

**SANDIA REPORT**

SAND2023-11056

Printed October 2023



Sandia  
National  
Laboratories

# Transforming Critical Mineral Demand for the Just Energy Transition

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## **ABSTRACT**

The following desk research outlines key federal policies that address the clean energy transition and offers several policy recommendations to increase tribal environmental justice and tribal sovereignty. Federal policies, such as the Inflation Reduction Act, Bipartisan Infrastructure Law, and Defense Production Act incentivize domestic mining and procurement of critical minerals needed for clean technologies and battery storage. This report examines two major impacts of incentivizing extractive industries: 1) threats to Tribal land, sovereignty, and treaty rights, and 2) degraded biodiversity and natural carbon sinks. Furthermore, one alternative to procuring critical minerals and four policy recommendations is suggested that can create additional pathways towards a just transition.



## **ACKNOWLEDGEMENTS**

I would like to thank the Department of Energy's Office of Indian Energy Policy and Programs for the opportunity to participate in Sandia National Laboratories' Intern Program. This experience has shaped my career objectives and purpose to become an advocate for Tribal energy sovereignty and rural energy resilience. I would also like to extend my appreciation towards the numerous Tribal communities, citizens, and partners for welcoming our program during field visits and conferences. Finally, I would like to thank Sandra Begay for her guidance, mentorship, and invaluable support.

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## ACRONYMS AND TERMS

Acronym/Term	Definition
ACWI	All Country World Index
BIL	Bipartisan Infrastructure Law
CEQ	Chair of Environmental Quality
CWA	Clean Water Act
DOD	Department of Defense
DPA	Defense Production Act
EPA	Environmental Protection Agency
EV	Electric vehicle
IPCC	Intergovernmental Panel on Climate
IMI	Investable Market Index
IRA	Inflation Reduction Act
MPCA	Minnesota Pollution Control Agency
MSCI	Morgan Stanley Capital International
NEPA	National Environmental Policy Act
PV	Photovoltaic
U.S.	United States
WHCNA	White House Council on Native American Affairs

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## 1. INTRODUCTION

The United States is poised to decrease greenhouse gas emissions and mitigate the worst effects of climate change by transitioning to clean energy and technologies. The recently passed Inflation Reduction Act (IRA) provides historic incentives to address climate change and Tribal sovereignty. Over \$722 million will be directed specifically towards Tribal communities, and over \$35 billion is designated towards electrification resources to transform energy systems in Indian Country [1]. From single households to large-scale Tribal utilities, the IRA bill boosts Tribal energy resiliency while also reducing dependence on fossil fuels. The IRA bill also initiates key policy changes that will allow Tribal Nations to fully participate in tax deductions during clean energy improvements [2].

A clean energy transition, however, requires a technological upheaval and restructuring of the energy supply chain. Several policies, including the IRA bill, address some of these challenges by increasing domestic procurement of “critical minerals,” or minerals vital to national security and the economy [3]. Minerals containing cobalt, nickel, lithium, and copper are essential for building clean energy components, including photovoltaic (PV) panels and electric vehicle (EV) battery storage. Transitioning to clean technologies will determine the health of the environment, economy, and future; however, developing a just transition is often times overlooked in favor of technical issues and efficiency. A just transition improves the environmental outcome and Tribal sovereignty through direct partnership with Tribal communities, especially during policy formulation. The following report outlines several unintended consequences of scaling domestic critical mineral mining and recommends policy reformations expected to increase pathways for a just transition.

