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Lithium Mining: Unearthing Old Mining Practices in a New Age of Extraction

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Recommended Citation

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Lithium Mining: Unearthing Old Mining Practices in a New Age of Extraction

Senior Project Submitted to
The Division of Social Studies
of Bard College

by

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Annandale-on-Hudson, New York
May 2022

This project is dedicated to my parents, brother, and grandparents, who have never stopped encouraging me to pursue the things that I am passionate about.

Acknowledgments

I would like to take the time to acknowledge and express my gratitude for the immense amount of support I received throughout the extent of this project.

I would first like to thank my advisor, Monique Segarra, for her expertise and undying commitment to making this project the best version of itself that it could be. This project would be half of what it is without her helpful insights and constant encouragement.

I would also like to thank my other project board members, Susan Winchell-Sweeney and Peter Rosenblum, for their wonderful comments and suggestions during my midway board. My project would not have been possible without them.

I would also like to acknowledge Robyn Smyth, whose classroom discussions last year inspired the topic of this paper.

Finally, this project certainly would not have been possible without my friends, family, and cat, George. Thank you for providing me with immense amounts of serotonin and inspiration when I could not see an end in sight. I am forever grateful.

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Introduction

We are entering uncharted territory. Climate change is forcing us to re-evaluate how we live and is illuminating the shortcomings of our efforts to mitigate it. On both counts, human-produced emissions of carbon dioxide and other greenhouse gases are causing an abnormally quick warming of the planet, leading to a set of environmental impacts such as ice caps melting, sea level rise, and the intensification of natural disasters in the form of increasing storms and wildfires (Hoegh-Guldberg et al., n.d). Across the United States, 162 million people are likely to experience a decline in the quality of their environment, whether this is from heat or access to water (Lustgarten, 2020). The scope and scale of the upcoming human migration due to these changes will test the limits and capacity of everyone.

One of the main contributors to carbon emissions in the United States (U.S.) is tailpipes. For every mile, a standard passenger vehicle emits approximately 404 grams of carbon dioxide, which amounts to an average of 4.6 metric tons a year (EPA, 2021). In order to reduce these emissions, the Biden Administration is focusing on transitioning from gas and diesel powered vehicles to electric vehicles (EVs). President Biden plans on providing every American city that has 100,000 or more residents with zero-emissions transportation options (Democratic National Committee, 2022). Additionally, the recently signed $1.2 trillion infrastructure bill, is designed to create jobs across the country through the distribution of billions of dollars to state and local governments and includes funds that target infrastructure supporting electric and other fuel alternative vehicles (Holland and Shalal, 2021). The Bill provides a $2.5 billion grant program, to enable public entities, such as states and their subdivisions, Native American tribes, metropolitan planning divisions, and other authorities charged with transportation purposes, to construct charging and fueling infrastructure across the nation (GT Alert, 2022).

The administration's goals are not only to reduce emissions, but also to increase the economic competitiveness of the U.S. economy. The global market has recently shifted its focus towards electric vehicles, supported by groundbreaking innovation and new technologies. Yet the United States still trails behind in the race to manufacture both electric vehicles and the batteries that go with them. Compared to countries like China, the U.S. market share for EVs is only one-third of that of Chinese manufacturers. President Biden recently signed an Executive Order that sets a progressive new goal of making half of all new electric vehicles sold in 2030 zero-emission (The White House, 2021). This target includes plug-in hybrids, battery-electric, and fuel cell electric vehicles. Biden's ambitious goals have sent signals to major car manufacturers such as General Motors, Ford Motors, and Stellantis NV, formerly known as Fiat Chrysler. In a joint statement, these three major companies state that they intend for 40% to 50% of all new vehicle sales by 2030 to be electric models (Shepardson, 2021).

To reduce emissions and to jump-start a new green economy, the Biden Administration's steps to create a greener and more sustainable future are commendable. Given current technologies, the administration's policies are stimulating an increasing demand for the production of batteries to fuel EVs. There is a less 'green' outcome behind the scenes however. A key component of these batteries is lithium, which is causing global demand for it to surge. Although the United States has high concentrations of underground lithium resources, the mining and processing of it only contribute about 1% to the annual lithium production supply (Blackmore, 2019). In comparison, what is known as "The Lithium Triangle", composed of Argentina, Bolivia, and Chile, as well as Australia, contributes to half of the world's supply. Most of it is then processed in China and other Asian countries to be turned into battery cells (Penn and Lipton, 2021).

Therefore, the United States is seeking to expand production in the U.S., which is projected to triple by 2025 (Siegler, 2021). Expanding domestic production will contribute to stable supply chains and enhance energy security. Currently, there is only one mine in the U.S, located in Nevada, and in order to meet rising demand, additional mines are being proposed in hopes to further exploit Nevada's abundant lithium reserves.

However, policies to support 'green' energy to mitigate climate change and encourage economic growth are in danger of overlooking the negative externalities of lithium extraction. Although new mines in the U.S. would allow the country to remain competitive in the lithium industry, the proposed expansion of extraction is raising concerns from various community members about the potential detrimental effects on agriculture, biodiversity, and the sacred lands of Indigenous peoples. Threats of pollution to drinking water sources, disruption to wildlife, and an impediment to religious practices are just a few of the problems which are currently causing a wave of protests and lawsuits, not only in the U.S. but in other major lithium producing countries as well, where extraction is impacting both the environment and Indigenous communities. Extraction can place intense pressure on the water supply, diverting water away from those who rely on it for their livelihoods. For Indigenous communities, in particular, lithium mining mirrors past practices of extraction that have caused environmental injustices historically.

This senior project analyzes the 'green versus green' tension between the push for electric vehicles to combat climate change and the resulting set of environmental and social externalities (the hidden costs) that are related to mining lithium to support the move to a green alternative. This project does not argue against a transition to a low carbon transportation system, but rather it asks if there is a way to tackle the climate crisis without adding to environmental and community harm. In addition, this project asks if there is a means to support a

just transition in the movement to a low-carbon economy. This transition should, ideally, not substitute one set of harms based on extraction and industrial production of fossil fuels and vehicles, for a 'green' system that continues past practices of environmental injustice on communities in proximity to sites of lithium extraction.

To address these questions, this project will use a comparative case study method, looking at two countries, Australia and Chile, both of which have established lithium extraction industries and also share similar struggles of Indigenous communities to contain the associated environmental and socio-economic harms. It will draw on secondary and primary literature to construct and analyze these cases, with the focus on deriving a set of lessons learned, as the U.S. is poised to expand lithium mining in Nevada. It that in many ways, lithium extraction in each country mirrors past problems with a mining industry that is still unevenly regulated by the state. It argues, however, that Indigenous stakeholders are making history in Australia and Chile and breaking new ground in gaining leverage and voice to challenge decisions made by companies and states. This increasing voice for Indigenous communities is in part a result of changing domestic and global recognition of Indigenous identities and rights as well as from the legacies and lessons from the historical struggles against mining operations. Moreover, the intersection of, and interest in, social justice and the environment has framed the impacts of lithium mining on the environment and Indigenous communities in ways that have increased the attention of non-Indigenous stakeholders and some politicians on these problems, creating an opening for Indigenous identities, culture, and rights to be institutionalized in new laws, and in the case of Chile, a new Constitution.

The project is organized as follows. Chapter One lays out the problem, the nature, and the life-cycle of lithium mining. Chapter Two explores the rise of lithium mining in the United

States. Chapter Three reviews recent debates and relevant literature regarding how to ‘green’ these processes and move toward a model of sustainable mining. It looks as well to debates over the reality of improving mining and strategies by which impacted communities can leverage their voice and concerns to be heard by mining corporations and other state actors who regulate the sector. Chapter Four presents the two case studies of Chile and Australia and a set of lessons learned, followed by Chapter Five which is a short analytic conclusion.

Lithium 101

What is Lithium?

Lithium is a soft and silvery-white alkali metal. It never occurs freely in nature but is instead only found in salts or compounds, such as pegmatitic minerals[1] (Wikipedia, 2022). Due to its extreme reactive properties, lithium offers large amounts of both electrical and heat conductivity. Its uses range from pharmaceuticals, chemicals, high-temperature lubricants, and ion batteries for electric vehicles and other electronics. Most of the commercial lithium that is on the market today is in the form of lithium carbonate, which is stable in comparison to pure lithium and can be easily converted into salts or chemicals. No matter the technique used, lithium extraction, by definition, is when the mineral is isolated from a sample and converted into a marketable form. Commercial lithium stems from two major underground sources: brine and mineral ore deposits (SAMCO, 2018).

Extraction: Brine vs. Ore

A majority of the lithium produced today is extracted from brine reserves that lie beneath salt flats. Drilling is required in order to reach the brine from underneath the surface, which is then pumped up to the surface and distributed into evaporation ponds. From here, the process of solar evaporation causes any liquid water to evaporate and leave behind lithium and other elements such as potassium and sodium. Once the brine reaches the ideal lithium concentration in the evaporation pond, it is pumped to a lithium recovery facility where the mineral is extracted through chemical treatment and filtration. At the conclusion of this process, the excess brine solution is returned back to the underground reservoir.

[1] Pegmatite is a course-textured igneous rock that contains interlocked crystals and in complex cases, mineral deposits as well.

In addition to the conventional lithium brine extraction technique, a hardrock and spodumene extraction process is also used. Although mineral ore deposits do not account for a very large share of the world's total lithium production, they yield 20 tons of lithium annually. Although these deposits are richer in lithium content than brine, they are also more costly to access due to the need to mine hard rock formations. In order to mine these formations, extra energy, chemical, and material consumption are required to extract the lithium from the ore. This means that the process can cost twice as much as brine recovery does and therefore has contributed to the smaller market share of lithium ore.

The extraction process itself typically involves removing the mineral from the mining pit and then heating and grinding it into a powder. This pulverized mineral substance is mixed with chemical reactants, such as sulfuric acid, in order to make a sludge that is then heated again, filtered, and concentrated through evaporation. The result of this process is a lithium carbonate product that is then sold, while the resulting wastewater is treated for reuse or disposal (SAMCO, 2018).

LIFE CYCLE OF A MINE

The process of traditional mining can be broken down into 5 steps: exploration and feasibility analysis, mine design and planning, construction of infrastructure and other equipment that will be used, exploitation and processing, and closure (Tajvidi Asr et al., 2019). The exploration stage can include building roads, mapping areas of interest, sampling, creating waste dumps, and sometimes even blasting open the landscape. The main objective of step two, mine design and planning, is to formulate a design system in which the resource is extracted and then supplied to the market. Infrastructure build-out in step three includes storage pools, tailings

dams, stockpiles, and other units used for the process. The actual resource begins to be mined and processed into usable and marketable substances at step four. The closure of a mine is the final step upon the completion of the operation, and includes environmental remediation of degraded mining sites and decommissioning of any and all facilities associated with the operation (Tajvidi Asr et al., 2019).

