- The **deep carbon dioxide reservoir** is now **closer to the surface** than before. If **stratification erodes**, carbon expected by models decades ago could **suddenly appear at the surface**.

Resources

Coal

Why in news: Angul district in Odisha is a major hub for **coal mining**.

- **India's major coal-producing states,** consistently leading in output and reserves, are Odisha, Chhattisgarh, Jharkhand, Madhya Pradesh, Telangana, Maharashtra, and West Bengal, with **Odisha often topping production, while Jharkhand holds the largest reserves** (Reports: Odisha now holds 99.2 billion tonnes of coal, making it the largest coal reserve in India. The state's production accounted for 25.74% of the country's total coal output in 2024)**,** followed by Odisha and Chhattisgarh.

Coal-Producing State	Major Coal Mines / Areas
Jharkhand	Jharia, Bokaro, North Karanpura
Odisha	Talcher, Ib Valley
Chhattisgarh	Korba, Mand-Raigarh
West Bengal	Raniganj
Madhya Pradesh	Singrauli, Sohagpur
Telangana	Singareni
Maharashtra	Wardha Valley
Uttar Pradesh	Singrauli
Andhra Pradesh	Godavari Valley
Assam	Makum

- **Other states** like UP, Assam, and Andhra Pradesh also contribute, with Tertiary coal found in the Northeast and JK.
- **Anthracite** is the highest grade of coal containing a high percentage of fixed carbon. It is hard, brittle, black and lustrous. It is found in smaller quantity in regions of Jammu and Kashmir.
- **Bituminous** is a medium grade of coal having high heating capacity. It is used for electricity generation. Most of bituminous coal is found in Jharkhand, Odisha, WB, Chhattisgarh, and MP.
- **Subbituminous** is black in colour, dull (not shiny) and has a higher heating value than lignite.
- **Lignite** is lowest grade coal with least carbon content. It is found in the regions of Rajasthan, Tamil Nadu, and J&

Cabinet Allows Export of Coal

- Allowed coal acquired through auctioning to be utilised for **any industrial use and export**.
- The **current policy** allows coal to be used only for cement, steel, sponge iron and aluminium via auctions.
- Policy for Auction of Coal Linkage for Seamless, Efficient and Transparent Utilisation of coal **(CoalSETU)** will allow guaranteed supply deals (coal linkages) obtained via auctions to be used for captive consumption, export, or any other purpose (including coal washing). The policy excludes resale in India.

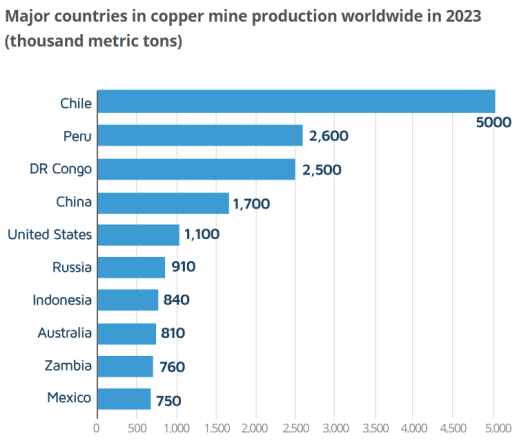
Norms for Opening Coal Mines

- Dispensed with the **Coal Controller Organisation (CCO)'s nod** for opening a coal mine or sections of a seam.
- Entrusts **board of the concerned coal firm** with the authority to accord the requisite permissions. This also applies to permission for re-starting mines that were non-operational for 180 days or more.
- **Board** can give approvals only after receiving **requisite approvals** from **Central or State governments** and/or **statutory bodies**.The **board** must submit **information to CCO** about the **opening of a mine**.

Copper

Why in news: India's copper cathode imports declined 34% due to a three-month supply disruption caused by a Quality Control Order (QCO).

- **Copper is classified as critical mineral in India** due to limited domestic production and its use in EVs, ACs, and wind turbines.
- **Copper wire imports rose 17%**, mainly from **UAE**.
- **Peru**, the world's top 3 producer of copper, supplies copper used in power lines, construction, and manufacturing. **India**, the **world's second-biggest importer of refined copper**, may have to source 91–97% of copper concentrate requirements from overseas by 2047.



