – for example a proposal in Maine that was shut down because it would infringe on indigenous territory.)

# The Big Problem

So, although there is a huge new market, the many companies trying to step up lithium production in the US can't do so without violating conservation regulations and destroying the environment.

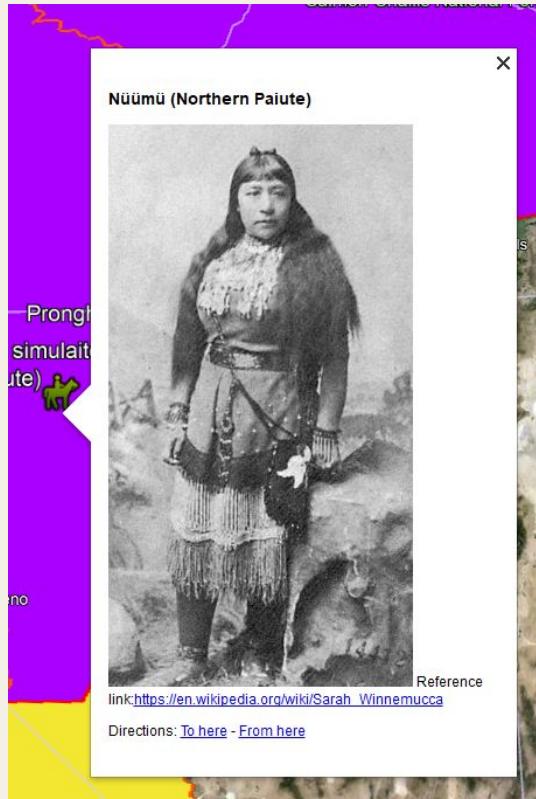
But without new lithium, it will be impossible to shift away from fossil fuels.

# Thacker Pass

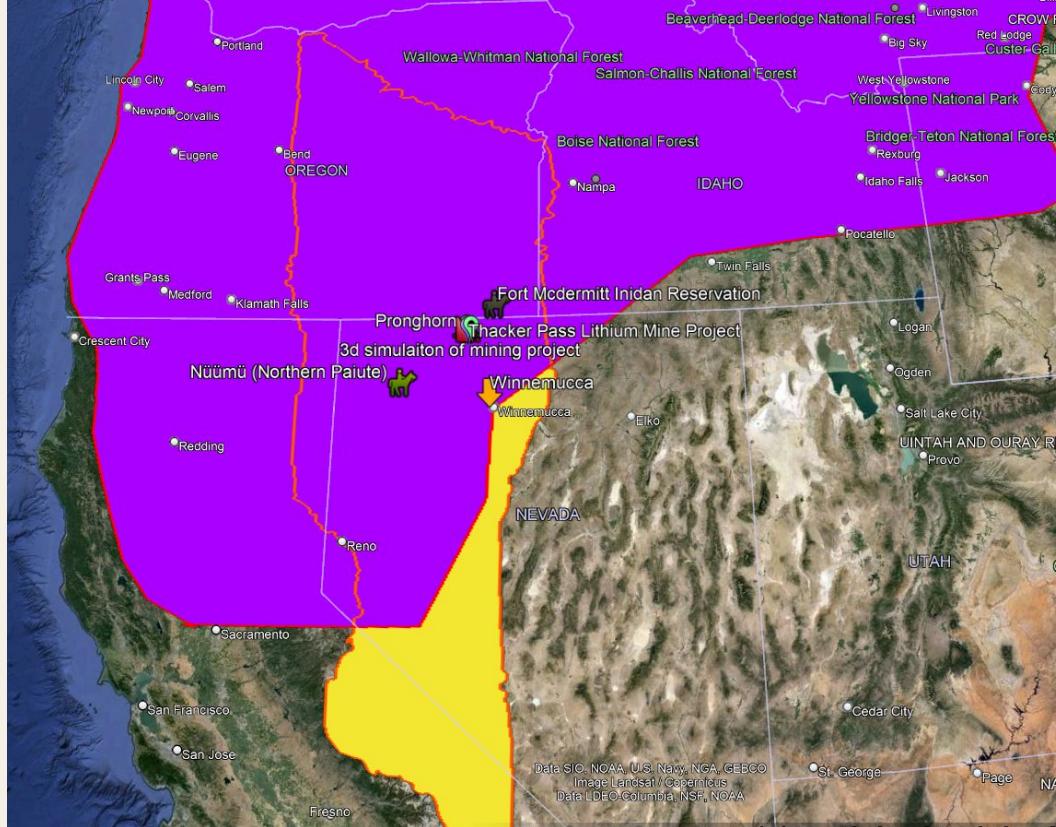


3D simulation of Thacker pass Mine Project

# INDIGENOUS PEOPLE



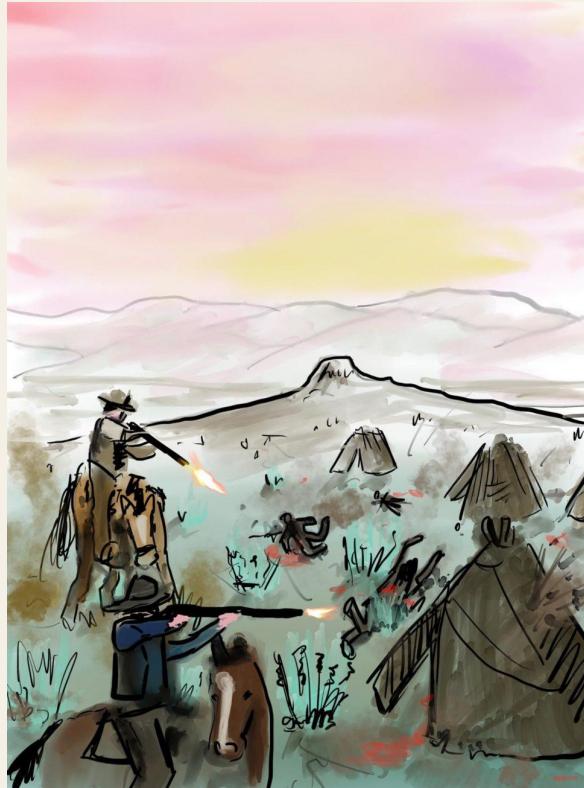
# INDIGENOUS TERRITORIES



# 1865 MASSACRE

US Federal Soldiers murdered  
Paiute People

Lithium mine project is a new  
version of genocide.