However, there are risks and potentially negative environmental impacts across the stages of a mine's life-cycle. Most of these impacts occur at the exploitation and processing stage and they range from water and soil pollution, explosions, and tailings dam failure (Tajvidi Asr et al., 2019).

The Rise of Electric Vehicles

Although the electric vehicle (EV) was introduced more than 100 years ago, it lost out in the market to gas-fueled cars, when Ford selected the gas combustion engine due to its power and mileage capabilities. Interest in EVs re-emerged in the wake of spiking oil prices and gas shortages in the 1970s as a means to lower U.S. dependence on foreign fossil fuels. During this time, many automakers such as General Motors and the American Motor Company developed prototypes for their own electric vehicle. Although this was a step in the right direction, the vehicles produced still lacked what gasoline-fueled cars had in terms of speed and miles per charge (Department of Energy, 2014). In the1990s, concerns about the environment and with the passage of the 1990 Clean Air Act Amendment and the 1992 Energy Policy Act, pushed this "green" solution forward even more. This increased interest in lowering carbon emissions further pushed motor companies to turn their most popular models electric (Department of Energy, 2014). On top of this, the California Air Resource Board set new transportation emission

regulations, which aided in the revival of interest in electric vehicles. The 2006 documentary, *Who Killed the Electric Car?,* also heavily promoted the use of electric cars to the public by showcasing the most popular EV at the time, General Motor's EV1 (Department of Energy, 2014). The EV1 quickly gained traction, but because of its high production costs, it never became commercially available and was discontinued.

Global interest in producing hybrid models, instead of fully electric, began with the release of the Prius in 1997. Japan was the first country to mass-produce a hybrid-electric vehicle, which was then released worldwide in 2000[2]. This trend continued with the groundbreaking startup of Tesla Motors in 2006. Rather than producing a mid-cost 'workhorse' like the Prius, Tesla focused on producing a luxury fully electric sports car that had the ability to reach up to 200 miles per charge (Department of Energy, 2014). This strategy challenged the idea that EVs were 'hairshirt' vehicle options by producing the first electric 'supercar' (Stringham et al., 2015). The success of this company acted as a catalyst for companies such as Chevy and Nissan to release their first electric cars. Currently, there are 19 types of battery-electric vehicles available in the U.S and 26 total when including model variants (Evadoption, 2022).

[2] Before the Prius could be released in the United States, the 1999 Honda Insight was marketed, making it the first hybrid car sold in the states since the early 1990s (Department of Energy, 2014).

Lithium Mining in the United States

This chapter lays out the background of lithium mining and its relation to U.S. extraction culture while providing an overview of past, present, and future challenges of lithium mining in Nevada raised by Indigenous tribes and other rural stakeholders. In doing so, it provides a comparative context for understanding both the differences in lithium extraction processes in Chile and Australia, and for considering the Biden Administration's push for a green transition in order to meet the U.S.'s ambitious climate goals.

Although lithium mining is a relatively new practice in the United States, resource exploration and mining practices run deep in its history. In the19th century, the mining industry took off with the discovery of gold, lead, copper, and silver (Bolles, A.S, 2020). The U.S. experienced a series of mining rushes, as people moved west to work in the mines. The Mining Law of 1872[3], both regulates the mining of specific minerals on federally owned public domain lands and also allows for individuals or corporations to stake claims on any discovery of minerals they may make. These property claims and explorations could be done without governmental authorization, therefore encouraging extraction on federal lands (Gerard, 1997). In addition, advancements in extraction technologies made it easier to access ore and further encouraged 'extractivism'. In the 20th century, the Mining and Mineral Policy of 1970 reflects an ongoing policy of the federal government to encourage and foster a stable domestic and economic mineral resource industry (Bureau of Land Management, n.d.).

The expansion of the mining industry depended on lands that were scarce in habitation and plentiful in land. States such as Colorado, Alaska, Montana, and Wyoming all harbored extensive extractive economies and were originally the home of Indigenous peoples. Over time,

[3] To this day, the law remains applicable to those minerals and lands that are subjected to it (Ballotpedia, n.d).

the expansion of settler colonialism in the United States produced a tumultuous history regarding the rights and treatment of its Indigenous population. After the Revolutionary War, the United States continued on with the policy of treaty-making with Native Americans, that of which the British had instilled (National Geographic Society, 2019). These treaties were generally used to define the boundaries of Native American lands and to compensate for the taken land. The Senate, however, often did not ratify these treaties, making them unenforceable by the U.S. government, and therefore leaving issues regarding land unsettled. In 1871, when Congress ceased to recognize tribes as entities capable of crafting treaties, the practice of treaty-making came to a close. Furthermore, as a result of the civil rights movements of the 1960s, the Indian Self-Determination Act of 1975 worked to restore some sovereignty to tribal governments and gave them more power and independence in federal funds and programs (National Geographic Society, 2019).

Despite the government's attempts to resettle, remove, assimilate, and allot, the civil rights movement of the 1960s included Indigenous peoples, in addition to African American mobilization. These movements led to the Indian Self-Determination Act of 1975, which worked to restore some sovereignty to tribal governments and gave them more power and independence in federal funds and programs (National Geographic Society, 2019).

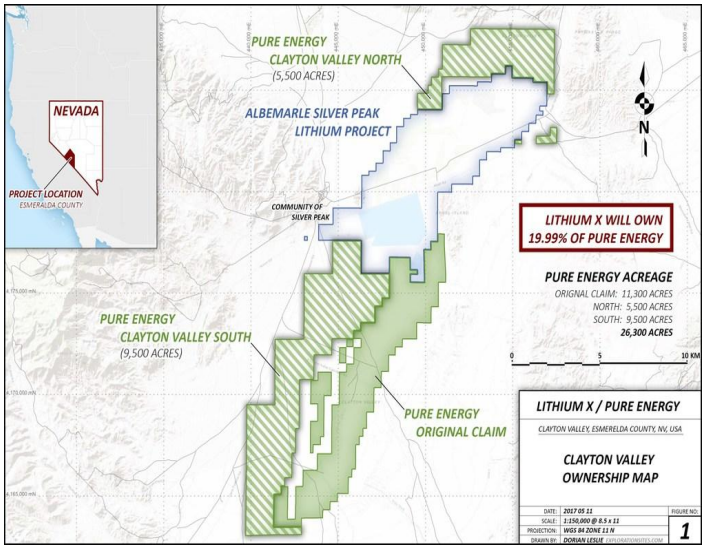
The intersection of Indigenous issues and extraction is part of the contemporary story regarding lithium extraction in the U.S. Currently, there is only one producer of lithium, located in Silver Peak, Nevada, and run by the company Albemarle (Albemarle, 2022). Originally established in 1863, Silver Peak is one of the oldest mining towns in the state (Esmeralda County, Nevada, 2021). Before lithium, it was known for producing a substantial amount of gold, silver, and other minerals. The mine was functioning until 1948, but when a fire destroyed

the local town of Silver Peak, activity slowed down until 1966, when the Foote Mineral Company began its lithium extraction operations in the nearby Clayton Valley. Before the introduction of electric vehicles, lithium was used for medical purposes. Test trials showed that it had beneficial properties to prevent the recurrence of manic and depressive episodes (IGSLi, 2018).

Extracting Lithium

The Foote Mineral Co. extracts lithium from brines from beneath Clayton Valley, using solution mining and chemical processing facilities. Although abundant, lithium does not occur in its natural form due to its highly reactive nature. In order to obtain the lithium, the company uses mining techniques that use extraction wells and evaporation pond systems in order to isolate the lithium concentrations from the brine in saltwater aquifers. After the lithium salts are concentrated in the brine, they are routed to the next pond in the system. This step is continued multiple times and can take between 12 and 18 months to complete (Albemarle, 2022).

Figure 1. Clayton Valley Mining Operation



Like any mining operation, lithium extraction takes a toll on the environment. This process of pumping the salty, mineral-rich brine to the surface requires approximately 500,000 gallons of water per metric ton of lithium (IER, 2020). The

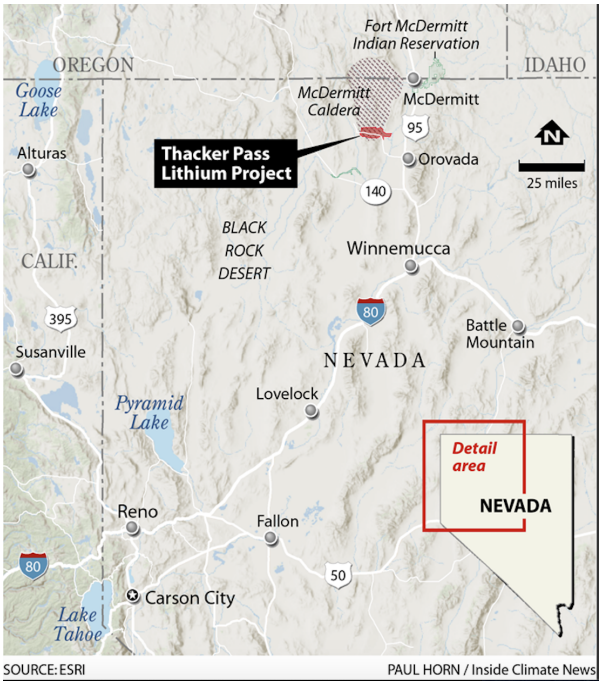
salty groundwater is pumped to the surface in Clayton Valley and captured in the ponds that cover 4,100 acres altogether (Nelson, 2017). In order to avoid a gap in production that could result in a shutdown, the plant must keep the water flowing at all times. This therefore could pose challenges to the replenishment of the aquifer or other water sources. Yet as environmentally conscious as this process is by using solar power in the evaporation process, lithium brine evaporation ponds are prone to damage and leaks due to the high levels of salinity of the water (BTL Liners, 2019). Because salt is corrosive in large quantities, the metal features of the holding pools could rust and other flexible liner materials could be damaged. In fact, researchers have found impacts of these processes on fish as far as 150 miles downstream from a processing plant (IER, 2020).

