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# PERSPECTIVE

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## Malaysia's Return to Mining: Redeveloping Rare Earth Elements (REE)

*Tham Siew Yean and Neo Hui Yun Rebecca**

*Picture taken at the entry-point to a Bauxite mining site in Bukit Goh in Malaysia's rural state of Pahang, Malaysia on 13 October 2015. The Malaysian government has called for a return to mining, focussing especially on the development of a sustainable non-radioactive rare earth element (NR-REE) industry that aims to shift from upstream to downstream activities. Picture: Manan Vatsyayana /AFP.*

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## EXECUTIVE SUMMARY


- Increasing scrutiny of mineral resources at the global level has led to greater domestic interest in Malaysia's mineral resources. The Malaysian government has called for a return to mining, focussing especially on the development of a sustainable non-radioactive rare earth element (NR-REE) industry that aims to shift from upstream to downstream activities.

- The history of REE development in Malaysia has been dogged with environmental, health and safety concerns, as exemplified by public concerns over the disposal of radioactive waste generated by Lynas's operations in the country since 2012.

- Concerns over deforestation have also emerged; REE appear to be located at or are close to high-carbon stock areas. The government is suggesting an alternative method for extracting NR-REE, i.e. through in-situ leaching which reduces land clearing and tree felling, but this risks polluting surface water in mining areas.

- The conversion of radioactive waste to non-radioactive waste has been experimented at the laboratory level, with the aim of creating a sustainable solution for the disposal of radio-active waste materials.

- While the government is considering an export ban on NR-REE to attract foreign direct investment for the development of downstream activities, there is as yet no discussion over the use of mineral rents, be it at the state and federal level.

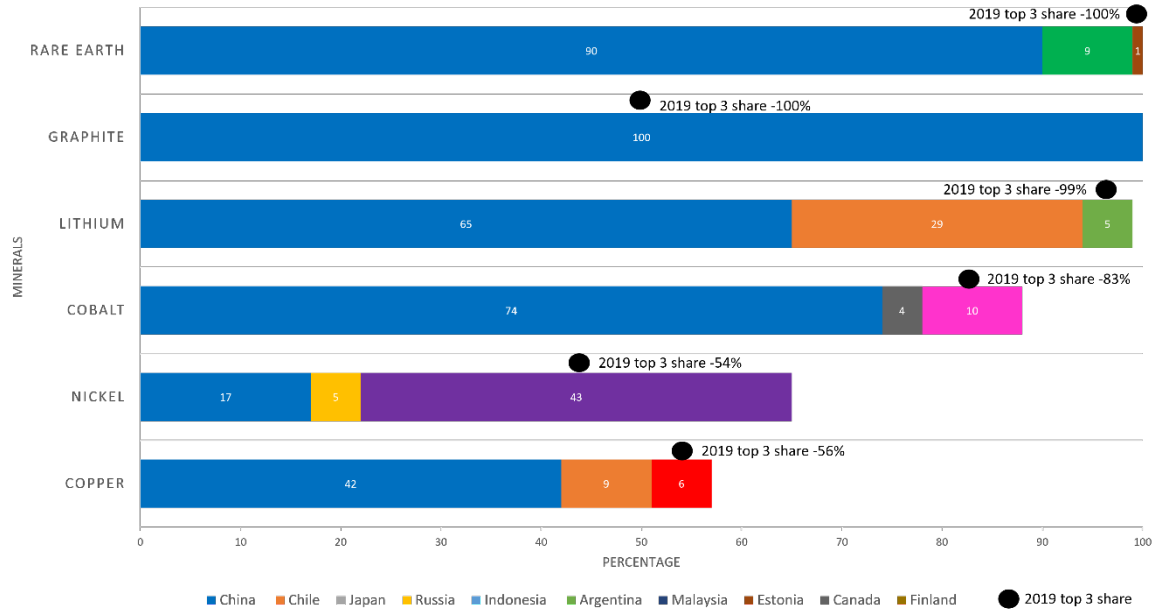
- Countries and companies cannot be expected to abandon the exploitation of mineral resources as a viable economic activity, however, and a more balanced approach is to subject the exploitation of these resources to stronger governance, greater transparency, and better accountability.

## INTRODUCTION

Mining—especially of tin—was historically an important activity on the Malay Peninsula, from the time the mineral was first discovered in the late 19th century till industrial development took off in Malaysia in the late 1960s.[1] As manufacturing expanded, mining became less important.

