Achieving Zero Emissions with More Mobility and Less Mining

Updated Effects of Lithium Extraction

June 2023

climate + community project

UC DAVIS

ACKNOWLEDGMENTS

This report has been informed through conversations and review by a number of activists, researchers, and mining experts, including from communities that live on the frontlines of lithium extraction. We are deeply grateful for the time these groups dedicated to helping us develop this report, and for their generosity in sharing their experiences and knowledge on its content. We are particularly grateful to community and peer review partners: The People of Red Mountain (Daranda Hinkey, Chanda Callao, Gary Mckinney), Great Basin Resource Watch (John Hadder, Kassandra Lisenbee), Fundación Ambiente y Recursos Naturales (Pía Marchegiani, María Laura Castillo Díaz), and Observatorio Plurinacional de Salares Andinos (Ramón Balcázar, Verónica Gostissa). We benefited from community review of the section on Portugal from Aida Alves Fernandes and Catarina Loureiro Alves Scarrott (Associação Unidos em Defesa de Covas do Barroso). We are grateful to peer reviewers James Blair, Yonah Freemark, Corey Harper, Steven Higashide, and Payal Sampat for their time and expertise. Johanna Bozuwa and Patrick Bigger provided guidance and support throughout the report development and process. We thank ClimateWorks, 11th Hour Foundation, and the Rockefeller Brothers Fund for their generous support of this work.

Achieving Zero Emissions with More Mobility and Less Mining

June 2023

THEA RIOFRANCOS Providence College

ALISSA KENDALL University of California, Davis

KRISTI K. DAYEMO University of California, Davis

MATTHEW HAUGEN Climate and Community Project

KIRA MCDONALD Climate and Community Project

BATUL HASSAN Climate and Community Project

MARGARET SLATTERY University of California, Davis

XAN LILLEHEI TEN x TEN

Graphics and Report by Xan Lillehei and A.L. McCullough

The **Climate and Community Project (CCP)** works to connect the demands of the climate justice movement to the policy development process. We aim to do this by developing new, investment-forward public policy proposals under the framework of the Decade of the Green New Deal that target the intersection of climate justice and the built environment. We support efforts to address the climate emergency at the scale, scope, and pace needed to confront our overlapping crises.

Suggested citation: Thea Riofrancos, Alissa Kendall, Kristi K. Dayemo, Matthew Haugen, Kira McDonald, Batul Hassan, Margaret Slattery, and Xan Lillehei, "Achieving Zero Emissions with More Mobility and Less Mining," 2023, Climate and Community Project [http://www.climateandcommunity.org/more-mobility-less-mining].

CO-SPONSORS:

The McHarg Center

SC^2 Socio-Spatial Climate Collaborative

EFFECTS OF LITHIUM EXTRACTION

> **One crucial piece of the transition to an electrified US transportation system is new demand for energy transition minerals, and specifically the most non-replaceable metal for EV batteries—lithium.**

Although lithium is geologically abundant, the vast majority of lithium extraction is concentrated in Australia, Chile, Argentina, and China. At the same time, the lithium extraction frontier is shifting to new regions as downstream battery and EV producers scramble to meet increasing demand, and governments, especially in China, the United States, Europe, and Canada, incentivize domestic extraction, expand domestic supply chains, and promote geopolitical alliances that facilitate trade in lithium and other "critical minerals." The result is intensified extraction within the countries that currently lead production, alongside prospecting and exploration in locales with previously small or non-existent lithium sectors.

Lithium can be found in a wide range of deposit types: rock, including both hard (pegmatite, most commonly spodumene) and soft (clay), and brine (including both continental salt flats and geothermal). In addition, lithium can be recovered from the "produced water" that is a byproduct of oil and gas production. All current operational lithium mines are either brine or hard rock; the rest of these deposit types (clay, geothermal, and oilfield) involve extraction techniques that have only been tested at the pilot scale. Thus, lithium extraction and processing projects can vary a great deal, and, with new extraction techniques, there remains considerable scientific uncertainty regarding the environmental consequences of commercial-scale production, including over water use and waste streams.[1]

Additionally, the type of lithium deposit is intertwined with needs for battery chemistry. Extraction from rock deposits produces lithium hydroxide, and extraction and evaporation from brine deposits produces lithium carbonate (although this can be converted into lithium hydroxide with further processing).[2] Lithium hydroxide is usable in high-nickel chemistries that enable longer driving ranges and do not require cobalt, which may make it more desirable for battery manufacturers and therefore incentivize extraction from rock deposits.[3]

---

1. Victoria Flexer, Celso Fernando Baspineiro, and Claudia Inés Galli, "Lithium Recovery from Brines: A Vital Raw Material for Green Energies with a Potential Environmental Impact in Its Mining and Processing," *Science of the Total Environment* 639 (October 2018): 1188–1204, https://doi.org/10.1016/j.scitotenv.2018.05.223.

2. John D. Graham, John A. Rupp, and Eva Brungard, "Lithium in the Green Energy Transition: The Quest for Both Sustainability and Security," *Sustainability* 13, no. 20 (2021): 11274, https://doi.org/10.3390/su132011274.

3. International Energy Agency, Global EV Outlook 2022: Securing Supplies for an Electric Future, OECD, 2022.

Like all forms of mining, lithium extraction and processing comes with a number of concerning social and ecological impacts. These include pollution, water depletion, loss of biodiversity, threats to human rights, nonmining livelihoods, and Indigenous sovereignty and cultural integrity.

The threats to human rights and Indigenous sovereignty are especially pertinent given that much existing and proposed lithium mining is on or near Indigenous lands. In the United States specifically, 79 percent of known lithium deposits sit within 35 miles of Native American reservations.[5] Lithium mines on Indigenous lands have often been developed without substantive enforcement of Free, Prior and Informed Consent (FPIC), which is based on an international human right standard, the United Nations Declaration on the Rights of Indigenous Peoples, that allows Indigenous people the right to give or withhold permission for the advancement of projects that would affect them or their land, or substantive community participation. While many harms of mining may be mitigated, the destruction of sacred or tribal lands transforms landscapes permanently. The lack of substantive enforcement of FPIC and respect for Indigenous sovereignty is further discussed in the global case studies of mining sites below.

In this report, to illustrate the oftentimes devastating consequences of lithium mining, we focus on a subset of deposit types and geographies encompassing both ongoing and proposed lithium extraction. While not an exhaustive analysis of all projects and their impacts, our selection captures the range of current and potential harm. In addition, our selection was shaped by our organizational relationships with the five community reviewers that evaluated this report: Observatorio Plurinacional de Salares Andinos (encompassing directly affected communities and allies based in Chile, Argentina, and Bolivia); Fundación Ambiente y Recursos Naturales (based in Argentina); Great Basin Resource Watch (based in Nevada); the People of Red Mountain (based in Nevada); and representatives from Associação Unidos em Defesa de Covas do Barroso (based in Portugal). We thus focus on Chile, Argentina, and Nevada, plus Portugal, to capture the EU's plans for a massive increase in regional

Table 1: Global Lithium Mine Production (metric tons)

Country	2021 Production	Resource Type
Australia	55,000	Hard rock
Chile	26,000	Brine
China	14,000	Hard rock and brine
Argentina	6,200	Brine
Brazil	1,500	Hard rock
Zimbabwe	1,200	Hard rock
US	1,000	Brine
Portugal	900	Hard rock

Table 1: US lithium production is withheld from public access to avoid disclosing company proprietary data, as all production is currently from one mine, owned by Albemare.[4]

4. "Mineral Commodity Summaries 2022," U.S. Geological Survey, 2022, https://doi.org/10.3133/mcs2022; "Albemarle to Double Silver Peak Lithium Production," 2021, Miningmagazine.com, January 8, 2021, https://www.miningmagazine.com/supply-chain-management/news/1402188/ablemarle-to-double-silver-peak-lithium-production.