In order to be approved, the current operating facilities are required to be designed, constructed, operated, and closed without discharging any fluids or exceeding state regulations for liquid release (Nevada State Environmental Commission, 2022). In addition, the operation is permitted to produce a maximum amount of 6,000 tons of lithium carbonate per year. In order to regulate these standards, any person or company who is seeking to extract lithium must undergo the regulatory permitting NDEP-BMRR program, and is required to renew it after 5 years (Nevada Division of Environmental Protection, n.d.). Although certain mining and exploration activities have been exempted in Nevada from these processes, it is required for lithium mining due to the potential risk of these activities contaminating the surface and groundwaters of the surrounding lands.

Social and Environmental Costs of Lithium Extraction

Expanding Lithium extraction in Nevada poses a set of challenges. First, it will encroach on the sacred tribal lands of the Paiute People. Peehee Mu'huh, translated as "rotten moon", is the Paiute name for a place made sacred by the bones of their ancestors. This area in northern Nevada, more commonly known as Thacker Pass, is where the McDermitt Paiute people were massacred. This occurred on September 12, 1865, when the 1st Nevada Cavalry surrounded a Paiute camp in the Thacker Pass area before dawn and murdered dozens of tribal members including men, women, and children (Stone, 2021). From what is known, there was but one survivor named Ox Sam. To this day most of the People belonging to the organization Atsa Koodakuh wyh Nuwu or People of the Red Mountain, are blood relatives of Ox Sam and feel a special connection to the land. This group is composed of members and relatives of the Fort McDermitt Tribe who want to stop the Lithium Nevada Company from constructing a mine on the site in which they believe to be a mass grave of their ancestors. This corporation is a wholly-owned subsidiary of the Canadian-based company Lithium Americas (Lithium Americas, 2019).

Figure 2. Thacker Pass Lithium Project



Over the months of 2021, resistance has caused other tribes throughout the Humboldt County region, as well as state and national organizations to speak up in opposition to the proposed mine. These groups such as the Inter-Tribal Council of Nevada Inc and The National

Congress of American Indians, represent Native Americans. Their arguments cite the cultural, historical, and spiritual significance of the land, concerns over environmental impacts, and a lack of tribal consultation in the approval process. Although the reservation is almost 50 miles away from the actual mine site and far beyond the groundwater source for the tribe, members still fear that the pollution could spread (Penn and Lipton, 2021). The fight against this mine mirrors the efforts being put forward by the Quechan Tribe, the San Carlos Apache, and the Standing Rock Sioux to halt extraction operations that will impact their land and water (Martin, 2021).

Despite the opposition of the Tribe and other stakeholders such as farmers and ranchers in the valley, the Bureau of Land Management approved the proposed mine five days before the end of the Trump Administration's term (Solis, 2021). This was just one of the many extraction projects that fast-tracked in the last remaining days of the administration, in an attempt to advance energy and mining efforts on public lands. In late 2019 and early 2020, the Bureau of Land Management sent letters to the four neighboring tribes[4] to notify them about the Lithium Nevada operation, while it was in the federal environmental permitting process (Stone, 2021). The project was formally approved in January before any of the tribes' leaders could offer any input, whereas other tribes with ancestral ties to Thacker Pass weren't contacted at all.

The company has since made aggressive moves to secure permits in recent months, in hopes to begin its operations in 2022 (Penn and Lipton, 2021). These moves have included hiring a lobbying team that includes Jonathan Slemrod, a former Trump White House aide. While the BLM contacted the Fort McDermitt Tribe's leadership about the project, members of the tribe weren't aware of the project or its approval until they read about it in the news (Stone, 2021).

[4] According to the Bureau of Land Management, the following tribes were notified: Fort McDermitt Paiute and Shoshone Tribe, Summit Lake Paiute Tribe, and the Winnemucca Indian Colony (Department of the Interior, 2020)

In addition to the impact on cultural rights and human health, expanding lithium mining in Northern Nevada has raised concerns about the environmental impacts amongst non-tribal stakeholders as well. Initially unopposed to the proposed mine at first, sixth-generation cattle farmer Edward Bartell is now worried about the long-term effects the mine will have on the region's air and water quality based on his reading of the Bureau of Land Management's (BLM) final environmental impact statement. His view shifted as he started to look deeper into the potential externalities it might have on the long-time family business. Overall, he fears that the water table on which his livelihood relies will drop by what is estimated to be 12 feet, as the mine will consume 3,224 gallons of water per minute, devaluing the land (Penn and Lipton, 2021). With no success, Bartell has asked Lithium Nevada to compensate his business and has moved on to suing BLM on the grounds that they rushed the environmental review process and downplayed the environmental impacts that the project would have on the land around him (Stone, 2021).

In addition to causing a potential water shortage, there are concerns about other forms of pollution and contamination stemming from these operations. Bartell expressed his anxiety about the approximately 5,800 tons of sulfuric acid that will be used by the mine every day. In order to procure sulfuric acid, the company will have to ship it by rail to the City of Winnemucca, where it would then be transported via trucks down rural roads to the mining facility. These trucks will be making up to 200 trips a day back and forth, carrying hazardous materials to the mine's on-site processing plant, and then back to the railroad with the mine products. Because of this, the area will be a combination of both a mine and chemical complex as well, drawing concerns ranging from emissions and air quality to leaks and spills (Kapoor, 2021).

Yet locals aren't the only ones expressing concerns about the proposed project. Biologists working for the Environmental Protection Agency (EPA) have also made their voices heard about the rapid approval process. The EPA project manager Jean Prijatel has questioned BLM on their long-term management plans after the mine is shut down. Without proper management, the mine has the capacity to contaminate the groundwater of local communities with heavy metals, such as antimony and arsenic, for at least 300 years. Although the BLM claims that it has options as to how it will be managed, they have offered no detailed mitigation plans, despite approving the mine (Kapoor, 2021).

It can be assumed that the fast-tracking of the approval process means that the BLM provided a minimally detailed report of what the externalities of the mine will look like, more specifically in relation to how it will affect the rare species or unique habitats that surround it. For example, the greater sage, whose population is already decreasing, is in danger of losing thousands of acres of habitat, as their breeding area lies less than a mile away from the proposed mine site. An assessment done in December by the Interior Department found that over the 41-years that the mine would be operating, around 5,000 acres of winter range used by pronghorn antelope would be degraded (Penn and Lipton, 2021). In addition, the mine site would destroy a nesting area of two golden eagles, whose feathers are used as a vital part of the local tribe's religious ceremonies.

Eventually, the mine will be dug deeper than the 370 feet, which it is currently set to reach (Penn and Lipton, 2021). In order to keep it dry, the company will have to continuously pump water out of it. Yet when the mine eventually closes, the pumping will cease, resulting in groundwater seeping back in, picking up any toxins that are exposed. Although Lithium Nevada plans on treating all groundwater for antimony pollution caused by the mine for several years

after closure, there are still concerns that the pollution will be an intergenerational problem, requiring continuous management. The proposed mine is predicted to produce 66,000 tons of battery-grade lithium carbonate a year (Penn and Lipton, 2021). Yet the extraction method, which requires clay being dug out from the mountainside and mixing it with sulfuric acid, will produce as much as 354 million cubic yards of mining waste that will be contaminated with the discharge from the sulfuric acid treatment. As permit documents disclose, this waste could additionally contain a modest amount of radioactive uranium.

In the U.S.there has been constant struggles between Indigenous peoples and corporations and state actors over the value of Indigenous culture and religion as a reason to prevent resource exploitation. According to legal experts, there are many factors that help explain why Indigenous communities often lose against big corporations and their own federal government when trying to protect their sacred lands (Golden, 2021). Some believe that it is due to the lack of understanding of Native religious practices, while others see it as a simple double standard. Stemming from the late 1800s, officials began outlawing Indigenous ceremonies, as well as visiting sacred spaces outside of designated reservations. More specifically the Code of Indian Offenses, a set of legislation only applied to Native Americans, was established by the Department of Interior in 1883. These de facto laws were set to punish any and all Native dancing and ceremonies including Sun and Ghost dances, potlatches, and any practices of medicine persons (Native Americans In Philanthropy, 2022). It gave agents the authority to imprison, use force, and withhold food rations for up to 30 days in order to halt any practices they deemed immoral or disruptive to the federally-mandated assimilation policies in place (Zotigh, 2018). This was the start of the extensive and agonizing history of religious persecution. The Code went on to be amended in 1933, eliminating the ban on Indian dances.

Yet despite the enactment of the American Indian Religious Freedom Act in 1978, which returned basic liberties to Native Americans, Inuit Aleuts, and Native Hawaiians based upon the First Amendment of the United States Constitution, Indigenous groups have continued to lose access to their own lands (Wikipedia, 2022). In the 1988 Supreme Court decision of Lyng v. Northwest Indian Cemetery Protective Association, the court ruled that the free exercise clause stated in the First Amendment does not bar the federal government from constructing a road through a portion of Six Rivers National Forest, an expanse of land considered a sacred religious site for three separate Native American tribes (Hermann, 2009). This decision ultimately set the tone for how the future of protecting sacred spaces would be.

The expansion of the lithium industry in the U.S. is running parallel to traditional mining practices in the past, even as we attempt to transition away from fossil fuels to a cleaner solution. Historically disempowered people, such as Indigenous groups, continue to be overlooked as mining companies continue to exploit the lands. The fast-tracking to permit the mines under the Trump administration reflected a commitment to extraction as a means of economic development at the cost of the environment and indigenous culture. The Biden Administration's support of EVs, consciously or not, continues this position, despite the goals of a low carbon economy to contribute to a sustainable and just transition and to a cleaner future.

Literature Review

Lithium extraction in Chile, Australia, and the United States raises questions regarding how to minimize the negative impacts of extraction on the environment and communities surrounding the mines, as well as waste processing facilities. This chapter reviews a set of conceptual frameworks, starting with current discussions and definitions of what sustainable mining entails as a practice to the negative externalities of extraction. The cases analyzed in this project are also examples of struggles of stakeholders pressing corporations and states to regulate extraction, and/or to prevent the expansion of extraction. To understand this dynamic across the cases, the chapter also reviews the strategies and tactics of stakeholders, in particular Indigenous groups, to leverage their voices through social movements. This is critical for understanding how and under what conditions can communities living near sites of extraction press for just transition in the shift to a low carbon transportation system.

As noted in Chapter One, mining poses a set of environmental challenges in the cycle of exploration, extraction, and closure. These can include water pollution, soil disruption, and stream disturbance. All of these contribute to the degradation of the landscape, eradication of habitats, and biodiversity loss. In addition to environmental damage, it can also lead to social damage. In many countries, mining has led to resource dispossession, which is the act of taking property away from an individual or group of people, which can then lead to the disruption of religious or cultural sites of many Indigenous peoples (Segarra, 2013).

