Mining, Biodiversity, and Protected Areas

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Overview

The green energy transition is upon us. Wind turbines and solar panels are replacing fossil-fueled power plants. The world will add as much renewable power in the coming five years as it did in the past 20, according to the International Energy Agency (IEA), and electric cars will account for nearly a quarter of all car sales worldwide by 2025, and closer to 40 percent in Europe and China.

These are vitally important steps in the fight to slow climate change. But the green energy transition brings its own set of challenges. Without good science and informed policies, the switch to renewable energy sources will create a host of new problems. The challenge is to ensure that any damage to nature and people caused by the move away from fossil fuels is kept to a minimum and does not exacerbate the global biodiversity crisis.

The fundamental issue is that renewable energy could be as materials-intensive as fossil fuels.[1] A wide variety of metals such as nickel, lithium, manganese, and cobalt go into producing batteries, solar panels, and wind turbines. Building a renewable energy infrastructure at the scale necessary to reach climate change goals such as keeping global temperature increases to less than 1.5°C will require vast new sources of each of these and many more resources, and demand is already surging. The World Bank expects the energy transition to increase demand for metals and minerals rapidly, by more than 500 percent by 2050 for some metals.[2] Bringing them to market means the world will face a mining boom of unprecedented proportions, on land and on the sea floor.[3]

Mining has long been recognized as a threat to protected areas and biodiversity in general, both directly due to habitat loss and degradation, and indirectly through supporting industries and increased access to biodiversity rich areas as a result of mining operations. According to one analysis, mining currently influences more than 19 million square miles (50 million square kilometers) or 35 percent of the earth's land surface excluding Antarctica.[4] Of that, 8 percent of mining areas border or overlap with protected areas, 7 percent with Key Biodiversity Areas, and 16 percent with wilderness.[5]

The increasing demand for minerals used in renewable energy production magnifies that threat. Consider just two of the resources critical for the expansion of renewable energy, nickel and lithium.

Nickel

Nickel is an essential component of most technologies for rechargeable batteries and is used in stainless steel and other applications. According to the IEA, switching to renewables will require producing nearly 6 million tons of nickel a year by 2040, roughly double the global total in 2022. That adds up to some 72 million tons of nickel in total between now and then.[6]

Producing all that nickel poses an enormous challenge, because it makes up a tiny fraction of the Earth's crust. High-concentration nickel deposits are already largely depleted, and the discovery of substantial new nickel deposits is unlikely. One alternative is to search for nickel in soils that result from the weathering of specific rock formations over millions of years.

Such nickel-rich soil occurs only with the right topography, seasonal and abundant rainfall, and warm temperatures. This uncommon combination of geology and climate occurs in certain places in Indonesia, the Philippines, the island of New Caledonia, and parts of Australia. Those places that also harbor rich biodiversity.

Extracting nickel from those soils requires cutting down all the trees in the area and scraping away the upper soil layers. Such strip mining destroys tropical forests and has other disastrous consequences, including pollution of air and water, damage to coral reefs and the marine environment, extermination of wildlife populations (including threatened and endangered species) and ecological and social damage to local communities.

Indonesia has met most of the increased demand for nickel over the past five years. In 2017 Indonesia produced just 17 percent of the world's nickel. Today it is responsible for around half, and that number is so rising so rapidly that nickel production may soon replace palm-oil production as the primary cause of deforestation in the country.

Another source of nickel is the sea floor. One area of the seabed in the Pacific contains trillions of potato-sized lumps of nickel, cobalt, manganese, and copper. Collectively the nodules hold an estimated 300 million tons of nickel alone—more than three times the United States Geological Survey's estimate of the world's land-based reserves. Companies are already making plans to exploit this resource, with as yet unknown impacts on deep-sea ecosystems.[7]

Lithium

Like nickel, lithium is a key component of rechargeable batteries. The growing demand has resulted in an exponential growth in lithium exploration and exploitation, particularly in a region of the High Andes known as the "lithium triangle." Sitting at more than 3,000 meters above sea level and spanning parts of Argentina, Bolivia, and Chile, between 50 and 85 percent of global proven lithium reserves are concentrated in this arid region.[8]

While lithium can be mined from hard rock, most lithium reserves, including those in the lithium triangle, are actually found in brine beneath the Earth's surface. Brine mining involves evaporating the brine in massive pools, leaving high concentrations of lithium behind. It's a simple but inefficient process: each ton of lithium requires 2 million liters of lithium-rich water to be evaporated, resulting in enormous quantities of water being lost every year, putting underground freshwater reserves in danger of salinization, and leaving behind tons of waste.[9]

The lithium triangle includes lakes, lagoons, marshes, bogs, and salt flats. These fragile but highly productive ecosystems are and vitally important for biodiversity and the wellbeing of local communities.

Role of Protected Areas

Mining and other types of development must abide by the mitigation hierarchy to manage risks to ecosystems.[10] This four-step process compels governments and private enterprises to prioritize avoiding impacts, and then minimizing, remediating, and compensating for any loss. Protected and conserved areas (PCAs) need to play a central role this process, which can help prevent expanded renewable energy production from exacerbating the biodiversity crisis by avoiding areas of high conservation importance, reusing mining waste, implementing lower impact mining techniques, rehabilitating old mining sites, and achieving a net gain of biodiversity. Recycling and circularity approaches also provide robust opportunities to reduce the overall negative impacts from mining as we move towards our climate goals.

Some but not all existing PCAs already ban mining activity within their borders, and 14 percent of protected areas contain mining operations or have them nearby.[11] Planning for and management of all types of PCAs must consider how to avoid and mitigate existing and potential threats from mining and other extractive activities that may expand due to increasing demand for renewable energy.

This will require both good science, transparent planning and innovative policies. The precise consequences of expanded mining on biodiversity remains largely unknown, as do the extent of the tradeoffs between slowing climate change through expanded use of renewable energy and the habitat loss and other potential harms this expansion may bring. All these areas require urgent investigation.

At the same time, national authorities and international agreements such as the UN Framework Convention on Climate Change and the Convention on Biological Diversity need to provide clear guidance on when, how, and who is responsible for managing these tradeoffs. Working together, scientists and policy makers can bring about the necessary transition to renewable energy in a sustainable manner that also recognizes the need to protect and restore our most valuable ecosystems.

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