Critical Minerals Royalty

- Seeking to reduce **import dependence** and **supply chain vulnerabilities** in **critical minerals**, the Cabinet approved the **rationalisation of royalty rates** for **graphite, caesium, rubidium, and zirconium**. **Graphite** will shift from a **per tonne royalty** to an **ad valorem basis**. Rationalisation would **promote auction** of blocks of **caesium, rubidium, zirconium**.

- **India** is **100% import-dependent** for cobalt, lithium, nickel, REEs and silicon, crucial for batteries, solar, semiconductors and advanced electronics.
- India **defines "critical minerals"** as those essential for economic development and national security, whose limited availability or concentrated production exposes the country to supply-chain risks.
- In the **30 minerals** classified as **critical** by **India**, **caesium and rubidium** are **not included**, though considered critical by the **US**, **Canada**, and **South Korea**. In **2023**, the **Centre identified 30 critical minerals**, including **lithium, cobalt,**

nickel, graphite, tin and copper.

- In **2025**, **India launched the National Critical Mineral Mission** to achieve self-reliance in the critical mineral sector. National Critical Minerals Mission aims to promote exploration of critical minerals within the country and offshore locations and create a fast-track regulatory approval process for critical mineral mining projects.
- India already mines and processes **seven critical minerals**. These include **copper**, **graphite**, **silicon**, **tin**, **titanium**, **rare earths**, and **zirconium**. In each case, India's **refining lags** either in **scale** or **quality**.
- India generates over **250 million tonnes of coal fly ash annually**, containing **light and heavy rare earths**. **Red mud** from aluminium plants contains **gallium**. **Zinc residues** contain **cobalt**. **Steel slag** carries **vanadium**.
- A **2024 IEEFA report** said **India's demand for critical minerals** is expected to **more than double by 2030**, while **domestic mining** may take **over a decade** to produce.

Rare Earth Permanent Magnets (REPM)

- To secure India's supplies of **rare earth magnets**, Cabinet approved a **new "first-of-its-kind" scheme** with a financial outlay of **₹7,280 crore** to manufacture **REPM** in India.
- Scheme, named **'Scheme to Promote Manufacturing of Sintered Rare Earth Permanent Magnets'**, was approved as India and Canada have **"tremendous potential"** to cooperate on **critical minerals**.
- The initiative aims to establish **6,000 metric tonnes per annum** of integrated **REPM manufacturing** in India. REPMs, especially **neodymium-iron-boron magnets,** are vital in **EVs, renewable, electronics, aerospace, and defence sectors**.
- The scheme will support the creation of **integrated REPM manufacturing facilities**, involving the conversion of **rare earth oxides to metals**, **metals to alloys**, and **alloys to finished REPMs**. Duration of the scheme is **7 years**.
- It will **reduce import dependence**, provide **resilience to the automotive supply chain**, encourage **investments in advanced materials**, and position India strongly in **global value chains for EVs and clean energy**.
- A major domestic source is **monazite-bearing beach sands**, which are associated with **thorium.**
- **India has asked State-run miner IREL to suspend a 13-year-old agreement on rare earth exports (**especially **neodymium**, used in magnets for electric vehicle motors**) to Japan** to safeguard domestic supplies.

Germanium

Why in news: India is engaging with **China** to address export restrictions on germanium, a critical mineral used in semiconductors, fibre optics, and solar panels. Germanium is **not a rare earth element**.

- **Over half of the global germanium supply** comes from **China**, and **India is fully reliant on imports**, currently sourcing it through the **UAE**. **China banned germanium and gallium exports to the US.**
- Germanium oxide is vital for manufacturing **fibre optic cables**.