The context of this definition stems from David Harvey's "accumulation by dispossession", which is the theory that capitalism and the quest for profit drive corporations to take over large amounts of land which they deem arable or rich in minerals. These takeovers are often justified by companies saying they will be bringing development to underdeveloped parts

of the world (Harvey, 2004). Although much of this analysis focuses on mineral extraction and its negative impacts on local communities, a key point is that it is done in order to benefit distant consumers, not the immediate surrounding communities (Segarra, 2013). This often results in "sacrifice zones", in which the well-being of the greater good is put before the health and safety of individuals and the environment[5]. This concept is useful in a discussion of lithium policy in the US and beyond because it proposes the question of whether or not this new age of mining is changing, or if it is falling back into the similar dirty exploitive dynamics of traditional mining, but in the name of green energy?

Extraction Waves -Technical and Political Solutions

Since the 1990s, there has been extensive analysis and debates over the impact of mining on societies and the environment. Much of this focus has been on the ability of communities, and social movements, many of which are transnational, to press mining companies and states to either enforce environmental laws and regulations or craft them in order to constrain harm. Currently, there is a new 'wave' of extraction. The global market has shifted its focus onto elements that are critical for the development of green technologies. Resources such as lithium, nickel, and cobalt all play a crucial role in the high performance of batteries and therefore are in even higher demand, as the demand for electric vehicles also increases (Malan, 2021).

As mining was accelerating globally in the 1990s, there emerged an interest in creating standards for 'sustainable mining' to mitigate the associated harms of extraction. Initiatives such as the International Council on Mining and Metals (ICMM) and the Mining, Minerals and Sustainable Development (MMSD) report were formed in order to examine the questions of how

[5] A "sacrifice zone" is defined as a geographical area that has been permanently damaged due to environmental harm or economic disinvestment. These tend to be places that are known as locally unwanted land use (LULU), or land in which external externalities are created for those living in close proximity (Wikipedia, 2022).

mining technologies and processes can improve in order to mitigate or minimize environmental harms. In addition to environmental laws and regulations, it is important to examine ways in which to reduce the environmental impact, whether it be minimizing pollution and land disruption, closing barren mines, minimizing externalities, or focusing on resource consumption. From here, another framework emerges. The overall focus of this one is the post-extraction phase, or more specifically, how the mined material is reused, recycled, or disposed of after it reaches the end of its life cycle (Gorman and Dzombak, 2018).

Sustainable Mining -Extraction and Economic Development

In addition to technical solutions to the environmental harms that mining can incur, following the 1992 United Nations Conference on Sustainable Development, also known as Rio 20+ or the Rio Summit, there emerged a focus on mining's contribution to sustainable development. Sustainable development encourages economic growth that improves the quality of life for the current and future generations (Dernbach, 1998, Dernbach, 2003, Cerin, 2006).

The Brundtland Report laid the foundational groundwork for the convening of the Summit five years later, as it defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 2022). This definition has since then been used to frame many developmental goals and has been built into international agreements on the environment. Yet despite this, the concept of sustainable development to this day is still vague. Since then, other definitions have been proposed (Elliott, 2006; Rogers et al., 2008, Richards, 2009). These include creating a situation in which the demand for the material and facilities is not reduced over time, integrating the economic, social, and environmental goals in order to maximize the

welfare of the current generations, while avoiding harm to the future generation's needs, and maintaining the balance between development and the environment so the societal and ecological systems don't become weakened at the lack of natural resources to which the system depends on.

In contrast, Crowson, (1998) argues that mining reserves are finite and will be depleted at some point, given that it is built upon the action of removing non-renewable resources from nature, making the concept of 'sustainable mining' an oxymoron. Rajaram et al., (2005) agrees with this point, stating that no mine can continue their extraction operations forever and that the depletion and extinction of the non-renewable resources can have detrimental effects on the environment. However, Laurence, (2011) indicates that sustainable mining is possible when a 'triple bottom-line' is achieved. For corporations, a triple bottom-line means a balance between economics, society, and the environment. If this is done correctly, the life of the mine will be optimized, benefits to the community strengthened, and a wider community acceptance of the industry will follow (Laurence, 2011).

Despite the fact that the triple bottom-line approach depicts the economy, society, and environment intersecting to create an ideal sustainable practice, in reality, at times these three elements have different influences and weights for corporations and for the states that regulate them. Out of these three components, the economy is often given priority when it comes to policymaking by state actors charged with regulating corporations and for corporate policies themselves (Giddings et. al 2002). The prioritization of an extraction-based economy by the market and states can contrast strongly with alternative views of the environment held by local Indigenous communities and actors. (Flint 2012).

Is Sustainable Mining Achievable?

Since the 1990s, there has been significant research on how mining and mineral resources aid sustainable development (Allen, 1991, Auty and Warhurst, 1993, Von Below, 1993, Mikesell, 1994, Hilson and Murck, 2000, Eggert, 2006). Despite criticisms claiming that mining can not be considered part of sustainable development, (Villas-Bôas et al., 2005) declares that although many people use the terms interchangeably, sustainability is not the same thing as sustainable development. As they define it, sustainability is a feature of a healthy social and environmental system. In addition, it refers to the resilience, or the ability to withstand external shocks and return back to normal, of those systems. With this definition in mind, minerals, which are nonrenewable, are not sustainable. On the other hand, sustainable development calls for the integration of environmental policies, strategies, and other legislation to satisfy the needs of humans in the present and the future. Based this definition, minerals can clearly be considered an integral part of sustainable development. We rely on the steady stream of these mineral inputs in order to improve our quality of life, while also keeping in mind that environmental protection is also crucial when supplying these resources.

Still, the question still remains on what constitutes a ‘sustainable’ mine? According to the International Institute for Sustainable Development, in order to truly shift to “sustainable mining”, both governments and companies must fully recognize the social implications of mining and enact laws and regulations that properly address these impacts. This might include legislation that requires companies to hold consultations with the surrounding community throughout the life of a mine site. They state that the key to any sort of sustainable development intervention is to consult the immediate communities or the ones that could benefit the most in order to understand and address their concerns and needs (Malan, 2021).

The three principles of economic, environmental, and social sustainability should be applied to all stages of the mining life cycle, in order to maximize the opportunities for economic, environmental, and social development. In order for mining to be in line with the sustainable development goals set in place, companies must meet the following criteria on the local, national, and international levels (Giannopoulou and Panias, 2006): considering both the negative and positive impacts of mining according to the employees of the operation, increased participation of local community members both during the mining process and after its closure, providing technical, economic, and structural facilities to assist in developing communities, and finally, applying the precautionary principle in a way that allows for the producer to economically minimize the environmental externalities created in the production process.

A cleaner future does not necessarily mean a more equitable one. As we attempt to move away from fossil fuels, we ensure that we enable not only a green transition, but a just[6] one as well. It is crucial to consider the following questions when thinking about just transitions: where and how the average individual fits into these large-scale transitions, who is paying for it, who is impacted, and the different roles that people can play. This can only be achieved if the sustainable development goals are successfully implemented and sustained. These include the strong enforcement of laws and regulations that determine the social outcomes of individuals involved, either directly or indirectly, by resource-intensive industries, global partnerships and collaborations, procedural and distributive justice, and the continuation and addition of employment opportunities (Nova, 2022).

[6] A "just transition" is based upon the principle that a healthy economy and clean environment can and should be able to co-exist with one another. The means in which to achieve this though should be equitable and should not have to cost community members their health, safety, economic assets, or environment (Justice Transition Alliance, 2022).

Global Social Mobilization and Stakeholder Engagement

The rise of mining on a global scale provoked the emergence of anti-extraction social movements across the world. Sidney Tarrow defines social movements as contentious collective action by people who normally lack regular access to, or influence over, social and political institutions. These movements differ from riots because they are sustained over time by the social ties that bring people with a common interest and sense of solidarity to challenge a status quo that is upheld by elites, authorities, and opponents. Actions such as protests and marches are not social movements by themselves. A movement includes the following properties: collective challenges (tactics of disruption with the intent of leveraging the power of the movement), a common purpose that is able to link people and organizations together regardless of location, solidarity (which builds on the already established idea that there is a common interesting in collaborating with one another), and sustained interaction with the challenges (Tarrow, 1998).

Social mobilization amongst Indigenous people and other groups against mining can also get the attention of non-governmental organizations (NGOs). These can range from local organizations, focusing on specific mining operations, to ones assuming broader objectives such as global policies. Examples of tactics deployed by NGOs are community outreach, organizing resistance campaigns, national and international lobbying, civil disobedience, and subcontracting to assist Indigenous development (Downing et. al 2002).

Since many of these movements are composed of people who are “outsiders” or come from different backgrounds that lack the same resources and power that the elites and authorities have, social movements depend on the resources acquired by social movement organizations (SMOs). These resources range from material (money or any sort of physical capital) to social in the form of moral support or solidarity. Finally, a key element of a social movement is knowing

how to frame the cause. According to Tarrow, framing should be done in a way that will make the claims of their movement resonate with the public on all different levels including the media, elites, sympathetic allies, or potential recruits that might join the cause (Tarrow, 1998).

National Resistance Movements: United States, Peru, and Papua New Guinea

In the U.S. in 2016, the Standing Rock Sioux's struggle against the Dakota Access Pipeline [DAPL] exemplified a social movement formation that pushed back against the construction of the DAPL, which would transport Bakken crude oil across their lands. They opposed it on the grounds that it would violate Article II of the Fort Laramie Treaty, which guarantees the protection and undisturbed use of their reservation lands, in addition to the potential contamination of their water supply. The tribe used a range of social movement tactics that included both dramatic and conventional forms of protest to influence decision-makers and assist in making their problem visible to a larger public. The tribe organized events such as horseback rides, runs, and marches. Moreover, camps and prayer circles were set up on the site on which construction was to take place. A number of these, however, resulted in standoffs with law enforcement, many of which used mace, rubber bullets, hoses, and attack dogs to break up demonstrations. These demonstrations succeeded in attracting other Native Nations, celebrities, non-Native allies, and even some politicians to travel out to the Sacred Stone Camp on the reservation and join the protests as allies (Native Knowledge 360º, 2018).