5. Samuel Block, n.d., "Mining Energy-Transition Metals: National Aims, Local Conflicts," Msci.com, accessed November 23, 2022, https://www.msci.com/www/blog-posts/mining-energy-transition-metals/02531033947.

lithium mining. This selection excludes two critical sites of current global lithium production: Australia and China. There is limited independent research on both cases, but for an assessment of the sector's impacts in China see Gu and Gao (2021), and for a discussion of lithium mining's consequences in Australia, see Burgess et al. (2021).[6]

Despite the specificity of deposit types, extraction methods, and socio-natural landscapes, the selected cases illustrate a shared pattern of harm and risk. One persistent concern across sites is water. Depending on the method of extraction, water is used as an input in mining and/or processing, and/or a sink for waste and contamination, and/or is part and parcel of the deposit itself (in the case of brine[7]). Currently, the consumption and/or contamination of water is particularly high stakes as a result of climate change–induced drought. Indeed, every single one of the cases discussed below is situated in a drought-affected region.[8] More than half of global lithium production currently occurs in areas characterized by high water stress—an issue that will only get more salient as the climate crisis intensifies.[9] Information about these mining projects and their potential impacts is often not disseminated transparently or equitably to impacted communities that are under-resourced when compared to corporations and governments.[10] Consequently, many existing and proposed projects have generated significant community resistance, which itself reflects a more general pattern of increasingly local skepticism toward large-scale mining projects, as well as communities' embrace of more militant, oppositional tactics to make their voices heard.[11]

Lastly, at the same time that global warming exacerbates the environmental harms of mining, mining directly contributes to the climate crisis, in two key ways. First, the mining sector accounts for 4–7 percent of global emissions (including emissions from both operations and power generation).[12] Second, large-scale mining and associated infrastructure can destroy the landscapes that function as vital carbon sinks. Tropical

6. Guozeng Gu and Tianming Gao, "Sustainable Production of Lithium Salts Extraction from Ores in China: Cleaner Production Assessment," Resources Policy 74 (2021): 102261, https://doi.org/10.1016/j.resourpol.2021.102261; Claire Burgess, Liz Downes, and Nat Lowrye, "Is Australian Lithium the Answer to Zero Emissions?" Aid/Watch, September 23, 2021, https://aidwatch.org.au/wp-content/uploads/2021/09/Will-Australian-Lithium-Bring-Us-Zero-Emissions.pdf.

7. For discussion of brine as water, see James Blair, Ramón Balcázar, Javiera Barandirián, and Amanda Maxwell, "Exhausted: How We Can Stop Lithium Mining from Depleting Water Resources, Draining Wetlands, and Harming Communities in South America," April 26, 2022, Natural Resources Defense Council, accessed November 23, 2022, https://www.nrdc.org/resources/exhausted-how-we-can-stop-lithium-mining-depleting-water-resources-draining-wetlands-and; Mojtaba Ejeian, Alexander Grant, Ho Kyong Shon, and Amir Razmjou, 2021, "Is Lithium Brine Water?" Desalination 518 (2021): 115169, https://doi.org/10.1016/j.desal.2021.115169; Ingrid Garcés and Gabriel Álvarez, 2020, "Water Mining and Extractivism of the Salar DE Atacama, Chile," in Environmental Impact V (Southampton, UK: WIT Press), 189–199.

8. Jonathan Gilbert, "Drought, High Costs Push Argentine Farmers to Grow More Soy," Bloomberg.com, September 21, 2022, https://www.bloomberg.com/news/articles/2022-09-21/drought-soaring-costs-push-argentine-farmers-to-grow-more-soy; John Bartlett, "'Consequences Will Be Dire': Chile's Water Crisis Is Reaching Breaking Point," The Guardian, June 1, 2022, https://www.theguardian.com/world/2022/jun/01/chiles-water-crisis-megadrought-reaching-breaking-point; Colton Poore, "Nevada's Long-Term Dry Spell: Megadrought or New Normal?," Reviewjournal.com, Las Vegas Review-Journal, July 20, 2022, https://www.reviewjournal.com/local/local-nevada/nevadas-long-term-dry-spell-megadrought-or-new-normal-2608291; "Drought Prompts Portugal to Restrict Water Use at More Hydropower Dams," Reuters.com, September 22, 2022, https://www.reuters.com/business/environment/drought-prompts-portugal-restrict-water-use-more-hydropower-dams-2022-09-27/.

9. International Energy Agency, "The Role of Critical Minerals in Clean Energy Transitions."

10. Araceli Clavijo, Walter F. Díaz Paz, Mauricio Lorca, Manuel Olivera Andrade, Martín A. Iribarnegaray, and Ingrid Garcés, "Environmental Information Access and Management in the Lithium Triangle: Is It Transparent Information?" *Journal of Energy & Natural Resources Law* (2022): 1–22, https://doi.org/10.1080/02646811.2022.2058770.

11. Marta Conde and Philippe Le Billon, "Why Do Some Communities Resist Mining Projects While Others Do Not?," Extractive Industries and Society 4, no. 3 (2017): 683; Paul Alexander Haslam and Nasser Ary Tanimoune, "The Determinants of Social Conflict in the Latin American Mining Sector: New Evidence with Quantitative Data," World Development 78 (2016): 401–419; Thea Riofrancos, Resource Radicals: From Petro-nationalism to Post-extractivism in Ecuador (Durham, N.C.: Duke University Press, 2020); Scheidel et al., "Environmental Conflicts and Defenders: A Global Overview"; Leah Temper, Sofia Avíla, Daniela Del Bene, Jennifer Gobby, Nicolas Kosoy, Philippe Le Billon, Joan Martinez-Alier, et al., "Movements Shaping Climate Futures: A Systematic Mapping of Protests Against Fossil Fuel and Low-Carbon Energy Projects," Environmental Research Letters 15, no. 12 (2020): 123004.

12. Taylor Kuykendall, Katya Bouckley, Filip Warwick, Stephanie Tsao, and Guarang Dholakia, "Mining Faces Pressure for Net-Zero Targets as Demand Rises for Clean Energy Raw Materials," S&P Global Commodity Insights, July 27, 2020, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/072720-mining-faces-pressure-for-net-zero-targets-as-demand-rises-for-clean-energy-raw-materials.

forests play a particularly pivotal role in this respect (hence condemnation of mining and other extractive industries in the Amazon); however, deserts—a label that applies to several sites discussed below—are also carbon sinks.[13]

Hard Rock and Clay

Rock extraction is done by digging out ores, primarily spodumene, from huge open pit mines and using sulfuric acid to dissolve excess minerals, leaving lithium and other valuable metals behind. Australia, currently the world's top producer, gets its lithium from hard rock extraction. Rock deposits yield higher concentrations of lithium than brine, but the extractive process is more complex and expensive, has higher greenhouse gas emissions, and uses more freshwater.[14] It produces significant pollution from the waste tailings left behind after the acid processing. Adding to the emissions intensity, more than 90 percent of Australia's lithium concentrate is shipped to China for further processing.[15]

United States

Mining regulation in the United States is overall deficient and seriously outdated. On federal public lands, mining is still primarily governed by the General Mining Act of 1872, which contains no water or environmental safeguards nor provisions for Indigenous consultation, let alone consent. At present, only one small lithium mine operates in the US: Silver Peak, a brine deposit located in southwest Nevada and run by the Albemarle Corporation that currently produces just under 1,000 metric tons of lithium per year.[16] However, the drive to onshore US lithium mining points to a significant increase in rock extraction. Near the end of the Trump administration in early 2021, the US Department of the Interior's Bureau of Land Management (BLM) approved a massive new lithium project on leased federal lands a few hundred miles away in northwestern Nevada's Humboldt County called Thacker Pass. Thacker Pass is the site of a large soft clay lithium deposit. Lithium Nevada, the corporation developing the project and a subsidiary of Lithium Americas, claims that it can produce 30,000 metric tons of lithium per year, which if it were a country would make the Thacker Pass project the second largest producer of lithium in the world.[17]

