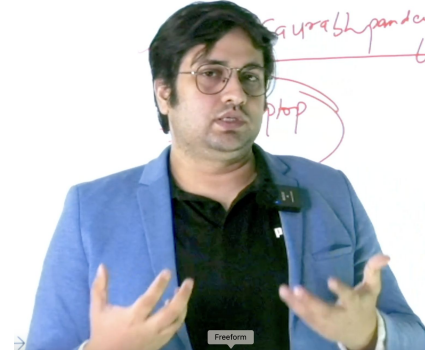


Topics

- Agarwood
- Dark oxygen
- Deep sea mining
- The Clarion-Clipperton Zone (CCZ)
- Uranus's moon Ariel
- Park fire
- Climate change Bill in south Africa
- The Sortino Ratio
- Natural farming
- Butterflies attract pollen
- Mains



By saurabh Pandey



THE HINDU

Target Mains -2024/25 -

Q ‘‘Natural farming has environment benefits but not without challenges’’ Discuss

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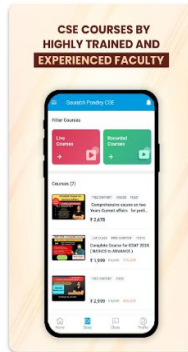
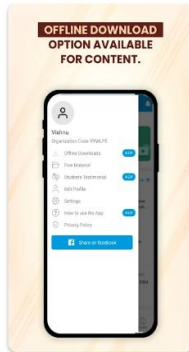
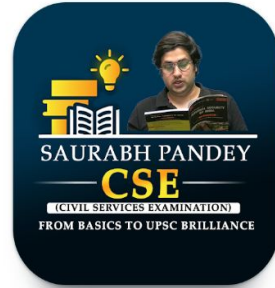
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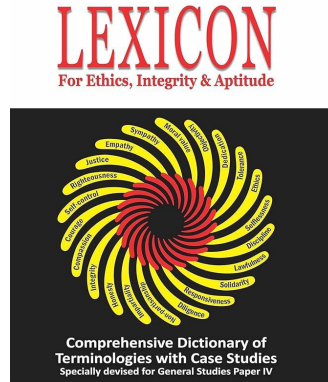
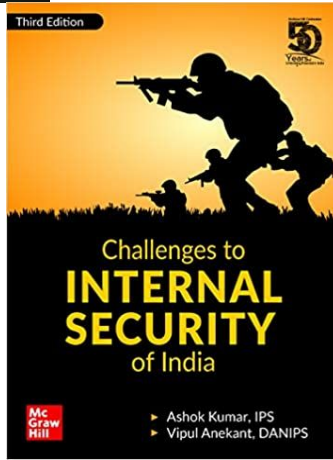
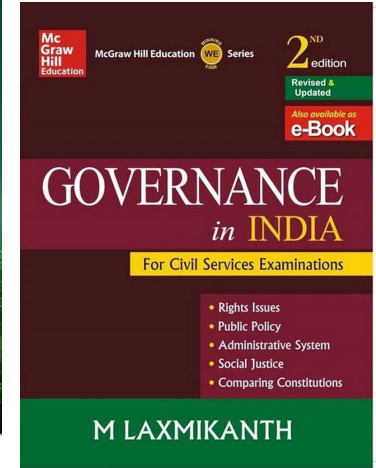
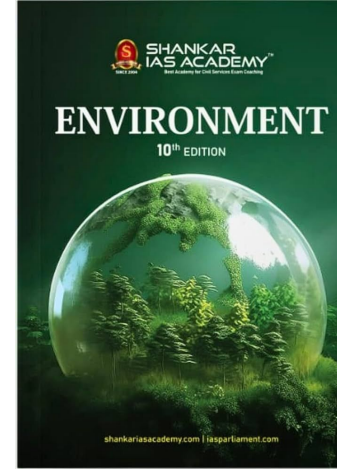
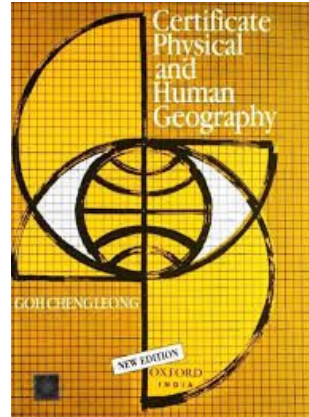
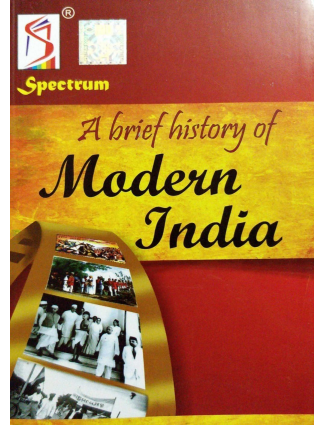
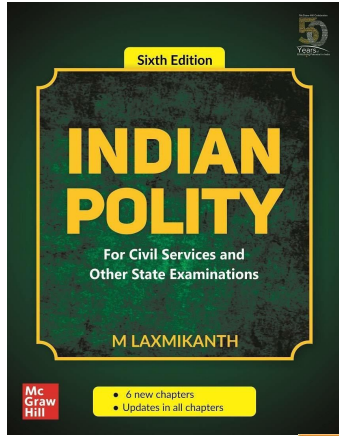
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CITES eases norms for agarwood export; move to benefit lakhs of farmers from the Northeast



Shiv Sahay Singh
KOLKATA

India has successfully prevented the inclusion of agarwood (*Aquilaria malaccensis*) in the Review of Significant Trade (RST) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The CITES also notified a new export quota of the highly valuable and aromatic resinous wood and oil of the tree from India from April 2024.