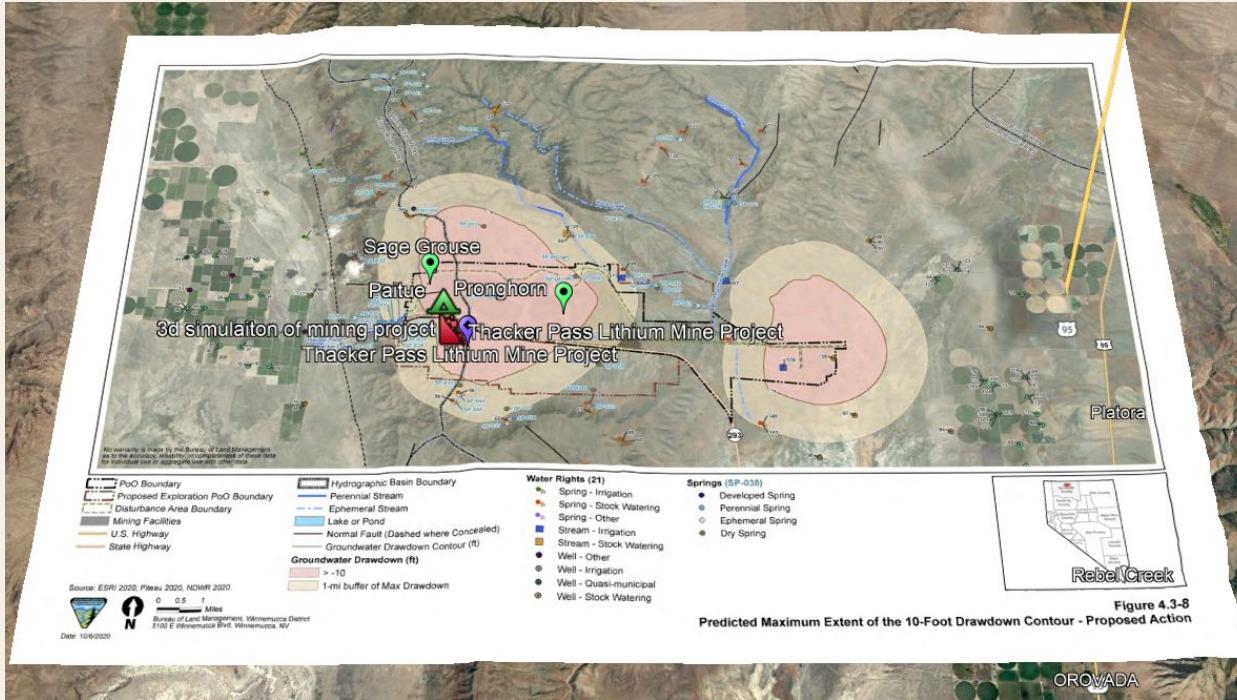


# INDIGENOUS PEOPLE PROTEST

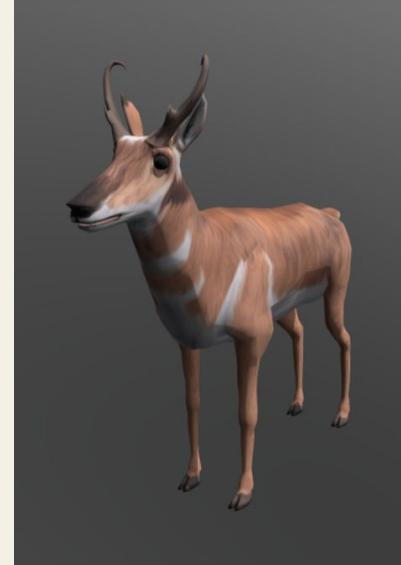
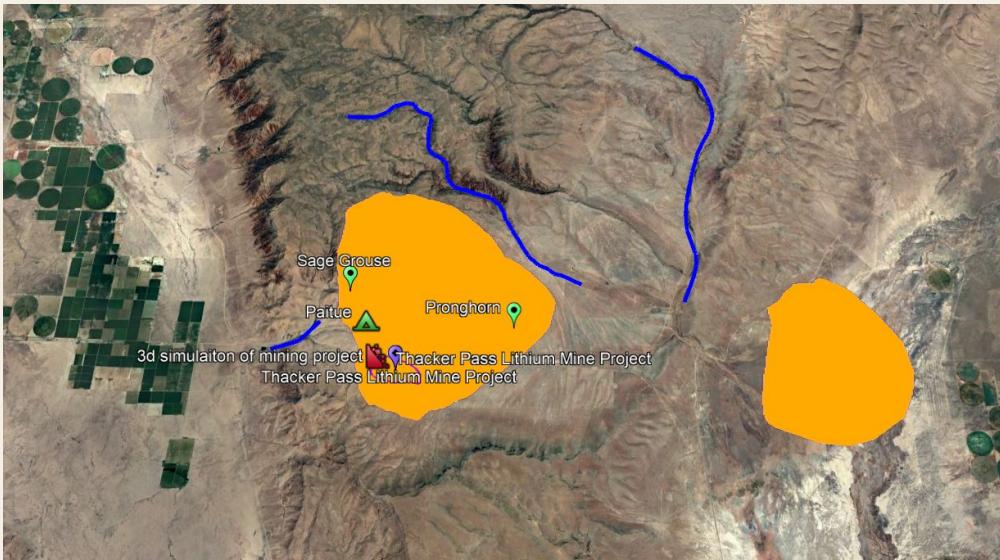


“So, if any tribes or anybody wanted to mitigate that destruction, what are we going to mitigate?” —Michon Eben, tribal historic preservation officer

# Water Contamination



# Water Contamination



Pronghorn



Sage Grouse

# Silver Peak – Introduction

- Only operational lithium extraction site in the U.S.
- Site under near continuous operation since the 1960s.
- Produces ~5,000 metric tons of lithium per year (as of 2021).
  - Plans to double production by 2025.



Image courtesy of [Green Car Congress](#).

# Silver Peak – Water Issues

- ~8,000 acre-feet per annum of water extracted from Silver Peak in 2017 (~3 billion gallons).
- Basin reserves will be ~200% appropriated by 2025.
- Brine extraction also depletes nearby freshwater reserves.