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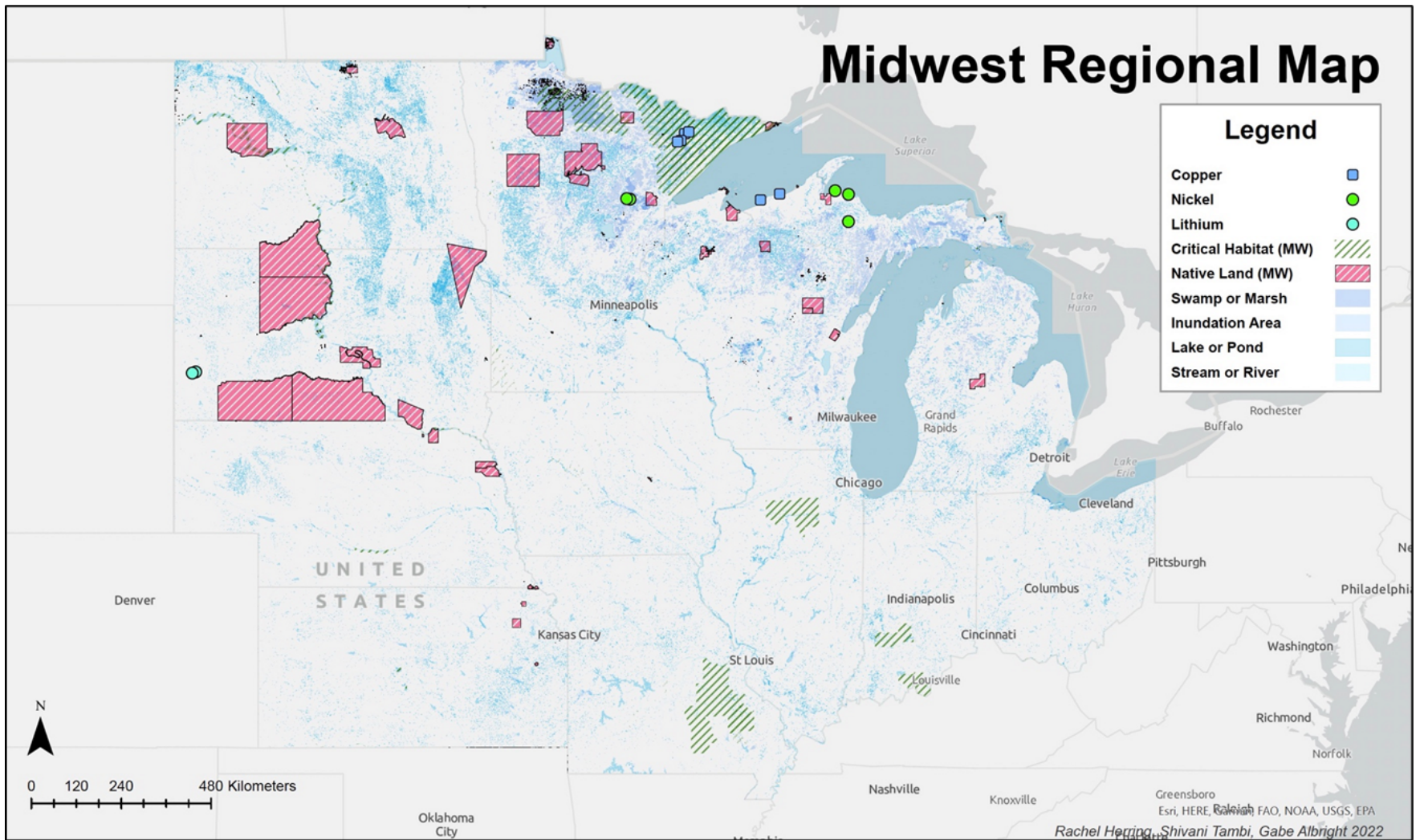
## 2. ISSUES

The IRA Bill, signed into law in August 2022, is the largest climate action bill passed by the federal government. The bill includes incentives, rebates, grants, loans, and investments to support an economic transition to clean energy. The transition from fossil fuels, however, creates greater demand for critical minerals used in clean energy technologies, such as EV batteries. The U.S. purchases most of its required critical minerals from international markets with weak environmental regulations, labor standards, and governances [4] that may not be reliable sources for the U.S.' future needs. In an effort to move away from exploitive supply chains and to build in resilience, the U.S. is developing a domestic mineral supply chain. These activities have resulted in several unintended consequences that could hinder a just transition, such as mounting tensions between Tribal Nations and domestic mining projects, negative impacts to biodiversity conservation, and uncertain prospects for environmental restoration [5]. Below, Figure 1 through Figure 3 illustrate active critical mineral mines in proximity to critical habitats, bodies of water, and Tribal Nations, sourced from the 2021 S&P Global mining properties database.

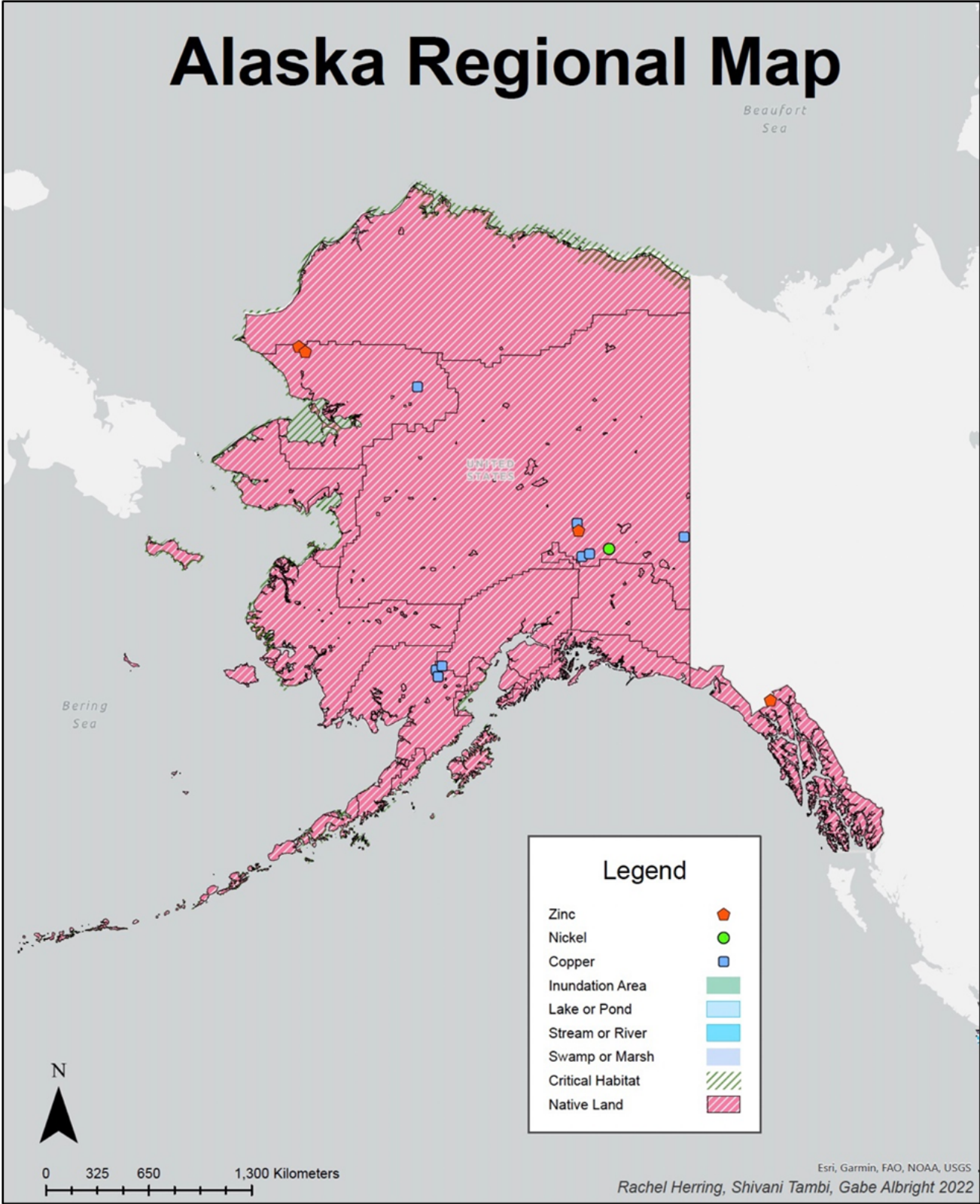
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**NOTE:** Native Alaskan people inhabit the State of Alaska and are governed by both Alaska Native Villages and Regional Corporations. Metlakatla is the only Alaska Native village with reservation land boundaries.

