Mapping the Impacts and Conflicts of Rare-Earth Elements

Challenges for the Green and Digital Transition

The Rare-Earth Elements Impacts and Conflicts Map documents contentious processes taking place across REE supply chains (extraction, processing and recycling sites). It documents more than 25 cases of socio-environmental contention in China, Chile, Brazil, Finland, Greenland, India, Kenya, Madagascar, Malaysia, Malawi, Myanmar, New Zealand, Norway, Spain, and Sweden, among other countries.

This collaborative mapping effort aims to reveal the environmental, social and human rights injustices and abuses that are taking place along REE global supply chains and how local communities are resisting across the world. This effort aims to bring to light how “green” and “just” energy transition policies really are on the ground.

As part of the Global Rare-Earths Element Network, in 2023 the **ODG**, the **Environmental Justice Atlas**, the **Institute for Policy Studies** and **CRAAD-OI** led a collaborative initiative with grassroots organizations and researchers from more than 20 countries to document socio-environmental conflicts related to the REE supply chain.

About Rare-Earth Elements

Rare-earth elements (REEs) are a group of 17 chemical elements considered critical for digitalization and for the energy transition. While called "rare", they are not in fact rare in the Earth's crust and can be found in many places. REEs have unique magnetic, optical and electronic properties that make them crucial (and difficult to substitute) for many uses such as wind turbines, solar panels, electric vehicles, LED and LCD screens, hard drives, fibre optic cables, catalysts, steel alloys, hydrogen technologies and all kinds of electric motors for cars, toys or drones. Nevertheless, REEs are not only strategic for wind, solar or electric batteries, but also for defence and aerospace engineering: to produce aircraft, missiles, satellites and communications systems. Indeed, the European Commission's proposal for the EU Critical Raw Materials Act, published in the spring of 2023, mentions the strategic need for these materials for the green and digital transition as well as for defence and the aerospace industry.

The International Energy Agency (IEA) suggests that to meet Net Zero Emissions goals the extraction of REEs would have to increase by a factor of 10 by 2030. Indeed, it has already increased by more than 85% between 2017 and 2020, driven mainly by the demand for permanent magnets for wind power technology and electric vehicles.

According to the US Geological Survey, in 2022 China was responsible for 70% (210,000 metric tons) of global REE production, followed by the US (14.3%), Australia (6%), Myanmar (4%), Thailand (2.4%), Vietnam (1.4%), India (0.96%), Russia (0.86%), Madagascar (0.32%) and Brazil, among others. REE reserves are documented in over 34 countries. After China (44 million tons), the second largest reserves are in Vietnam (22 million tons), followed by Russia and Brazil (21 million tons each). In terms of processing, 87% takes place in China, while 12% takes place in Malaysia (by Lynas Rare Earths, an Australian corporation) and 1% takes place in Estonia.

Pressures to extract and process REEs are accelerating globally. However, REE mining has been linked to larger environmental impacts than other minerals and metals. REEs are usually present in very low concentrations and are combined; this means that their extraction and separation are expensive, require large amounts of energy and water, and generate large quantities of waste. Moreover, they are often mixed with different radioactive and hazardous elements such as uranium, thorium, arsenic and other heavy metals which pose high health and environmental pollution risks. Extraction methods include open-pit mining (generally involving intense water usage), underground and in-situ leaching.

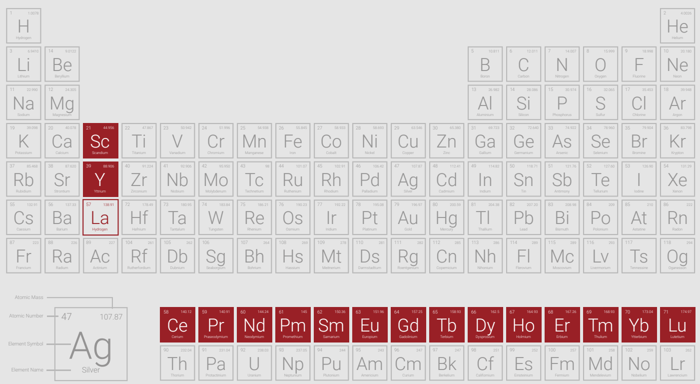
While there are high expectations regarding REE recycling, this remains a marginal source (less than 1%). There are many obstacles to REE recycling, such as the low concentration of end-products and the difficulty inherent in separating individual REEs from each other. Recycling is also far from being a clean industry, as it requires large amounts of energy and generates hazardous waste.