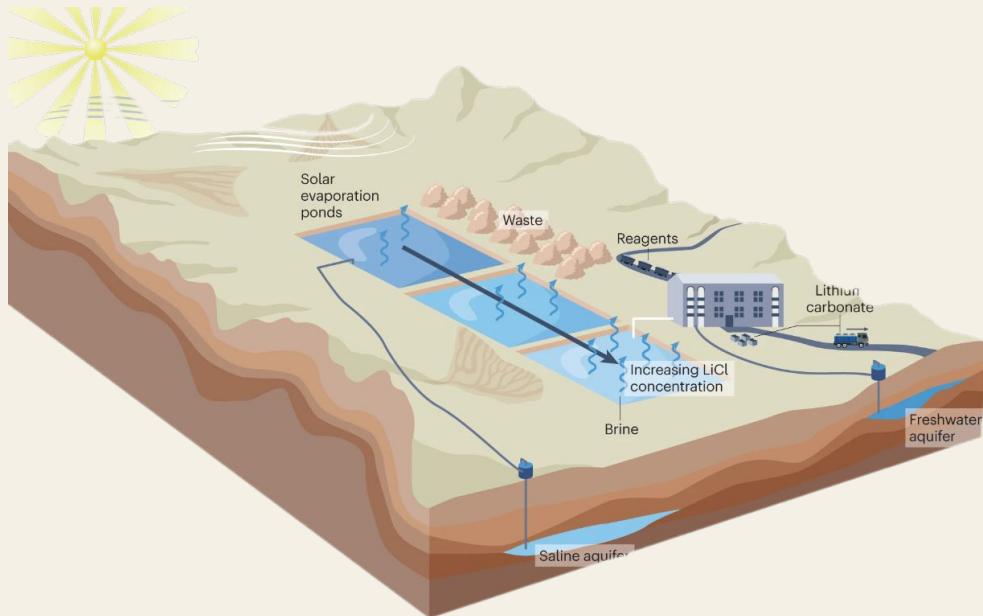


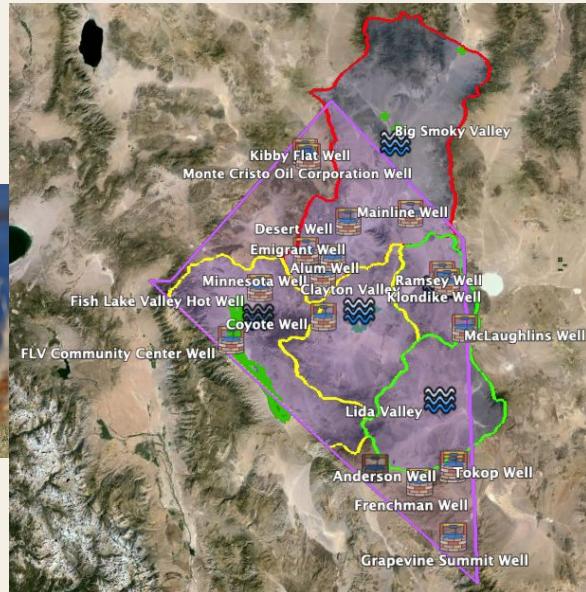
Image courtesy of [Nature](#).

# Silver Peak – Prevailing Issues

- Sustained extraction at Silver Peak threatens...
  - Water access for municipal and agricultural use (extreme risk).
  - Migratory waterfowl populations.



Image courtesy of [NDOW](#).



# Silver Peak – Intersecting Issues

- Silver Peak lithium extraction occurs on unceded Indigenous land.
- Operates adjacent to highly disadvantaged communities.
- Albemarle (operator) labor force is not unionized.



Image courtesy of [Goldfield Historical Society](#) on Facebook.



# Great Salt Lake - Introduction

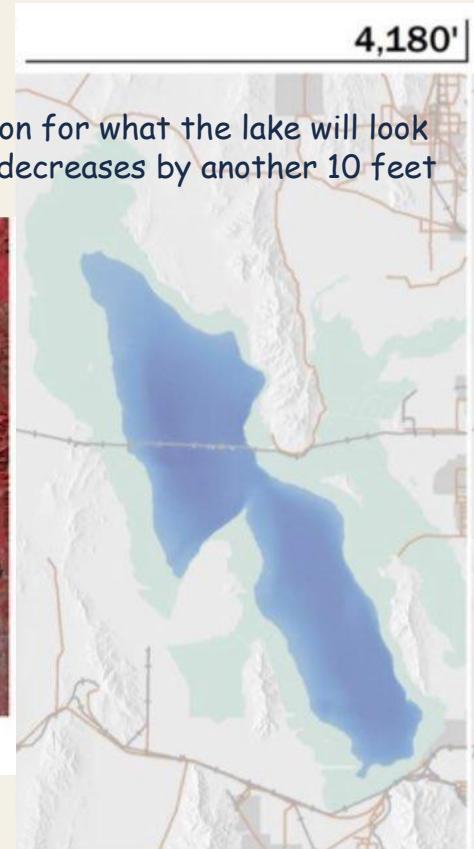
The Great Salt Lake in Utah has been shrinking – it is now at its lowest volume ever recorded

The lake's receding waters leave behind a so-called "toxic dust bowl" that is greatly harmful to both the local ecosystem and the residents of the nearby areas.

Lithium extraction could be the straw that breaks the camel's back.



Right: a projection for what the lake will look like if its depth decreases by another 10 feet



# Lake Overview

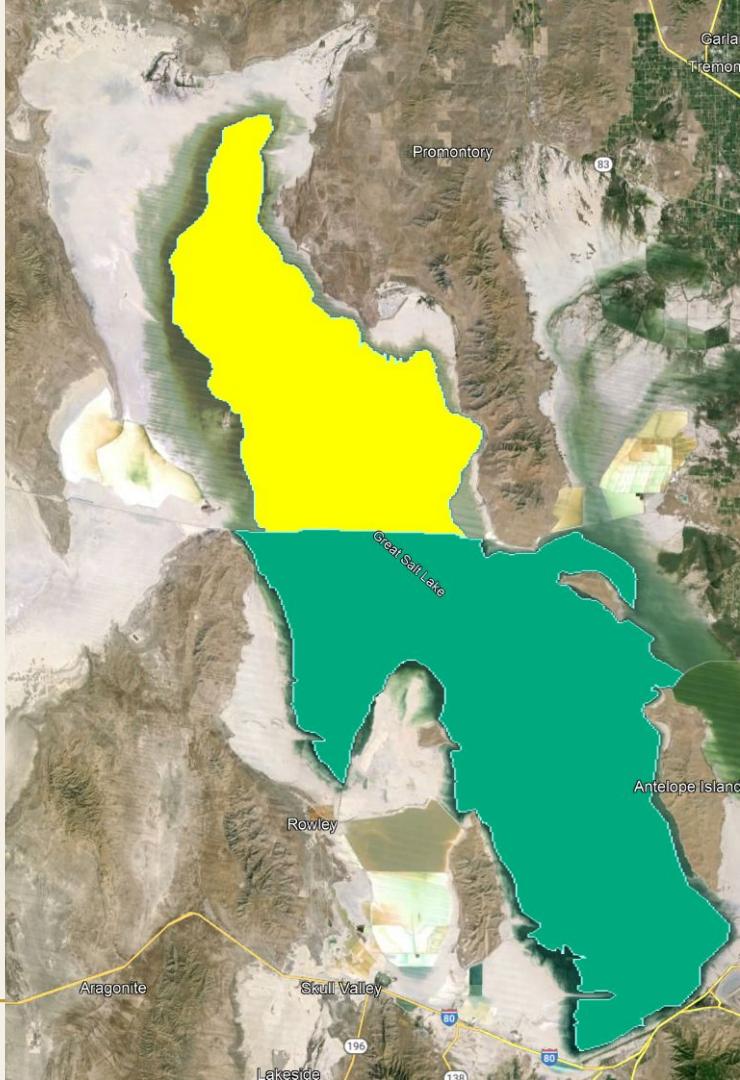
The Great Salt Lake is a large saltwater lake in Utah, that is four times as salty as the ocean.