Furthermore, the Standing Rock Sioux simultaneously filed lawsuits against the U.S. Army Corps of Engineers, arguing that they handed out water permits too quickly and failed to consult the tribe on major potential environmental impacts (Plumer, 2016). In the final ruling, the Court decided that shutting down the pipeline would cause no major economic disruptions,

despite what DAPL claimed, but they did, however, find that the Army Corps could potentially justify its decision not to do a full environmental review. While this justification was taking place, the operation would not be shut down (EarthJustice 2022). It did not end there though because years of litigation followed, including the formally ordered shutdown of the project by Montana's U.S. District Judge Brian Morris (Herr 2021). Through the year of approval, revokement, and re-approval, the Biden Administration will not shut down the pipeline while another environmental review, ordered by the federal courts, is taking place. This review is expected to be completed by September 2022.

The Indigenous People of the Peruvian Amazon have also mobilized against the extraction of hydrocarbons in the region of Río Corrientes (Corrientes River). Similar to Standing Rock, the extraction of this subsoil resource involved the dispossession of territory. In this case, the Occidental Petroleum Corporation had begun to transform the Río Corrientes basin into the largest oil field in Peru by the mid-1970s. Throughout the 1990s, local protests increased greatly over the socio-environmental impacts that Occidental's operations were having, such as the oil spills resulting from ruptured pipelines in 1994 and 1996 and the contamination of the surrounding lands with chlorides and other environmentally damaging concentrates. Yet in 2002, the Federation of Native Communities of Río Corrientes (Federación de Comunidades Nativas del Río Corrientes, FECONACO), founded in 1991, began to mobilize (Bebbington and Scurrah 2014).

In conjunction with other organizations, they began to formulate strategic demands that they planned to present to the Peruvian government and Pluspetrol, in addition to legal action against Occidental. It wasn't until 2005 that the federation's leaders met with the Minister of Health and persuaded them to conduct public health examinations for the people living within

the oil company's area of impact. Although the Ministry of Health attempted to bury or delay the publication of its report on this study, the results were leaked, prompting an even greater push by FECONACO and its allies for them to make the report publicly available. This applied pressure was successful. In 2006, the Ministry of Health officially released the report on their website. Armed with this and support from their allies, FECONACO proceeded to launch media advocacy campaigns, targeting governmental branches and administrations, as well as the Ministry of Health once again (Bebbington and Scurrah, 2014).

Although there were many roadblocks, such as a media campaign launched by the Peruvian government to discredit FECONACO, the Dorissa Accord was crafted. The federation considered this a victory, for it achieved agreements that would prompt the avoidance of contaminations in the rivers, streams, and lakes of their lands, and will guarantee the health and safety of their people. Furthermore, the state pledged to allocate 5 percent of the oil tax to the communities that are directly located within the affected areas. Yet most importantly, FECONACO leaders gained respect for their communities and restored the dignity that had been lost over the years (Bebbington and Scurrah, 2014).

Papua New Guinea is home to a wealth of natural resource deposits of copper, gold, and nickel. More specifically, the town of Panguna, located on Bougainville Island, was once home to one of the world's largest copper mines (Jorari 2022). Furthermore, it is also located on Nasioi land, in the southern Bougainville cultural sphere (Hyndman 1987). Confirmed in 1960 by an Australian geologist from the colonial administration, copper mineralization on Nasioi land came into focus. It wasn't until 1963 though, that the transnational Bougainville Copper Limited (BCL), a combination of the companies Rio Tinto and Broken Hill Corporation began to survey the area. In addition to generating more than a billion metric tons of mining waste, which

continues to seep into the surrounding lands, the environmental destruction caused by the project disrupted the expansion of subsistence farming and cash-crop production practiced by these people. As a reaction to their landowner rights being ignored, the Nasioi people gave both active and hostile resistance to the state and BCL (Hyndman 1991). The majority of them refused employment offered by the mine and rejected personal financial gain in order to gain autonomous control over resources (Moulik 1977).

After two decades of having their own natural resources exploited and turned into national resources, the Bougainville Revolutionary Army (BRA), formed by Bougainvilleans seeking independence from Papua New Guinea, mounted a successful Fourth World resistance movement using media and academic focuses in order to raise awareness about the way the state has ignored them and how they are united as people. It wasn't until 1989, amid rising anger about the environmental impacts and inequitable distribution of the profits by surrounding communities, that the mine closed.

These cases reflect a trend in a growing concern for human rights that has intersected with environmental struggles, many by Indigenous tribes. As a result, there has been an increase in the formalization of legal rights for Indigenous people (Handelsman 2001). The increased pressure on the mining sector, especially in developing nations, to meet the growing market demands, has caused a push for major revisions in mining laws and other legal documents, to be redefined. In some cases, these changes come simply from redefining or more clearly defining the obligations that mining companies have to the native populations and what legal status they have against the companies (Downing et. al 2002).

These trends are also reflected in the cases analyzed in this project. The following section will further examine the relationships between the state and the stakeholders and will

build upon the concepts of sustainable development in order to understand further if sustainable mining is practical. Itt will study two countries that have been balancing lithium production with the needs and concerns of Indigenous communities and other stakeholders.

Case Studies

This chapter analyzes two of the largest producers of lithium in the world, Australia and Chile, in order to understand the historical and current status of lithium extraction. On the one hand, for each country lithium provides a pathway for economic growth and development, and on the other, that pathway may not align with the interests of Indigenous communities and/or other stakeholders. The two cases have different forms of mining practices, degrees and character of stakeholder engagement, state and government responses, and environmental regulations. Understanding the similarities and differences helps us address a central question of this project: will lithium mining support a transition to low carbon transportation, or is it going to replicate past injustices and environmental harms associated with fossil fuel extraction?

Australia

Located between the Indian and the Pacific Oceans, lies the oldest, flattest, and driest inhabited continent in the world. As part of the British Commonwealth, Australia is a federal parliamentary constitutional monarchy, comprised of six individual states[7]. Similar to the federal structure of the U.S., each state has a regional government. With a stable democratic political system, Australia has a strong economy that is based on its abundance of natural resources and agricultural production. These include minerals such as iron and zinc and energy ores like coal and uranium, which are used for domestic energy production and also exported internationally, amounting to a value of around $233,772 million dollars (Geoscience Australia, 2021).

This section analyzes lithium mining in Australia's largest state, Western Australia (WA). Western Australia occupies 33 percent of the country’s total land area, and its economy is driven

[7] Australia additionally has ten federal territories, which, unlike the states, do not have the power to create and approve laws for themselves, so they have to rely on the federal government to do so (Hannan, 2018).

primarily by mineral and petroleum extraction and processing, which accounts for around one-fourth of its GDP (Wikipedia, 2022). In addition, it is known for its agriculture, horticulture, fisheries, forestry, and other manufactured goods, which also support a large portion of employment across the state. (Conacher and Fox, n.d.). More specifically, mining, which is one of the backbones of the state, accounts for around one-fourth of Western Australia's GDP, contributing to approximately 46 percent of the nation's total exports and employing a small number of the workforce (Conacher and Fox, n.d.).

WA is also the home to Australia's aboriginal people, also known as Aboriginal Australians, who have been occupying the land for between 50,000 and 120,000 years and are thought of as being the first people to occupy the continent (Blakemore, 2019). In Australia today, an estimated 3 percent of the entire population has Aboriginal heritage and they still struggle to gain recognition and retain their ancestral culture from the government (Australian Institute of Health and Welfare, 2021).

The Indigenous population of Australia is composed of two distinct cultural groups; the Aboriginal and Torres Strait Islander people (AIATSIS, n.d.). Those who identify with the Aboriginal people are those who are related to the ones who already inhabited the continent before 1788 when Britain began to colonize. Those who call themselves Torres Strait Islanders are those who descend from residents of the Torres Strait Islands, which is now modern-day Queensland. Combined, these two Indigenous groups have over 250 different languages and have their own individual laws and customs (Blakemore, 2019). Table 1 organizes these two distinct cultural groups into the ways in which they are represented in the country and the areas in which they inhabit.

Table 1. Indigenous Recognition

	Representation	**Territories**
Aboriginal Australians	● No formal representation at the national scale	● Australian mainland ● Adjacent islands such as Tasmania, Fraser Island, Tiwi Islands, and Hinchibrook Island
Torres Strait Islanders	● Torres Strait Regional Authority: established to administer the Torres Strait Islands ● No formal representation at the national scale	● Torres Strait Islands ○ North of Queensland ○ 17 out of 274 islands inhabited

In the 1980s, Australia began to extract lithium and it now supplies approximately 54 percent of the world's lithium, surpassing Chile's market share. The life-cycle of lithium production falls under Australia's environmental regulation. These regulations stem from the overarching federal legal system, which has an environmental regulatory framework that is governed by the legislation created within the Commonwealth, states, and territory governments. Broadly speaking, a major component of the Australian environmental regulatory system, is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC), which is seen as being one of the most impactful pieces of Australian governmental legislation that has been put in place to date (Department of Agriculture, Water and the Environment, 2021). The EPBC provides a legal framework for the protection and management, both nationally and internationally, of crucial flora, fauna, heritage sites, and other ecological communities. More specific to Western Australia though is the Environmental Protection Act of 1986, which is

overseen by the Western Australian Environmental Protection Agency (EPA). The 1968 law serves as a regulatory tool to prevent and/or mitigate any and all harms in order to enhance, conserve and preserve the environment (Government of Western Australia, 2022). Similar to the U.S., the Western Australian EPA is a subnational agency that implements any protective policies under the *Environmental Protection Act 1986* (EPA, 2022).

Mining in Western Australia

WA's lithium supply comes from the world's largest open-pit lithium mine known as the Greenbushes Project, operated by Talison Lithium, which is a joint venture between the United States's Albemarle and China's Tianqi (Talison, 2021). This operation is located 250km south of Perth in the town of Greenbushes, also known as the Shire of Bridgetown-Greenbushes. Shires are commonly used to describe rural local government areas (Wikipedia, 2022). The facility is recognized for being the longest continuously operated area in Western Australia and is estimated to contain approximately 4.3 million tonnes of lithium carbonate equivalent within it (NS Energy, n.d.). Currently, the companies want to expand their current mining pit to the south of Western Australia in order to meet the increasing demand for lithium. This expansion would allow the output of lithium to rise from approximately 608,000 tonnes to around 1.95 million tonnes (Benton, 2020).