Since agarwood is cultivated in different parts of India, especially in the northeastern States, this development is going to benefit lakhs of farmers in certain districts of Assam, Manipur, Nagaland, and Tripura.



Agarwood extract is used in the preparation of incense, air fresheners, purifiers as well as medicines. SPECIAL ARRANGEMENT

Aquilaria malaccensis was listed in Appendix II of the CITES (a category of species that are not necessarily threatened but whose trade must be controlled) for the first time in 1995 based on India's proposal at CoP9 in 1994.

The removal of India

from the RST for *Aquilaria malaccensis* was achieved based on a non-detriment findings (NDFs) study of the plant species by the Botanical Survey of India (BSI) and the Ministry of Environment Forest and Climate Change (MoEFCC).

The NDF prepared by

the BSI suggested that the harvest of plants should be allowed from home, community gardens, plantations on leased/patta lands, private or community plantations, or any other types of small-scale or large-scale plantations.

However, the NDF added that "harvesting of plants or collection of seeds/seedlings/saplings and other propagules should not be allowed from the existing wild populations or plants in the protected areas and reserve forests".

The export quota recommended by the NDF for 2024-2027 for agarwood chips and powder/sawdust is 1,51,080 kg a year and agarwood oil is 7,050 kg a year.

"The absence of an ex-

port quota for a long period and other trade-related restrictions in India caused an increase in informal trade/export of agar chips, oil, powder etc. to the Middle East and other foreign countries. It also caused an increase in costs of agarwood chips and oil in the global market as India is a major agarwood trading nation with which most importing countries have long trade records," the NDF report said.

Despite the export ban, the illegal trade of agarwood and its derivatives has continued in India, with more than 1.25 tonne of chips and six litres of oil/derivatives reportedly seized in six States between 2017 and 2021, a report by TRAFFIC, an NGO, said.

Agarwood



- **Agarwood, also known as oud, aloeswood, eaglewood, or gaharu, is a fragrant dark resinous wood used in incense, perfume, and small carvings.**
- **It is formed in the heartwood of aquilaria trees when they become infected with a type of mold, which in response produces a highly aromatic resin.**
- **This process can take several years, and only a small percentage of infected trees produce the high-quality resin sought after by collectors and the fragrance industry**
- **The aquilaria trees are native to Southeast Asia, the Indian subcontinent, and East Asia.**



- **The demand for agarwood has historically been high due to its use in religious ceremonies, traditional medicine, and luxury goods.**
- **It is considered one of the most expensive raw materials in the world on a weight-for-weight basis, with prices varying widely depending on the quality and source**



- **The most prized agarwood comes from trees infected with the mold in their natural habitat, as the infection process is unpredictable and the resulting resin varies greatly.**
- **Artificial cultivation and infection of trees are practiced in some areas, but the quality of the resulting agarwood may not match that of naturally infected wood**
- **Agarwood has a complex and rich fragrance profile, with notes that can range from sweet and floral to earthy and woody, depending on the source and the level of resin content. In perfumery, agarwood oil is highly valued for its ability to fix other fragrances and for its unique scent.**





- .
- **The trade in agarwood has historically been a significant driver of its depletion in the wild, leading to the classification of many aquilaria species as endangered.**
- **Conservation efforts and sustainable harvesting practices are crucial to preserving these trees and the traditional uses of agarwood.**



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- **The CITES also notified a new export quota of the highly valuable and aromatic resinous wood and oil of the tree from India from April 2024.**
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Surprising 'dark oxygen' discovery could ensnarl deep-sea mining

Deep-sea mining is expected to be a major marine resource extraction activity in the coming decades. The International Seabed Authority has established at least two 15-year contracts with the Government of India to look for polymetallic nodules and polymetallic sulphides in the deep seabed

The Hindu Bureau

An unknown process is producing oxygen deep in the world's oceans, where it is too dark for photosynthesis, scientists reported on July 22 in the journal *Nature Geoscience*. The finding has important implications because oxygen helps support life and the discovery implies the existence of previously unknown ecosystems.

Many governments are also bound to take notice since one explanation for the oxygen is that polymetallic nodules are transporting electric charges that split water molecules around them, releasing oxygen. Polymetallic nodules are lumps of iron, manganese hydroxides, and rock partially submerged in many parts of the ocean floor. If their concentration exceeds 10 kg per square metre, mining them is considered to be economically feasible – and many countries are planning to do so as a new resource.

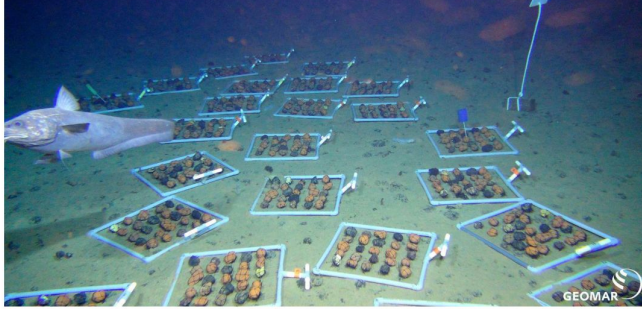
On July 22, *Reuters* reported an unnamed "top government scientist" saying India is planning to "apply for licences to explore for deep-sea minerals in the Pacific Ocean". India's Ministry of Earth Sciences is also currently building a submersible vehicle that will look for and mine similar resources in the Indian Ocean as part of its 'Deep Ocean Mission'.

Where was the study conducted?
The oxygen discovery raises questions about how deep-sea mining to extract polymetallic nodules will affect marine ecosystems.