Global developments since then have changed the world demand and supply of critical minerals in the world. Critical minerals, defined by the Energy Act of 2020, are mainly non-fuel minerals or elements identified to have a high risk of supply chain disruption but which have an essential function in one or more energy technologies.[2] Projections from the International Energy Agency (IEA),[3] indicate that the rush for clean energy and the attendant demand for electric vehicles (EVs) and batteries needed to power the EVs have driven up the demand for critical minerals such as aluminium, nickel, tin, rare earth elements (REE) etc. Geopolitical tensions have also spurred a proliferation of new industrial policies seeking to reduce overdependence on limited sources of supply. Supply is however concentrated to a few economies, with the share of the supply in the top three economies in 2022 remaining the same or even larger, seen over the last three years (Figure 1).

**Figure 1: Share of top three producing countries in processing of selected minerals, 2022[4] (Last updated 11 Jul 2023)**




Sources: See endnotes

Developing countries that are resource-rich in critical minerals are therefore keen to seize this high-demand opportunity to join the emerging new supply chain and to use these resources as a new source of growth. Likewise in Malaysia, interest in mining activities has revived in line with the rise in global interest. This article traces new interest in the development of mining activities, the types of minerals available, and their location in Malaysia. Current policies and challenges to develop the rare earth industry is used as a case study.

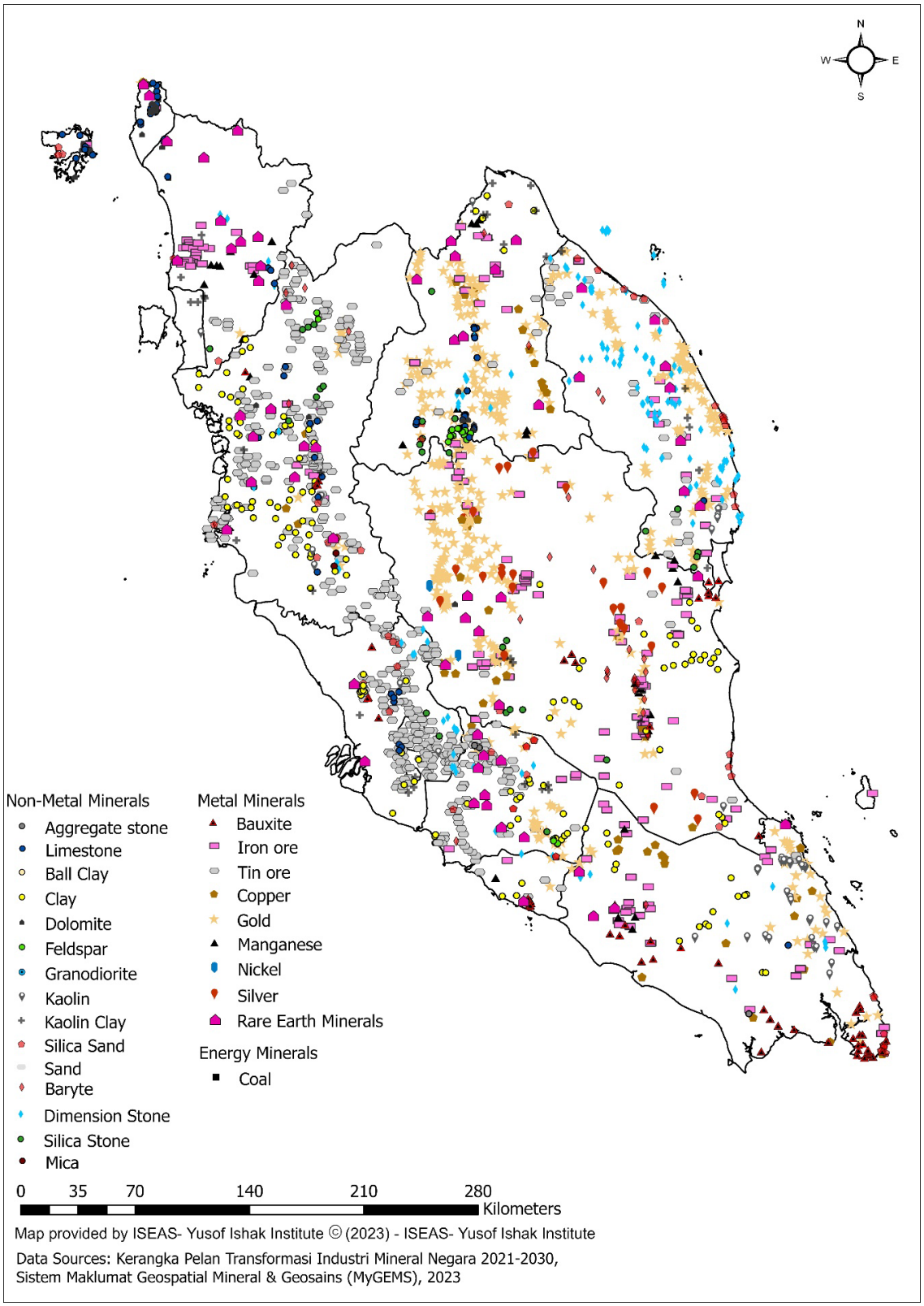
## A RELOOK AT MINERAL RESOURCES IN MALAYSIA