Figure 3. Greenbushes Mine

Additionally, this expansion would require a new lithium concentrate plant to be constructed at Kemerton. Located approximately 95 km from the Greenbushes mines, the Kemerton Strategic Industrial Area, also known as Kemerton Industrial Plant, represents the growing industrial footprint of lithium in Western Australia. Albemarle commenced construction of these facilities in 2019 (Albemarle, 2022, Landcorp and Department of State Development, 2017). Importantly, for the company, the plant was created in order to lessen the dependency that the company has on China for processing procedures and is now one of the world's largest lithium hydroxide processing plants. The operation will take spodumene ore and produce it into a lithium hydroxide product, along with a sodium sulfate by-product. When completed, it is expected to have an initial capacity of about 50,0000 metric tons of lithium hydroxide, but with the ability to eventually produce 100,000 metric tons. According to the company, the construction of Kemerton symbolizes a new era of the lithium refining industry in Western Australia. As for Tianqi, the company is also constructing a lithium hydroxide (Da Silva, 2018).

Unlike the operations in Chile and the United States, Australia practices an open-pit mining technique. This process requires a traditional drill and blast method and requires lithium ore, also known as spodumene, to be mined in the open pit from fresh and unweathered zones of pegmatite, or igneous rock (Talison Lithium, 2021). Talison is currently processing the spodumene ore in two separate plants, one technical and one chemical, to produce the lithium mineral concentrate, which is then bagged and shipped from the port of Bunbury (NS Energy, n.d.).

In contrast to other mining companies in Western Australia who are responsible for their waste (tailings), Albemarle partners with an independent Australian-based company, Cleanaway, to dispose of theirs (Graham et al., 2021). Cleanaway is a sustainable waste management

solution company. Historically, Albemarle relied on sending its waste to China but decided to curtail that practice in favor of domestic remediation again to lessen its dependence on China. This choice, however, has recently strained relations between Cleanaway and community leaders over the proposed expansion of their nearby preexisting Banksia Road Landfill in order to store an additional 500,000 tons of lithium waste from their facility (Keenan, 2019). This would result in 600,000 tonnes of material waste from the Kemerton processing plant being disposed of 3.5 km outside the town of Dardanup. The existing landfill, where Cleanaway has applied to take the tailings, is already so large that it is highly visible from the road that runs through the Ferguson Valley wine region[8] (Young, 2019).

This proposal has received pushback from the residents of Ferguson Valley who already put up with dust, debris, and runoff from the neighboring landfill site which encroaches on surrounding farmlands, state parks, and conservation areas (Young, 2019). Although Cleanaway submitted a statement to the Australian EPA saying that the waste was inert and non-toxic, the waste material is so new to Australia that the company had to get samples of it from China in order to determine what to classify it as. This has raised concerns about how benign this waste material actually is. In this case, the community won, and the application was withdrawn due to the pressure of public protest in Dardanup (Keenan, 2019).

Albemarle followed up with a proposal to instead truck the spodumene tailings 580 km inland to the Koolyanobbing iron ore mine, near Southern Cross. This proposition raised concerns from the leaders of the Shire of Yilgarn government about its impact on increasing truck traffic along the Great Eastern Highway. The community leaders argued that if the waste

[8] Across WA, there is a web of processing and waste management facilities. The Department of Environment and Conservation noted approximately 206 waste management facilities throughout the State, based upon their survey of local governments taken in 2007. This number could vary depending on the failure of local governments to take the survey or not accounting for private landfills in the State (Municipal Waste Advisory Council, 2011).

was as harmless as Albemarle claims it is, it should be stored at the mine site, in order to avoid the excessive amounts of suggested trucking. Albemarle eventually elected that they would not move forward with the Dardanup plan (Lucas, 2020).

Lithium Mining and the Blackwood River

Compared to the extraction techniques practiced in the United States and Chile, Australia's open-pit mining is more water-conscious. Yet despite the conservation of water, lithium ore mining comes with its own inherent risks to the environment and surrounding communities. This technique often involves displacing thousands of acres of soil and rock, also known as "overburden material", or the material that lies above the area of exploitation (Bolton, 2021). As a result, land nearby the mining site is often disrupted, plant life is eradicated, and more times than not, there is a loss in biodiversity.

In addition to assessing environmental harms and providing mitigation plans to obtain a permit for extraction, companies in WA need to assess if they will be disturbing land that has cultural importance for Aboriginal communities. Before Talison (Albemarle/Tanqi) was able to start operations in the South of WA, they had to determine whether or not there were any sites or landmarks that hold significance to Aboriginal heritage, as defined by Section 5 of the Western Australian *Aboriginal Heritage Act 1972* (AHA) (Burgess et al., 2021). This act, by law, protects all Aboriginal heritage sites in Western Australia, regardless of if they are registered with the Department of Planning, Lands, and Heritage (DPLH) (Wikipedia, 2021). The Minister for Aboriginal Affairs of Western Australia must approve any activity that has the potential to cause a negative impact on Aboriginal heritage sites. Under this act, sites that hold outstanding ecological or cultural importance may be declared a protected areas.

The DPLH Aboriginal Sites and Places Register, however, did not contain a reference to any registered sites within the Talison's proposed area (Goode and O'Reilly, 2018). The only site that was of concern was a location known as 'Blackwood River', which has a tributary located to the south of the survey area and to the northwest where a road is to be upgraded. Land use in this area is primarily agricultural and pastoral, from horticulture to sheep, beef, and dairy production (Government of Western Australia, 2022). Supposedly, Talison's expansion will not directly impact these tributaries. However, concerns were raised by those living on the surrounding land that the entirety of the Blackwood River System, inclusive of all of its tributaries up to their high watermark, had not been recorded by the DPLH as a significant Aboriginal site (Goode and O'Reilly, 2018).

These communities argue that the site of the Blackwood River carries sacred significance. It is believed to have been created by the *Waugal,* the spirit of the Noongar people, and central to their beliefs and customs (South West Aboriginal Land & Sea Council, 2022). This area also includes the South West Yarragadee Aquifer, which directly feeds the Blackwood River and therefore is believed to contain the spiritual essence of the *Waugal.* In addition, the river is also reported to hold customary significance as being a *bindi*, or path, connecting inland areas of Nannup to the west coast. Furthermore, it is recorded to be a place of importance to Aboriginal people, for it marks a cultural boundary between the Pibelmen and Wardandi language groups.

As a result of consultations held with the South West Boojarah #2 Native Title Claim group, it was found, as determined by the AHA, that there were no new sites of Aboriginal significance, even when the tributaries were surveyed. This means according to the report [9] which was prepared by Talison and presented to the environmental advisory company GHD and

[9] REPORT OF AN ABORIGINAL HERITAGE SURVEY FOR THE TALISON LITHIUM MINE EXPANSION M01/2, M01/3, M01/6, M01/7 & L01/1 GREENBUSHES, WESTERN AUSTRALIA

to the Department of Planning, Lands & Heritage, Talison can proceed with its plans without breaching Section 17 of the AHA (Goode and O'Reilly, 2018). In addition to this, it was recommended that there be Aboriginal monitors present during the ground-disturbing construction and the company provides project-related employment opportunities, when possible, to Indigenous community members.

Indigenous Stakeholder Resistance-Reform and Status Quo

Erupting from the Black Lives Matter protests in Australia, where thousands of people demanded an end to racial inequality in a country whose Indigenous population has historically suffered from lower rates of employment, higher rates of imprisonment, and lower life expectancy, the Government of Western Australia stated that it will push for a more inclusive environment for Indigenous tribes (Burton and Barrett, 2020, Henriques-Gomes and Viscontay, 2020). For example, the State Premier's department wants to have Indigenous groups be responsible for evaluating the importance of sacred lands, instead of separate governmental committees (Government of Western Australia, 2022).

Moreover, an increasing focus on social justice, internationally and in Australia, has the potential to alter the historical bias of the government to support mining to the detriment of cultural sites (Burton and Barrett, 2020). Notably, according to state parliament records, miners have submitted more than 460 applications to destroy or disturb sites that hold cultural or environmental significance in the area since 2010. All but one of these requests was approved.

This makes the recent signs of change more impressive. Newly proposed legislation to extend and strengthen protection for cultural heritage and Indigenous lands stems from outrage over a mining company, Rio Tinto's, destruction of a site at Juukan Gorge in May 2020. Located

in the Pilbara, or a large, dry, and thinly populated area, of Western Australia, the site contained 46,000 years of cultural and archeological evidence showing continuous human occupation. Rio Tinto acknowledged that they decimated the area as part of their efforts to expand the iron ore mines and apologized for the anguish in which they might have caused the Puutu Kunti Kurrama and Pinikura (PKKP) people. Juukan Gorge was a focusing event that highlighted not only the damage that mining operations can have but also the weaknesses of the current laws meant to protect Aboriginal cultural heritage (Allam, 2021).

Although the *Aboriginal Heritage Act 1972* paved the way for the enforcement and preservation of Aboriginal policies and territory, it is outdated. Because of this, the Government of Western Australia is making a new law, known as the *Aboriginal Cultural Heritage Act 2021 (*ACH Act), to further protect Aboriginal heritage (Government of Western Australia, n.d.). This provides a contemporary framework that allows for the furthered recognition, protection, and conservation of Aboriginal heritage while simultaneously recognizing the foundational importance of Aboriginal culture to Aboriginal people (Government of Western Australia, 2022). In the 1972 Act, miners, developers, Government officials, and others were not required to consult Aboriginal people about their heritage. Moreover, it allowed the government to define what Aboriginal heritage is. The new act will alter this by requiring miners, developers, Government officials, and others to consult Aboriginal people about their heritage, as well as enabling Aboriginal groups to decide what Aboriginal heritage is. Additionally, the new legislation will have the ability to stop anyone who is attempting to alter Aboriginal territory without the permission of the Aboriginal people, as well as making the punishment easier to administer and much harsher than before[10].

[10] After passing the upper house of the Parliament of Western Australia unamended in December 2021, it will now move to receive approval from the Governor of Western Australia, also known as Royal Assent, which is the last step before a Bill becomes an Act. This approval is likely to be before the end of 2022. While in this transitional

Even the new law, however, is considered by many people as not being sufficient enough of a reform for Aboriginal people. This criticism stems from various stakeholders, ranging from Aboriginal groups to the Law Society of Western Australia, and internationally to the United Nations. Ironically, Aboriginal groups claim that they were not included in a policy dialogue prior to the legislation being decided on. They note that although it is an improvement from the 1972 legislation, it is seen as a lost opportunity to create an inclusive process and regulatory tool to curb business as usual while sites of Aboriginal heritage continue to be destroyed and exploited (Kruijff, 2021). Furthermore, the proposed legislation may end up falling short of some demands being made by Indigenous groups since it is unlikely to give them full vetoing power on decisions and developmental plans (Burton and Barrett, 2020). According to Indigenous activists and land rights lawyers, the right to veto might face opposition from lawmakers, who see the requests as too constraining for land use planning.