It "is a **keystone ecosystem in the Western Hemisphere**", home to a large variety of birds – 10 million of them, and marine life. Brine shrimp from the lake feed many commercially grown farm shrimp and fish, and along with fertilizer from the lake, **feed millions worldwide**.



A composite image showing a landscape view of the Great Salt Lake on the left and key facts about the lake on the right. The landscape shows the shallow, light blue water and distant mountains under a clear sky. The facts section includes:

- TYPE:** SALTWATER LAKE
- SURFACE AREA:** 950 SQ MI
- COMMON WILDLIFE IN AND AROUND THE LAKE:**
  - STILTS
  - PLOVERS
  - SANDPIPER
  - DUCKS
- MAX DEPTH:** 33 FT AVERAGE
- MAX ELEVATION:** 4,190.5 FEET



# The Problem

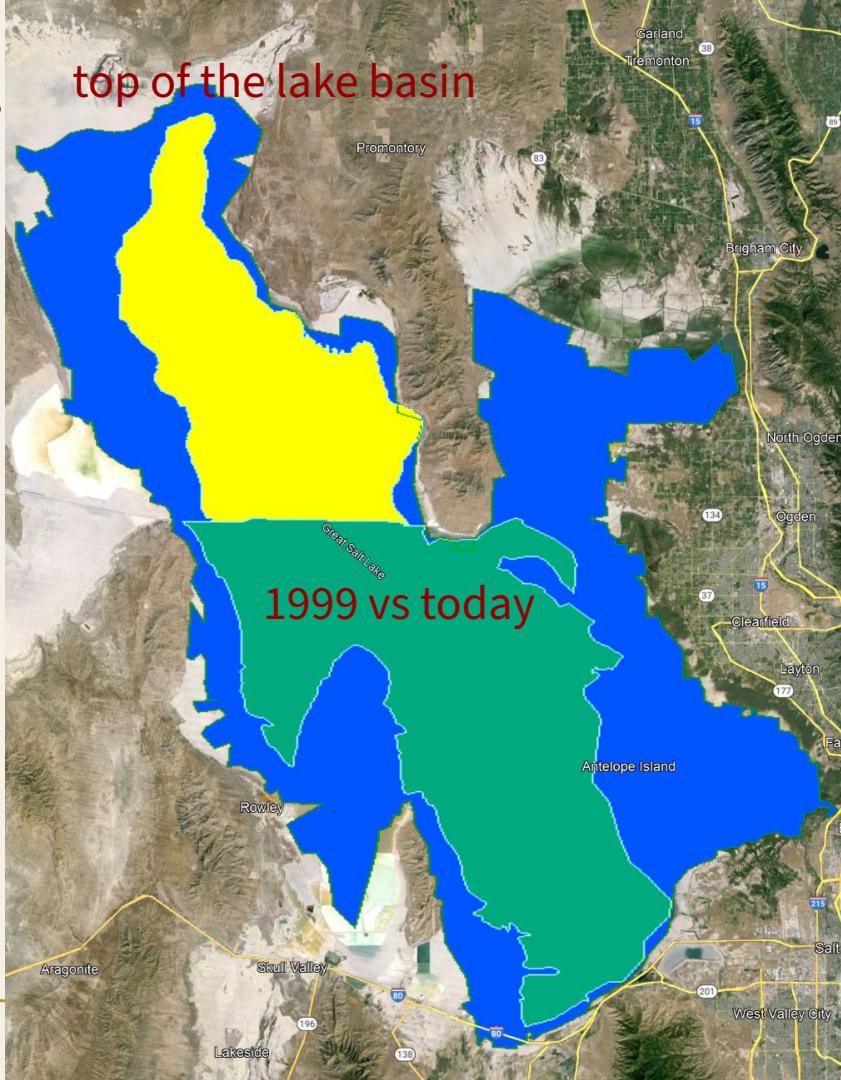
**The GSL has lost 73% of its water and 60% of its area.**

The loss of the lake promises for more than just the destruction of the entire lake ecosystem and the vast majority of Utah's wetlands.

Once the lake has turned into a dry bed, the toxic dust that the lake suppresses will be unchecked.

Something similar occurred in the 20s in Owens Valley, near LA. The city of LA diverted all the water away from the lake, causing it to dry up. For nearly a century after, the lake became a massive dust pollution hazard, until the 2010s, when LA spent 2.5 billion dollars to mitigate the dust storm.

The trouble LA had with a lake a twelfth the size of the GSL foreshadows the depth of the catastrophe that would unfold if Utah were to let the lake evaporate. The entire basin and its surrounding areas would become a permanent toxic dust cloud.