Malaysia's National Mineral Industry Transformation Plan 2021-2030 (NMITP), launched in 2021, aims to develop the mineral industry sustainably, and along the entire value chain, as a new source of growth for Malaysia. It maps the mineral resources in the country, which include metallic and non-metallic minerals. Figures 2 and 3 show their extensive presence in every state of Malaysia.

The plan reveals that Malaysia possesses mineral resources potentially worth RM 4.11 trillion (approximately US$982 billion); these include both metallic and non-metallic minerals. The estimated value of metallic minerals alone is RM1.03 trillion, with critical minerals possessing a potential estimate value of up to US$182 billion.[5] Metallic minerals such as nickel, manganese, copper, and aluminum are used in EV battery production. While Rare Earth Elements (REE) are also used for the development of electric vehicles (EVs), they are not used in lithium-ion batteries. Instead, they are necessary for the magnets that form the main propulsion motors.

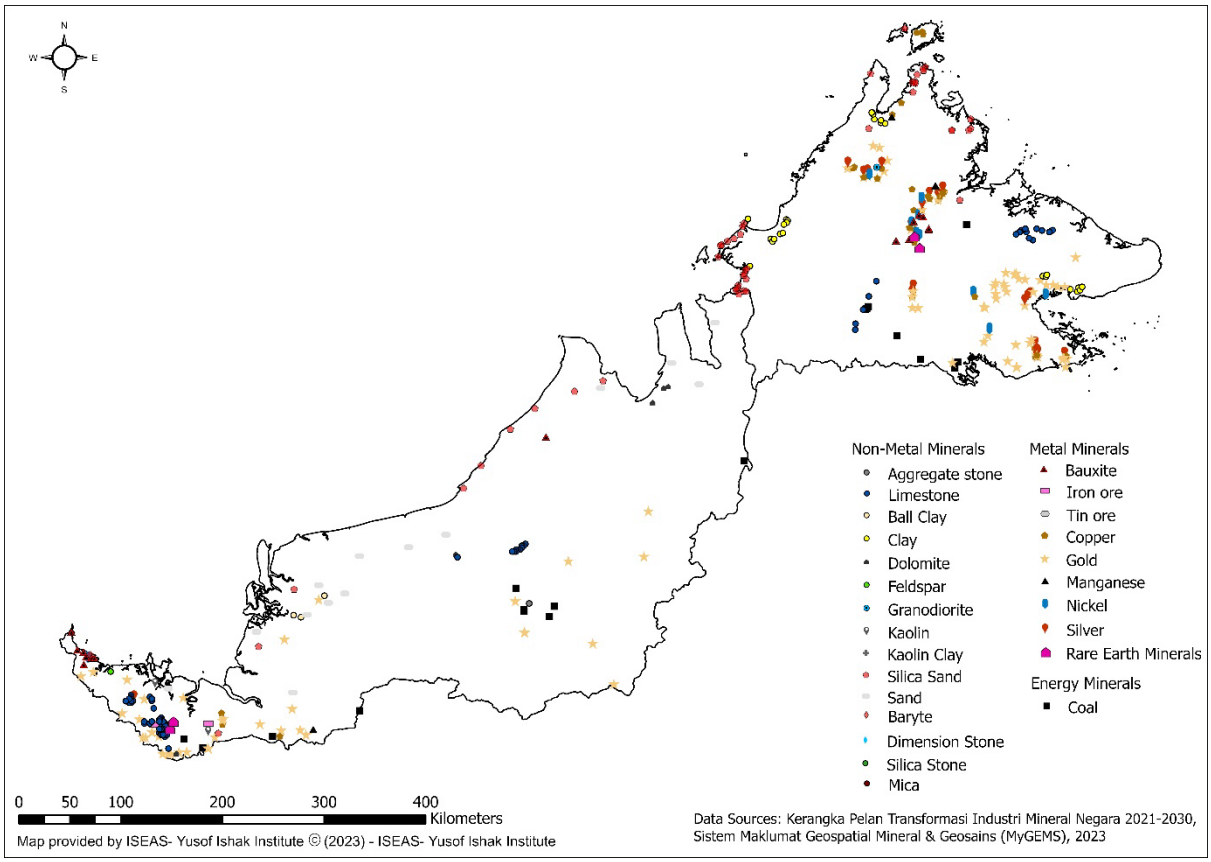
The plan considers five minerals (with estimated value of deposits) to be strategic: *non-radioactive rare earth elements (NR-REE) such as lanthanide elements*[6] *(*RM747.42 billion*)*; bauxite (RM20.3 billion); tin ore (RM140.4 billion); silica sand (RM27.9 billion); and kaolin (RM25.5 billion).