The scientists behind the study, from Germany, the U.K., and the U.S., were studying the Clarion-Clipperton Zone, a part of the ocean floor off Mexico's west coast. Covering an area larger than India, the Zone is considered to have the world's highest concentration of polymetallic nodules, including 6 billion tonnes of manganese and more than 200 million tonnes each of copper and nickel.

When the scientists were conducting experiments at a depth of 4 km, they noticed the oxygen concentration in some places rapidly increased instead of decreasing. They conducted follow-up studies in 2020 and 2021. In each case, they released a device from the surface that would land on the ocean floor, where it would isolate a small volume of the floor along with some sea water and measure the oxygen levels.

This underwater region is called the abyssal zone. It receives too little sunlight for photosynthesis to be feasible. Instead, life-forms here get oxygen from water carried in by a global circulation called



A study under way on the seafloor of the Clarion-Clipperton Zone to investigate the impact that potential manganese nodule mining in the deep sea would have on ecosystems there. ROV-TEAM/GEOMAR

the 'Great Conveyor Belt'. Still, the amount of oxygen is low and without any local production, the device should have measured the oxygen levels dropping as small animals consumed it. But the scientists found the opposite: it increased, sometimes tripling in just two days.

They double-checked the finding by recreating the conditions on the ocean floor in their lab, and found the oxygen levels to increase up to a point before dropping.

What is the source?

When they measured the physical characteristics of the nodules, they found their surfaces to have a voltage of up to 0.95 V. Splitting one water molecule requires 1.5 V, but the researchers have suspected the voltage could build up if many nodules are close together, like the cells of a battery.

Andrew Sweetman, an ecologist with the Scottish Association for Marine Science in the U.K. and a coauthor of the study, told *Nature*, "We have another source of oxygen on the planet, other than photosynthesis." His team is calling it 'dark oxygen'.

Oxygen sources are valuable because they allow life to survive. But as the lab experiment indicated, the nodules could only produce oxygen as long as they could muster a sufficient voltage. The nodules' own energy source is also not clear.

What is deep-sea mining?

Given the quantity of polymetallic nodules on the ocean floor, deep-sea



The finding has important implications because oxygen helps support life and the discovery implies the existence of previously unknown ecosystems

mining is expected to be a major marine resource extraction activity in the coming decades. The International Seabed Authority has established 15-year contracts with at least 22 contractors – including the Government of India – to look for polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts in the deep seabed. China alone is expected to mine 17% of the Clarion-Clipperton Zone.

The new finding raises the possibility of such mining damaging ecosystems that require 'dark oxygen' to survive. Experts have found deep-sea mining itself could be harmful to the marine environment, 'dark oxygen' or not.

In 1989-1996, scientists from Germany conducted the Disturbance and Recolonisation (DISCOL) Experiment in the Peru Basin as the world's "first large-scale impact assessment" to assess the "environmental impacts originating from the mining of polymetallic nodules". They built a device that disturbed the sea floor like a deep-sea mining exercise might have and collected data about how the disturbances changed local oceanographic and sedimentological

THE GIST

Polymetallic nodules are lumps of iron, manganese hydroxides, and rock partially submerged in many parts of the ocean floor. If their concentration exceeds 10 kg per sq.m, mining them is considered feasible. Many countries plan to do so

When many nodules are close together they could generate enough voltage to split one water molecule. According to one researcher, "We have another source of oxygen on the planet". His team is calling it 'dark oxygen'.

The finding raises the possibility of mining damaging ecosystems that require 'dark oxygen' to survive. Experts have found deep-sea mining itself could be harmful to the ocean, 'dark oxygen' or not

profiles, among other things.

A 2019 study in the journal *Scientific Reports* reported that "the effects of simulated mining impacts induced during the DISCOL [Experiment] were still evident in the megabenthos of the Peru Basin after 26 years."

The affect on deep-sea mining

The same study also reported "significantly lower heterogeneity diversity in disturbed areas" and added that "if the results of this experiment ... can be extrapolated to the Clarion-Clipperton Zone, the impacts of polymetallic nodule mining there may be greater than expected, and could potentially lead to an irreversible loss of some ecosystem functions".

In November 2023, *Nature* reported based on a paper published then that deep-sea mining "for minerals could harm deep-sea jellyfish, according to the first study of mining impacts on animals living in the water column."

Scientists also know less about ecosystems in the abyssal zone than they do about many of those aboveground, which means the models scientists use to predict their fate and their role in global climate processes could be unreliable. With these and other issues in mind, on July 20, three major European insurance companies said they would exclude deep-sea mining from their underwriting portfolios.

'Dark oxygen' adds to these challenges. If deep-sea mining doesn't find sustainable ways to respond to them, it may be rendered altogether infeasible.



Dark oxygen



- **An unknown process is producing oxygen deep in the world's oceans, where it is too dark for photosynthesis.**
- **Many governments are also bound to take notice since one explanation for the oxygen is that polymetallic nodules are transporting electric charges that split water molecules around them, releasing oxygen.**
- **Polymetallic nodules are lumps of iron, manganese hydroxides, and rock partially submerged in many parts of the ocean floor.**
- **If their concentration exceeds 10 kg per square metre, mining them is considered to be economically feasible — and many countries are planning to do so as a new resource**

Deep sea Mining

- **Deep sea mining refers to the process of retrieving mineral deposits from the deep seabed, typically found at depths of 200 meters (656 feet) or more below sea level.**
- **The seabed contains vast quantities of minerals and metals such as copper, zinc, silver, gold, and rare earth elements, as well as non-metallic minerals like phosphates, sulfur, and sand.**



There are several types of deep sea mineral deposits that are of interest for mining:

Polymetallic Nodules: These are potato-sized lumps found on the deep ocean floor, particularly in the abyssal plains. They contain a mix of metals including manganese, nickel, copper, and cobalt.