1.	Lanthanum (La)	7.	Europium (Eu)	13.	Thulium (Tm)
2.	Cerium (Ce)	8.	Gadolinium (Gd)	14.	Ytterbium (Yb)
3.	Praseodymium (Pr)	9.	Terbium (Tb)	15.	Lutetium (Lu)
4.	Neodymium (Nd)	10.	Dysprosium (Dy)	16.	Scandium (Sc)
5.	Promethium (Pm)	11.	Holmium (Ho)	17.	Yttrium (Y)
6.	Samarium (Sm)	12.	Erbium (Er)		

- **REE** are a group of **17 elements** (15 lanthanides from lanthanum to lutetium, and scandium and yttrium). The main sources of REEs are minerals such as **bastnasite, loparite and monazite**.
- Based on their atomic numbers, they are divided into **two groups**: the **light group**, also known as the **Cerium group (light REE)**, and the **heavy group**, also known as the **Yttrium group (heavy REE)**. **REEs** are crucial for their high density, melting point and conductivity. They are moderately abundant, but hard to extract economically.
- The **first commercial use** was in an **incandescent lamp mantle**, which is composed of 99% thorium oxide and 1% cerium oxide. The **first successful technical use was in Sunglasses (Neophan)**.
- **China has largest share** of world's reserve of RREs. **China** built global supremacy in this sector by controlling **90% of global REE processing** and **70% of production**, despite holding only **30% of global reserves.**
- **India has the third largest reserves** of REEs. India produces **less than 1%** of the total world share. Government has opened up REE exploration for **private entities**.
- In 2023, **MMDRA was amended** to support **domestic mining**, **exploration licences**, **national auctions**, **mining associated minerals**, and a **national mineral exchange**. Minerals of REE group were **classified as Critical**.
- India imported over **53,000 metric tonnes of REE magnets in FY 2024-25**, despite having **8% of the world's REE reserves**. These reserves are mainly in **monazite sands** across **Andhra Pradesh, Odisha, Tamil Nadu and Kerala.** India's **monazite sands** have several **light rare earths**, including **Neodymium**, which are used in magnets.
- **Phosphors** use **europium and terbium**, while **lasers and optical devices** use **neodymium and erbium**.
- Rare-earth elements are also used in **catalysts**, **glass and ceramics**, and **polishing powders**.
- Rare-earth elements are good **phosphors** because they produce **sharp, stable colours**.
- Companies target minerals such as **bastnäsite** and **monazite**, and certain **clay deposits**. Some rare-earth minerals occur alongside **thorium or uranium**.
- The world has more than **90 million tonnes of rare-earth-oxide equivalent**. **China (44 MT)**, **Brazil (21 MT)**, **India (6.9 MT)**, **Australia (5.7 MT)**, **Russia (3.8 MT)**, **Vietnam (3.5 MT)**, **the U.S. (1.9 MT)**, and **Greenland (1.5 MT)**. These estimates **exclude scandium**. Recently, **Japan** announced plans to **excavate mud rich in rare-earth elements** from **6 km underwater** off **Minamitori Island** in **2026**.