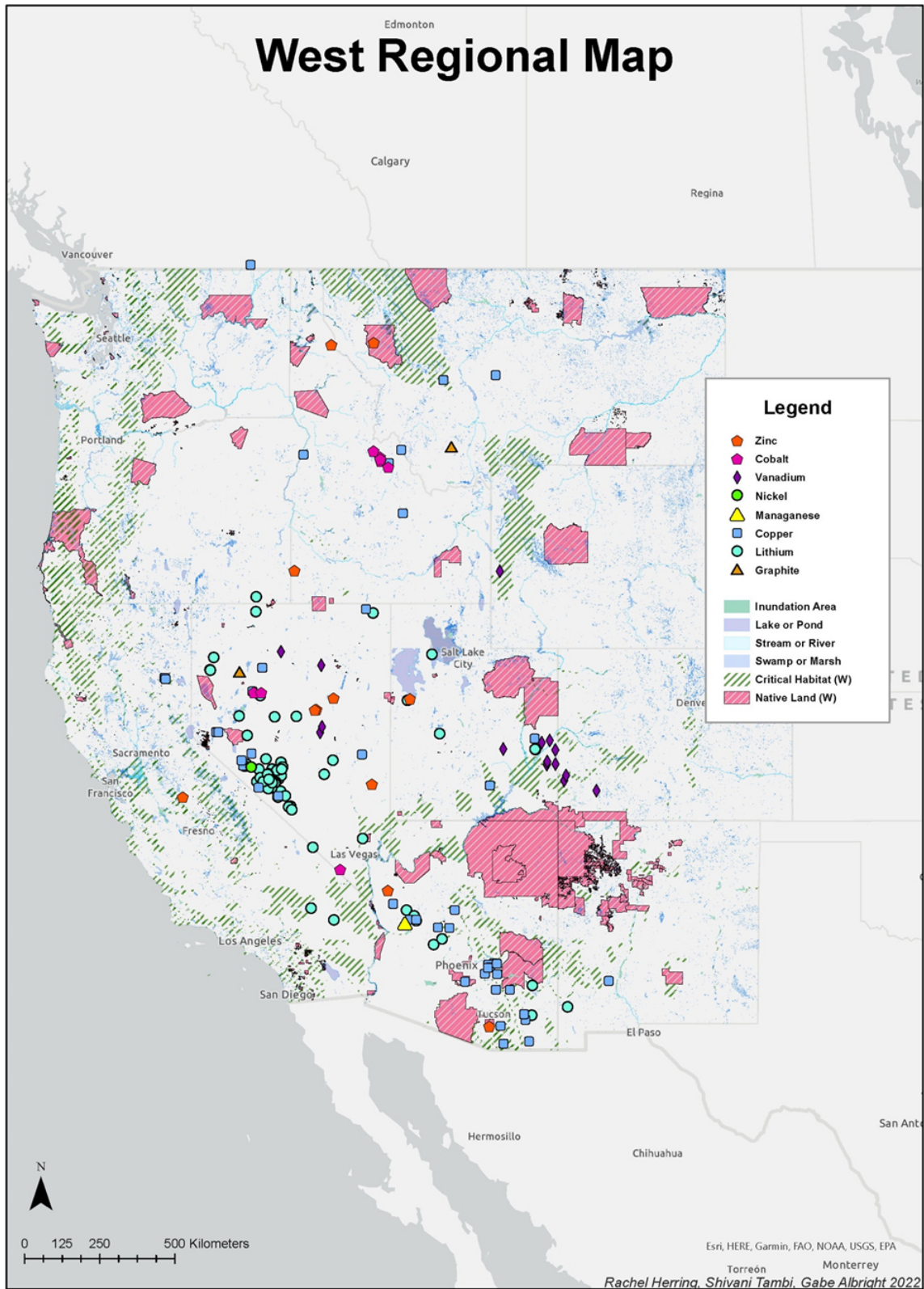
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**Figure 1. Midwest Regional Map of Active Critical Mineral Mines [40]**