The proposed mining at Thacker Pass would disturb approximately 5,695 acres and last for 41 years, and at the end of its operating span the open pit mine would be entirely filled in.[18] Once up and running, the mining operation would use approximately 5,200 acre-feet of water per year (equivalent to the water usage of around 15,000 US households) from a nearby groundwater well.[19] It would also produce 354 million cubic yards of clay tailings waste over its lifespan using novel technology, which has the potential to leak and contaminate area soil and water.[20]

13. S. Boyd, "Carbon Sequestration in Our Desert Lands," Desertreport.org, accessed Nov 23, 2022, https://desertreport.org/carbon-sequestration-in-our-desert-lands-copy/; John Hribljan et al., "Carbon Storage and Long-Term Rate of Accumulation in High-Altitude Andean Peatlands of Bolivia," Mires and Peat 15 (2015); Verónica Molina et al., "Greenhouse Gases and Biogeochemical Diel Fluctuations in a High-Altitude Wetland," *Science of the Total Environment* 768 (2021): 144370, https://doi.org/10.1016/j.scitotenv.2020.144370; Verónica Molina et al., 2018, "Distribution of Greenhouse Gases in Hyper-Arid and Arid Areas of Northern Chile and the Contribution of the High Altitude Wetland Microbiome (Salar de Huasco, Chile)," Antonie van Leeuwenhoek 111, no. 8 (2018): 1421–32, https://doi.org/10.1007/s10482-018-1078-9.

14. Cristina Chaves, Elma Pereira, Paula Ferreira, and António Guerner Dias, "Concerns about Lithium Extraction: A Review and Application for Portugal," Extractive Industries and Society 8, no. 3 (2021): 100928, https://doi.org/10.1016/j.exis.2021.100928; Jarod C. Kelly, Michael Wang, Qiang Dai, and Olumide Winjobi, "Energy, Greenhouse Gas, and Water Life Cycle Analysis of Lithium Carbonate and Lithium Hydroxide Monohydrate from Brine and Ore Resources and Their Use in Lithium Ion Battery Cathodes and Lithium Ion Batteries," Resources, Conservation and Recycling 174 (2021): 105762.

15. "Insights into Australian Exports of Lithium," Australian Bureau of Statistics, April 8, 2022, https://www.abs.gov.au/articles/insights-australian-exports-lithium.

16. "Albemarle to Double Silver Peak Lithium Production," 2021, Miningmagazine.com, January 8, 2021, https://www.miningmagazine.com/supply-chain-management/news/1402188/ablemarle-to-double-silver-peak-lithium-production.

17. Graham et al., "Lithium in the Green Energy Transition."

18. US Bureau of Land Management, "Thacker Pass Lithium Mine Project Final Environmental Impact Statement," December 4, 2020, https://eplanning.blm.gov/public_projects/1503166/200352542/20030633/250036832/Thacker%20Pass_FEIS_Chapters1-6_508.pdf.

19. For the basis of this calculation, see "How We Use Water," Environmental Protection Agency, May 24, 2022, https://www.epa.gov/watersense/how-we-use-water; US Bureau of Land Management, "Thacker Pass Lithium Mine Project Final Environmental Impact Statement."

20. Steven H. Emerman, n.d., "Prediction of Seepage from the Clay Tailings Filter Stack (CTFS) at the Lithium Nevada Thacker Pass Mine, Northern Nevada," Great Basin Resource Watch, https://www.gbrw.org/wp-content/uploads/2022/06/Exhibit-4-Thacker_Pass_Report_Emerman_Revised2. pdf; Ivan Penn, Eric Lipton, and Gabriella Angotti-Jones, "The Lithium Gold Rush: Inside the Race to Power Electric Vehicles," New York Times, May 6, 2021, https://www.nytimes.com/2021/05/06/business/lithium-mining-race.html.

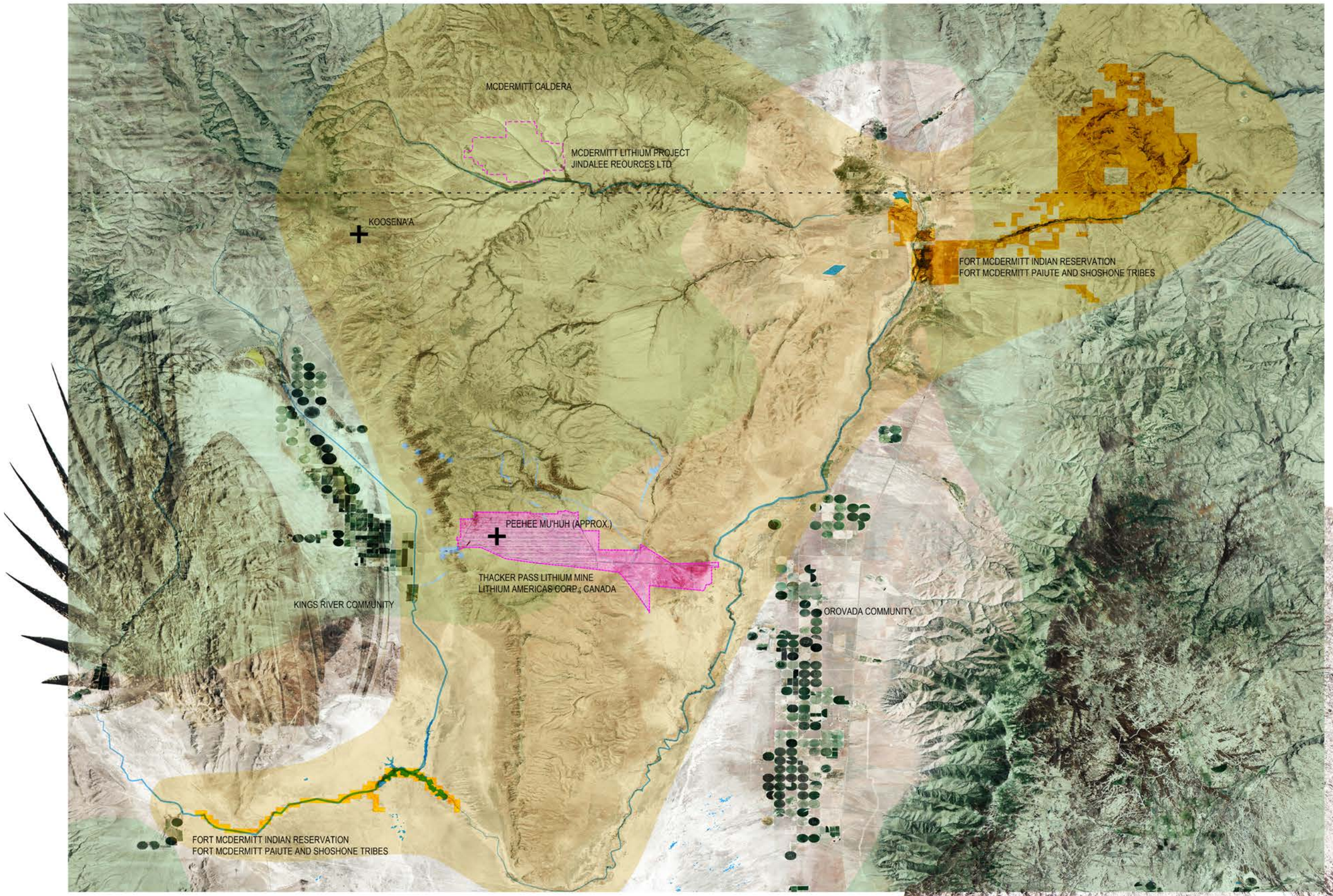


Figure 1: Nevada map

Thacker Pass, Nevada, USA

- Reservation
- Sacred Land
- Significant Indigenous Place
- Mining Concession
- Disturbance Area
- Water
- Perennial Streams and Springs
- Extreme Drought (2022)
- Sagebrush

0 — 17000'

Sources

"Big Sagebrush (Artemisia Tridentata) Extent, North America | Data Basin." n.d. Accessed November 6, 2022. https://databasin.org/datasets/94d42dae93e24d5cb701d381ff760e43/.