Polymetallic Sulfides: These are mineral deposits formed from hydrothermal vents, which are commonly found near mid-ocean ridges. They contain a variety of metals such as copper, zinc, lead, and gold.

Cobalt-Rich Ferromanganese Crusts: These are found on seamounts (underwater mountains) and plateaus and are rich in cobalt, as well as other metals like nickel and platinum.

The Clarion-Clipperton Zone (CCZ)



- **The Clarion-Clipperton Zone (CCZ) is a large area in the northeastern equatorial Pacific Ocean, approximately 5 million square kilometers in size, located roughly between Hawaii and Mexico.**
- **It is named after two seamounts, Clarion and Clipperton, that are found within this region. The CCZ is particularly notable for its mineral resources, especially the polymetallic nodules found on its seafloor.**
- **Polymetallic nodules, also known as manganese nodules, are potato-sized lumps that contain a variety of metals such as manganese, nickel, copper, and cobalt.**
- **These nodules are of significant interest for deep-sea mining because they are rich in elements that are crucial for modern technologies, including batteries and electronics.**

- **The CCZ is under the jurisdiction of the International Seabed Authority (ISA), an autonomous international organization established under the United Nations Convention on the Law of the Sea (UNCLOS) to regulate the exploration and exploitation of mineral resources in the international seabed areas beyond the limits of national jurisdiction (the Area).**
- **Several countries and private companies have expressed interest in exploring the CCZ for its mineral resources.**

WHAT IS IT?

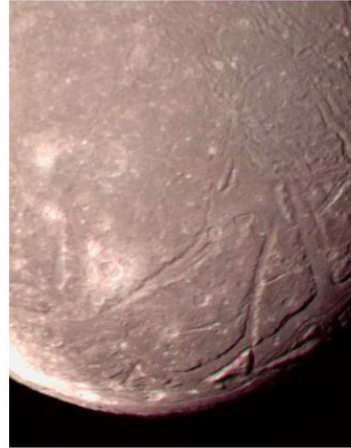
Ariel: another watery moon?

Vasudevan Mukunth

The Solar System has many mysteries. We don't know why the Sun's corona is so hot. We don't know why Saturn's moon, Titan, has such a significant atmosphere. We don't know why Triton rotates in the direction opposite to its host planet, Neptune, although a recent study found an answer: Triton and Pluto had a common origin before Neptune pulled Triton to itself.

Another mystery in the Solar System may be coming to a similar close. Astronomers have been curious why the surface of Uranus's moon Ariel has frozen carbon dioxide (CO₂). At that distance from the Sun, the CO₂ should have already vaporised into space — yet the ice covers the moon's surface. On July 24, NASA's James Webb Space Telescope (JWST) reported evidence of a liquid ocean buried under Ariel's surface, supplying CO₂ to the world above.

The people behind the finding came to this conclusion when they found carbon monoxide. If Ariel has to have this compound, it has to have a surface temperature around 18 degrees C less than what it is, or it could have a subsurface ocean producing carbon oxides. One side of Ariel has cracks and grooves through which icy slop and these compounds could be gushing out to



This image of the complex terrain of Ariel was taken by Voyager 2 in 1986. NASA

the surface. JWST also found signs of carbonite minerals, which could be formed when water interacts with rocks.

More studies and space missions will be needed to confirm these details. If there are, we'll have yet another water-bearing moon out there.

For feedback and suggestions

for 'Science', please write to science@thehindu.co.in with the subject 'Daily page'



Uranus's moon Ariel

- **Astronomers have been curious why the surface of Uranus's moon Ariel has frozen carbon dioxide (CO₂).**
- **At that distance from the Sun, the CO₂ should have already vaporised into space**

BIG SHOT



Embers blowing away from a burning tree near Payne Creek, California, as the Park Fire, which has grown to 1.4 lakh ha, continued to spread on Saturday. Strong winds and dried vegetation fueled the fire that destroyed 28,000 ha in the first 24 hours after a man allegedly pushed a burning car into a ravine. In 2018, more than 18,000 structures were destroyed and 85 people were killed in nearby Paradise when a camp fire entrapped thousands of people and became the most destructive in California history. AFP

Park fire



- A "park fire" typically refers to a wildfire that occurs within a park, usually a national park, state park, or a similar protected area.
- These fires can be naturally occurring, often started by lightning strikes, or they can be human-caused, such as from campfires, fireworks, or arson.
- Wildfires in parks can have both beneficial and detrimental effects.
- In some ecosystems, fire is a natural and necessary part of the ecological cycle, helping to clear dead vegetation, promoting the growth of new plants, and providing habitat for certain species.
- However, if a park fire gets out of control, it can pose significant threats to human life, infrastructure, and natural resources.
-



- **Managing park fires involves a complex set of strategies, including controlled burns, firebreaks, and the use of firefighting crews and equipment.**
- **The goal is to minimize the damage caused by fires while also allowing for the natural role of fire in the ecosystem.**

Mapping - Payne Creek, California

What is South Africa's new law on climate change?

What are the features of the law? Does India have an omnibus legislation on climate change?

Jacob Koshy

The story so far:

South Africa's President, Cyril Ramaphosa, signed into law a piece of legislation that will impose mandatory curbs on the emissions from large, fossil-fuel heavy industries and, require climate-adaptation plans from towns and villages. The President said this would enable South Africa to meet its emissions reduction commitments under the Paris agreement.

What is the significance of this law?