**Figure 2. Alaskan Regional Map of Active Critical Mineral Mines [40]**



**Figure 3. Western Regional Map of Active Critical Mineral Mines [40]**

## 2.1. Tribal Sovereignty

According to a 2021 report from Morgan Stanley Capital International (MSCI), 97% of nickel, 89% of copper, 79% of lithium and 68% of cobalt reserves and resources in the United States are located within 35 miles of Tribal Nations [6]. Culturally significant areas and sacred sites that are not directly on reserved land are also impacted by a growing number of domestic mining projects, and some permitting processes are fast-tracked, undermining treaty rights and Tribal consultation.

Peehee Mu’huh (Thacker Pass) in Nevada, Chich’il Bildagoteel (Oak Flat) in Arizona, and Lilgayaq (Nushagak River of Bristol Bay) in Alaska are examples of culturally significant areas threatened by proposed critical mineral mines in the 21<sup>st</sup> century. In January 2023, the Environmental Protection Agency (EPA) issued a Final Determination under the Clean Water Act, stating the proposed Pebble Mine of Bristol Bay will have “unacceptable adverse effects on anadromous fishery areas” in the watershed, which resulted in the project being terminated [7]. Conversely, Lithium Americas began construction on the Thacker Pass lithium project in March after receiving approval from the Bureau of Land Management. Tribes opposing the Thacker Pass mine are motivated to protect and honor the site because of its cultural, historical, and religious importance, and are concerned about the potential ecological damage [8]. Lithium Nevada Corp.’s mine at Thacker Pass also pits environmentalists and Native Americans against Biden’s efforts to accelerate the transition from fossil fuels to cleaner, renewable energy sources. Because of the conflicts that arose during the Thacker Pass mine project, the Biden Administration paused Resolution Copper, the proposed mine on Oak Flat, to conduct further consultation with Tribes in the area.

White House Council on Native American Affairs (WHCNAA) is holding tribal consultations on the following topics to illustrate the efforts to address specific tribal topics<sup>1</sup>:

- Propose, revise National Environmental Policy Act (NEPA) regulations (the Bipartisan Permitting Reform Implementation Rule, a.k.a. the Phase 2 rule)
- Sacred Sites Best Practices Guide Consultation
- Tribal Treaty Rights Tribal Leader Consultation
- Inflation Reduction Act Tribal Leader Engagement
- National Electric Vehicle Initiative for Tribal Nations Webinar

In Minnesota, the increase in sulfide mining projects posed a risk to treaty rights and Tribal sovereignty [9]. NewRange Copper Nickel, formerly known as the Polymet Copper Mine, is one project that had inadequate Tribal consultation. In 2018, the EPA received notice from the Army Corps of Engineers of PolyMet’s Clean Water Act (CWA) Section 404 permit application and Minnesota Pollution Control Agency’s Clean Water Act (MPCA’s CWA) Section 401(a)(1) certification. The Clean Water Act Section 404 permit is a required step to continue development, but the Section 401(a)(1) certification process only addresses water quality requirements by Minnesota. The EPA did not notify the Fond du Lac Band, as required by Section 401(a)(2), which determines how the project may impact the Band’s treaty rights to fish, and the project’s impact on the freshwater species inhabiting the affected body of water [10]. Additionally, the Band’s water quality requirements differ from CWA Section 401(a)(1) state water quality. The Corps issued a permit for the Polymet project without proper Tribal consultation conducted by the EPA and without Section 401(a)(2) [11].

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<sup>1</sup> <https://www.bia.gov/whcnaa>

The Fond du Lac Band sued the EPA in federal court shortly after. In 2021, the U.S. District Court for the District of Minnesota ruled that the EPA had a duty to make a “may affect” determination pursuant to CWA Section 401(a)(2) [12]. Following the case, the EPA asked the Corps to suspend the CWA Section 404 permit it had issued for the mine project, and the Corps complied. The EPA then completed its review under CWA Section 401(a)(2) and determined that the discharge from the proposed PolyMet project “may affect” the water quality of both the Fond du Lac Band and the State of Wisconsin. After losing the permit, Polymet joined Teck Resources in a 50:50 joint venture agreement under New Range Copper Nickel [13]. As of June 2023, NewRange does not have a new CWA 404 wetlands permit that allows the project to move forward [14].