**Figure 2. Mineral Resources in Peninsular Malaysia, 2023**




Source: Authors

**Figure 3. Mineral Resources, East Malaysia, 2023**




Source: Authors

Of the five strategic minerals identified, NR-REE[7] has the highest estimated value and hence is the focus for the current administration's strategic interest. The following section explores the exploitation of NR-REE and the outstanding challenges involved.

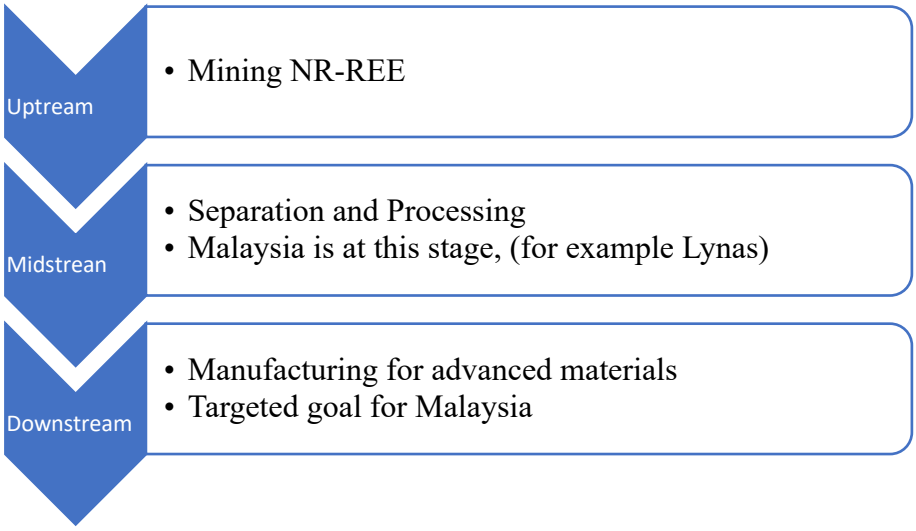
*Case Study: Redeveloping the Rare Earth Element (REE) industry*

There were two companies producing REE in the 1970s, namely, Malaysian Rare Earth Corporation (MAREC) and Asian Rare Earth (ARE) in Perak. These were sister companies with Japanese equity partners.[8] ARE mainly produced intermediate mixed RE products which were exported to RE purification plants in Japan and Europe to produce high-purity individual REEs for use in high-tech applications. MAREC, on the other hand, mainly focused on the export of yttrium oxide concentrate to countries like Japan, USA, United Kingdom and Norway, where the mineral was further purified to produce valuable Heavy Rare Earth Elements (HREE) commonly used in clean energy technology.[9] Both companies were closed down in 1992 due to public protests and conflicts over the dangers associated with the disposal of radioactive waste materials.[10] Apart from that, the high maintenance cost of the plants, worsened by the 14-month suspension issued by the High Court to curb environmental dangers, was another factor that attributed to the plants' eventual closure.[11]

