BAJIRAO IAS ACADEMY

THE HINDU ANALYSIS

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NUCLEAR NON-PROLIFERATION TREATY



India's quest for Critical Minerals



DHIRAJ NAYYAR

THE MISSING MINING DRIVE

India must fast-track exploration of critical minerals

THE EVOLUTION OF human civilisation is intrinsically linked to the use of metals. Around 7,000 years ago, civilisation made a great leap from the Neolithic Age to the Chalcolithic Age. Subsequently, it grew more advanced as it moved to the Bronze Age and then the Iron Age. In more recent times, epochs have not necessarily been named after metals or their source - minerals that occur under the surface. But eras have been defined by them. Coal powered the first industrial revolution of the 19th and early 20th centuries. Oil and its derivatives fuelled the second industrial revolution (think cars and planes), and global prosperity in the second half of the 20th century. Now, the long 21st century is going to be the critical minerals age.

In a way, it already is. The president of the world's largest economy has put critical minerals at the core of his foreign and domestic agenda. The reason Donald Trump wants to "annex" Canada and Greenland is to have control over their vast mineral wealth. The only reason he is remotely interested in solving the Russia-Ukraine conflict is the potential for the US to access Ukraine's rich mineral resources. At home, Trump is opening up vast tracts of federal land - previously on no-go lists - for mineral exploration on a fast-track basis, cutting approvals time from a year to less than a month. Minerals have also taken centre-stage in the global trade war. China is using its disproportionate control over rare earth materials to threaten the US and the rest of the world with the debilitating consequences of restricted supply.

China alone accounts for two-thirds of global rare earths mining. Australia, Chile and China account for a majority of lithium mining. In processing, there is complete dominance across the board by just one country, China. Sixty-six per cent of the processing of critical minerals (also including copper and aluminium) takes place in China, For rare earths, this goes up to more than 90 per cent. China alone can bring the global EV industry to a halt by restricting the supply of rare earths. It is happening right at this moment.

Twenty or even 10 years ago, the thought of critical minerals or rare earths being at the centre of global conflict, whether geopolitical or geoeconomic, would not have been taken very seriously. The only natural resource that figured in the context of international security and strategy was oil. Since then, two things have happened. First, a growing consciousness about climate change. Second, technological advancement towards a fourth industrial revolution.

The technologies that help mitigate climate change — by enabling a substitution of fossil fuels like coal and oil — are heavily mineral-intensive. An electric vehicle uses six times the minerals a conventional vehicle does, largely because its battery is made of lithium, cobalt and nickel. Renewable energy infrastructure for solar and wind power is also mineral-intensive. For example, an offshore wind infrastructure project consumes nine times the minerals that a conventional power plant would.

The fourth industrial revolution, which involves AI, robotics and big data, is also mineralintensive. For example, any digital or digital connectivity infrastructure requires copper in large quantities. Copper is critical because of its electrical conductivity. Data centres, the backbone of big data and AI, consume a lot of copper. They also consume large amounts of energy. Tomitigate climate change, a lot of this needs to be sourced from renewable sources. There are several other examples of the mineral intensity of emerging technologies. As the adoption of these technologies cows, the de-

mand-supply gap of critical minerals will grow. The biggest risk to the emerging landscape is the heavy concentration in the supply of critical minerals, much greater than the concentration in oil. There are two stages of the value chain that are of concern. First, the extraction of the metal ore from the surface. Second, the processing of that ore into usable metal. There is a high degree of concentration in the first. Cobalt comes almost exclusively from Congo. Indonesia dominates the mining of nicket, almost 50 per cent of the global supply. China alone accounts for two-thirds of global rare earths mining. Australia, Chile and China ac-

alone accounts for two-robust supply, china alone accounts for two-robust algobal rare earths mining. Australia, Chile and China account for a majority of lithium mining. In processing, there is complete dominance across the board by just one country, China. Sixtysix per cent of the processing of critical minerals (also including copper and aluminium) takes place in China. For rare earths, this goes up to more than 90 per cent. China alone can bring the global EV industry to a halt by restricting the supply of rare earths. It is happenine right at this moment.