## **2.2. Biodiversity**

Restoring and protecting global biodiversity is essential to preventing the worst effects of climate change. Both terrestrial and blue ecosystems sequester half of the carbon emitted into the atmosphere by anthropogenic activities [15]. According to a report by The Nature Conservancy, Paulson Institute, and Cornell Atkinson Center for Sustainability, all economies need to adequately value nature by creating transformative financial and political systems that 1) deter harmful activities and 2) support nature-based solutions and conservation [16]. Current spending on biodiversity conservation is insufficient, and an additional \$598-824 billion must be spent annually to stop the global loss of biodiversity [17].

Heavy-industrial mining projects typically operate in remote and undeveloped areas and often impact pristine habitats and fragile environments. A 2021 MSCI report states that in 2020, over 20% of global mines owned by MSCI All Country World Index (ACWI) Investable Market Index (IMI) constituents are in regions identified as biodiversity hotspots, and 13% operate in pristine environments that have at least 97% of the environment’s biodiversity intact [18]. The report finds that modern mining projects could play a significant role in global biodiversity loss, and historically, mining projects have had multiple spatial scale impacts on biodiversity [19]. At the site-level, operations and waste-management contributes directly to habitat loss, degradation, and declines in region-wide ecosystems. Biodiversity impacts also occur over great distances and from indirect processes, such as the development and over-exploitation of resources [20].

Ecosystem services play a vital role in the importance of biodiversity conservation. The National Wildlife Federation defines an ecosystem service as any positive benefit, indirect or direct, that wildlife or ecosystems provide to people [21]. The Intergovernmental Panel on Climate Change (IPCC), a body of the United Nations, states that ecosystem services are negatively impacted by both climate change and anthropogenic stressors [22]. Peatlands, for example, are significant carbon sinks and are an essential nature-based solution to carbon sequestration and storage. Although peatlands cover less than 3% of the world’s surface, they store over 30% of the total global carbon stored in soil [23].

The destruction of peatlands releases significant amounts of carbon into the atmosphere and accelerates climate change. One quarter of global peatlands, or roughly 0.5% of the world’s land surface, have already been disturbed and contributed 4% to all global greenhouse gas emissions [24]. In 2022, the Wildlife Conservation Society shared a statement from 40 international peatland researchers, raising concerns of the protection of global peatland as an ecosystem service from the threats of increasing extractive industries and development [25]. Minnesota has over six million acres of peatland, which is the second largest area in the United States behind Alaska [26]. Above, Figure 1 and Figure 2 show current mining projects in Minnesota and Alaska. This number will increase as new incentives and grants are distributed.



### 3. CONTEXT

There are three key components of historical and political context involved in the present-day problem: determinants, policy environment, and major stakeholders.

#### 3.1. Determinants

The demand for critical minerals increases as the United States transitions to renewable energy technologies that require high-capacity battery storage. Below, Figure 4 shows the major import sources of mineral commodities in year 2020 that the United States was 50% or greater reliant on. Securing a domestic supply chain of critical minerals contributes to greater national security and lessens reliance on foreign markets. Additionally, the IRA bill outlines greater tax provisions for the purchase of new EVs with battery components secured in a domestic supply chain.



Figure 4. U.S. Import Reliance (2020) [38]

#### 3.2. Policy Environment

The General Mining Act of 1872 still governs hard rock mining on public lands 151 years later. The law does not include any environmental, reclamation, or financial assurance provisions, and allows mining companies to stake claims on public lands regardless of potential conflicts [27]. Several new policies add complexity to this specific policy environment with an increase of potential conflicts. First, Executive Order 14017 of America's Supply Chains supports domestic supply chain development and creates an interagency working group for identifying risks in the supply chain for critical minerals [28]. Second, provisions outlined in the Inflation Reduction Act (IRA) support the development of renewable energy, EVs, and other green technologies reliant on critical minerals [29]. Third, the Bipartisan Infrastructure Law (BIL) invests in earth-mapping resources to investigate and secure domestic critical mineral deposits [30]. Fourth, the Defense Production Act (DPA) allows the Department of Defense (DoD) to increase domestic mining and processing of critical minerals for large-scale battery supply chains [31]. Lastly, while the IRA bill provides financial

opportunity for the development of critical mineral recycling facilities, there are no current reforms to state and federal recycling laws. Figure 5 illustrates battery recycling requirements by state in 2021.