In 2008, Lynas Malaysia Sdn Bhd (Lynas), a wholly-owned subsidiary of Lynas Corporation Ltd of Australia, was given a manufacturing license to produce rare earth oxides and carbonates at Gebeng Industrial Estate in Kuantan, Pahang. Setting up the Lynas Advanced Material plant (LAMP) in Malaysia was an expansion by the company to strengthen its rare-earth's supply chain, following a significant investment of $304 million (AU$450 million) pledged through an equity-raising initiative.[12] Lynas used this location in Malaysia to develop a facility to process mineral concentrates imported from its mine in Australia. In 2011, in response to public concerns over health and safety issues over the radioactive waste associated with the processing of REE, the government called for a third-party assessment by a team of experts from the International Atomic Energy Agency (IAEA), on Lynas' compliance with international safety standards and good practices and radiation safety.[13] The team found that Lynas complied with the radiation safety standards imposed by the regulatory authorities, and their findings were made public. The plant then restarted operations in 2012 by refining and processing rare earth oxides mined from Mount Weld into high-quality separated rare earth materials for export to manufacturing markets in Asia, Europe and United States.[14] The plant has since boasted an annual production capacity of 22,000 tones, helping the company to double its total production. It also provided 450 jobs for locals, making the east coast of Malaysia an attractive place for other investors interested in the rare-earth supply chain.[15] Despite this, each renewal of the operating license of Lynas remains contentious amid public protests over radioactive waste materials from the plant.[16] The tussle over the extension of its operating license and the disposal of radioactive waste materials continued until the latest episode when it was up for renewal again in 2023. The license was subsequently extended till March 2026.[17]

REE development continues to be championed by certain segments of Malaysian society. In 2014, Akademi Sains Malaysia (ASM), together with the Ministry of Science, Technology, and Innovation (MOSTI), produced a Blueprint for the establishment of REE industries in the country as a new source of growth. A critical component of this plan was the call for development of midstream and downstream activities, rather than a mere focus on upstream extraction alone; this was to increase value-added activities in the country (Figure 4). Midstream refers to the transformation of minerals into refined products through separation and purification while downstream activities input these refined products into manufacturing.

**Figure 4. Value Chain Activities for Developing NR-REE**




Source: Tham 2023[18]

Although the suggested blueprint was not adopted, the government came up with the NMITP in 2021. Like the blueprint, this latter plan also emphasized downstream development as the way forward for mineral resource development. The New Industrial Master Plan 2030 (NIMP 2030), launched in September 2023, also calls for downstream development by using mineral resources to manufacture advanced materials, with the types of advanced materials being left to be determined by the market players.

The government subsequently announced a plan to prohibit the export of raw NR-REE,[19] a move reminiscent of Indonesia's shift towards resource nationalism in its ban of nickel exports for furthering downstream activities. The reason behind both bans is to encourage the establishment of production plants within the country; this would hopefully create jobs for locals and raise national incomes through higher-value processed materials being exported instead of raw metals. Malaysian Investment Development Authority (MIDA) also provided incentives to attract investments for the development of downstream activities such as Pioneer Status (which includes five-year partial income tax exemption) and Investment Tax allowance.