Although Western Australia, recently, has shown a more progressive attitude in its efforts to institutionalize a stronger voice and participation of Aboriginal communities into law it still falls short of fully recognizing or balancing the cultural rights of Indigenous communities with economic growth provided by the mining sector. Although the government did not give Cleanaway a permit to expand its waste facility, this may be so because the community resisting was not solely Indigenous voices. Nonetheless, it shows that the actions of Indigenous and non-indigenous stakeholders alike have been effective in leveraging their voices against potential construction and environmental degradation within their lands, as lithium companies attempt to expand their operations. Additionally, the state has eliminated any outside sources of inputs and outputs and by doing so has created the whole lithium mining life-cycle within, from exploration

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period, the *Aboriginal Hertiage Act 1972* will remain in place in order to allow advocates to continue to seek consent from Section 18 for any activity that will have impact on Aboriginal sites (Government of Western Australia, 2022).

to disposal. This eliminates any sort of dependency on outside resources and guarantees that they remain competitive in the global market.

Chile

Located along the western seaboard of Latin America, Chile is a country with a long history of mining that continues to play a large role in national development. Revenues from the mining sector go towards supporting national expenditures in health, education, employment, and infrastructure (Segarra, 2013). It is considered one of the most developed countries in Latin America, but its democracy has faced many challenges. In 1973, Chile transitioned from a democratically elected socialist government to a military dictatorship. Led by General Augusto Pinochet Ugarte, Chile embarked on the neo-liberal reform pathway of liberalization, privatization, and deregulation of many government programs. Under Pinochet, civil liberties were abolished and any remnants of the leftist economy were extinguished. The deregulatory stance of the state and its support of business led to a weakening of environmental regulations by opening up the country to mining investments and allowing water rights to be bought and sold more easily (Sengupta, 2021). Environment legislation was spread thin across various state agencies heading fisheries, forestry, and energy.

After the return of democracy in the 1990s, the newly elected Concertación[11] Government viewed environmental protection as a top priority, as it established a more integrated legal and institutional structure. The government promulgated the General Environmental Law, or Ley de Bases Generales del Medio Ambiente, and established the National Commission on the Environment (1994-2010), also known as Comisión Nacional del

[11] The Concertación was a coalition government composed of center-left political parties. These coalitions are usually formed as temporary alliances, when no single political party gains the majority. These situations usually occur during times of crisis, such as war or political turmoil (Rogers, n.d.).

Medio Ambiente (CONAMA) (Wikipedia, 2022). As the United States EPA, a key purpose of the Commission is to protect both human health and the environment.

In addition, Chile has an extensive Indigenous population, with more than 2 million of the country's population identifying as Indigenous. The tribes that are federally recognized by Chilean Law 19.253 include the Mapuche, Aymara, Diaguita, Atacameño, Rapanui, Colla, Quecha, Chango, Yagan, and Kawashkar (Marca Chile, 2021). According to a national census taken in 2017 the region of Antofagasta, which is the home to the operations of SQM and Albemarle and the center for lithium extraction and processing, has a population of 10,996, composed of 16 different communities (Liu and Agusdinata, 2020). Within this population, 50% of the residents belong to Indigenous groups.

Yet Chile, in contrast to other Andean countries with a significant Indigenous population like Bolivia and Ecuador, does not recognize its Indigenous groups as distinct entities with rights over the natural environment within its Constitution. Because of the lack of Constitutional rights to representation, these groups have faced many challenges leveraging their voices in Chilean politics and policy, especially when inserting themselves into decision-making over natural resources and territory rights. However, in 2007, the Chilean government did adopt the U.N. Declaration on the Rights of Indigenous Peoples in 2007, and a year later ratified the International Labor Organization Convention 169 which, in addition to recognizing the human rights violations Indigenous people have had to face, also calls for policies to protect Indigenous heritage.

Lithium SQM and Albermarle

Located at 2,300 meters above sea level within the Atacama Desert plains in northern Chile between the Cordillera de Domeyko and the Andes mountains are the Atacama Salt Flats, also known as the Salar de Atacama. This unique Mars-like area covers 3,000 km^2, making it Chile's largest salt flat and the third-largest in the world, behind the vast Salar de Uyuni, Bolivia[12] (10,582 km^2) and the Salinas Grandes, Argentina (6,000 km^2) (ESA, 2017). In addition to being surrounded by mountain ranges, the landscape around the flat is also dominated by volcanoes including Cerros de Tocorpuri, Sairecabur, and Láscar, the most active volcano in the Andes (Smithsonian Institution, 2013). Underneath these flats, there is an estimated amount of 7.5 million tons of lithium reserved (Hyland, n.d.). This area is the ideal location for lithium mining due to its infrequent rains, strong winds, and the high levels of solar radiation that it experiences. All of these factors play a part in increased rates of evaporation, leaving behind concentrated lithium-rich salt deposits.

Combined, the mining operations of SQM, a Chilean mining company, and Albemarle occupy more than 30 square miles of the flats. Similar to the operations in the United States, mineral-rich brine, which is salinated groundwater containing lithium, is pumped up from beneath the crust of the flats into expansive open-air evaporation pools. Contained within the first pool is a liquid mixture of borax, manganese, potassium, and lithium salts, which can take up to a year to fill completely (Katwala, 2018). After full, the brine is left to evaporate for anywhere between eight months and three years, ultimately leaving behind lithium carbonate when finished (Reuters Staff, 2010).

[12] The Salar de Uyuni holds an estimated quarter amount of the world's lithium, but has continuously failed to find the best way to mine it. Now, eight foreign companies are competing to start extraction pilot projects on the flat (Krauss, 2016).

Among these barren and arid flats live the Atacama people, also known as Atacameño, who have inhabited the area for over 6,000 years (Baillargeon, n.d.). These communities are not homogenous, but consist of numerous different cultures. The livelihoods of communes such as the San Pedro de Atacama, which lies at the edge of the Salar, are based primarily on tourism and agriculture (Explore-Atacama.com, n.d.). The salt flat supports unique biodiversity, most notably the Andean Flamingos. Currently, there are environmentally sensitive protected areas within the Salar that are to remain off-limits to any sort of extraction based on agreements amongst the Indigenous communities, Chiles' National Parks Service, and the mining companies. Although lithium mining is relatively new to the country, mining has always been a crucial part of the Chilean economy. Along with lithium, resources such as copper, silver, and gold have been key components in establishing and maintaining Chile's place in the global market. In fact, the mining sector contributes approximately 11% to the country's GDP and represents over half of its total exports (International Trade Administration, 2022). Up until 2013 when Australia surpassed it, Chile was the world's leading lithium producer (Maxwell and Mora, 2019).

It wasn't until 1996 that Chilean chemical company Sociedad Química y Minera de Chile (SQM), in the midst of the successful production of potassium nitrate, began searching for lithium as a secondary product (SQM, 2022). In addition to SQM, the United States-based company Albemarle currently operates two sites in Chile (Albemarle, 2022). As noted above, Albemarle's operation is in the Salar de Atacama, with a second location that processes lithium, located in the "La Negra" industrial sector 27 kilometers southeast of the city of Antofagasta in Northern Chile. Operations started in 1984 with a lithium carbonate plant and continued on with an addition of a lithium chloride plant in 1998. Here, the brine extracted from the Salar de

Atacama site is chemically processed into battery-grade lithium carbonate, used for electric cars, devices, and other equipment.

There is another side to this “white gold” though because lithium mining is using up all of the freshwater in the region’s aquifers. This entire process requires copious amounts of water. More specifically, it takes an estimated amount of 500,000 gallons of water per one ton of lithium (Xanders, n.d.). Taking into account the dry climate of Salar de Atacama, the area is already scarce of water. Moreover, mining activities consume approximately 65% of the region’s water. Furthermore, government figures issued by Comité de Minería No Metálica (the Nonmetallic Mining Committee) have shown that the groundwater recharge capacity of the basin of the flats is 6,810 liters per second, with a brine output of 8,842 liters per second (Heubl, 2020). This means that more water is being taken out from the ground than being put in. More specifically between the years 2002 and 2017, the total water storage of the area declined at a rate of 1.16 mm per year. Furthermore, in comparison to the estimated domestic use, water used for mining processes is found to be approximately 50 times the amount, and hundreds of times the estimated consumption for tourism (Liu and Agusdinata, 2020). This means that areas that are in closer proximity to mining operations are experiencing declining soil moisture and ground cover, higher rates of environmental degradation, and faster evaporation of local water sources

The draw down on water is impacting the livelihoods of Indigenous and farming communities in the area. These livelihoods are traditionally based upon an agro-pastoral economy but have recently been disrupted by the ‘extractivism-as-development’ economy, as mining practices continue to expand in the region (Liu and Agusdinata, 2020). Farming in these regions is based mainly on quinoa and herding llamas, both water-intensive practices. In addition to impacting farming communities, the diversion of water to extraction in the Salar is leading to

a decline in the Andean flamingo population. Given that their main diet consists of brine shrimp and other small invertebrates found in saline water, Andean Flamingos are highly dependent on the availability of wetlands (Line, 1997, Fish and Wildlife Service, 2010). Satellite images have shown that these wetlands in the Atacama region are drying up in correlation with mining.

Community Resistance to Extraction as Development

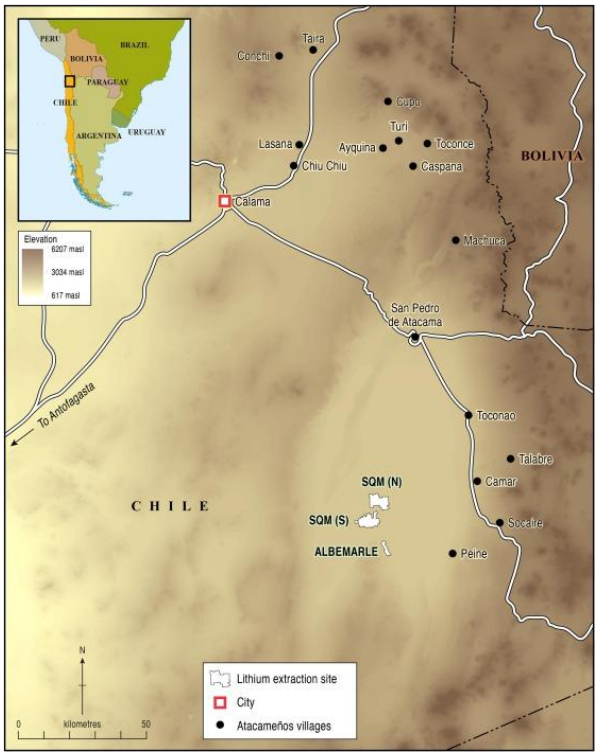
The environmental and social impacts of lithium extraction have begun to mobilize community resistance. The Atacama People's Council, a group representing the Indigenous communities living on the salt flats, has noted that in the past years, meadows and lagoons in the southern part of the flats have shrunk. Some tribal members have even noted that they never had informed consent of these projects on their territory. Although as noted earlier, Chile ratified the International Labor Organization ILO Convention No. 169 in 2008, which requires governments to consult Indigenous communities when major projects intrude on their territory and ancestral grounds, Albemarle and SQM's licenses to mine in Atacama date back to 1982, and 1993, allowing them to avoid this legislation (Houmann Mortensen and Boddenberg, 2019).