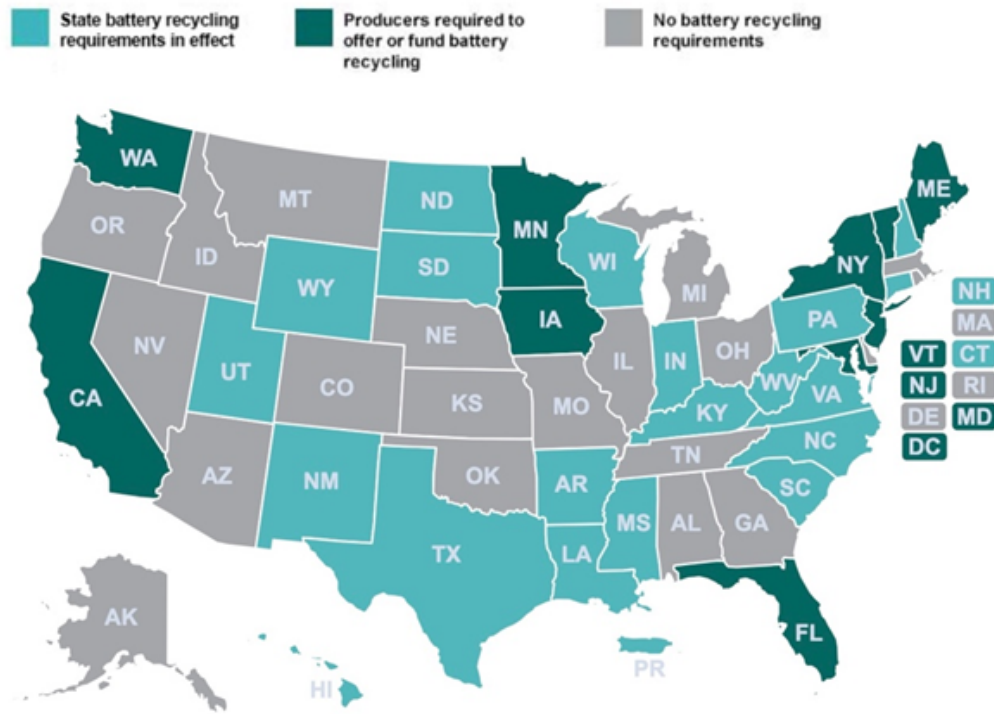


Figure 5. U.S. Battery Laws by State (2021) [39]

### 3.3. Major Stakeholders

Several key groups of stakeholders are both directly and indirectly involved and/or impacted. Direct stakeholders include federal policymakers, federal agencies, corporations eligible for tax incentives, mining corporations, community members, Tribal Nations near critical mineral mining projects, and corporations that purchase critical minerals. Indirect stakeholders include EV purchasers, constituents benefitting from ecosystem services, and Tribal Nations outside of mining districts.

## **4. RECOMMENDATION**

### **4.1. Critical Mineral Procurement Alternative**

Battery and e-waste recycling is a proven and safe alternative to mining projects. Additionally, increasing recycling initiatives could support safer mining development by decreasing the need to consider some of the riskier domestic proposals. A report published by Earthworks in 2021 notes that recycling could reduce primary demand compared to total demand by 2040 (including 25% for lithium, 35% for cobalt and nickel, and 55% for copper) [32]. As initiatives and alternatives gain momentum, recycling will become more feasible and accessible. In 2023, Apple announced it will expand the use of recycled materials in all new Apple products by 2025, including 100% recycled cobalt, through developing and implementing recycling mandates [33]. Policy changes that support recycling, as outlined below, could act as a catalyst for widespread recycling mandates across all sectors.

### **4.2. Policy Alternatives**

#### **4.2.1. Tax-Credits for Recycled EV Battery Components**

To support critical mineral recycling, new EV batteries should require a certain percentage of recycled materials to qualify for tax-credits. Currently, the IRA bill provides several levels of tax-credits for new EV purchasers, which can accumulate up to \$7,500. The credit is split into two parts for vehicles delivered on or after April 18, 2023. To qualify for the first \$3,750, the vehicle battery must contain materials at least partially sourced with critical minerals extracted or processed in the United States or allied countries. The percentage of critical minerals needed in EV batteries to qualify for the critical mineral tax credit in 2023 is 40%, which increases by 10% annually until 2027. To be eligible for the second \$3,750 tax credit, 50% of the battery component percent value requirement must be manufactured or assembled in North America in 2023, with the requirement increasing by 10% until 2029 [34]. Battery and e-waste recycling initiatives will gain traction by switching the EV battery requirements from a percentage of domestically sourced minerals to a percentage of recycled minerals.

#### **4.2.2. Federal Requirements for Battery and E-waste Recycling**

As described above in Figure 5, battery recycling requirements vary by state. By making e-waste and battery recycling a federal law, behavioral change will occur on multiple levels, from consumer to industry. Building recycling capacity domestically could also decrease toxic disposal methods, alleviate waste exports to developing countries, safeguard worker conditions, and decrease overall recycling costs [35].

#### **4.2.3. Conduct Rigorous Environment Assessment and Honor Treaty Rights**

The General Mining Act of 1872 is severely outdated and requires numerous improvements on its protocols and guidance for assessing risks to both the environment and Tribal sovereignty. The Department of Interior launched an interagency group on mining reform in 2022, with outcomes still to be determined [36]. One recommendation is to include a third-party risk assessment in pre-feasibility stages, similar to the voluntary carbon credit market, that verifies the quality and safety of the mining project. Assessment and verification should be conducted by an interagency group and prioritize investigating the integrity and science of the mining proposal. Environmental assessments

need to weigh the risks of carbon emissions due to the development of a project on carbon sinks or other critical habitats, such as peatlands.