Ferrous Scrap

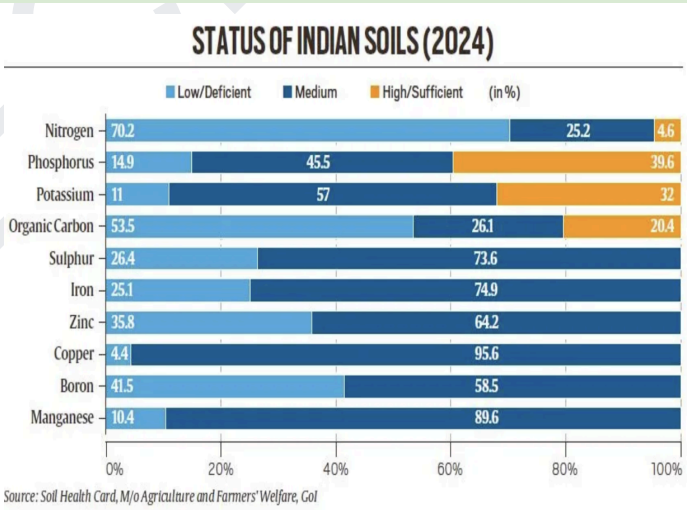
- **Depletion of international ferrous scrap sources** due to export curbs by the UAE and potential EU restrictions linked to circular economy and environmental criteria is creating challenge for India, which is now scrap deficient.
- **India's scrap demand** to reach 65 million tonne (MT) annually by 2030, with a potential import gap of 20–30 MT.
- The **Centre's vehicle scrapping policy (2021)** aims to encourage recycling and remove old, polluting vehicles, but its uptake is currently low. Expediting the policy is critical to generating end-of-life vehicle (ELV) scrap.
- Indian producers like **Tata Steel** have begun **establishing steel recycling plants** to **formalise domestic scrap processing**. The government is actively promoting a shift to **Electric Arc Furnace (EAF) steelmaking**, which uses scrap as primary feedstock.
- **Central Electricity Regulatory Commission** has noted that the National Electricity Plan may recommend retiring thermal plants over a certain age, such as 25 years. **India's steel consumption**, currently 152 million metric tonne (MT), is projected to grow to 220 MT by FY30, 260 MT by 2035, and 390 MT by FY50.

Critical Minerals Recycling Scheme

- Cabinet approved **₹1,500-crore incentive scheme** to develop recycling capacity for critical minerals in India.
- The scheme aims at **separation and production of critical minerals** from **secondary sources**. Recycling of critical minerals involves recovery from end-of-life products such as **copper, lithium, nickel, cobalt, and REEs**.
- The incentive scheme is part of the **National Critical Mineral Mission (NCMM).**
- The scheme will operate for **six years**, from **FY2025-26 to FY2030-31**.
- **Eligible feedstock** includes e-waste, lithium-ion battery scrap, and catalytic converters from end-of-life vehicles.
- **One-third of the total outlay** is earmarked for **small and new beneficiaries**, though **large and established recyclers** are also eligible. **Incentives** will be provided for **investments in new units**, as well as **expansion, modernisation, or diversification** of **existing units**.

Soil Profile

- In 2024-25 (FY25), India **exported 20.2 million tonnes (MT) of rice** in a global market of 61 MT. **FCI holds about 57 MT of rice** — the highest stock in 20 years. This stock is nearly four times the buffer norm.
- **Soil micronutrient deficiencies** impair agricultural productivity and degrade the nutritional quality of crops. Crops grown on nutrient-deficient soils mirror those deficiencies, leading to a silent but pervasive malnutrition.
- **Zinc deficiency in soils** leads to low zinc content in cereals like wheat and rice. This is **linked to childhood stunting**.
- **Soil Organic Carbon** defines the physical, chemical, and biological properties of soil, governs soil's holding capacity and nutrient use efficiency.
- As per the **Indian Institute of Soil Science (IISC)**, **SOC in the range of 0.50–0.75 per cent is adequate**.
- The **World Food Laureate** prescribes that the **carbon content** in soils should be **at least 1.5 to 2 per cent**.



Source: Soil Health Card, M/o Agriculture and Farmers' Welfare, GoI

- **Our soils suffer from a deficiency of sulphur**, as well as **micronutrients like iron, zinc and boron**.
- The **Indian Council for Research on International Economic Relations (ICRIER)** and **OCP Nutricrops** have committed to **collaborating to improve soil health** in India and beyond.

Potato

Why in news: Centre cleared a proposal to set up the **South Asia regional centre of Peru-based International Potato Center** (CIP) at Singna in Agra.

- It will serve **farmers in potato-belt states** like **Uttar Pradesh, Bihar, and West Bengal**, and also cater to **South Asian countries**.
- The major objective is to **increase food and nutrition security, farmers' income, and job creation**.
- Every **potato species** is **genetic mix** from cross between **wild tomatoes** and **Etuberosum plants** about **90 lakh years ago**. Modern potatoes carry roughly **40% tomato-type genes** and **60% Etuberosum genes**.
- **Bio-fortified potatoes** with **added iron content** will soon be available in **Indian markets**. The **first variety** of iron-fortified potato has been **released in Peru**. **Bio-fortified sweet potatoes** with **vitamin A** using **CIP technology** are already available in **Karnataka, Assam, West Bengal, and Odisha**.