"California-Nevada Drought Status Update | March 15, 2022." n.d. Drought.Gov. Accessed November 5, 2022. https://www.drought.gov/drought-status-updates/california-nevada-drought-status-update-3-15-22.

Callao, Chanda. 2022. "Mining Map Question," October 19, 2022.

Hadder, John. 2022a. "Map Review Question," October 19, 2022.

———. 2022b. "Map Review Question," October 24, 2022.

Hinkey, Daranda. 2022. "Mining Map Question," October 29, 2022.

Karl, Nick A, Jeffrey L Mauk, Tyler A Reyes, and Patrick C Scott. 2019. "Lithium Deposits in the United States." U.S. Geological Survey. https://doi.org/10.5066/P9ZKRWQF.

"McDermitt Puts Jindalee at Top of US Lithium Stock-Pile." 2021. May 4, 2021. https://www.mining-journal.com/resourcestocks-company-profiles/resourcestocks/1409509/mcdermitt-puts-jindalee-at-top-of-us-lithium-stock-pile.

Mckinney, Gary. 2022. "Mining Map Question," October 22, 2022.

"National Hydrography Dataset (NHD) - USGS National Map Downloadable Data Collection." n.d. U.S. Geological Survey. Accessed November 6, 2022. https://catalog.data.gov/dataset/national-hydrography-dataset-nhd-usgs-national-map-downloadable-data-collection.

"Proposed Thacker Pass Lithium Mine | Great Basin Resource Watch." n.d. Accessed November 5, 2022. https://gbrw.org/proposed-thacker-pass-lithium-mine/.

"TIGER/Line Shapefile, 2020, Nation, U.S., American Indian/Alaska Native/Native Hawaiian (AIANNH) Areas." n.d. U.S. Department of Commerce, U.S. Census Bureau, Geography Division, Spatial Data Collection and Products Branch (Publisher). Accessed September 5, 2022. https://catalog.data.gov/dataset/tiger-line-shapefile-2020-nation-u-s-american-indian-alaska-native-native-hawaiian-aiannh-areas.

This project has faced significant local resistance from various groups, including environmentalists, ranchers, and Indigenous tribes, because of a lack of consultation with local tribes and an inadequate environmental review. The definite or potential ecological impacts of Thacker Pass include groundwater depletion, pollution, and habitat destruction for species like sage grouse, golden eagles, Lahontan cutthroat trout, and pronghorn antelopes.[21] Ranchers in particular are concerned that the mine's water usage will negatively impact their cattle grazing operations. Additionally, Atsa Koodakuh wyh Nuwu (People of Red Mountain) is a group of Fort McDermitt Paiute and Shoshone Tribe members organizing against this project proposed for the land they call Peehee Mu'huh (rotten moon). This area has cultural and spiritual significance to tribal members because they harvest traditional foods and medicinal plants in the area. Peehee Mu'huh is also the site of multiple massacres of Indigenous people by US soldiers, including the killing of dozens of Paiute people in 1865.[22] The exact locations of victims' graves remain unknown; documents that are available do not specify them. The last Indian massacre recorded in the area occurred in February 1911, near the Santa Rosa mountains. Unlike some other forms of harm, cultural harms like desecrating sacred land have no possibility for mitigation.

A coalition of ranchers (Edward Bartell), Indigenous groups (the People of Red Mountain, the Burns Paiute Tribe, and the Reno-Sparks Indian Colony), environmental justice organizations (Great Basin Resource Watch), and environmental groups (Basin and Range Watch, and Wildlands Defense) sued the BLM, seeking to stop the Thacker Pass mine.[23] In February 2023, the initial ruling rejected most of the mine opponents' arguments but did rule that BLM broke the law in permitting the project on claims land that were not validated as required by US mining law. The judge, however, did not vacate the permit, as was seen in two other cases, allowing for construction to continue. On February 21, 2023, an emergency injunction was filed after the ruling to protect the affected land, biodiversity, and cultural sites, but the request was rejected. In March 2023, the Ninth Circuit court ruled to allow initial construction to begin, pending review of the environmental justice and conservation groups' appeal.[24] Efforts to appeal the March 2023 court ruling and stop the Thacker Pass project have continued.

Portugal

Portugal has the largest lithium reserves in Europe.[26] However, at 60,000 metric tons, it is still relatively small when compared to the reserves of major producers like Australia and Chile. In 2021, Portugal was producing low-grade lithium for glass and ceramics usage, which accounted for just under 1 percent of global lithium production.[27]

In the wake of the 2008 financial crisis, Portugal took on loans from the EU and the International Monetary Fund that came with structural adjustment policies to incentivize exploration for potential new lithium mining and processing; similarly, the European Battery Alliance and Raw Material Alliance has promoted extraction among EU member states, helping to coordinate supply chains and secure project funding.[28] The EU wants to have a more self-reliant supply chain for the

21. Ivan Penn, Eric Lipton, and Gabriella Angotti-Jones, "The Lithium Gold Rush: Inside the Race to Power Electric Vehicles," *New York Times*, May 6, 2021, https://www.nytimes.com/2021/05/06/business/lithium-mining-race.html.

22. Maddie Stone, "Native Opposition to Nevada Lithium Mine Grows," *Grist*, October 28, 2021, https://grist.org/protest/native-opposition-to-nevada-lithium-mine-grows/.

23. Chloe Atkins and Christine Romo, "The Cost of Green Energy: The Nation's Biggest Lithium Mine May Be Going Up on a Site Sacred to Native Americans," *NBC News*, August 10, 2022, https://www.nbcnews.com/specials/the-cost-of-green-energy-the-nation-s-biggest-lithium-mine-may-be-going-up-on-a-site-sacred-to-native-americans/index.html.