The Climate Change Bill was approved by South Africa's National Assembly last November. South Africa relies on coal as its primary fuel source for electricity generation and is one of the world's top 15 greenhouse gas (GHG) emitters. According to an official estimate, net emissions in 2017 were estimated at 512 million tonnes of carbon dioxide equivalent (Mt CO₂e), an increase of 14% from 2000. In 2022, this fell to 405 Mt

CO₂e, a 3% fall from 2021, according to Statista. It is unclear if these numbers are strictly comparable and if the fall was linked to the worldwide, temporary dip in emissions following COVID-19. The energy sector represents roughly 80% of gross emissions, with energy industries (-60%) and transport (-12%). Being an economy which is dependent on agriculture and tourism, South Africa has faced increasing Western pressure to accelerate its transition away from fossil fuel.

What steps has South Africa taken?

Every country submits Nationally Determined Contributions (NDC), which are time-bound commitments to lower emissions. South Africa submitted its first NDC in 2016 and its updated NDC in 2021. The updated NDC commits to 31% reduction and a fixed target for GHG emissions levels of 398-510 MtCO₂e by 2025, and 350-420 MtCO₂e by 2030.

The NDC outlines an approach for a 'just transition,' – or the sustainable movement to jobs away from fossil-fuel

dependent industries – to achieve targets, focusing on agriculture, forestry and other land use, energy, industrial processes and product use, and waste sectors. South Africa has estimated that it requires \$8 billion per year by 2030. It has set an internal goal of reaching 'net zero emissions' by 2050 in its Low-Emission Development Strategy submitted in 2020. In addition, the Presidential Climate Commission released its Just Transition Framework in 2022, which aims to inform policy making at the nexus of climate and development to enable deep, just transformational shifts. These were the actions that preceded the signing of the Climate Change Bill.

What about India?

India does not have a comprehensive legislation on climate change. Priyanka Chaturvedi, the Rajya Sabha parliamentarian, had moved a Private Member's Bill, called the Council on Climate Change Bill, most recently in 2022. This proposed setting up a Council,

chaired by the Prime Minister, for advising the Union government on all matters related to climate change but there has been no significant movement on this so far. However, climate change features in multiple Acts and subordinate legislation. These include the Environmental Protection Act, Forest Conservation Act, Energy Conservation Act, Water (Prevention and Control of Pollution) Act among others.

Are these enough?

In April this year, the Supreme Court ruled that citizens have a "right against the adverse effects of climate change," and referred to the fact that India did not have an omnibus legislation on climate change. "Despite Constitutional guarantees that give the citizens equality before the law and right to life and personal liberty, it was now necessary, in the Court's view, to explicitly link the impact of climate change as something which impedes these rights of liberty, life and equality." Prior to the UN Conference of Parties in Dubai last year, India communicated that the intensity of its energy emissions had reduced by 33% from 2005-2019, 11 years ahead of target. It also committed to revising its emissions intensity to 45% by 2030 in the updated set of NDC. Emission intensity refers to the total amount of GHG emitted for every unit increase of GDP. It is different from absolute emissions. India has also committed to source 50% of its electricity in 2030 from non-fossil fuel resources.

THE GIST

▼ South Africa's President, Cyril Ramaphosa, signed into law a piece of legislation that will impose mandatory curbs on the emissions from large, fossil-fuel heavy industries.

▼ South Africa relies on coal as its primary fuel source for electricity generation and is one of the world's top 15 greenhouse gas (GHG) emitters.

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Climate change Bill in south Africa

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Use Sortino Ratio for goal-based investment

THINKINVESTOR

Sortino Ratio (SR) is more appropriate for goal-based investments in mutual funds; It would be useful if Asset Management Companies (AMCs) also disclose this metric alongside IR

Venkatesh Bangaruswamy

Previously, in this column, we discussed SEBI's proposal for asset management companies (AMCs) to disclose Information Ratio (IR) for each of their funds. IR is appropriate for investing surplus cash as such investments do not have a time horizon nor the need to earn a required return to achieve a life goal. Sortino Ratio (SR) is more appropriate for goal-based investments in mutual funds. Here, we discuss why SR is a better measure and why it would be useful if AMCs also disclose this metric alongside IR.

Downside risk

For goal-based investments, you must define risk and required return. The required return is the minimum return your investment must earn over a given time frame to accumulate the money needed to achieve desired goal. Call this Minimum Acceptable Return or MAR. This is the expected post-tax compounded annual return.

The risk in goal-based investments can earn lower than MAR in any year during the time horizon for a goal. So, downside deviation is a better measure of risk than standard deviation, for the latter measures both the upside and downside deviation. To determine MAR, you must define the time horizon, the amount needed to achieve the goal and the amount you can save. If MAR is 8.5%, it means your combined investments in equity and bonds will need to earn 8.5% annually to achieve the goal.

Suppose the pre-tax expected return on equity is 12% and post-tax return is 10.5%. The SR is calculated as the excess return of the fund over the pre-tax equity MAR divided by downside deviation of returns below the equity MAR. This tells you about the risk of investing in the fund to achieve a goal as SR is related to MAR.

Conclusion

The MAR to determine SR is the expected pre-tax annual return on equity and is independent of the goal you pursue. Hence, AMC's can report SR for each fund alongside the IR. Importantly, AMC's must use uniform equity MAR for determining SR. Otherwise, comparing SR among peer funds may not be meaningful. It would be useful if AMC's disclose SR over one-, three-, five- and 10-year periods and since inception. The time horizon is very specific to each goal. So, you must determine the

The Sortino Ratio

- The Sortino Ratio is a financial metric used to evaluate the performance of an investment or a portfolio by comparing its return to its downside risk.
- It is similar to the Sharpe Ratio, but instead of considering the total risk (both upside and downside volatility), the Sortino Ratio focuses only on the downside risk.
- The formula for the Sortino Ratio is:
- $\text{Sortino Ratio} = (\text{Average Return} - \text{Required Return}) / \text{Downside Deviation}$

Should India focus on natural farming?