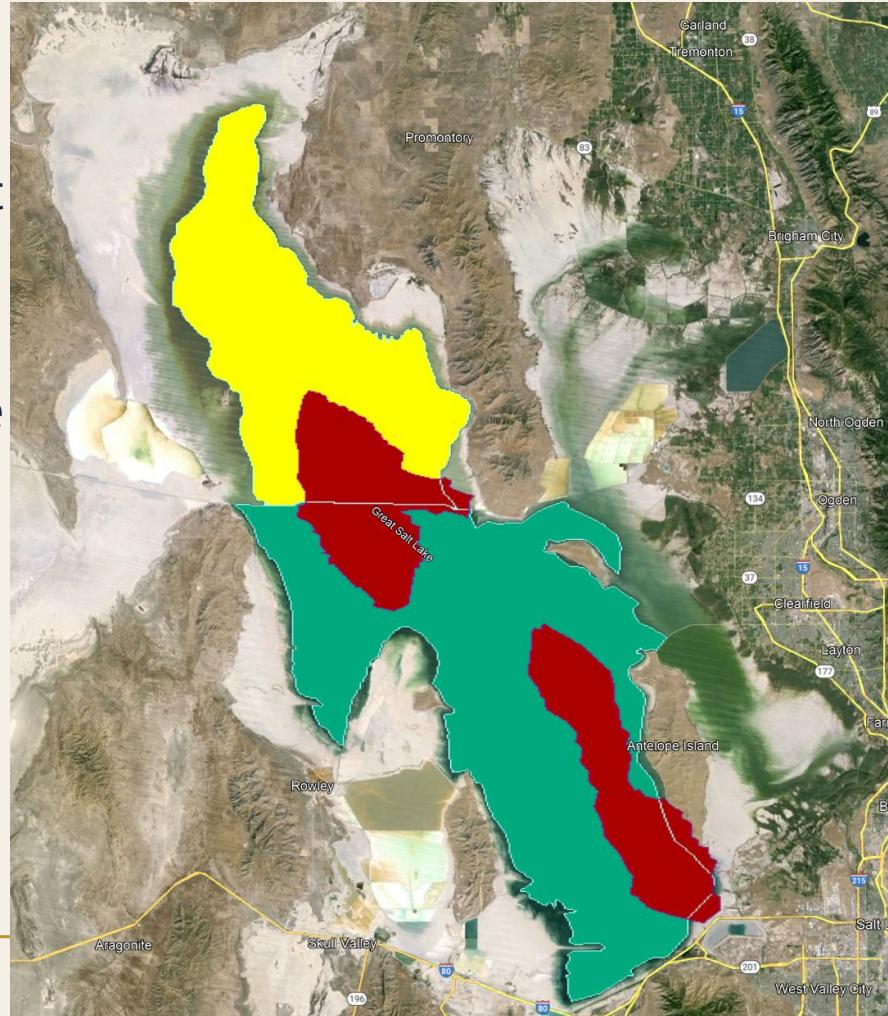
# The Cause

**Efforts to conserve water and refill the lake are only doing a tenth of what is needed**

175 years ago, the first of the settlements that would later become Utah started to appear around the lake.

Since then, human-related water usages have caused the lake to shrink by as much as 11 feet in total (at its low point in 2016). The drought doesn't help.

It is expected that, to save the lake, water usage in the salt lake watershed must decrease by anywhere from a third to a half.



# Where Lithium Comes in – I

**As of 2024, the future of the lake is looking brighter – but increased water usage from lithium could be devastating**

Closed-basin brines account for 66% of the world's lithium supply.

Currently, the main way of lithium extraction from salt water sources is by brine evaporation.

This basically entails evaporating a bunch of salt water, leaving behind whatever minerals were in that water.

As one might expect, this is extremely wasteful from a water perspective. Additionally, this is inefficient and only captures a small portion of the lithium in the brine.

Currently, mineral extraction only consumes 8% of the GSL's water (compared to 30% or more from agriculture, the highest user)

## Where Lithium Comes in – II

The Great Salt lake contains at least 2.3 million tons of lithium (over a third of what has been discovered in all of China). Notably, its water has lithium concentrations 20 times lower than the already inefficient South American production areas. Extracting significant lithium from the GSL would destroy it.

Brine extraction technology is completely untenable, however. In the salt flats of Salar de Atacama, in Chile, a whopping 65% of the local water supply is used for lithium extraction. And although it is not as bad as mining, brine extraction can still cause harmful byproducts: "[Research in Nevada found impacts on fish as far as 150 miles downstream from a lithium processing operation.](#)"

New technologies might hold a solution. The company Lilac Solutions, whose techniques were created with the GSL in mind, claims it has a way to extract lithium from water without evaporating anything at all. It would consume 225k acre-feet per year – but would return it all to the lake without so much as changing its chemical composition. Lilac claims it would be able to recover 65% of the lithium from the lake, wasting 20-50 times less lithium than in current South American operations.

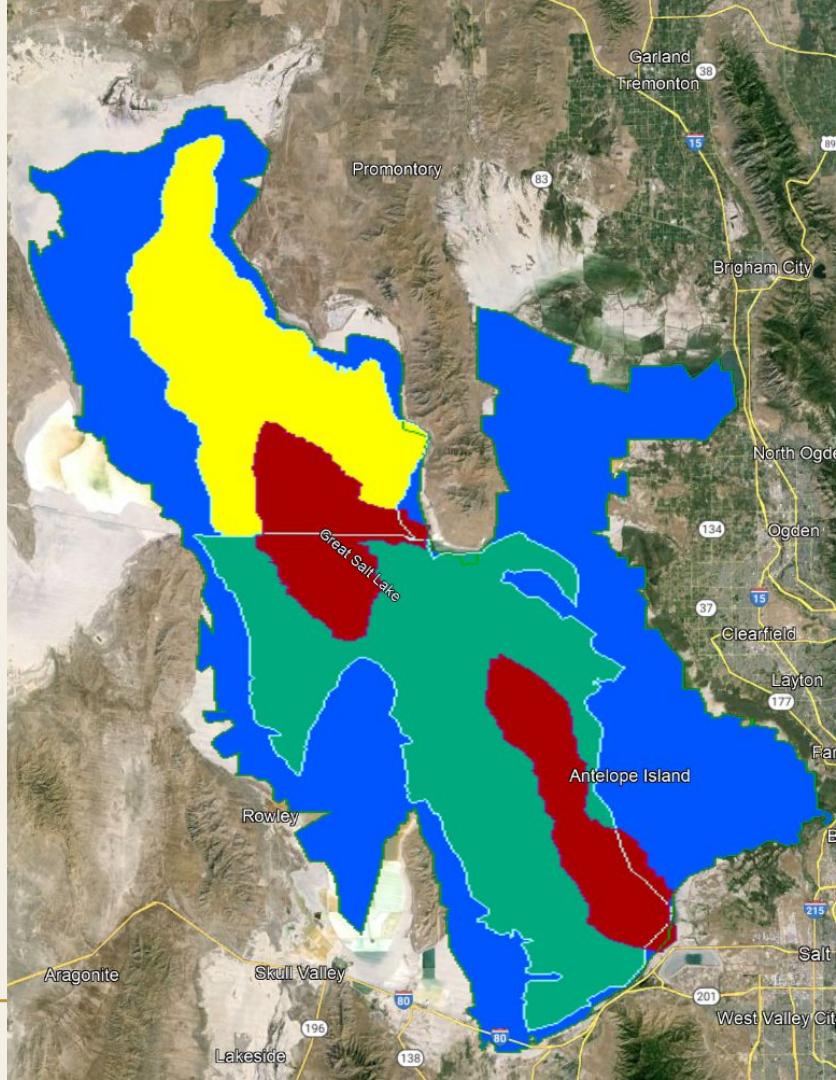
**However, these technologies are still far away from full deployment.**

# The Solution

The solution is pretty simple: excess water usage around the Great Salt Lake can't be allowed, so wasteful lithium brine extraction can't be allowed to rush ahead.

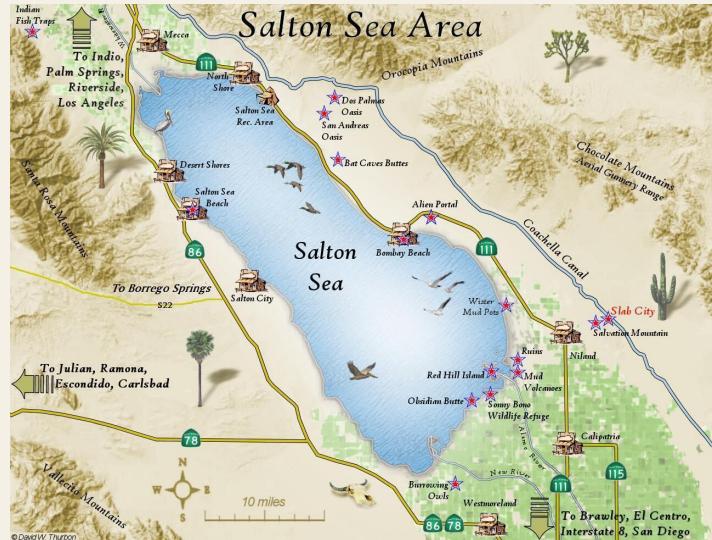
Utah lawmakers already are on this task. They blocked a recent attempt by Compass Minerals to extract lithium. The company currently extracts minerals from the lake for fertilizers, by evaporating only around 55,000 acre-feet per year.