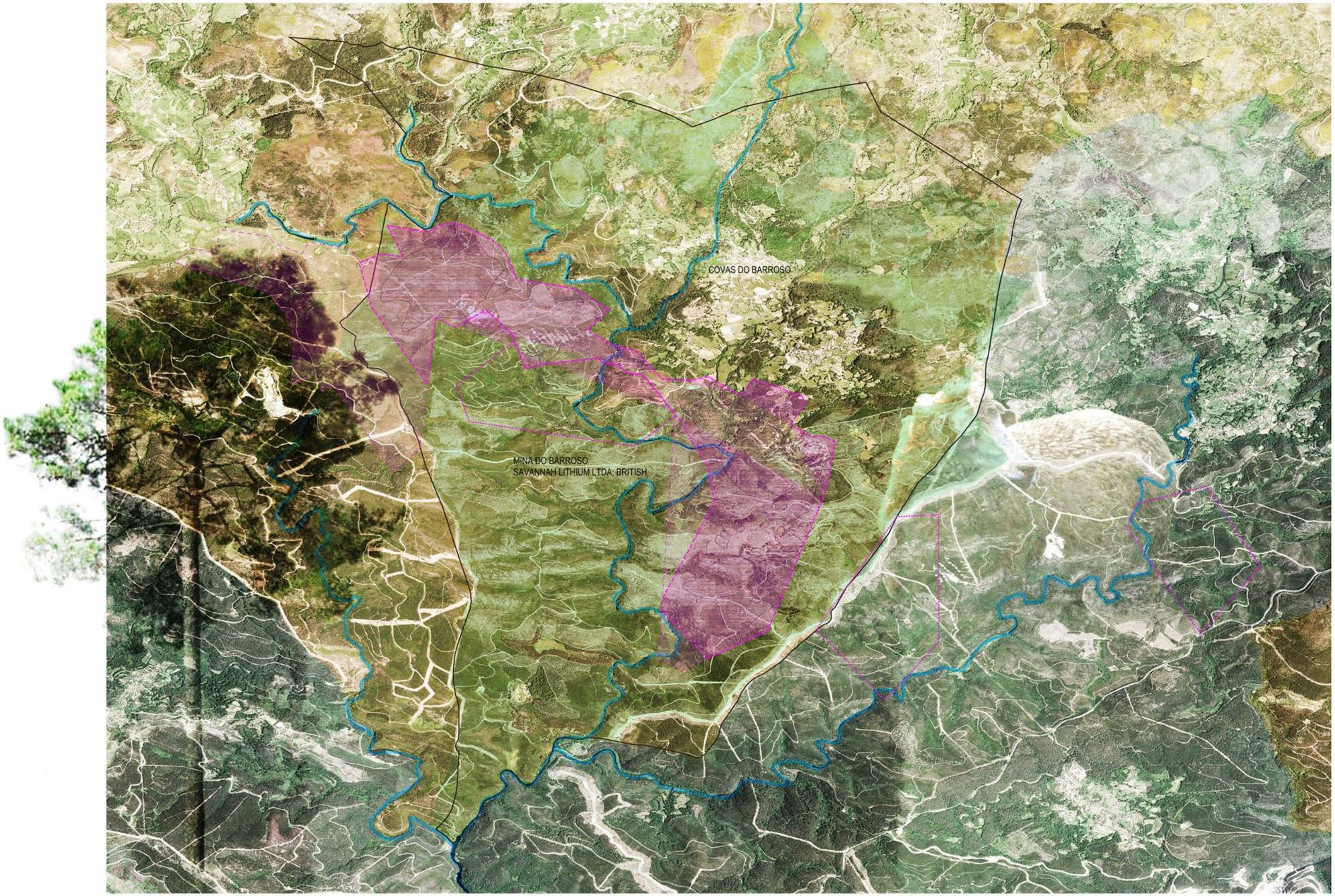
24. Scott Sonner, 9th Circuit denies emergency bid to halt Nevada lithium mine," AP News, March 1, 2023, https://apnews.com/article/lithium-mine-electric-vehicle-batteries-biden-environment-c234fad151f3cd5543f163bdb7ab72aa.

25. "U.S. Court Sets January 2023 Hearing for Lithium Americas Mine Suit," Reuters, October 6, 2022, https://www.reuters.com/legal/us-court-sets-january-2023-hearing-lithium-americas-mine-suit-2022-10-06/.

26. Chaves et al., "Concerns about Lithium Extraction: A Review and Application for Portugal."

27. Felix Malte Dorn, "Inequalities in Resource-Based Global Production Networks: Resistance to Lithium Mining in Argentina (Jujuy) and Portugal (Região Norte)," Journal für Entwicklungspolitik 37, no. 4 (2021): 70–91; "Mineral Commodity Summaries 2022."

28. Dorn, "Inequalities in Resource-Based Global Production Networks: Resistance to Lithium Mining in Argentina (Jujuy) and Portugal (Região Norte)"; Riofrancos, "The Security–Sustainability Nexus: Lithium Onshoring in the Global North." For a longer history of geological surveying for and promotion of Portugal's "lithium potential," see A. Lima, F. Noronha, B. Charoy, and Js Farinha, "Exploration for Lithium Deposits in the Barroso-Alvao Area, Northern Portugal," in C. J. Stanley et al. (eds.), Mineral Deposits: Processes to Processing, Vols. 1 and 2 (1999); Jorge M. F. Carvalho and João A. L. B. Farinha, "Lithium Potentialities in Northern Portugal," 17th Industrial Minerals International Congress, Barcelona, Spain, March 28–31, 2004, 1–10.



Portugal

- Barroso (GIAHS)
- Baldios
- Mine Limit
- Mining Concession
- Mining Concession Blocks
- Debris piles
- Water
- Drought (2022)

0 2000'

Sources

"Agência Portuguesa Do Ambiente - SNIAmb." n.d. Accessed November 8, 2022. https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid=%7B904F4CBA-26C4-43C5-9E66-8045F6F3C771%7D.

"Área de Pedido de Ampliação C-100 Mina Do Barroso.Pdf." 2019. Direção-Geral de Energia e Geologia.

"Barroso Agro-Slyvo-Pastoral System | Globally Important Agricultural Heritage Systems (GIAHS) | Food and Agriculture Organization of the United Nations | GIAHS | Food and Agriculture Organization of the United Nations." n.d. Accessed November 8, 2022. https://www.fao.org/giahs/giahsaroundtheworld/designated-sites/europe-and-central-asia/barroso-agro-slyvo-pastoral-system/en/.

"DORNELAS - COVAS DO BARROSO, BOTICAS." 2020. Savannah Lithium LDA.

"Download Data by Country | DIVA-GIS." n.d. Accessed October 2, 2022. https://www.diva-gis.org/gdata.

"Drought Prompts Portugal to Restrict Water Use at More Hydropower Dams | Reuters." n.d. Accessed November 8, 2022. https://www.reuters.com/business/environment/drought-prompts-portugal-restrict-water-use-more-hydropower-dams-2022-09-27/.

"First-Level Administrative Divisions, Portugal, 2015 - Digital Maps and Geospatial Data | Princeton University." n.d. Accessed November 8, 2022. https://maps.princeton.edu/catalog/stanford-gy612dn2324.

"Mapa Do Pedido de Concessao Mineira Bloco A B C Aldeia e Irmaos 13.10.2015.Pdf." 2015. Direção-Geral de Energia e Geologia.

"Mapa Do Pedido de Concessao Mineira Imerys 06.12.2010.Pdf." 2010. Direção-Geral de Energia e Geologia.

"Mapa Mina Do Barroso 2012.Pdf." 2012. Direção-Geral de Energia e Geologia.

Scarrott, Catarina. 2022. "Invitation to Review Report Section on Portugal.," November 6, 2022.

Figure 2: Portugal map

energy transition, and the Portuguese government has been approving new exploration for lithium.[29]

British mining company Savannah Resources has proposed the Barroso lithium mine in northeastern Portugal, which would be the largest lithium mine in Europe. But this project has been delayed for years because of ongoing environmental reviews and community resistance.[30] The Barroso mine would produce around 14 million metric tons of tailings over 12 years, which would be enclosed by waste rock. If the waste mound fails, the potentially toxic tailings waste could flow into nearby rivers.[31] Many residents of Barroso live off the land, particularly through "agro-sylvo-pastoral"–smallholder agriculture; this project presents a direct threat to their environment and their livelihoods.[32] Indeed, the Barroso region is designated a Globally Important Agricultural Heritage System by the Food and Agriculture Organization of the United Nations.[33] The Local Community of Common Land of Covas do Barroso has filed a lawsuit against Savannah Resources claiming that the parcel they purchased for the mine is on land that has long been held in common—land that cannot be sold and is managed jointly by community members.[34]

Brine

Lithium found in brine deposits is extracted by pumping the brine out of underground aquifers, then concentrating the brine to increase the percentage of lithium salts. Typically, this concentration is achieved via evaporation from large pools under the sun until the lithium levels reach approximately 6 percent of the solution,[35] a process that takes around a year to complete. Producing 1 metric ton of lithium in this manner requires evaporating approximately 2 million liters of water from brine.[36]

This extraction process leaves behind piles of waste salts and toxic chemicals and appears to have significant deleterious impacts on local freshwater stores and ecosystems, including iconic flora and fauna such as the two of the three flamingo species endemic to the area[37] and microbial life for which the brine is a habitat.[38] The environmental consequences of brine extraction are a form of "slow violence": less immediately visible because they are generally less direct and more gradual, but cumulatively harmful, particularly given the proximity of other large-scale extractive sectors (especially copper)

29. Leonie Kijewski, "Portuguese Villagers Fear Hunt for Lithium Will Destroy Their Livelihoods," Politico, April 27, 2022, https://www.politico.eu/article/portugal-village-fear-hunt-lithium-destroy-livelihood/.