Neither the US nor India can rely on China. It is time to emulate America's policies and fast track the exploration of critical minerals. India remains under-explored for all minerals. This state of affairs is no longer an option, especially if India is to become a serious player in manufacturing. It is near-impossible to secure mineral supply chains from overseas — even the US is struggling. As a country that is geologically rich, India must explore within.

The author is chief economist, Vedanta Ltd

CRITICAL MINERALS

- Minerals essential for Economic Development & National Security
- Their associated Economic Impact is higher than any other raw material

WHY ARE THESE MINERALS CRITICAL?



11

(b) Energy

Defence

Clean Energy Transition Essential for the World transitioning towards Clean Energy.

Overdependency on other Countries

For Strategic autonomy of a country that is over dependent on others to produce critical minerals.

Supply Risk

Rare availability & growing demand of Minerals

MAJOR INDUSTRIES THAT RELEY ON CRITICAL MINERALS

Aerospace



Transportation



mearcai

Agriculture

- □ The evolution of human civilisation is intrinsically linked to the use of metals.
- □ Around 7,000 years ago, **civilisation made a great leap from the Neolithic Age to the Chalcolithic Age.** Subsequently, it grew more advanced as it moved to the Bronze Age and then the Iron Age.
- □ Coal powered the first industrial revolution of the 19th and early 20th centuries.
- □ Oil and its derivatives fuelled the second industrial revolution (think cars and planes), and global prosperity in the second half of the 20th century.
- □ Now, the long 21st century is going to be the **critical minerals age**.
- □ The reason <u>Donald Trump</u> wants to "annex" Canada and Greenland is to have control over their vast mineral wealth.
- □ The only reason he is remotely interested in **solving the Russia-Ukraine conflict** is the potential for the US to access Ukraine's rich mineral resources.
- □ Minerals have also taken centre-stage in the global trade war.
- □ China is using its **disproportionate control over rare earth materials** to threaten the US and the rest of the world with the debilitating consequences of restricted supply.

□ The only natural resource that figured in the context of international security and strategy was oil. Since then, two things have happened.

First, a growing consciousness about climate change.
 Second, technological advancement towards a fourth industrial revolution.

- □ The technologies that help mitigate climate change by enabling a substitution of fossil fuels like coal and oil are **heavily mineral-intensive**.
- □ An electric vehicle uses six times the minerals a conventional vehicle does, largely because its battery is made of **lithium, cobalt and nickel**.
- □ Renewable energy infrastructure for solar and wind power is also mineral-intensive.
- □ For example, an offshore wind infrastructure project consumes nine times the minerals that a conventional power plant would.
- □ The fourth industrial revolution, which involves AI, robotics and big data, is also **mineral**-**intensive**.
- □ For example, any digital or digital connectivity infrastructure requires copper in large quantities.

□ The biggest risk to the emerging landscape is the **heavy concentration in the supply of critical minerals,** much greater than the concentration in oil.

There are two stages of the value chain that are of concern.

First, the extraction of the metal ore from the surface.
Second, the processing of that ore into usable metal.

□ There is a high degree of concentration in the first. **Cobalt comes almost exclusively from Congo.**

□ **Indonesia dominates the mining of nickel**, almost 50 per cent of the global supply.

□ China alone accounts for two-thirds of global rare earths mining.

□ Australia, Chile and China account for a majority of lithium mining.

□ In processing, there is complete dominance across the board by just one country, **China. Sixty-six per cent** of the processing of critical minerals (also including copper and aluminium) takes place in China.

For rare earths, this goes up to more than 90 per cent. China alone can bring the global EV industry to a halt by restricting the supply of rare earths.

Neither the US nor India can rely on China. It is time to emulate America's policies and fast track the exploration of critical minerals.