#### **4.2.4. Tribal Representation in Policy and Government**

The 2023 Executive Order, *Revitalizing Our Nation's Commitment to Environmental Justice for All*, is a momentous step towards recognizing marginalized communities that experience the worst impacts of pollution and climate change. Each federal agency is required to submit an environmental justice plan to the Chair of Environmental Quality (CEQ). While integrating environmental justice into each agency is monumental, a step further is creating an additional environmental justice department that is consulted with during policy formulation. This will ensure that policies are formed with integrity and inclusivity and alleviates pressure on agencies to design implementation strategies. Lastly, treaty rights should be honored and acted upon, which includes seating a delegate from both the Choctaw and Cherokee Nations in congress [37].

#### **4.3. A Just Transition**

The purpose of these recommendations is to increase environmental justice, Tribal sovereignty, and create inclusive pathways for policy formulation. To mitigate the worst effects of climate change, we need an urgent transition to clean energy and technologies. Incentivizing extractive industry and relying on outdated mining laws policies hinders the main objective of a clean energy transition: avoid, reduce, and sequester greenhouse gas emissions. If reducing emissions remains a priority in climate bills, alongside environmental justice, equitable and feasible policies will follow. Participation and collaboration with Tribal Nations during the policy formulation stage ensures pathways towards a just transition and safeguards biodiversity. While the recommendations are just a few short-term solutions, it is intended to offer possibilities that can lead to a just relationship with the natural world.

## REFERENCES

- [1] Lewis, Jamal K., Begay, Jade and Frederick, Kailea. “The Inflation Reduction Act of 2022 Investments for Tribal and Indigenous Communities.” NDN Collective, Rewiring American, November 30, 2022. <https://ndncollective-org.nyc3.cdn.digitaloceanspaces.com/app/uploads/sites/3/2022/11/IRA-Benefits-to-Tribal-and-Indigenous-Communities.pdf>
- [2] Elliott, Nicole M., Gebeck Carroll, Kayla and Parsons, Kenneth W. “Tribal Provisions in the Inflation Reduction Act Address Energy, Climate Change.” Holland & Knight, December 13, 2022. <https://www.hklaw.com/en/insights/publications/2022/12/tribal-provisions-in-the-inflation-reduction-act-address-energy>
- [3] American Geosciences Institute. “Critical Mineral Basics.” 2023. <https://www.americangeosciences.org/critical-issues/critical-mineral-basics#:~:text=Critical%20minerals%20are%20mineral%20resources,was%20once%20a%20critical%20mineral.>
- [4] The White House. “Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth.” June 2021, pg. 194. <https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf>
- [5] Block, Samuel. “Mining Energy-Transition Metals: National Aims, Local Conflicts.” MSCI, June 3, 2021. <https://www.msci.com/www/blog-posts/mining-energy-transition-metals/02531033947>
- [6] Block, Samuel. MSCI.
- [7] EPA. “Final Determination for Pebble Deposit Area.” February 3, 2023. <https://www.epa.gov/bristolbay/final-determination-pebble-deposit-area>
- [8] Lithium Americas. “Lithium Americas Commences Construction at Thacker Pass.” March 2, 2023. <https://www.lithiumamericas.com/news/lithium-americas-commences-construction-at-thacker-pass>
- [9] Thompson, Darren. “Mille Lacs Band of Ojibwe Launches Initiative Opposing Multi-Billion Dollar Nickel Mine.” Native News Online. March 20, 2023. <https://nativenewsonline.net/environment/mille-lacs-band-of-ojibwe-launches-awareness-initiative-aimed-at-opposing-multi-billion-dollar-nickel-mine>
- [10] Fong, Tera. “Overview of EPA’s Clean Water Act Second 401(a)(2) Evaluation and Recommendations on Fond du Lac Band’s Objection to the Proposed Clean Water Act Section 404 Permit for the Northmet Mine Project.” EPA. May 3, 2022. <https://www.epa.gov/system/files/documents/2022-05/Presentation%20on%20EPA%E2%80%99s%20Evaluation%20and%20Recommendations%201.pdf> p. 13
- [11] EPA. “Polymet Northmet Mine.” September 27, 2022. <https://www.epa.gov/mn/polymet-northmet-mine>
- [12] EPA. “Polymet Northmet Mine.”
- [13] Polymet Mining. “Polymet strikes 50:50 joint venture agreement with Teck Resources Joint Venture to develop Northmet, further study Mesaba opportunity.” July 20, 2022. <https://polymetmining.com/investors/news/polymet-strikes-5050-joint-venture-agreement-with-teck-resources/>