However, the lithium extraction plans might consume as much as 428,000 acre-feet per year (140 billion gallons) – in a lake that is being destroyed by a deficit of 1.2 million acre feet per year. Compass backed down, but this highlights the tradeoffs between green energy lithium and other environmental concerns.



# Salton Sea - Introduction

- The Salton Sea is believed to have the highest concentration of lithium, contained in geothermal brines, in the world.
- Salton Sea has the potential to produce an estimated 375 million lithium batteries for electric vehicles — more than the total number of vehicles currently on U.S. roads.
- Disadvantaged communities living near the sea already suffer disproportionately from air pollution and other environmental health hazards. They are experiencing textbook environmental racism with pollution and water quality issues.



# Air Quality Issues

*salton sea*

- The construction and operation of lithium and geothermal facilities in Imperial Valley may impact already damaged air quality through emissions of particulate matter, greenhouse gases, and hydrogen chloride.
- As the sea recedes, more toxic dust is being released and damaging the lungs of indigenous people nearby.



# Scarce Fresh Water

*salton sea*

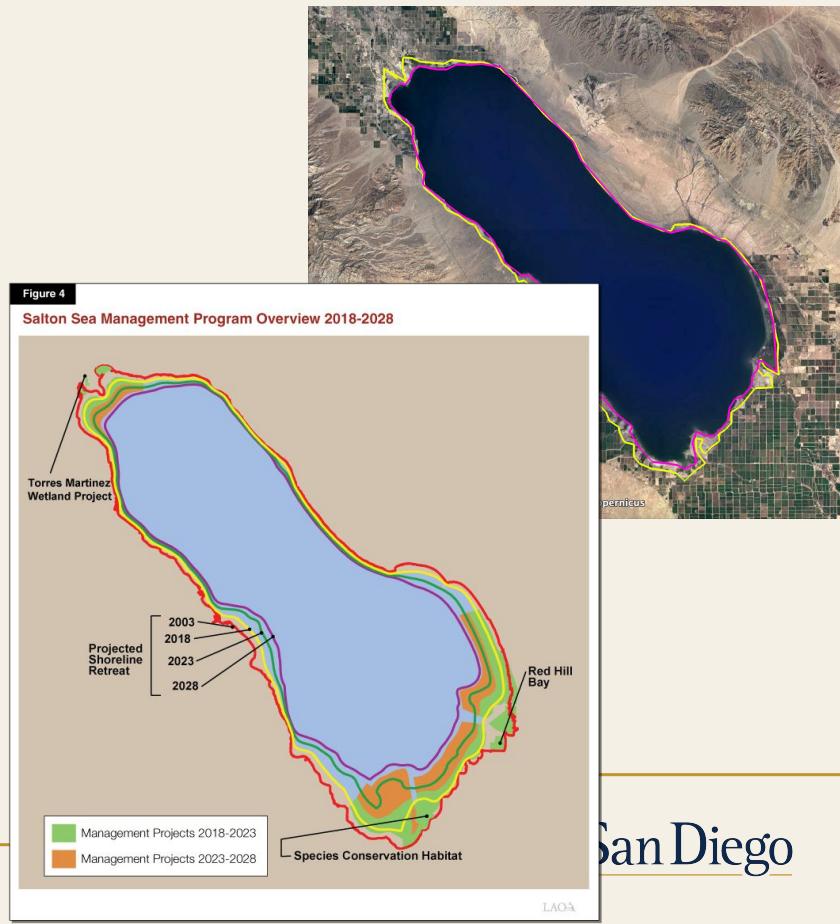
- Lithium extraction projects will consume Colorado River water for cooling and processing. If the lithium industry expands to its planned capacity, it will exceed the freshwater currently allocated by the Imperial Irrigation District for non-agricultural use.
- Evaporating water levels and warming of water temperatures.
- Indigenous tribes and environmental orgs. are against the Thacker Pass and Rhyolite Ridge lithium mine because that region is already suffering a drought and it could deplete clean water resources.



## **Hazardous Waste and Materials and Salton Sea degradation**

salton sea

- Direct lithium extraction process causes hazardous byproducts that are harmful to humans. Starting off with arsenic lead and cadmium, that will need to be disposed of safely.
  - The Salton Sea is rapidly shrinking, emitting harmful dust contaminated by pesticides and fertilizers. If water is redirected from agriculture to lithium production, the Sea will shrink quicker and worsen the air quality issue and compromising restoration efforts.
  - *... solution under mitigation slides*



**San Diego**



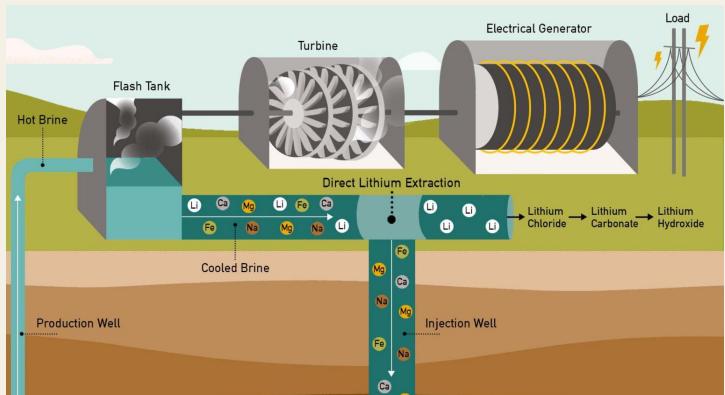
# 3. Mitigation Measures

Image courtesy of [Inside Climate News](#).

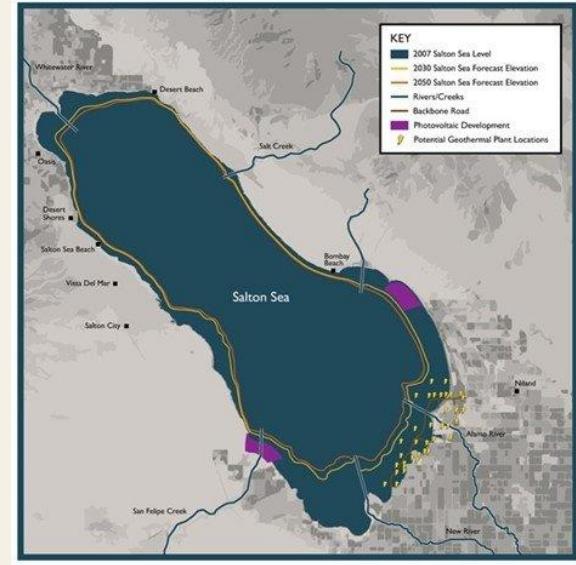
# Mitigation methods - Salton Sea

## New technologies

- Salton Sea lithium can be extracted and could give the U.S. the ability to produce domestically sourced lithium and gain dependence nationally for the metal instead of on rival countries for a supply.