- India is the **world's second top producer and consumer of potato**. **China** leads globally. **India and China account for over one-third of global potato production. Other:** Ukraine, Russia, US, Germany, Bangladesh, France, Poland.
- The **potato** is the **third most available food crop** in the world, after **rice and wheat**, while **sweet potato** is in the **6th**

position, after **maize and cassava**.
- **UP and West Bengal led production with 15 MT each in 2020-21**, followed by **Bihar (9 MT)**. **Gujarat, Madhya Pradesh and Punjab** are also **significant potato producers** in India.
- **Conditions:** Loamy and sandy loam soils, rich in organic matter with good drainage and aeration are most suitable for cultivation of potato crop. The soil with pH range of 5.2-6.4 is considered to be ideal. Potato is a temperate climate crop, however it grows under a diverse range of climatic conditions. **Brought to India by Portuguese.**
- **ICAR has two different centres** working on tuber crops: **ICAR-CPRI (Shimla)** for potato and **ICAR-CTCRI (Thiruvananthapuram)** for sweetpotato.
- Upcoming CSARC will be 2nd major international agricultural research institute in India, after the **IRRI-SARC (International Rice Research Institute – South Asia Regional Centre)** established in **Varanasi in 2017**.
- **CIP is headquartered in Lima, Peru**, and was **founded in 1971** as a **research-for-development organisation** focused on **potato, sweet potato, and Andean roots and tubers**.

Tomato

- Tomatoes were once deemed **sinful**, **stinky**, and called "**poison apples**", linked to **superstition** and **illness** due to reactions with **lead** in copper-based dinnerware.
- Tomatoes were **not native to India** but were brought by **Portuguese traders** in the **15th century**.
- Plant biologists classify the **tomato as a fruit**. Rich in **antioxidants** that benefit **heart** and **brain**.
- Tomatoes reduce **heart disease risk**, lower **high blood pressure**, and prevent **constipation** due to cellulose fibre.
- The red pigment **lycopene** in tomatoes may help protect those **above 70** from **Alzheimer's disease**.
- India produced **210 lakh tonnes** of tomatoes in **2022–2023**, second only to **China.**
- The **Indian Institute of Horticultural Research, Bengaluru** developed hybrids like **'Arka Rakshak'** (disease-resistant) and **'Arka Shreshta'** (long shelf-life).
- **States:** MP, Odisha, Karnataka, West Bengal, Andhra Pradesh, Gujarat, and Tamil Nadu.
- **Countries:** China and India lead the world in tomato production by a significant margin, followed by Turkey, US, and Egypt with Italy, Iran, Brazil, Spain, and Mexico also being major contributors
- **Tomatoes need** full sun (6+ hrs), warm temperatures (ideally 21-24°C/70-80°F), well-drained, nutrient-rich soil (pH 6.0-7.0), consistent moisture (1-2 inches/week), and good air circulation, thriving in warm, sunny, moderately humid conditions but struggling with frost, extreme heat (above 32°C/90°F), and heavy clay soil, requiring support and mulch for best growth and disease prevention.