REEs comprise the 15 elements of the lanthanide group of the periodic table:

La | Lanthanum
Sc | Cerium
Pi | Praseodymium
Nd | Neodymium
Pm | Promethium
Sm | Samarium
Eu | Europium
Gd | Gadolinium
Tb | Terbium
Dy | Dysprosium
Ho | Holmium
Er | Erbium
Tm | Thulium
Yb | Ytterbium
Lu | Lutetium

Because of their similar physical chemical properties, they also include:

Y | Yttrium
Sc |Scandium



The Rare-Earths Impacts and Conflicts Map

The cases of socio-environmental resistance to REE extraction, processing and recycling documented on the map signal worrying trends regarding the historical and ongoing environmental, social and human rights impacts and abuses taking place across REE supply chains.

Communities around the world are denouncing the severe impacts that REE mining, processing and recycling have on water, soil, air and the health of communities. Since REEs are usually present in very low concentrations and in combination with radioactive elements and heavy metals, REE mining and processing is both highly environmentally and socially risky. Social unrest is also generated by a lack of transparency and participation in decision-making procedures and controls, including disregard for indigenous rights. Many of the documented cases involve flagrant abuses of human rights, with different forms of violence (repression, legal persecution, criminalization, physical violence) exerted against local communities, environmental and human rights defenders as well as civil society organizations.

Story featured in this report
Conflict of the complete map
Extraction
Processing
E-waste & recycling

What impacts have we observed?

Violence, criminalization and human rights abuses

Common practices documented on the map include the lack of recognition of the rights of communities, their livelihoods and worldviews (e.g. Madagascar, Brazil, India, Sweden, Finland), as well as other forms of violence, such as direct threats, intimidation, and false charges filed against environmental defenders (e.g. Myanmar, India, China). REE mining is advancing in Myanmar in the context of a dictatorship, with frequent examples of persecution and violence against communities.

Kachin State
Myanmar

Myanmar serves as a major exporter of REEs to China. Over the last decade there has been a significant surge in illegal REE mining in Kachin State, on the border between China and Myanmar. This illicit mining has occurred in collaboration with armed groups, resulting in human rights violations and causing extensive damage to local ecosystems and the livelihoods of the region's inhabitants. Previously renowned for its pristine forests, rich biodiversity and clean waterways, this area is now transforming into a landscape marked by deforestation and the presence of turquoise-coloured toxic pools generated by rare earth mining and harmful leaching agents. Mining activities are contaminating streams, causing wild animals to flee the area, impacting local livelihoods and causing multiple health issues among local communities. Reports signal that when village leaders have tried to file complaints about the impact of rare earth mining on their land and livelihoods, they have been met with threats and intimidation from militias. In some cases, villagers have been beaten or imprisoned for speaking out.

Featured story

Featured story

Bayan Obo

China

Bayan Obo is an industrial mining town that has extracted and processed REEs as well as iron and niobium (among other materials) in Inner Mongolia, China, since the 1960s. It is the largest REE mineral deposit in the world. In 2019 it produced 45% of the world's REEs. Decades of operations have led to the massive pollution of local soil and water with heavy metals, fluorine and arsenic, which have been seriously poisoning local inhabitants and ecosystems. Long-term industrial mining activities have produced huge amounts of tailings that contain rare-earth elements as well as toxic chemical elements, heavy metals and radioactive elements. This pollution affects the Yellow River watershed, which nearly 200 million people rely on for drinking water, irrigation, fishing, and industry. Bayan Obo is a global reminder of the enormous hazards, radioactive pollution risks and related health consequences that REE extraction and processing entail.

What impacts have we observed?

Environmental and health impacts

REEs are usually found in low concentrations. As a result, huge amounts of ore need to be processed to obtain small amounts of REEs, creating large piles of waste. Moreover, REEs are usually combined, which means large amounts of energy and materials are required to separate them. Finally, in many cases REEs coincide with radioactive and hazardous elements. Consequently, mining, beneficiation, separation and refining are potential sources of hazardous waste and pollutants for water, soil, air and human bodies.

The largest REE extraction and processing site on Earth in Bayan Obo (China) has been operating for decades, resulting in the devastating pollution of superficial and underground water, soil and air, severely affecting the health of local ecosystems and communities. Similarly, environmental pollution (and Chinese competition) led to the closure of REE operations at Mountain Pass Mine in the US in the 2000s; nevertheless, this operation has recently been reactivated to ensure the US' REE supply. REEs are also extracted as secondary materials from old and already socially and environmentally contentious mines such as in Brazil (niobium mine in Araxá, Brazil) or Madagascar (titanium oxide mine in Mandena).

Since 2011, communities in Malaysia's Kuantan District have fought Lynas' REE processing operation and its associated pollution, unsafe radioactive waste management and disposal methods. Communities from Kachin in Myanmar are protesting against illegal REE mining operations that have polluted their territories and livelihoods. Moreover, electronic waste recycling centres like the one in Guiyu (Guangdong, China) have been associated with heavy metal pollution in soil, water and even human blood.

What impacts have we observed?