30. Peter Wise, Alice Hancock, Chris Campbell, and Sam Fleming, "EU Digs for More Lithium, Cobalt and Graphite in Green Energy Push," Financial Times, August 16, 2022, https://www.ft.com/content/363c1643-75ae-4539-897d-ab16adfc1416.

31. Steven H. Emerman, n.d., "Evaluation of the Tailings Storage Facility for the Proposed Savannah Lithium Barroso Mine, Northern Portugal," Unece.org, accessed November 23, 2022, https://unece.org/sites/default/files/2021-10/frCommC186_13.10.2021_annex3_eng.pdf.

32. José Martins, Catarina Gonçalves, Jani Silva, Ramiro Gonçalves, and Frederico Branco, "Digital Ecosystem Model for GIAHS: The Barroso Agro-Sylvo-Pastoral System," ***Sustainability*** 14, no. 16 (2022): 10349, https://doi.org/10.3390/su141610349.

33. Martins et al., "Digital Ecosystem Model for GIAHS: The Barroso Agro-Sylvo-Pastoral System."

34. Catarina Demony, "Portuguese Community Files Legal Action against Lithium Mining Company," ***Reuters***, July 22, 2022, https://www.reuters.com/article/portugal-lithium-idUSL8N2Z33JZ; Climate and Community Project Community Review Process, Aida Fernandes, November 10, 2022.

35. Beatriz Bustos-Gallardo, Gavin Bridge, and Manuel Prieto, "Harvesting Lithium: Water, Brine and the Industrial Dynamics of Production in the Salar de Atacama," Geoforum 119 (2021): 177–189; José Cabello, "Lithium Brine Production, Reserves, Resources and Exploration in Chile: An Updated Review," ***Ore Geology Reviews*** 128 (2021): 103883.

36. Garcés and Álvarez, "Water Mining and Extractivism of the Salar de Atacama, Chile."

37. Jorge S. Gutiérrez, Johnnie N. Moore, J. Patrick Donnelly, Cristina Dorador, Juan G. Navedo, and Nathan R. Senner, "Climate Change and Lithium Mining Influence Flamingo Abundance in the Lithium Triangle," Proceedings of the Royal Society B 289, no. 1970 (2022): 20212388; P. Marconi, F. Arengo, and A. Clark, "The Arid Andean Plateau Waterscapes and the Lithium Triangle: Flamingos as Flagships for Conservation of High-Altitude Wetlands under Pressure from Mining Development," Wetlands Ecology and Management (2022): 1–26.

38. Cristóbal Bonelli and Cristina Dorador, "Endangered Salares: Micro-Disasters in Northern Chile," Tapuya: Latin American Science, Technology and Society 4, no. 1 (2021): 1968634; Carolina F. Cubillos et al., "Microbial Communities from the World's Largest Lithium Reserve, Salar de Atacama, Chile: Life at High LiCl Concentrations," Journal of Geophysical Research: Biogeosciences 123, no. 12 (December 2018): 3668–81.

resulting in compounding impacts.[39] Unfortunately, there is a dearth of independent scientific studies regarding specifically how brine extraction interacts with freshwater aquifers and some debate among scientists on the subject; a great deal of corporate self-monitoring and research funding further muddies the waters.[40]

Direct lithium extraction (DLE) is an emerging technology that actively extracts lithium and other desired minerals from brines, allowing the rejected brine stream to be pumped back underground. This process could significantly reduce environmental impacts of brine extraction. Industrial-scale DLE methods have been proposed in Germany, Argentina, and California's Salton Sea region, where lithium-rich geothermal brines can provide geothermal energy and lithium, but this technology has yet to be proven at scale (US-based Livent does use DLE at its Fénix lithium project in the Salar de Hombre Muerto in Catamarca, Argentina, although the brine is first pre-concentrated using the traditional evaporation technique.[41])

Brine extraction is how lithium is mined in the so-called Lithium Triangle of Chile, Argentina, and Bolivia thousands of feet above sea level in the Andes Mountains. This area contains more than half of both global resources and reserves, and it is where nearly one-third of current global lithium production comes from.[42]

Chile

Chile is the second-largest producer of lithium in the world, trailing only Australia at 26,000 metric tons in 2021. In Chilean law, brine is treated as a mineral rather than water, and mining is regulated at the federal level. Lithium was declared a strategic resource and nonconcessionable in 1979, which has in effect limited the number of mining projects to those with concessions that predate this statutory change.[43] Currently, two large-scale lithium mines are in production on the Atacama Salt Flat, operated by SQM and Albemarle. However, the country's state-owned copper company, Codelco, plans to explore and exploit lithium in the Maricunga Salt Flat, as does Minera Salar Blanco, a joint Australian-Chilean-Canadian venture.[44] In January 2022, a tender for new lithium contracts was suspended by Chile's Supreme Court on the grounds that the auction did not specify specific territories and thus made prior consultation of Indigenous peoples impossible; however, the progressive Boric government has had plans to establish a state-owned company and enter into joint ventures with foreign lithium companies.[45]

The Atacama Salt Flat is surrounded by Andean mountains and is located in the Atacama Desert, the oldest and driest desert in the world.[46] Lithium extraction in Chile threatens the health and viability of Atacama ecosystems, which are important for local communities and humanity

39. Rob Nixon, Slow Violence and the Environmentalism of the Poor (London: Harvard University Press, 2013); Bonelli and Dorador, "Endangered Salares: Micro-Disasters in Northern Chile"; Blair et al.,"Exhausted: How We Can Stop Lithium Mining from Depleting Water Resources, Draining Wetlands, and Harming Communities in South America," 20–22; Bárbara Jerez, Ingrid Garcés, and Robinson Torres, "Lithium Extractivism and Water Injustices in the Salar de Atacama, Chile: The Colonial Shadow of Green Electromobility," Political Geography 87 (2021): 102382, https://doi.org/10.1016/j.polgeo.2021.102382.

40. For existing studies, see the previous note and the following: Sally Babidge, Fernanda Kalazich, Manuel Prieto, and Karina Yager, "'That's the Problem with That Lake; It Changes Sides': Mapping Extraction and Ecological Exhaustion in the Atacama," Journal of Political Ecology 26, no. 1 (2019): 738–760; Wenjuan Liu and Datu B. Agusdinata, "Interdependencies of Lithium Mining and Communities Sustainability in Salar de Atacama, Chile," Journal of Cleaner Production 260 (2020): 120838; Brendan J. Moran, David F. Boutt, Sarah V. McKnight, Jordan Jenckes, Lee Ann Munk, Daniel Corkran, and Alexander Kirshen, "Relic Groundwater and Prolonged Drought Confound Interpretations of Water Sustainability and Lithium Extraction in Arid Lands," Earth's Future 10, no. 7 (2022): e2021EF002555.