## KEY CHALLENGES IN THE REDEVELOPMENT OF REE

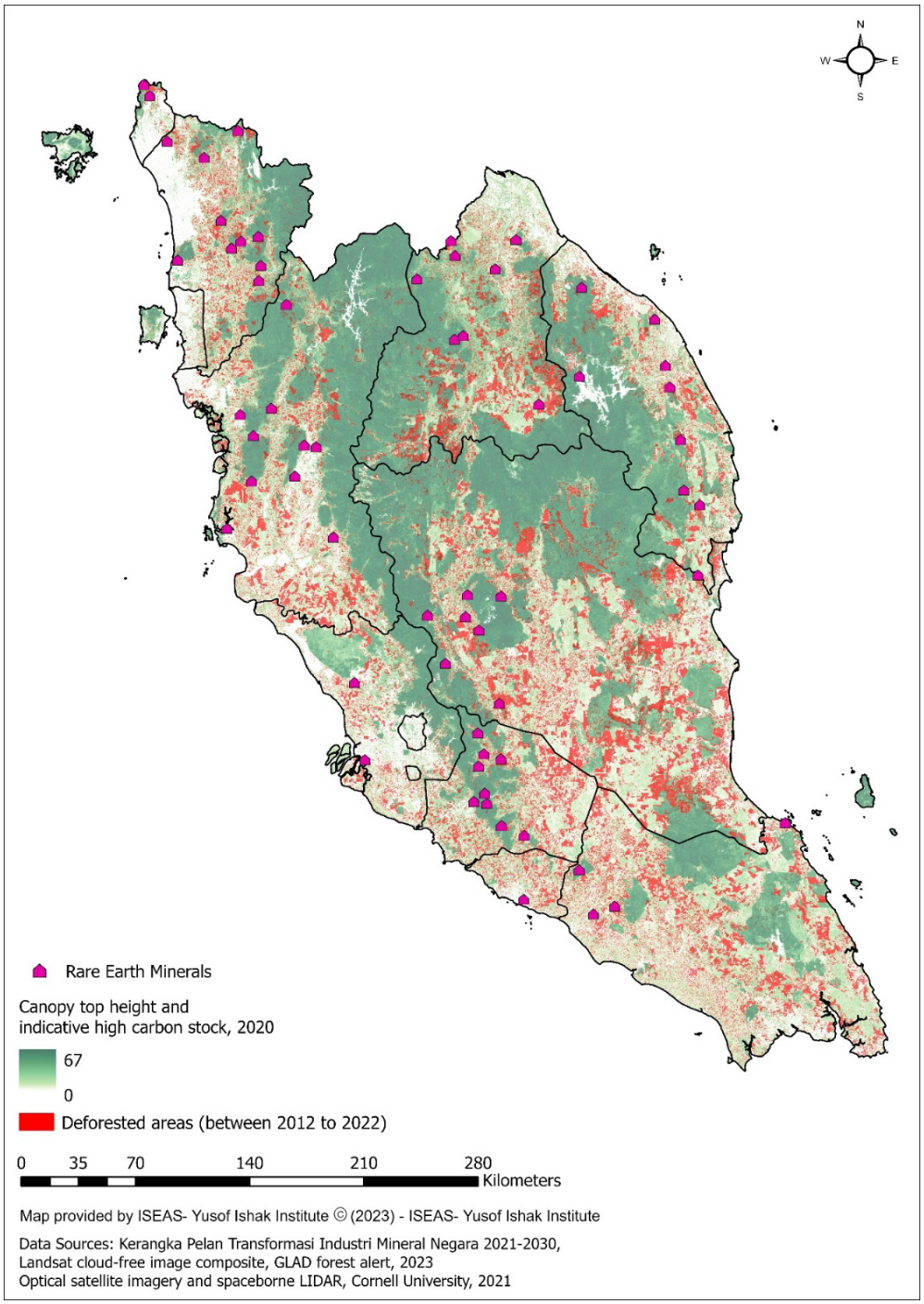
*Environmental Concerns*

As noted by IEA,[20] local and regional development are affected by mineral exploitation in three significant ways. The first is the use of the land where the unmined minerals are found. Deforestation is a key concern. For example, the spurt in nickel mining in Indonesia since 2019 has led to a loss of 76,301 hectares in the country,[21] escalating the loss in biodiversity and the habitats of some endangered species.

Likewise, NR-REE in Malaysia appear to be located near or at high-carbon stock areas (see Figures 5 and 6 below). A deeper investigation of these locations also revealed the great extent