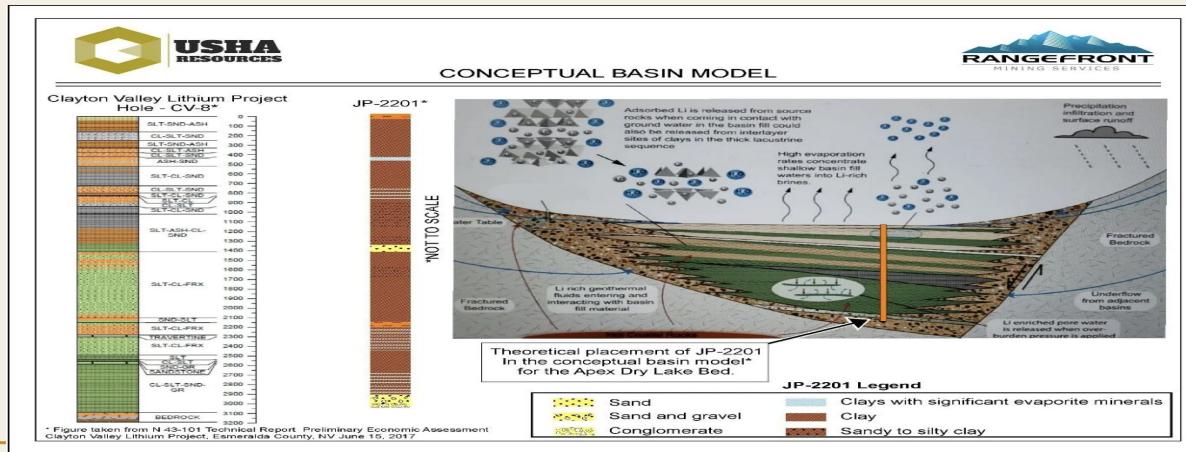
- ★ Geothermal power plants, like near the Salton Sea, have a small physical footprint by capturing lithium from geothermal fluid, which is less impactful on the immediate environment.
- ★ (For example, researchers found that if Germany built just 33 geothermal plants, it could supply 70% of the EU's lithium battery needs.)



# Jackpot Lake Nevada Lithium Project

## Water rights

This diagram shows the mining process and related materials at the Jackpot Lake, the purification of lithium brine requires large amounts of water. Due to Nevada's unique location, clayton valley and silver peak also need large amounts of water, which is creating a race for water in Nevada. This has even led to a law battle , a factor that has further shortened the company's rate of expansion



# Lithium Recycling

**Benefit : low-cost, environmental friendly, sustainable**

ABTC has achieved a landmark technological innovation that enables the recovery of lithium resources in an advanced manner with high efficiency, low cost and low environmental pollution, as well as the further refining of lithium intermediates into other energy sources such as nickel and cobalt.



# 4. Discussion and Conclusion

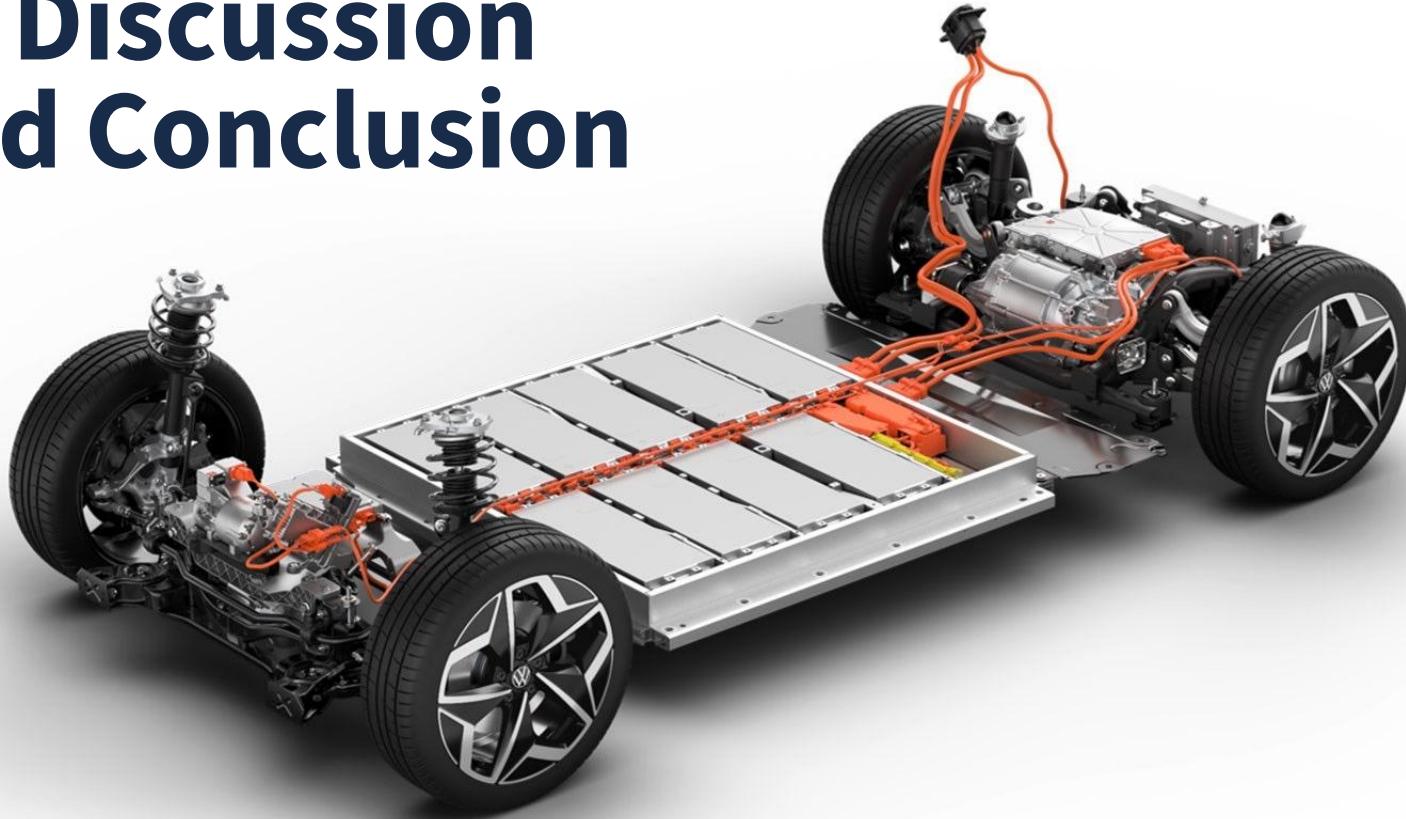


Image courtesy of CAR Magazine.