A common tactic for mining companies to get community support for extraction is to promise members of the surrounding communities job opportunities and additional services in health and education that the state should be providing, but often does not. Albemarle's strategy is to distribute money to the local communities, universities, and municipalities as a form of compensation to curb negative public sentiment towards their operations. This act of corporate social responsibility, however, does not change the fact that there was never consent by Indigenous communities for extraction in the Salar.

In 2019, the Atacama's Indigenous Council filed a lawsuit demanding the termination of a $25 million plan developed by SQM to remediate damages from over-extraction (Sherwood, 2020). This suit came from charges by officials claiming that the company was over-pumping lithium-rich brine from the salt flats. In spite of the fact that the Indigenous groups won, Chile's environmental regulators appealed to the Chilean Supreme Court to defend SQM's plan. The regulators have since removed themselves from the legal battle, forcing SQM to start again on a new and potentially tougher plan. Although victorious, the Indigenous council said that they did not go far enough with their requests. Council president Sergio Cubillos states that the ultimate goal of the fight is to have the environmental permits of SQM revoked and their operations shut down, claiming that "The damages committed by this company are immeasurable and they must assume their responsibility" (Sherwood, 2020). If not the complete shutdown, the council is asking for the suspension or reduction of mining efforts of SQM until they file environmental compliance.

In light of these protests, SQM struck an agreement with the Camar, one of the 18 communities residing along the flat, in hopes of facilitating a more fluid dialogue with them (Sherwood, 2020). Despite the fact that the company did not give details about the agreement, the community of Camar revealed in a statement that the pact would improve SQM's stewardship of the flat. SQM has also signed an

Figure 4. Mining Operations of SQM and Albemarle



agreement with the Atacameño community of Toconao and the Chilean National Parks authority in order to co-manage the protected area of Laguna Chaxa, located on the Salar (Babidge and Bolados, 2018). This broad area is located within the Los Flamencos National Reserve, which was created by Supreme Decree No. 50 of the Ministry of Agriculture in 1990 in order to protect the flora and fauna within (Comunidad Lickan Antay De Toconada, 2022). For their part, in this agreement, both SQM and Albemarle do their own groundwater monitoring which they share with the local communities.

These voices of resistance have not gone unheard. The continuous protests over social and environmental injustices in 2019 contributed to the decision for Chile to rewrite its Constitution (Sengupta, 2021). The Constitutional Convention is composed of 155 elected Chileans, 17 of those seats being reserved for members of Indigenous communities. After the election of its members in 2021, the convention got to work. According to the enabling legislation it's under, the Convention has nine months, with an extension of three months possible, to produce a working draft of the new constitution. After this, a National Constitutional referendum will take place, 60 days after an executive Decree is published in the Official Gazette[13] calling for a national vote. All individuals who are registered to vote will be required to take part in this voting process (Ministerio de Hacienda, 2021).

Although new to Chile, this process has been used as a key tool by other Latin American countries in order to advance the rights of Indigenous people and protect the natural environment. More specifically, Ecuador's 2008 constitution and Bolivia's proposed Law of Mother Nature both worked to directly extend rights to nature. This will not only shape the way that the country of 19 million people is governed, but it will also determine the future of lithium.

[13] A government gazette is a periodical publication that releases public or legal notices upon authorization (Wikipedia, 2022).

The Constitutional Convention will work to decide questions such as: how should mining be regulated, and what voice should local communities have over it? Should Chile retain a presidential system? Should nature have rights? How about future generations? It is assumed that the Convention will make water a public good. However, this may not solve the problem of water use in the Salar because it has to first be determined whether or not the salt brine beneath the desert is technically water (Sengupta, 2021). The mining companies argue it is not, due to the fact that it is neither suitable for human nor animal consumption. Although brine extraction is currently regulated by the mining code, the new constitution could change that by defining brine as water. This new classification would ultimately give more authority to Indigenous groups over their resources[14].

Despite the Ministry of Social Development's attempt to raise questions on behalf of these tribes by kickstarting the "Indigenous Constitutional Assembly Process", the process fails to protect Indigenous rights against public and private conservation initiatives, recognize the importance of Indigenous contributions to biodiversity, or even protect and recognize Indigenous community-based conservation projects (IWGIA, n.d). Despite these issues, there has been positive change that has come from the continuous communication between the Chilean government and various Indigenous groups, especially the Mapuche peoples. This dialogue has pushed for a rewriting of Chile's Constitution, which will give the Indigenous population greater representation and rights (Boyce, 2020, Watson, 2020). In addition, the Chilean government adopted the U.N. Declaration on the Rights of Indigenous Peoples in 2007, and a year later

[14] Independent audits are currently being conducted for Albemarle and SQM. In this case, the Certification Body, known as ERM CVS, is the 3rd party conducting these examinations (ERM CVS, 2022). Although both are in early stages, when complete, these public reports will be composed of over 100 pages of assessments including waste disposal, brine extraction, and concentrations at both these sites. According to the Initiative for Responsible Mining Assurance (IRMA), these audits are done with the intention to enhance transparency and access to information about the environmental and social implications and performance at each site, while actively improving performance (IRMA, n.d.).

ratified the International Labor Organization Convention 169 which, in addition to recognizing the human rights violations Indigenous people have had to face, also calls for policies to protect Indigenous heritage.

Through this case it is clear that the stakeholders within Chile were able to leverage their voices, despite lack of recognition, in order to spark change on the national level. Although environmental governmental oversight and relations between the Indigenous stakeholders and the state have been strengthened, the question still remains of how to manage Chile's heavy reliance on mineral resources, while also taking into consideration the voices of the local community members and the environmental degradation that comes with it.

Analytical Conclusion

I originally started this project with the interest in examining the expansion of lithium mining in the U.S. and the impact it has and will have on environmental and social systems. I was interested to see if the Biden Administration's ambitious goals to move the U.S. to EVs had taken into consideration that this green goal depended on often dirty extraction and processing practices. Furthermore, I wanted to explore the ways in which stakeholders can influence change on the local and national levels, in order to hold mining companies accountable and to push governments toward a truly "green" and "just" transition as we move away from fossil fuels.

In order to think about the U.S. and to see it in context, I chose to analyze how lithium mining is playing out in other established mining countries and to ask if there were lessons to be learned for the United States to obtain the ambitious climate goals and transition to a low carbon economy. Is the practice of lithium mining actually that much better for the environment than other extraction practices such as coal mining? Or have the mining industries and those connected to them been greenwashing the practice to make it seem like the clean solution to our messy climate crisis?

At first glance, electric vehicles are the golden ticket to a sustainable future. Although this is true in terms of reducing human-produced carbon emissions, this view of EVs overlooks the environmental and social issues that lithium mining creates in itself. Although in my case analysis I found similar externalities in lithium as in fossil fuel extraction, I did find that a rising interest in Indigenous rights, coupled with the broader acceptance of environmental justice movements, has created a window of opportunity for stakeholders to raise their voices that was not available before.

Despite the ambiguities as to which laws apply in Australia for extraction and Indigenous rights, at the national or state levels, it was clear in the case study that Australia and its states have made sure to consider the heritage of their Indigenous population and the land which they occupy. More specifically though, the state of Western Australia has crafted legislation, such as the *Aboriginal Heritage Act 1972* to ensure that no land holding Aboriginal significance is disturbed by any activity without approval from the Minister for Aboriginal Affairs. In continuation, it has made impressive efforts to update laws and regulations in order to expand the rights of its Indigenous people, as seen with the updated version of the act, the *Aboriginal Cultural Heritage Act 2021.* However, the state did so without consulting the set of people to which it is most applicable, so despite this, the Indigenous are yet again a second thought of the government. However, these steps are still more than the United States has been taking to notify their Native populations about mining developments.

Chile is the only country in Latin America that does not recognize its Indigenous groups within its Constitution, yet it has come to a national decision to rewrite the Constitution in order to incorporate greater human rights. This of course was a result of stakeholder protests and mobilizations against the environmental injustices resulting from the mineral-rich areas of their lands being exploited and left demolished. Moreover, this positive change in the increased transparency of the mining companies is displayed by Albemarle and SQM's efforts to make their water monitoring data available to the public. Yet it must be noted that just because this information is available, does not necessarily mean that it is accessible. It is putting faith in the notion that every individual will understand the data and/or the language that these reports are written in.

As seen in Chile and Australia, the mining companies are pledging that they are making efforts to incorporate ‘sustainable’ practices into their production processes by increasing transparency with the community and promoting natural resource management to preserve the environment. Overall, it is an improvement from traditional mining practices that have polluted and disturbed the surrounding environment to fulfill the perpetually growing demand for fossil fuels. Yet the cases of Australia and Chile indicate that lithium mining is nothing more than an abridged version of old exploitative mining practices on an industrial scale. Based on the definitions of sustainable development and mining explored in the literature review, I believe that these countries and the companies within are failing to practice sustainable mining practices, despite what they promote, and are therefore falling short of a truly “just” transition.

As stated before, the objective of this project is not to argue against transitioning to a green economy. Instead, it is to bring awareness to the effects of lithium mining and to showcase the lessons and improvements the United States should make as they venture deeper into the lithium market. The overall message that the U.S. should takeaway is that they must be cognisant of the environmental and social harms that are the results of these new mining techniques if they don’t want to end up with sacrifice zones as both Australia and Chile have.

We are not likely to break this status quo soon, as demands for natural resources to fuel our green-economy craze heightens, and more land is exploited. Though what we can work to break is the historic systematic oppression of stakeholders, specifically those who are Indigenous, by curating laws and regulations that take into consideration their voices.

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