What are the concerns on yields? What have been the findings on the ground? How did two studies on the yield potential of natural farming differ? What happened when Sri Lanka decided to ban chemical fertilizers, substituting it with natural ones?

Vikas Vasudeva

The story so far:

In her Budget proposals for 2024-25, Union Finance Minister Nirmala Sitharaman announced that in the next two years, one crore farmers across the country will be initiated into natural farming supported by certification and branding. Implementation will be through scientific institutions and gram panchayats, adding that 10,000 need-based bio-input resource centres will be established.

What is the mission?

As part of the National Mission on Natural Farming (NMNF), the government intends to motivate farmers to adopt chemical-free farming and draw them towards adopting natural farming willingly on the system's merit. The government believes that the success of the NMNF will require a behavioural change in farmers to shift from chemical-based inputs to cow-based, locally-produced inputs. The natural farming scheme under the 'Bharatiya Prakritik Krishi Paddhati' has a total outlay of ₹4,645.69 crore for six years (2019-20 to 2024-25).

What is natural farming?

In natural farming, no chemical fertilizers and

'If we adopt natural farming for wheat and rice, which are India's staples, we shall be able to feed only around one-third of our population'

pesticides are used. It promotes traditional indigenous practices which are largely based on on-farm biomass recycling with a stress on biomass mulching, use of on-farm cow dung-urine formulation; managing pests through diversity, on-farm botanical concoctions and exclusion of all synthetic chemical inputs directly or indirectly. The emphasis is on improving natural nutrient cycling and increasing organic matter in the soil. Grounded in agro-ecology, it is a diversified farming system that integrates crops, trees and livestock, allowing the optimum use of functional biodiversity. Those advocating natural farming believe that it holds the potential to enhance farmers' income while delivering many other benefits, such as restoration of soil fertility and environmental health, and mitigating and/or reducing greenhouse gas emissions.

What are the challenges and concerns?

Agriculture and food experts have their reservations surrounding a large-scale transition from chemical farming to natural farming in a country like India, which has a huge population. Catering to its food-growing needs isn't an easy task, they point out. Recently, an academic paper titled, 'Zero Budget Natural Farming (ZBNF): Implications for Sustainability, Profitability, and Food Security', published by the National Bank for Agriculture and Rural Development and the Indian Council for Research on International Economic Relations, pointed out the "sheer disparity" in the outcomes of the two different experiments surrounding ZBNF (now renamed as Bhartiya Prakritik Krishi Paddhati), one conducted by the Centre for Economic and Social Studies (CESS) and Institute for Development Studies Andhra Pradesh, and the other by the Indian Council of Agricultural Research (ICAR) and the Indian Institute of Farming Systems Research (IIFSR).

Sandip Das, Mahima Khurana and Ashok Gulati write in the paper the importance of long-term experimentation before declaring natural farming as a nationwide agriculture practice. The paper, which delves into the promising yet contentious realm of natural farming, navigates through contrasting findings

from the two studies, revealing divergent perspectives on ZBNF. While Andhra Pradesh emerges as a forerunner in adopting ZBNF with encouraging results, the IIFSR study raises concerns about the sustainability and yield (productivity) potential of this farming method.

For instance, the paper notes the CESS study has found that in the case of a variety of crops, lower cost of biological inputs suggested under ZBNF has led to improved yields of crops and farmers' incomes, thus increasing the food and nutritional security of farmers practising ZBNF. However, findings of agro-scientists of the ICAR-IIFSR, a government institute, show a 59% decline in wheat yields and a 32% decline in basmati rice yield compared to integrated crop management, adversely impacting food supply.

What are the lessons from Sri Lanka?

It's vital that before launching a large-scale transition from chemical to natural cultivation, extensive studies and assessments are conducted. A couple of years ago, neighbouring Sri Lanka went through economic and political turmoil after it decided to turn completely organic, and banned the import of chemical fertilizers. The government's policy shift had severe consequences with farmers struggling to get natural fertilizers; they faced a reduction in yields of key crops including rice, the staple, putting the country's food security at risk. A sharp price escalation was witnessed in the country, resulting in huge protests and unrest.

What is the way forward?

Noted economist and former professor at the Ludhiana-based Punjab Agricultural University, M.S. Sidhu, asserts that natural farming could be beneficial at a localised level, but in a populous country like India, adopting natural farming at a large scale may not be a successful model. "Food security is a major concern. If we adopt natural farming for cereals, which are mostly staples, we shall be able to feed only around one-third of our population. Wheat and rice are our staple foods, growing these crops through natural farming could result in lower yields, and hence it's not advisable unless scientific studies are conducted on yields". Supplementary foodstuffs may be grown through natural farming, he points out. "Rigorous scientific tests of natural farming, especially surrounding the crop yields should be held before its nationwide implementation to fend off the fear of potential risk to national food security," says Prof. Sidhu.



Hard at work: Workers transplanting paddy seedlings at a field in Palakkad, Kerala on July 13. K. K. MUSTAFAH

National Mission on Natural Farming (NMNF)

What is the mission?

- **As part of the National Mission on Natural Farming (NMNF), the government intends to motivate farmers to adopt chemical-free farming and draw them towards adopting natural farming willingly on the system's merit.**
- **The government believes that the success of the NMNF will require a behavioural change in farmers to shift from chemical-based inputs to cow-based, locally-produced inputs.**
- **The natural farming scheme under the 'Bharatiya Prakritik Krishi Paddhati' has a total outlay of ₹4,645.69 crore for six years (2019-20 to 2024-25).**



Natural farming

Natural farming, also known as nature farming or do-nothing farming, is an agricultural practice that seeks to cultivate food in a way that mimics natural ecosystems and processes, with minimal human interference.