Coconut Oil

- The prices of **soyabean, sunflower, and mustard oils** have risen. **Coconut oil** is now **more expensive than sesame (gingelly) oil**. **Coconut oil prices** are at **all-time high**.
- The **El Niño event** from **2023 to 2024** affected the **growth of coconut flowers and fruit development** during the **2024-25 marketing year**. It takes roughly **a year for a coconut to mature**, so the **impact is being felt now**.
- **Coconut trees take 3-5 years** to bear fruit, even the **improved dwarf and hybrid varieties**.
- **Indonesian** government planning restrictions on raw whole coconut exports.
- **Philippines** has introduced a 3% blending of coconut oil-based CME in diesel from 2024.
- Of the **5.7 lakh tonnes** of **coconut oil produced in India**, only about **3.9 lakh tonnes** is used for **food purposes**. Remaining goes into manufacture of **hair oil, cosmetics, soaps**, and **other industrial applications**.
- Like other **indigenous cooking oils** (mustard, sesame, groundnut, cottonseed), coconut oil has lost market share to **imported – palm, soyabean, and sunflower**.
- **States:** Karnataka, Tamil Nadu, and Kerala are India's leading coconut-producing states, collectively contributing the vast majority (around 90%) of the nation's total output, with Karnataka recently emerging as the top producer, followed closely by Tamil Nadu and Kerala. Other significant producing states include Andhra Pradesh, West Bengal, Odisha, Maharashtra, and Gujarat, with island territories like Lakshadweep also being major growers. It is native to India.

COCONUT OIL PRODUCTION IN TOP 3 COUNTRIES

	2023-24	2024-25	2025-26
Philippines	**18.50** (14.90)	**16.30** (11.30)	**16.65** (11.30)
Indonesia	**10.30** (7.06)	**9.90** (6.50)	**10.00** (6.80)
India	**5.70** (0.19)	**5.70** (0.15)	**5.73** (0.15)

INDIA'S EDIBLE OIL CONSUMPTION IN 2023-24

Palm oil	97.54
Soyabean oil	52.8
Mustard oil	37.81
Sunflower oil	35.85
Rice bran oil	11
Cottonseed oil	9.42
Groundnut oil	6.98
Coconut oil	3.9
TOTAL*	58.66

- According to **Coconut Development Board**, coconut requires an **equatorial climate** with **high humidity**.
- The **ideal mean annual temperature** is **27°C** with **5-7°C diurnal variation**.
- A **well distributed rainfall** of **1300-2300 mm per annum** is preferred.
- **Grown in different soil types** such as **laterite, coastal sandy, alluvial**, and in **reclaimed soils of marshy lowlands**.
- Coconut **tolerates salinity** and a **wide range of pH from 5.0 to 8.0**. Proper drainage, good water holding capacity, optimum soil moisture, and absence of rock or hard substratum within 2 m of the surface are ideal for growth.
- **Established in 1981**, the **Coconut Development Board (CDB)** is a **statutory body** under **Ministry of Agriculture**.
- The **CDB's mandate** is for the **integrated development of coconut cultivation and industry** in India. The Board

focuses on **productivity increase** and **product diversification**.

Asafoetida

Why in news: Heeng (Ferula assa-foetida) is widely used in Indian cuisines and mentioned in **Mahabharata**, **Ayurveda**, and **Charaka Samhita Sutrasthana 27/299** for its medicinal properties. Sourced from **Iran, Afghanistan, Central Asia**.

- From 2018–2020, CSIR-IHBT sourced seeds from **Iran and Afghanistan.** Brought to India by Persians.
- Thrives in **cold, arid, high-altitude regions** (10–20°C, tolerates –4°C to 40°C). Grows in **sandy, well-drained soil** with 200–300 mm annual rainfall. Matures in **5 years**; resin is extracted from **taproot and rhizome** for culinary use.
- India was the **world's largest consumer** but **fully dependent** on imports. Government launched indigenous cultivation led by **CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur**.
- **States:** Himachal Pradesh, particularly the cold desert areas of Lahaul & Spiti, with efforts also expanding to Ladakh, parts of Uttarakhand, and Jammu & Kashmir, leveraging cold, arid conditions suitable for Ferula cultivation.
- First plantation in **Kwaring village, Lahaul Valley**. Expansion to **Janjheli, Mandi district** (mid-hill region).
- Demonstration plots and training set up in **Lahaul & Spiti, Mandi, Kinnaur, Kullu, Chamba**.