41. Graham et al., "Lithium in the Green Energy Transition."

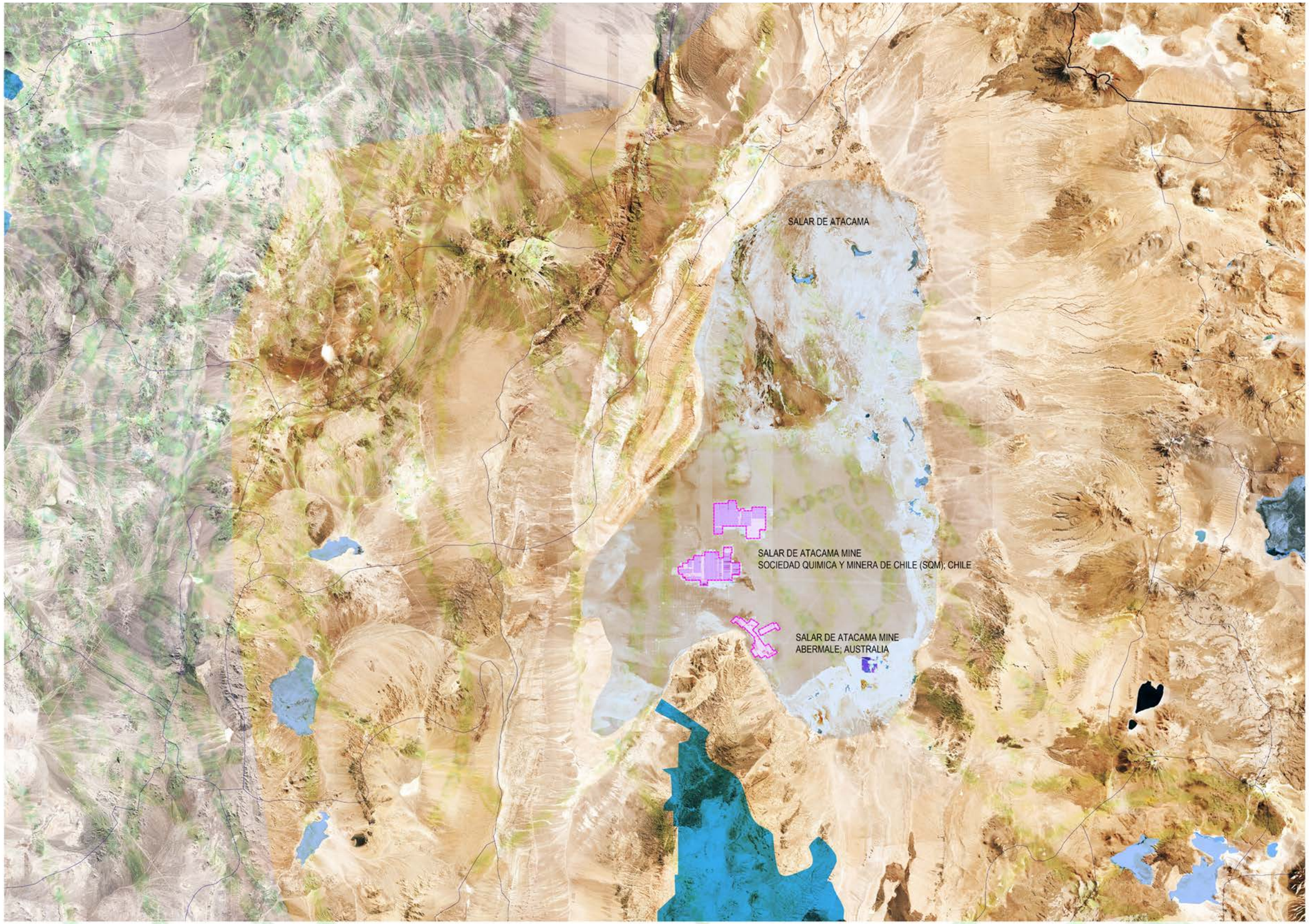
42. "Mineral Commodity Summaries 2022."

43. Florencia Heredia, Agostina L. Martinez, and Valentina Surraco Urtubey, "The Importance of Lithium for Achieving a Low-Carbon Future: Overview of the Lithium Extraction in the 'Lithium Triangle,'" *Journal of Energy & Natural Resources Law* 38, no. 3 (2020): 213–36, https://doi.org/10.1080/02646811.2020.1784565.

44. "Chile Copper Giant Codelco to Start Lithium Exploration in March," Reuters, February 16, 2022, https://www.reuters.com/business/energy/chile-copper-giant-codelco-start-lithium-exploration-march-2022-02-16/; "Salar DE Maricunga, Atacama, Chile," AID/WATCH | Exposing Bad Aid for over 30 Years, September 23, 2021, https://aidwatch.org.au/case-studies/salar-de-maricunga-atacama-chile/.

45. Mining.com, accessed November 23, 2022, https://www.mining.com/web/chiles-mining-minister-says-country-open-to-new-lithium-tenders/.

46. Alan T. Bull, Juan A. Asenjo, Michael Goodfellow, and Benito Gómez-Silva, "The Atacama Desert: Technical Resources and the Growing Importance of Novel Microbial Diversity," *Annual Review of Microbiology* 70, no. 1 (2016): 215–34, https://doi.org/10.1146/annurev-micro-102215-095236.



Chile

- Atacamenos/Lickantay Lands
- Lithium Mines
- Water
- Monturaqui-Negrillar-Tilopozo Aquifer
- Watersheds
- Drought (2022)

0 19,000'

Sources

Chile, I. D. E. n.d. "Límites cuencas." Accessed November 5, 2022. https://www.ide.cl/index.php/medio-ambiente/item/1678-limites-cuencas.

EJOLT. n.d. "Lithium Mining in the Salar de Atacama, Chile | EJAtlas." Environmental Justice Atlas. Accessed October 8, 2022. https://ejatlas.org/conflict/mineria-de-litio-en-el-salar-de-atacama-chile.

"First-Level Administrative Divisions, Chile, 2015 - Digital Maps and Geospatial Data | Princeton University." n.d. Accessed September 11, 2022. https://maps.princeton.edu/catalog/stanford-np155sc7540.

"HOTOSM Chile Waterways (OpenStreetMap Export) - Humanitarian Data Exchange." n.d. Accessed November 5, 2022. https://data.humdata.org/dataset/hotosm_chl_waterways.

javieravalentinavergarasalas. 2015. "Pueblos Originarios en Chile." Pueblos Orginarios en Chile (blog). April 13, 2015. https://pueblosorginariosenchile.wordpress.com/2015/04/13/pueblos-originarios-en-chile/.

Reuters. 2022. "Chile Announces Unprecedented Plan to Ration Water as Drought Enters 13th Year." The Guardian, April 11, 2022, sec. Environment. https://www.theguardian.com/environment/2022/apr/11/santiago-chile-ration-water-drought.

Viñales, Freddy. 2022. "Comments from OPSAL," October 19, 2022.

Figure 3: Chile map

more broadly. Scientists recently identified plants in the Atacama that are adapted to the arid conditions and genetically similar to food crops, which means they may be highly useful for adapting agriculture to a warming planet.[47]

The ecological impacts of brine extraction in Chile, particularly its water usage, have come under increasing scrutiny. Earlier this year, the Chilean government sued lithium mining company Albemarle (along with Antofagasta and BHP for their copper mines) because of their exploitation of the Monturaqui-Negrillar-Tilopozo aquifer and impact on surrounding ecosystems.[48] The other major lithium mining company operating in Chile, Sociedad Química y Minera de Chile (SQM), has been subject to numerous investigations and lawsuits for labor, financial, and environmental violations.[49] For example, in 2016 Chilean regulators initiated sanctions against SQM for overconsuming freshwater and brine, and also for tampering with their own environmental monitoring systems.[50] In January 2019, regulators accepted a company plan to bring its operations into compliance with its contract and Chilean law.[51] But later that same year, the Council of Atacameño Peoples (Consejo de Pueblos Atacameños, or CPA)—which represents the 18 Indigenous Atacameño communities that live around the Atacama Salt Flat—successfully appealed the plan. Their appeal forced the company back to the drawing board, resulting in a new commitment to cut brine and water use in half—though it certainly remains to be seen whether the company will achieve these goals.[52]

Given this long history of lithium companies violating regulations, lithium mining has faced opposition from a variety of groups in Chile. It has also generated serious tension and division within affected Indigenous communities in large part because of the economic resources the companies promise.[53]

Argentina

Argentina is the fourth-largest producer of lithium in the world—6,200 metric tons in 2021—but it has around 50 proposed projects, which could dramatically increase its production and push it above Chile and China.[54] As in Chile, lithium mining creates tensions within communities because of the trade-offs between economic and infrastructural benefits offered by corporations (that are lacking from the government) versus the social and ecological harms that mining causes, a contradiction that companies can exploit to their advantage.[55] Brine extraction threatens nearby Indigenous pastoralism and the unique wetlands full of important biodiversity, including species like flamingos, "pumas, Andean foxes, vicuna [sic], hairy armadillos, and endangered Andean mountain cats and short-tailed chinchillas."[56]

Mining regulation is mostly decentralized in Argentina and varies significantly at the provincial level.[57] This is the result of federal deregulation in

47. Gil Eshel, Viviana Araus, Soledad Undurraga, Daniela C. Soto, Carol Moraga, Alejandro Montecinos, Tomás Moyano, et al., "Plant Ecological Genomics at the Limits of Life in the Atacama Desert," Proceedings of the National Academy of Sciences of the United States of America 118, no. 46 (2021): e2101177118, https://doi.org/10.1073/pnas.2101177118.