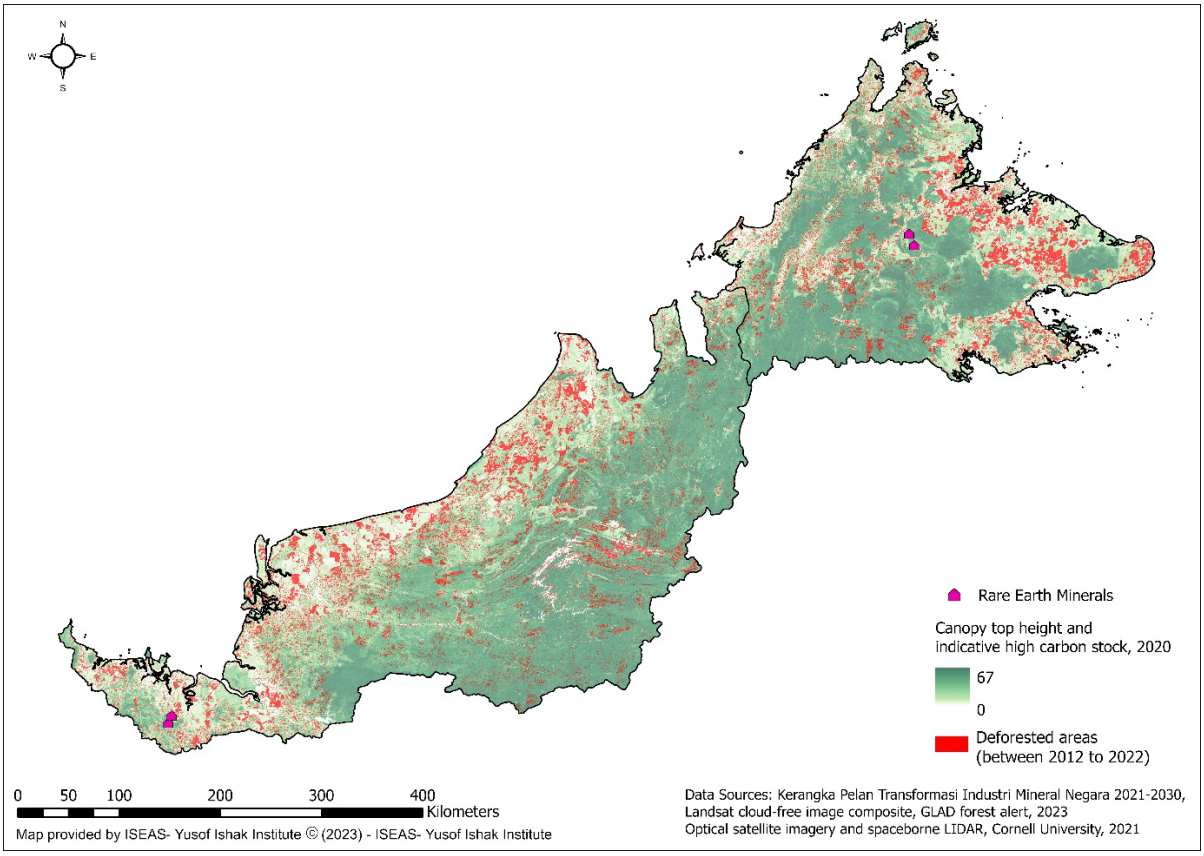
to which surrounding areas have been deforested over the last 10 years (2012 to 2022). Although the causes of the deforestation are not known, this connection highlights forested areas can be encroached upon once a certain area is identified for future NR-REE mining.

**Figure 5. Deforestation around NR-REE locations and High Carbon Stock Areas in Peninsular Malaysia, 2012-2022**[22]




Source: Authors

**Figure 6. Deforestation around NR-REE locations and High Carbon Stock Areas in East Malaysia, 2012-2022**




Source: Authors

A difference in attitude toward sustainability is also evident between federal and state governments, where state governments are keen to pursue economic interests for REE mining over federal attempts to preserve national carbon stock. Beginning with the 2019 Budget, the federal government has used Ecological Fiscal Transfer (EFTs) to facilitate state government efforts to protect rainforests. However, since land use is controlled by state governments, there have been instances of individual states diverging from the original sustainability goals set by the federal government. The Kelantan state reportedly revealed plans in October 2023, to remove the status of "environmentally sensitive area" (ESA) for up to 88% of its total protected area; this is to free up land for development, albeit the types of development involved are not specified.[23] Similarly, Kelantan had in 2022 estimated that NR-REE mining can boost the state's economy by RM125 billion, thereby indicating that this is possibly part of the state's development plan.[24]

To mitigate deforestation due to mining, in-situ leaching has been proposed as an alternative to open cast mining. This method mainly entails the extraction of REE via the injection of chemicals such as ammonium sulfate into hills containing REE deposits. The minerals are then dissolved into a liquid form before being extracted at the surface. This method is known to avoid destruction of vegetation and removal of topsoil, essentially resolving the risk of deforestation. There are other potential pitfalls, however, even if less land clearing and tree

felling problems are encountered with in-situ leaching as compared to open cast mining. There is, for example, a possibility of leakage from the leaching ponds which contain pollutants, to underground water or other waterways.[25]