Lack of information and public consultation

In the documented cases, companies provided little to no information about their projects, prevented meaningful community participation and, in the case of indigenous communities, violated their rights to free, prior and informed consent. Most cases documented on the map are related to complaints from local communities about a lack of transparency and poor participation spaces. Examples can be found in Chile, Spain, Sweden, Madagascar, India, Kenya, Malawi...

Featured story

Peninsula of Ampasindava
Madagascar

Communities and organizations are mobilizing against rare earth mining on the Ampasindava Peninsula in northwestern Madagascar. This area is home to northern Madagascar's last remaining forests, recognized as a global biodiversity hotspot and home to IUCN-listed endangered and vulnerable species. The well-being of the populations on the peninsula depends largely on the maintenance of these ecosystems, which provide them with numerous products (food, energy, construction materials, pharmacopoeia and sources of income) and ecosystem services (water, protection against cyclones, microclimate, soil fertility). Since 2016, local communities have been opposing the mining project on the basis that it will infringe on many of their human rights. This includes their land rights and livelihoods, as most live mainly from fishing and agriculture—particularly the cultivation of high-value-added export crops such as vanilla, cocoa and coffee that would be put at risk.
Since the beginning of the Tantalus Rare Earths Malagasy project –which was acquired by Reenova, then by HARENA Resources Pty Ltd in 2023– it has affected local communities that have denounced the irregular nature of mining permits, neglected test pit rehabilitation work, a lack of local participation and free, prior and informed consent, as well as disregard for the social, human rights and environmental impacts that would result from this project.

What impacts have we observed?

Featured story

Norra Kärr
Sweden

A deposit of REEs has been found near Jonköping, close to Lake Vättern in Sweden. Leading Edge Minerals, the Canadian company on the lead, claims the deposit will be important for the whole world and that the minerals will mostly be used for green technology. In 2009 they were granted a concession. However, the Supreme Administrative Court of Sweden later overturned the concession as Leading Edge Materials had not submitted an environmental impact assessment. Norra Kärr is located near a "Natura 2000" area which is protected by EU law and is close to Lake Vättern which, as of 2020, provides 250,000 people in Sweden with fresh water. The local groups are monitoring the companies' moves closely. The project is still under discussion. There is a proposal to eliminate permit requirements for mining concessions near Natura 2000 areas.

Impacts on Water

Mining and metal processing are not only water-intensive activities that can endanger communities' water supply. REE-related activities are also a source of hazardous and radioactive pollutants that have left legacies of pollution in old (Bayan Obo in China, Mountain Pass in the US) and new operations (Malaysia, Myanmar). Water access and quality are among the main concerns mobilizing local communities. This is the case in Norra Kärr, Sweden, where the mining project is close to Lake Vättern. Sulphuric acid is used to separate rare earth minerals from other minerals. The waste minerals are then stored in tailing ponds. Environmental groups are concerned that both acids and minerals (potentially including uranium and thorium) will leak into the surrounding environment and specifically into Lake Vättern, which could pollute the drinking water for hundreds of thousands of people.

Impacts on traditional livelihoods, traditional knowledge and cultural heritage | sacred places

Many of the current and proposed mines are operating in Indigenous territories across the world, endangering sacred sites as well as other culturally important areas where communities hunt and gather traditional medicines. This is the case in Madagascar, Malaysia, Chile and Finland, among many others.

What impacts have we observed?

Impacts on fragile and (un)protected ecosystems

Many proposed REE mining projects are developed in recognized protected areas or biodiversity hotspots: in Asia (Myanmar, Vietnam, India), Africa (Madagascar, Kenya, Malawi), Latin America (Brazil, Chile) or even in Europe (Greenland, Sweden). REE extraction is also connected to the destruction of coastal areas and ecosystems in India (intensive sand mining), and potential impacts on the oceans. There are deep-sea mining projects in New Zealand and Norway (among others) that are currently on hold given the uncertain and serious environmental and biological risks that this new mining frontier entails.

Featured story

Kuantan
Australia - Malaysia

Australia's Lynas Rare Earth Limited (Lynas) mines rare earth ores from its remote semi-arid Mt Weld mine in Western Australia. The REEs are concentrated and enriched at the mine into a lanthanide concentrate (LC), which is then transported to Pahang State in Malaysia. The LC is then chemically processed at the Lynas Advanced Materials Plant (LAMP) in the Gebeng Industrial Estate on tropical peatland. Since 2011, communities in Kuantan District have fought against Lynas' pollution, unsafe radioactive waste management and disposal methods. These communities' actions have gained recognition and support from some international organizations due to the massive radioactive toxic legacy of long-lived radionuclides such as uranium and thorium, toxic heavy metals (including residual rare earth minerals) and chemicals. While Lynas promised to remove its radioactive waste to obtain an operating license from the Malaysian Government, it has since reneged on that legal undertaking by constructing a scientifically unsafe above-ground "permanent" disposal facility in the peat swamp next to the LAMP. In Western Australia, the same type of waste has to be disposed of in underground landfills engineered to be isolated from the biosphere for at least 1,000 years and under regulatory control for at least 10,000 years. To date, Lynas has accumulated over 1.5 million tons of radioactive waste in a wet and low-lying peat swamp in Malaysia near residential estates and coastal resorts. The community-driven campaign "Stop Lynas" denounces greenwashing by the company and a lack of law enforcement by the government, the risks posed by the radioactive waste and hazardous pollution, the impact on water availability, long-term cancer risks for the community, and damage to local livelihoods and ecosystems.