Cost of Pulses and Oil Imports

Cost of pulses, oil imports

India's imports of pulses and edible oils have scaled new highs, even as the cultivation of these crops have turned increasingly unremunerative for farmers. Here's what's been happening - and why



RAD GULAB SINGH LODHI has harvested around 90 quintals of summer moong (green gram) from his 16 acres of land in

Nanhegaon village of Madhya Pradesh's Narsinghpur district. But he is worried about the government's apathy in procuring the crop that is fetching

about Rs 6,500 per quintal in the open market, as against its official minimum support price (MSP) of Rs 8,682. And it's not only moong

Lodhi cultivates soyabean during the kharif (monsoon) season, sowing in early-July and harvesting by mid-October, followed by chana (chickpea) and masoor (red lentil) during rabi (winter-spring).

After harvesting mesoor around March 10 and chang about 5-10 days later, he sows summer moong that matures in 60-70 davs

and wheat are. "But I can't grow rice or tic production (Charts loand 1b). wheat, except for self-consumption, here. This black cotton soil is suitable for pulses mt in 2013-14, and 17.2 mt and 16.3 mt in the and oilseeds." Lodhi says.

Lodhi, 65, is a progressive farmer who plants the best recommended varieties of soy- 26.1 mt in 2022-23. abean, moong, musoor, and chang. And yet, sovabean is selling in the state's mondis at Rs due to chang and moong. Scientists bred 4.100–4.200 per guintal – below not only the short-duration varieties (100–120 days) of MSP of Rs 5.328 for the upcoming 2025-26. but even the Rs 4.892 of last year's crop.

Lodhi is stoic about his situation, and is going ahead with planting soyabean. "Wkulp yu hu (what option do I have)?" he says.

Record pulses imports

The woes for the growers of pulses and which was an El Niño-induced drought year. Domestic production fell to 24.2 mt in 2023oilseeds come amid all-time high imports during 2024-25(April-March) 24 and recovered to 25.2 mt in 2024-25 as

Pulses imports touched 7.3 million tonnes per Agriculture Ministry data. (mt), valued at \$5.5 billion, surpassing the previous record of 6.6 mt (\$4.2 billion) for 2016-17

For five years from 2017-18, the imports peaked during the last fiscal.



None of these crops is procured by the of pulses fell to an average of 2.6 mt, worth government at MSP in the same way as rice \$1.7 billion, on the back of improved domesincluded 2.2 mt of yellow/ white peas

chang that required hardly any irrigation, and

moong in kharif and rabi, as well as in the

achieved in nulses was reversed in 2023-24.

However, this relative self-sufficiency

spring and summer

(largely from Canada and Russia), 1.6 mt of India's pulses output, which stood at 19.3 chang(from Australia), 1,2 mt each of arher or pigeon-pea (from Mozambique, Tanzania, drought years of 2014-15 and 2015-16 re-Myanmar, Sudan and Malawi) and mosoor spectively, rose to 27.3 mt in 2021-22 and (from Canada, Australia and United States), and 0.8 mt of urad or black gram (from Much of this increased production was Myanmar and Brazil's

As imports surged, the consumer price index (CPI) inflation in pulses eased to 3.8% year-on-year by December 2024 and further varieties of moong that were amenable to to 2.6%, - 0.4%, - 2.7%, - 5.2%, and - 8.2% in growing in all seasons. Farmers today plant the following five months. The boot is on the other foot now, with

The 7.3 mt of pulses imports in 2024-25

orhor and chong selling at Rs 6,450-6,500 and Rs 5,450-5,500 per quintal respectively in Maharashtra's Latur mondi, below their corresponding MSPs of Rs 7,550 and Rs 5,650.

The story of oils

The story in vegetable oils has been more Falling output and retail inflation in uniform - that of increasing import depulses soaring to double digits by mid-2023 nendence The last 11 years have seen imports more

led to a slashing of duties on imports, which than double from 7.9 mt to 16.4 mt, a trend

that needs to be arrested, if not reversed, In value terms, imports almost trebled from \$7.2 billion in 2013-14 to \$20.8 billion in 2022-23, which was around the time when international prices slovrocketed owing to supply disruptions due to the Russia-Ukraine war. While global prices have come off those peaks, the quantum of imports has continued to rise (Charts 2a and 2b).