The possibility of contamination remains a contested issue currently. Studies on the impact of in-situ leaching practices in China, which has used this technology since the late 1960s,[26] have shown that there is REE pollution of surface water in mining areas.[27] The Department of Minerals and Geoscience, Malaysia, countered this claim in October 2023, based on findings at an in-situ leaching pilot project for mining non-radioactive rare earth elements (NR-REE) in Mukim Kenering, Hulu Perak, Perak.[28] It remains to be seen if the public is convinced by the findings of one pilot project, as opposed to the evidence available on China's experience in using this method.

Waste generation from mineral development and processing is another concern. The Lynas tussle over radioactive toxic waste has been momentarily resolved by a proposal to convert radioactive waste to non-radioactive waste. Although the technology is available in Malaysia, it is still at the laboratory level, and is not yet ready for commercial application.[29]

*Use of Mineral Rents for Development*

Mineral rents can be a good source of income for fostering development. Perak, for example, was reported to have received RM1.66 million in royalty payment for the production of Rare Earth Carbonate (REC) from its rare earth pilot project; the product was then exported to China. The prospects of making a quick buck from selling REE has led to reports of illegal REE mining in Negeri Sembilan and Malacca.[30]

Unfortunately, there has been no disclosure on royalty payments, except when queried in parliament. Neither is there any disclosure on the division of mineral royalty payments between the federal and state governments. More importantly, how the mineral rents are used, be it at the federal or state level remains unknown. The debate as well as the suggested plans and the government's response through the media have taken a firefighting approach; it has focused mainly on public environmental concerns and safety issues, while the use of mineral rents has not been discussed. For natural resources, which are limited in supply, the conversion of this type of natural capital into physical capital that can drive development is critical, but the road towards capturing mineral rent for this use is paved with governance issues and the political economy of a country.

Although the NIMTP has included governance as one of the important pillars for the development of the mineral industry, there is no discussion on accountability for the revenue received and for these revenues being invested to benefit public welfare for the immediate and the distant future. Accountability requires proper disclosure of revenues paid by the companies involved in mineral development, and much greater transparency in communications with the public.

The government is currently developing a NR-REE business model in conjunction with ASM and Sunway University.[31] It remains to be seen if the use of mineral rents is included in the business model or if the business model merely includes a computation of the rate of return to

investment for the investors, without any further discussion on the cost and benefit of mining incorporating the social costs involved.

## CONCLUSION

The renewed interest in mining in Malaysia coincides with the rising global interest for greater use and diversification of sources of critical minerals. Yet mining activities face considerable environmental challenges. Mining companies applying for mining rights need to comply with the environmental laws of the country, which includes robust and comprehensive environmental and social impact assessments. More importantly, environmental challenges require that there be strong enforcement as well as monitoring mechanisms for compliance.

Exploiting mineral resources also requires effective cost-benefit analysis of the extraction and use of mineral resources throughout the production and supply chain. This includes careful computation of the social costs of mining and not just the economic returns from down-streaming mining activities within Malaysia.

Since mineral resources are finite in supply, it is equally important that the mining rents collected, be it at the federal or state level, are channelled for development purposes such as investments in tangible public goods such as education and health, or in infrastructure needed by the respective states. Greater transparency and accountability are clearly needed to guarantee that the mineral resources of the country are not exploited for the gains of a few, but for the greater good of the country.

Hence, the government, be it at the state or federal level, must ensure that mining projects are executed with stronger governance, clear transparency, and better accountability so that the mistakes of the past or in other countries that have traversed the same route, will not be repeated.

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[22] Figures 5 and 6 show the canopy top height for forested areas found in Malaysia, together with tree loss data. These data were obtained using Sentinel-2 optical satellite images using reference data from GEDI lidar waveform. The forested areas were based on satellite images obtained from 1 September 2020 to 1 March 2021. Retrieved from: https://nlang.users.earthengine.app/view/canopy-height-and-carbon-stock-southeast-asia-2020. The tree loss data showcase the global forest change from 2000 to 2022. To streamline these with those of recent years, data from 2012 to 2022 were used in the creation of the maps. Retrieved from: https://storage.googleapis.com/earthenginepartners-hansen/GFC-2022-v1.10/download.html

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