The quest for mineral control: the geopolitics of REEs

As REE demand is increasing rapidly, there is a global quest to secure access and control. Chinese market dominance (70% extraction and 85% processing) has produced fears in the United States and the European Union. In the context of increased tensions between China and the West, this "mineral cold war" has transformed the geopolitics of critical raw materials—including rare-earth elements.

In recent years, for instance, the United States has sought to "secure the supply chain" by diversifying its sourcing of rare-earth elements. This has meant more domestic mining (reviving the Mountain Pass site in California and processing the ore on-site rather than sending it to China) as well as exploring new deposits in places like Bear Lodge in Wyoming. The European Union is also promoting the development of REE extraction projects in the region, such as in Sweden, Finland, Spain and Serbia. China is securing its provision of REEs by developing mining projects in Asia, Africa and Latin America.

Among other policies, the US Inflation Reduction Act requires electric car manufacturers to source at least 40% of their batteries' mineral content from the United States or allies (read: not China). That percentage is to rise to 80% by 2027. Washington is not only scrambling to secure its own critical minerals; it is also forcing allies to reduce trade with China and compete for minerals elsewhere in the world. Similarly, the EU Commission presented the Critical Raw Materials Act (2023), which established ambitious goals for 2030: to reach 10% of critical mineral extraction, 40% of processing from European countries, and for a maximum of 65% of strategic raw materials consumed in the EU at any relevant stage of processing to be sourced from a single third country.

In this context, in the summer of 2023 Beijing imposed export controls on gallium and germanium, which are critical components of solar cells, fibre optics, and the microchips used in electric vehicles, quantum computing and telecommunications. In August, Chinese exports of these minerals dropped from nearly 9 metric tons to zero.

At the same time, other industrialized countries have embarked on efforts to guarantee their own access to raw materials, including REEs. These efforts to "secure the supply chain" are presented as an opportunity for countries in the Global South to increase their income and even gain leverage by developing further processing and manufacturing, as well as demanding higher intellectual property rights in future deals. Nevertheless, the impacts and conflicts surrounding the expansion of REE supply chains point to the exacerbation and creation of new "zones of sacrifice" where communities and ecosystems are destroyed around mineral extraction or processing sites. That challenge applies to mineral-rich regions within the Global North as well. The new geopolitics of rare-earth elements not only pits the West against China, but also opens an urgent debate about the social and environmental unsustainability and the injustices of current energy transition scenarios.

CORPORATE POWER

REEs projects are controlled by companies mainly based in China, the US, Canada and Australia. Actually, one mega-company - China Rare-Earths Group- controls 70% of the country's REEs output. In the analyzed cases, we find a mixture of national (sometimes state-owned) companies and foreign companies carrying out REEs related operations. The main companies extracting REE globally are: Lynas Corporation, Iluka, Alkane Resources (the three based in Australia), Shenghe Resources (based in China), and Molycorp (in the United States). Of these, the Australian mining company Lynas Rare Earths Ltd. (LYC.AX) is involved in the largest Rare Earths processor outside of China, in Malaysia. In 2022, the company signed an agreement with the US Department of Defense to construct a Rare Earths separation facility in Texas, which is expected to be operational in 2025.

Urgent policy questions

The map documents how REE supply chains are rapidly expanding at a great environmental and social cost. While the central question for industrialized economies has remained how to urgently secure the sources that can meet a booming demand of critical materials for a green and digital transition, the REE Impacts and Conflicts Map highlights the increasingly unsustainable and unjust distribution of environmental, social and health burdens on communities across REE global supply chains. Some questions need to be urgently addressed, such as:

- **How can we envision environmentally just and sustainable energy transition and digitalization processes that do not exacerbate unjust and unsustainable practices or violate human rights?**
- **How can we challenge and rethink energy demand scenarios (energy for what, for whom, at what cost) and establish clear limits?**
- **How can we rethink industrial design (prolonging product lifespan, increasing recycling and decreasing e-waste, waste generation and energy use)?**
- **How can we develop energy transition policies that do not push aside environmental, social or participation rights in the name of climate urgency (for instance, looking for solutions beyond technological fixes)?**
- **How can we ensure that this transition takes biophysical limits into account?**

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