The 16.4 mt of imports during 2024-25 mainly comprised 7.9 mt of palm (primarily from Indonesia and Malaysia), 4.8 mt of sovabean (from Argentina and Brazil), and 3.5 mt of sunflower oil (from Russia, Ukraine, and Argentina).

On the other hand, India's production of oil from domestically grown oilseeds and secondary sources such as cottonseed, rice bran and maize is estimated at just about 10 mt, which translates to an import dependence of well over 60%. CPI inflation in vegetable oils, unlike

pulses, has been ruling at double digits since November 2024, with the latest May reading at 17.9%. It explains the government's May 30 decision to cut the basic customs duty on crude palm, soyabean, and sunflower oil from 20% to 10% and the overall import tariff (after adding an agriculture cess and social welfare surcharge) from 275% to 16.5%

The US Department of Agriculture (USDA) expects the lowering of duty to result in a "further increase" in soyabean of imports by India. Although this market is dominated by Argentina, "the reduced tariff can boost the import of US soyabean oil." USDA report dated June 10 has stated.

All this suggests imports will likely hit a new high in the current fiscal, even as the USDA has projected a record-breaking global vegetable oil output of 235 mt for 2025-26, led by palm (80.7 mt) and soy abean (70.8 mt). That may not be good news for farmers like Lodhi.

The Sovahean Processors' Association of India has expressed concern over the 11-percentage-point duty cut, which is expected to "flood the Indian market with cheaner imported oils". That will make oilseed cultivation less attractive to farmers, who may sow less area and switch to more profitable crons in this kharif season, said Davish Jain, chairman of the Indore-based association.

> LONGER VERSION ON indianexpress.com/explained

Pulses and oilseed farmers across India face a persistent crisis due to the **lack of** systematic government procurement at Minimum Support Prices (MSP).

Unlike rice and wheat, which benefit from **robust public procurement,** crops like moong, chana, masoor, and soyabean are often sold in open markets at rates well below their MSPs.

This disparity leaves farmers vulnerable to market fluctuations, forcing them to sell at loss-making prices, despite using highyielding, recommended crop varieties.

All-Time High Imports in 2024-25

□ India imported 7.3 million tonnes (mt) of pulses worth \$5.5 billion in 2024–25, surpassing the previous record of 6.6 mt (\$4.2 billion) in 2016–17.

□ This marks a significant jump from the average 2.6 mt (\$1.7 billion) imported annually between 2017–18 and 2022–23.

Past Gains in Self-Sufficiency Reversed

India had achieved relative self-sufficiency in pulses with output rising to 27.3 mt in 2021–22 and 26.1 mt in 2022–23, thanks to high-yield, short-duration varieties of chana and moong.

□ These gains were undone by an El Niño-induced drought in 2023–24, which reduced production to 24.2 mt, recovering only slightly to 25.2 mt in 2024–25.

Duty Cuts Trigger Import Surge

□ With retail inflation in pulses hitting double digits by mid-2023, the government slashed import duties, prompting a surge in imports.

India's Vegetable Oil Crisis: Rising Imports and Farmer Distress

Soaring Import Dependence

- Over the past 11 years, India's vegetable oil imports have doubled—from 7.9 million tonnes (mt) in 2013–14 to 16.4 mt in 2024–25.
- □ In value terms, imports rose from \$7.2 billion to \$20.8 billion, driven partly by the Russia-Ukraine war's supply disruptions.

Heavy Reliance on Imported Oils In 2024–25,

India imported: 7.9 mt of palm oil (Indonesia, Malaysia) 4.8 mt of soyabean oil (Argentina, Brazil) 3.5 mt of sunflower oil (Russia, Ukraine, Argentina) resulting in an import dependency of over 60%.

Impact on Indian Farmers

- The Soyabean Processors Association of India has warned that the duty cut will flood Indian markets with cheaper oils, hurting local prices.
- This may discourage farmers from sowing oilseeds, especially soyabean, in the upcoming kharif season, affecting domestic production further.