48. Cecelia Jamasmie, "Chile Sues BHP, Albemarle, Antofagasta over Water Use," Mining.com, April 8, 2022, https://www.mining.com/chile-sues-bhp-albemarle-antofagasta-over-water-use/.

49. Jerez et al., "Lithium Extractivism and Water Injustices in the Salar de Atacama, Chile."

50. Willie Shubert, "Chile Renews Contract with Lithium Company Criticized for Damaging Wetland," Mongabay Environmental News, December 26, 2018, https://news.mongabay.com/2018/12/chile-renews-contract-with-lithium-company-criticized-for-damaging-wetland/.

51. "Chile: Detienen Proceso Sancionatorio de SQM Acusada de Graves Infracciones Ambientales," Noticias Ambientales, January 22, 2019, https://es.mongabay.com/2019/01/chile-detienen-sanciones-por-danos-ambientales-en-salar-de-atacama/.

52. Aislinn Laing, "Chilean Lithium Miner SQM Dealt Blow by Environmental Court Ruling," Reuters, December 27, 2019, https://www.reuters.com/article/us-chile-sqm-idUSKBN1YV05T; "Chile Lithium Producer SQM Gets Green Light on Environmental Plan," Reuters, August 30, 2022, https://www.reuters.com/business/sustainable-business/chile-lithium-producer-sqm-gets-green-light-environmental-plan-2022-08-30/.

53. Jerez et al., "Lithium Extractivism and Water Injustices in the Salar de Atacama, Chile"; Guillaume Peterson St-Laurent and Philippe Le Billon, "Staking Claims and Shaking Hands: Impact and Benefit Agreements as a Technology of Government in the Mining Sector," The Extractive Industries and Society 2, no. 3 (2015): 590–602, https://doi.org/10.1016/j.exis.2015.06.001.

54. Fred Pearce, "Why the Rush to Mine Lithium Could Dry Up the High Andes," Yale Environment 360, September 19, 2022, https://e360.yale.edu/features/lithium-mining-water-andes-argentina.

55. Lucas Isaac Gonzalez and Richard Snyder, "Modes of lithium extraction in Argentina: Mining politics in Catamarca, Jujuy, and Salta," 2020.

56. Pearce, "Why the Rush to Mine Lithium Could Dry Up the High Andes."

57. Heredia et al., "The Importance of Lithium for Achieving a Low-Carbon Future."

Argentina

- Indigenous land
- Provincial Boundary
- Lithium Mines
- Mining Concession Blocks
- Debris piles
- Water
- Flamingo Frequency
- Drought (2022)

0 66,000'

Sources

"Andean Flamingo (Phoenicoparrus Andinus) - Species Map - EBird." n.d. Accessed November 5, 2022. https://ebird.org/map/andfla2.

"Cuencas Hídricas Del Noroeste Argentino — GeoNode." n.d. Accessed November 6, 2022. http://geoportal.idesa.gob.ar/layers/geonode%3Acuencas_noa_ll.

"GADM." n.d. Accessed November 5, 2022. https://gadm.org/download_country.html.

Gumbricht, T., R. M. Román-Cuesta, L. V. Verchot, M. Herold, F. Wittmann, E. Householder, N. Herold, and D. Murdiyarso. 2022. "Tropical and Subtropical Wetlands Distribution." Center for International Forestry Research (CIFOR). https://doi.org/10.17528/CIFOR/DATA.00058.

Heath, Maximilian. 2022. "Argentina Corn Planting Stalled as 'great Drought' Fears Rise." Reuters, September 15, 2022, sec. Americas. https://www.reuters.com/world/americas/argentina-corn-planting-stalled-great-drought-fears-rise-2022-09-15/.

"HOTOSM Argentina Waterways (OpenStreetMap Export) - Humanitarian Data Exchange." n.d. Accessed November 6, 2022. https://data.humdata.org/dataset/hotosm_arg_waterways.

"Mapa de pueblos originarios." 2020. Argentina.gob.ar. November 10, 2020. https://www.argentina.gob.ar/derechoshumanos/inai/mapa.

Marconi, P., F. Arengo, and A. Clark. 2022. "The Arid Andean Plateau Waterscapes and the Lithium Triangle: Flamingos as Flagships for Conservation of High-Altitude Wetlands under Pressure from Mining Development." Wetlands Ecology and Management 30 (4): 827–52. https://doi.org/10.1007/s11273-022-09872-6.

"OLAROZ LITHIUM FACILITY - Orocobre Limited." n.d. Accessed November 6, 2022. https://www.orocobre.com/operations/salar-de-olaroz/.

"Project | Lithium South (TSX-V: LIS | OTCQB: LISMF)." n.d. Accessed November 5, 2022. https://www.lithiumsouth.com/projects/.

Figure 4: Argentina map. Besides the projects depicted in this map, three more projects have been approved for the start of exploitation (Sal de Vida, Sal de Oro, and Tres Quebradas) in Catamarca, in addition to multiple other projects that are currently under exploration and prospecting.[58]

response to structural adjustment in the early 1990s, which also provided corporations with incentives to mine; previously, natural resources were owned by the federal government.[59] This "localized governance" does not correlate to addressing community concerns around lithium mining projects; a multinational mining company and a provincial government or an Indigenous community are often on unequal footing in terms of negotiations.[60]

As a signatory of the UN Declaration on the Rights of Indigenous Peoples, the Argentinean government is ostensibly supposed to obtain Free, Prior and Informed Consent from Indigenous peoples for lithium extraction that affects their lands. However, as in other countries, community members near lithium mining in Argentina have noted a lack of information from both companies and governments on the potential risks and negative environmental impacts of these projects.[61] Resistance to lithium extraction projects varies significantly between and within provinces, as a result of factors like power and resources of local Indigenous movements, proximity to population centers, and provincial government policies for mining.[62]

---

58. Marconi et al., "The Arid Andean Plateau Waterscapes."

59. Dorn, "Inequalities in Resource-Based Global Production Networks: Resistance to Lithium Mining in Argentina (Jujuy) and Portugal (Região Norte)"; Gonzalez and Snyder, "Modes of lithium extraction in Argentina: Mining politics in Catamarca, Jujuy, and Salta." Natural resources and policy choices in Latin America.

60. Gonzalez and Snyder, "Modes of Extraction in Latin America's Lithium Triangle: Explaining Negotiated, Unnegotiated and Aborted Mining Projects," Latin American Politics and Society, forthcoming 2022.

61. Pía Marchegiani, Jasmin Höglund Hellgren, and Leandro Gómez, "Lithium Extraction in Argentina: A Case Study on the Social and Environmental Impacts," n.d., FARN, https://goodelectronics.org/wp-content/uploads/sites/3/2019/05/DOC_LITHIUM_ENGLISH.pdf.

62. Gonzalez and Snyder, "Modes of lithium extraction in Argentina"; Javiera Barandiarán, "Lithium and Development Imaginaries in Chile, Argentina and Bolivia," World Development 113 (2019): 381–91, https://doi.org/10.1016/j.worlddev.2018.09.019.