- [14] Kraker, Dan. “U.S. Army Corps revokes key Northmet copper nickel mining permit.” MPR news. June 6, 2023. <https://www.mprnews.org/story/2023/06/06/us-army-corps-revokes-key-northmet-copper-nickel-mining-permit>
- [15] United Nations. “Biodiversity – our strongest natural defense against climate change.” <https://www.un.org/en/climatechange/science/climate-issues/biodiversity>
- [16] The Nature Conservancy. “Financing Nature: Closing the Global Biodiversity Financing Gap.” 2023. Print.
- [17] The Nature Conservancy. “Financing Nature: Closing the Global Biodiversity Financing Gap.”
- [18] Block, Samuel and Mollod, Gillian. “Mining’s Impact on Biodiversity: A Rising Risk?” MSCI. June 9, 2021. <https://www.msci.com/www/blog-posts/mining-s-impact-on-biodiversity/02547548673>
- [19] Block, Samuel and Mollod, Gillian. “Mining’s Impact on Biodiversity: A Rising Risk
- [20] Sonter, Laura J, Ali, Saleem H. and Watson, James E. M. “Mining and biodiversity: key issues and research needs in conservation science.” Royal Society. December 5, 2018. <https://royalsocietypublishing.org/doi/10.1098/rspb.2018.1926>
- [21] The National Wildlife Federation. “Ecosystem Services.” <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Understanding-Conservation/Ecosystem-Services>
- [22] IPCC. “Fact Sheet: Biodiversity.” November 2022. [https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC\\_AR6\\_WGII\\_FactSheet\\_Biodiversity.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf)
- [23] Bonn, Aletta et. al. “Peatland Restoration and Ecosystem Services.” Cambridge University Press. June 5, 2016. <https://doi.org/10.1017/CBO9781139177788.002>
- [24] Wildlife Conservation Society. “Scientists Decry Exploitation of Peatlands as Mining, Oil Exploration Continues with Few Restraints—World’s Largest Carbon Sinks and Refuges for Biodiversity at Risk.” December 1, 2022. <https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/18374/Scientists-Decry-Exploitation-of-Peatlands-as-Mining-Oil-Exploration-Continues-with-Few-RestraintsWorlds-Largest-Carbon-Sinks-and-Refuges-for-Biodiversity-at-Risk.aspx>
- [25] Wildlife Conservation Society. “Scientists Decry Exploitation of Peatlands as Mining, Oil Exploration Continues with Few Restraints—World’s Largest Carbon Sinks and Refuges for Biodiversity at Risk.”
- [26] Minnesota Department of Natural Resources. “Minnesota Scientific and Natural Areas Patterned Peatlands.” <https://www.dnr.state.mn.us/snas/peatlands.html#:~:text=At%20over%206%20million%20acres,expansiveness%20and%20spectacularly%20patterned%20landscape>.
- [27] DOI. “Interior Department Launches Interagency Working Group on Mining Reform.” February 22, 2022. <https://www.doi.gov/pressreleases/interior-department-launches-interagency-working-group-mining-reform>
- [28] The White House. “Executive Order on America’s Supply Chains.” February 24, 2021. <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/>
- [29] EPA. “Summary of Inflation Reduction Act provisions related to renewable energy.” June 1, 2023. <https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy>

- [30] Bipartisan Infrastructure Law Investments. “Bipartisan Infrastructure Law supports critical-minerals research in central Great Plains.” USGS. October 26, 2022. <https://www.usgs.gov/news/state-news-release/bipartisan-infrastructure-law-supports-critical-minerals-research-central>
- [31] DOD. “Defense Production Act Title III Presidential Determination for Critical Materials in Large-Capacity Batteries.” April 5, 2022. <https://www.defense.gov/News/Releases/Release/Article/2989973/defense-production-act-title-iii-presidential-determination-for-critical-materi/>
- [32] Institute for Sustainable Futures. “Reducing new mining for electric vehicle battery metals: responsible sourcing through demand reduction strategies and recycling.” Earthworks. April 2021. <https://earthworks.org/wp-content/uploads/2021/09/UTS-EV-battery-metals-sourcing-20210419-FINAL.pdf>
- [33] Apple Newsroom. “Apple will use 100 percent recycled cobalt in batteries by 2025.” April 13, 2023. <https://www.apple.com/newsroom/2023/04/apple-will-use-100-percent-recycled-cobalt-in-batteries-by-2025/>
- [34] DOE. “Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV) Tax Credit.” <https://afdc.energy.gov/laws/409>
- [35] Singh, Ana. “Out of Sight, Out of Mind: How the United States Discards E-Waste.” Berkeley Political Review. December 5, 2019. <https://bpr.berkeley.edu/2019/12/05/out-of-sight-out-of-mind-how-the-united-states-discards-e-waste/>
- [36] DOI. “Interior Department Launches Interagency Working Group on Mining Reform.” February 22, 2022.
- [37] Ahtone, Tristan. “The Cherokee Nation is Entitled to a Delegate in Congress. But Will They Finally Send One?” Yes! Solutions Journalism. January 4, 2027. <https://www.yesmagazine.org/democracy/2017/01/04/the-cherokee-nation-is-entitled-to-a-delegate-in-congress-but-will-they-finally-send-one#:~:text=In%20the%20case%20of%20the,can%20simply%20send%20a%20representative.>
- [38] U.S. Geological Survey, Major Import Sources of Nonfuel Mineral Commodities for with the United States was greater than 50% Net Import Reliant in 2020, 2021, <https://doi.org/10.3133/mcs2021>
- [39] Call2Recycle, Recycling Laws By State, 2021, <https://call2recycle.org/recycling-laws-by-state/>
- [40] Rachel Herring, Gabe Albright, Shivani Tambi, “Critical Mineral Mining Projects, Critical Habitats, and Tribal Nations” Middlebury Institute of International Studies, California, December 2022.
- [41]

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