New Green India Mission

New Green India Mission roadmap in climate change battle

NIKHIL GHANEKAR

NEW DELHL JUNE 19

THE CENTRE on Tuesday released a revised roadmap for the National Mission for Green India, also known as the Green India Mission (GM). The GIM is a key component of India's national effort to combat the effects of climate change

In addition to the core objectives of inest cover on another 5 million hectares. creasing and restoring forest and green cover, Between 2015-16 and 2020-21. CIM facilithe mission will address the issues of land tated tree plantation and afforestation activdegradation and desertification. The revised ities across 11.22 million hectares (mha) of roadmap will also focus on restoration of the land through central and state schemes. Aravalli range, Western Ghats, the Himalayas and mangroves.

The mission so far

GIM was rolled out in 2014 as one of the an Environment Ministry response tabled in ight missions under India's National Action Lok Sabha this February. Plan on Climate Change (NAPCC), to be im-Activities under GIM are concentrated in lemented over 10 years. The revised

roadman is for the neriod unto 2030. nerability, potential for sequestration (the estation and degradation, leading to a total The GIM's core aim is to combat the efprocess by which plants and trees store carfects of climate change by increasing forest bon using photosynthesis), forest and land and tree cover, and the ecological restoration degradation, and restoration potential. of degraded ecosystems and forests. It also

Ministry officials told The Indian

Express. A central focus of the

stitutions.

Environment

aims to improve the livelihoods of commu-

nities that are dependent on forest produce.

crease in forest and tree cover on 5 million

hectares, and on improving the quality of for-

Between 2019-20 and 2023-24, the

Centre released Rs 624.71 crore to 18 states

for interventions under GIM, of which Rs

575.55 crore has been utilised, according to

The mission specifically targeted an in-

Revised roadmap in Delhi, the National Capital Region and The revised GIM roadmap accounts for Punjab. GIM interventions in the Aravallis on-ground climate impacts and feedbackre- will work in sync with the Aravalli Green ceived from implementing Wall project, recently launched partner states and scientific in-

by the Centre to combat degra-EXPLAINED dation and desertification in CLIMATE one of the world's oldest mountain ranges.

revised mission plan will be the restoration Under the Green Wall project, restoration and saturation of vulnerable landscapes works have been planned initially across 8 through regionally conducive best practices. lakh hectares spanning 29 districts and four This includes area and landscape-specific states. This would be done in forest areas. restoration activities in three important grasslands, water systems and their catchmountain ranges - the Aravallis, the Western ment areas, and through the plantation of na-Ghats, and the Indian Himalayas, along with tive, locally conducive species. The project is estimated to cost Rs 16,053 crore, and aims to mangrove ecosystems

The Aravallis, a natural barrier against the create a buffer zone of 5 km around the mounstates based on mapping of ecological vul- Thar desert, have witnessed extensive defortain range, covering 6.45 million hectares.

loss of forest cover in at least 12 places, acdegradation, deforestation, and illegal mining, the revised roadmap will focus on afcording to past studies by the Wildlife Institute of India. These gaps have resulted forestation, groundwater recharging, and the eco-restoration of abandoned mining areas. in frequent sandstorms and dust pollution

> Combating desertification Around a third of India's geographical

area - 97.85 million hectares - underwent land degradation during 2018-19, according to the Indian Space Research Organisation's Desertification and Land Degradation Atlas. India has committed to creating an additional carbon sink of 2.5 to 3 billion tonnes of

carbon dioxide through additional forest and tree cover by 2030 under the United Nations Framework Convention on Climate Change. The natural carbon sinks of forests, restored grasslands, wetlands, and mountain ecology will help offset greenhouse gas emissions and act as natural sponges and barriers in absorbing climate change impacts.

In the Western Chats, which have seen tonnes of CO2 equivalent was created by Lok Sabha earlier this year.