# Discussion

## **What can be done about lithium extraction?**

- 1.Improved lithium extraction technology
- 2.Consider alternatives to water resources
- 3.Lower development and recycling costs for lithium
- 4.Reducing the impact of industrial exploitation on land resources
- 5.Reducing lithium demand where possible

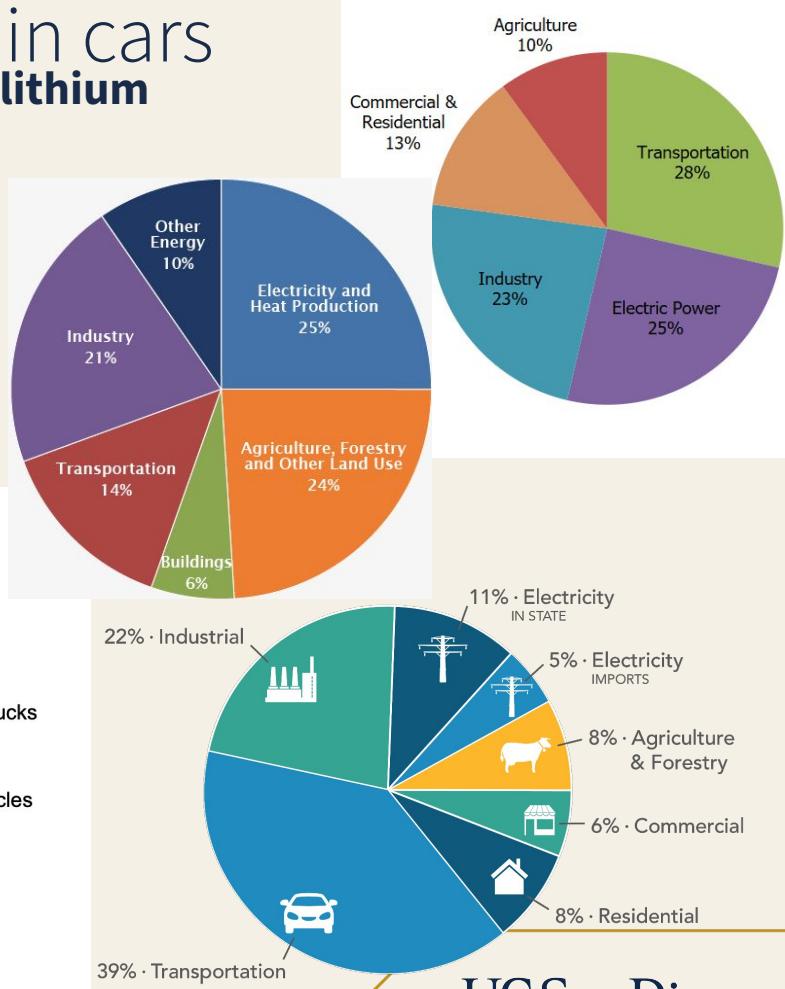
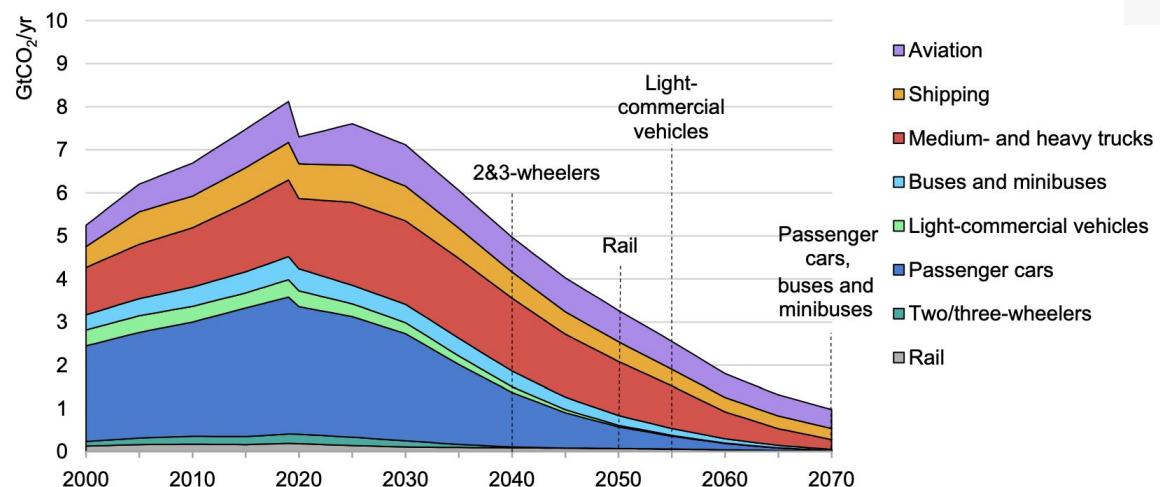
# The Consequences of Inaction - in cars

## It's wrong to think that we should stay away from lithium

Worldwide, transportation emissions comprise only 14% of carbon emissions – but in the US, this figure is 28%. This rises to an incredible 39% in California.

**Sustainable development initiatives can decrease this figure eightfold worldwide by 2070 – but without lithium, this will be completely impossible.**

Figure 3.16 Global CO<sub>2</sub> emissions in transport by mode in the Sustainable Development Scenario, 2000-70



# The Consequences of Inaction - in energy

## **Without lithium, we will be stuck with gas cars and fossil fuels**

No matter what the oil and coal industries want to tell you, these energy sources are dead ends from the environmental and safety perspectives.

Coal pollutes around 250 times as much as clean energy sources, in addition to causing huge pollution from mining operations, many deaths due to mine accidents, and other unavoidable attendant effects such as acid rain (even with so-called "clean technologies").

Oil is not much better, and while nuclear is overall the best clean energy technology by far, it is expensive and hard to ramp up and its waste is hard to deal with (and people are afraid of it for no reason, thanks in part to bribes by fossil fuel companies).

**Energy is 25% of emissions worldwide. Without lithium, the UN's sustainable development goals will be impossible.**

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# What can YOU do?

About lithium extraction? Nothing lmao, you are not a lithium extractor

But, there are startups with proprietary technology that can solve all these shortcomings with less wasted lithium to boot. Two of these companies, Lilac Solution and EnergyX, are already in small-scale test operations in South America and are hoping to move to the US.

**But, you can still make a difference by recycling your rechargeable batteries.**

# Thank you!

Website: <https://github.com/benjamint8/mapping-western-US-lithium>