It is a holistic approach that aims to enhance the natural fertility of the soil, foster biodiversity, and promote the health of crops, livestock, and the environment as a whole.

Key principles and practices of natural farming include:

No-till or Minimal Till: The soil is not tilled, or if tilled, it is done minimally to reduce soil disturbance and maintain soil structure, which helps in retaining moisture and nutrients.

No Chemical Fertilizers or Pesticides: Instead of using synthetic chemicals, natural farming relies on the use of organic matter such as compost, manure, and crop residues to enrich the soil and control pests and diseases.



Use of Indigenous Microorganisms (IMO): These are beneficial microorganisms found in the soil that are encouraged to proliferate, which helps in breaking down organic matter and making nutrients available to plants.

Crop Rotation and Polyculture: Planting a variety of crops in succession or in combination to improve soil health, suppress pests, and enhance biodiversity.

Natural Pest Control: Encouraging natural predators and beneficial insects to control pest populations, rather than using chemical pesticides.



Water Conservation: Using techniques such as mulching and water-saving irrigation methods to reduce water usage and maintain soil moisture.

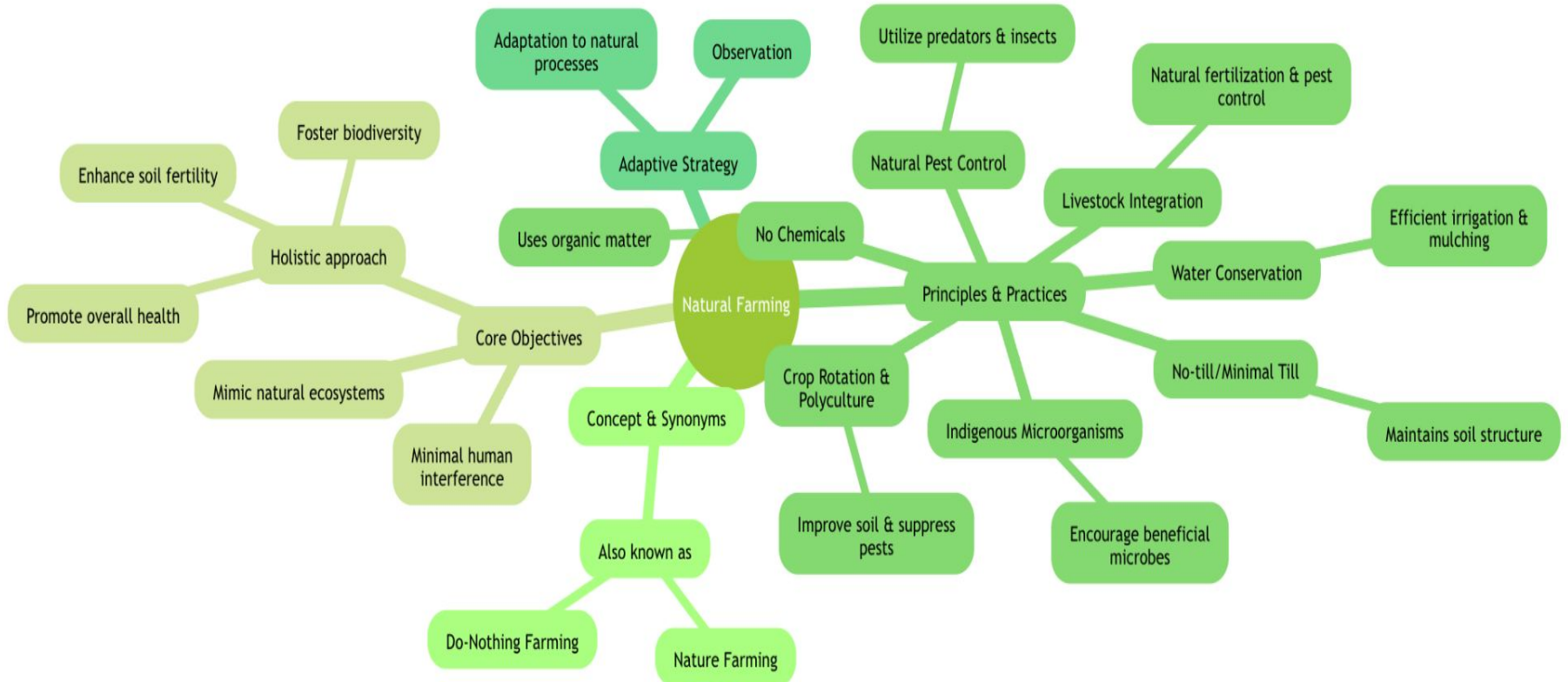
Livestock Integration: In some forms of natural farming, livestock are integrated into the farming system to provide natural fertilization and help control weeds and pests.

Observation and Adaptation: Farmers practicing natural farming closely observe natural processes and adapt their practices accordingly, aiming for a harmonious balance between human activity and the natural environment.

- **Natural farming is not only about producing food but also about restoring and maintaining the health of the land, water, and air.**
- **It is a sustainable approach that aims to reduce the environmental impact of agriculture and promote the long-term health of the planet**

figures:

figure 1.1 mindmap:



What are the challenges and concerns?