> graded land by 2030. To restore large swatthes of forests and degraded lands, the restoration of impaired open forests is key - cost-ef fective and high-impact for CO2 sequestration, the revised GIM roadman says, based on Forest Survey of India (FSI) estimates According to the FSI, this approach alone

An additional carbon sink of 2.29 billion projections

tween 2005 and 2021, as per the Environment Ministry statement made in India has also made an ambitious com mitment to restore 26 million hectares of de-

has the potential to sequester 1.89 billion tonnes of CO2 over approximately 15 mil lion hectares. It also estimates that by align ing ongoing schemes and intensifying al forestation efforts. GIM can help India expand its forest and tree over up to 24.1 million hectares. This would be enough to achieve a carbon sink of 3.39 billion tonnes of CO2 equivalent by 2030, as per the FSFs

The Centre released a revised roadmap for the National Mission for Green India (**GIM**).

The updated plan emphasizes not just increasing and restoring forest and green cover, but also focuses on ecological restoration in critical regions such as the Aravalli ranges, Western Ghats, Himalayas, and mangroves.

As a key part of **India's climate action** strategy, the revised GIM will also address land degradation and desertification, expanding its role in building environmental resilience.

Achievements of the Green India Mission (GIM)

- Launched in 2014 under the National Action Plan on Climate Change (NAPCC), the Green India Mission aims to:
- Increase forest and tree cover on 5 million hectares Improve the quality of forest cover on another 5 million hectares
- Restore degraded ecosystems and enhance livelihoods of forest-dependent communities
- From 2015-16 to 2020-21, the mission supported tree plantation and afforestation across 11.22 million hectares through various central and state schemes.

GREEN INDIA MISSION (GIM

One of the eight missions under India's National Action Plan on Climate Change (NAP<u>CC)</u>

I TARGET AREAS

- Increase forest/tree cover
- Improve ecosystem
 services
- Enhance forest-based livelihoods
- Adapt ecosystems to climate change

🕂 CHALLENGES

- Fund delays
- Capacity constraints
- Poor community
 participation
- Bureaucratic delays

Afforestation of degraded forest land: 1.5 m ha Afforestation of non-forest land 1.8 m ha Agroforestry and social forestry 0.9 m ha

Forest improvement: 1.8 m ha Urban and peri-urban greening 0,2 m ha

- Helps meet Paris Agreement targets (NDCs)
- Contributes to ecological sustainability
- Supports rural employment

Revised Green India Mission

- Strategy to **Combat Land Degradation and Desertification** Scale of the Challenge
- According to ISRO's Desertification and Land Degradation Atlas, about 97.85 million hectares (one-third of India's land) faced degradation in 2018–19.
- □ India has pledged to Create an additional carbon sink of 2.5–3 billion tonnes of CO₂ by 2030 through increased forest and tree cover.
- Restore 26 million hectares of degraded land by 2030 under its international climate commitments (UNFCCC)
- Natural carbon sinks—forests, wetlands, grasslands, and mountain ecologies—will help: Absorb greenhouse gas emissions
- □ Act as natural buffers against the impacts of climate change Contributions .
- □ So Far Between 2005 and 2021, India created an additional carbon sink of 2.29 billion tonnes of CO₂ equivalent, as per a statement in the Lok Sabha.

Nuclear Non Proliferation Treaty



What it is?

- NPT is a global treaty that aims to prevent the spread of <u>nuclear weapons</u> and technology, while promoting peaceful uses of nuclear energy and global nuclear disarmament.
- Established in: Signed in 1968, entered into force in 1970.
- **191 countries** are parties to the treaty.
- Notable non-signatories: India, Pakistan, Israel (North Korea withdrew in 2003).

Key Features

- Nuclear States Defined: Recognises only five states (USA, UK, Russia, France, China) that tested nuclear weapons before 1967 as nuclear-weapon states.
- Safeguards System: IAEA monitors civilian nuclear programs to ensure nuclear materials are not diverted to weapons use.
- Withdrawal Clause: Article 10 allows any state to exit the treaty with 3 months' notice if national security interests are at risk.
- Global Coverage: With 191 member countries, NPT is one of the world's most universal treaties despite criticism over the P5 monopoly.
- Verification Mechanism: IAEA inspectors conduct regular site visits to verify compliance and uphold the integrity of non-proliferation norms



Thank you

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