- **Agriculture and food experts have their reservations surrounding a large-scale transition from chemical farming to natural farming in a country like India, which has a huge population.**
- **Catering to its food-growing needs isn't an easy task.**
- **a government institute, show a 59% decline in wheat yields and a 32% decline in basmati rice yield compared to integrated crop management, adversely impacting food supply.**

- **A couple of years ago, neighbouring Sri Lanka went through economic and political turmoil after it decided to turn completely organic, and banned the import of chemical fertilizers.**
- **The government's policy shift had severe consequences with farmers struggling to get natural fertilizers; they faced a reduction in yields of key crops including rice, the staple, putting the country's food security at risk**

Butterflies accumulate enough static electricity to attract pollen

The Hindu Bureau

Butterflies and moths collect so much static electricity whilst in flight, that pollen grains from flowers can be pulled by static electricity across air gaps of several millimetres or centimetres. The finding, published in the *Journal of the Royal Society Interface*, suggests that this likely increases their efficiency

and effectiveness as pollinators.

The University of Bristol team also observed that the amount of static electricity carried by butterflies and moths varies between different species and that these variations correlate with differences in their ecology, such as whether they visit flowers, are from a tropical environment, or fly during the

day or night. This is the first evidence to suggest that the amount of static electricity an animal accumulates is a trait that can be adaptive, and thus evolution can act upon it by natural selection.

That many animal species accumulate static electricity as they fly most likely through friction with the air is already known. What was not known is whether

butterflies, moths, and other pollinators too accumulate sufficient static electricity, and if the accumulated static electricity can indeed attract pollen.

Testing process

To test this, the researchers studied 269 butterflies and moths across 11 different species, native to five different continents and inhabiting multiple different

ecological niches.

“Butterflies and moths accumulate a net electrostatic charge. All individuals measured, from various phylogenetic, ecological and biogeographical groupings, carried a net electrostatic charge, suggesting that electrostatic charging is a universal trait among the Lepidoptera,” they write.

“This shows that despite

their wingbeat frequency being about two orders of magnitude lower than most other insects, butterflies and moths are still capable of accumulating appreciable electrostatic charge.” Importantly, the magnitude of the net electrostatic charge on the Lepidopterans measured is sufficient to facilitate contactless pollination, they note.

Butterflies attract pollen

- **Butterflies and moths collect so much static electricity whilst in flight, that pollen grains from flowers can be pulled by static electricity across air gaps of several millimetres or centimetres.**
-

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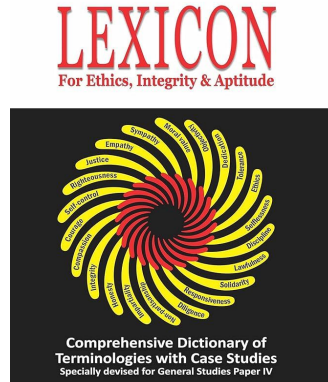
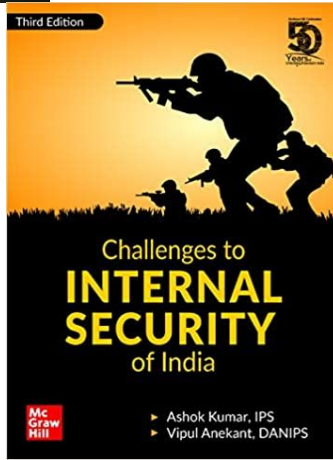
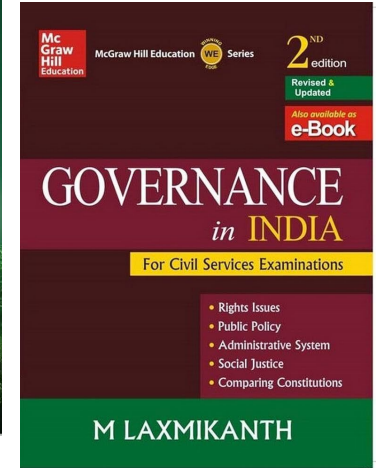
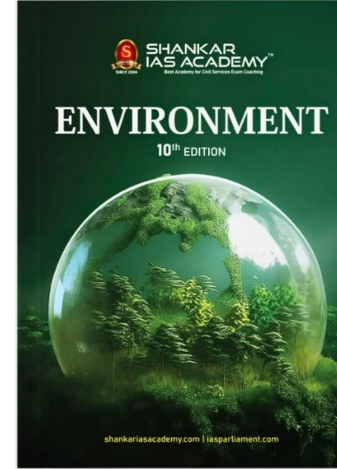
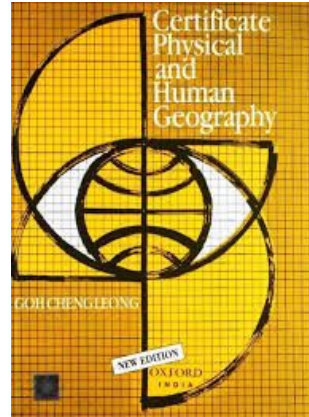
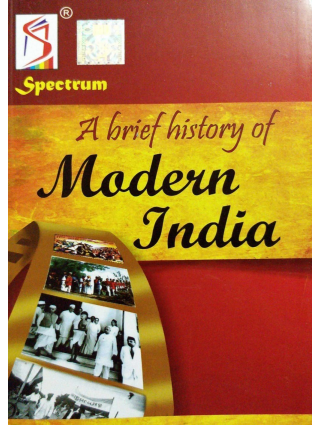
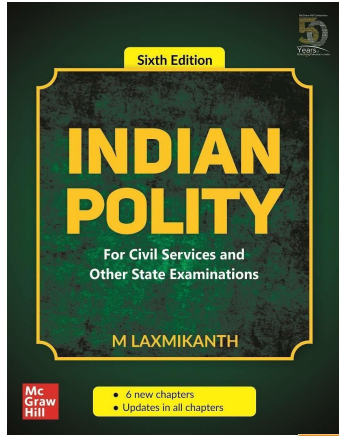
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Q ‘‘Natural farming has environment benefits but not without challenges’’ Discuss

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