Pathaneer

- **Palmyra climbers of Thoothukudi, Tamil Nadu** earn their livelihood by harvesting **pathaneer (palm sap)** from flower clusters of trees. Pathaneer is a **refreshing drink** and can be processed into **panangkarkandu (palm candy)** and **karupatti (palm jaggery)**. Sale of **toddy** made from fermented pathaneer is **prohibited in Tamil Nadu**.
- **Palm jaggery and palm candy** are favoured over white sugar as they are **chemical-free, preservative-free, and rich in minerals, vitamins, and antioxidants**. The **palmyra** is the **State tree of Tamil Nadu**.
- Sap is available only for **five months in a year**, making the work **seasonal**.
- Sap collected in **lime-coated mud pots** to prevent fermentation.

Milk

- **Top five milk producing states** are Uttar Pradesh (15.72%), Rajasthan (14.44%), Madhya Pradesh (8.73%), Gujarat (7.49%), and Maharashtra (6.70%).
- India's **milk production in 2023-24** was **239.3 million tonnes**. **Cows contributed 53.12%** of the total milk production. **Buffaloes contributed 43.62%** of the total milk production. **Production:** India > EU > USA > Pak > China > Brazil.
- The **per capita milk availability** has increased from **124 grams** earlier to **471 grams (global average of 323 g/day)**.
- **Operation Flood**, launched in **1970**, ushered in the **White Revolution** and transformed the dairy sector in India. Last year, Home Minister announced plans for **"White Revolution 2.0"**. The idea of **White Revolution 2.0** revolves around **cooperative societies**, the same foundation as **Operation Flood**.
- In **1951-52**, India produced just **17 million tonnes** of milk.
- Per capita milk availability varies from **329g in Maharashtra** to **1,283g in Punjab**.

Almond

- The **almond harvest in Kashmir** is both a **seasonal and cultural event**, with this year's **bumper**.
- **Almond trees bloom in early spring**, turning the landscape **pink and white** before ripening in summer.
- **Kashmir's moderate climate, fertile soil, and water sources** make it ideal for almond cultivation.
- **Kashmiri almonds** are **small, sweet, and rich in oil**. Both **soft-shell and hard-shell almond varieties** are cultivated.
- Farmers face challenges like **erratic weather, limited modern techniques, cheaper imports, shrinking farmlands, and weak policy support**. Government plans to introduce **high-density almond varieties** to address these issues.
- **Countries:** USA (especially California) overwhelmingly leads in almond production, followed by major players like Australia, Spain, Turkey, Morocco, and Iran, with the EU (Spain), China, Chile, and India also contributing.
- **States:** JK is India's dominant almond producer, contributing over 90% of output, followed by Himachal Pradesh as the second-largest, with Uttarakhand and Maharashtra also having significant, though smaller, cultivation.
- **Conditions:** Almond trees need a Mediterranean climate (hot, dry summers; mild, wet winters), full sun, well-drained loamy/sandy soil (pH 6.0-7.5), and specific winter chilling hours (250-350 < 45°F) for dormancy, but avoid frost during early spring flowering for good pollination and to prevent fungal issues. Consistent irrigation, especially in dry periods, and proper spacing are crucial for high yields, though they can tolerate some drought and poor soil.
- Brought to India by **Persians**.

Cotton

- India has decided to withdraw **11% import duty** on cotton till **September 30**, amid declining domestic production to **294 lakh bales**, the lowest in **15 years**, against the required **318 lakh bales** (including non-mill use).
- **Imports** are expected to be at an all-time high primarily from **Australia**, **U.S.**, **Brazil**, **Egypt**.
- India's rise as a **global cotton producer** began after **2004–05**, driven by reforms such as the **Technology Mission on Cotton (1999–2014)** and the introduction of **Bt cotton** in **2002–06**.
- India traditionally exported **Bengal desi and short-staple varieties**, but shifted to **medium and long-staple exports**.

- **Cotton Corporation of India** procures cotton only when prices fall below **MSP**; by **June 2025**, it procured **34% of production** — the highest in seven years.
- **Rising costs** are linked to **falling acreage**, **stagnant productivity**, and **lower cotton-to-lint ratio**.
- **Bt hybrids** now cover **95% of cotton acreage**, but the technology — over **two decades old** — has **lost potency** against **pest resistance**, especially the **pink bollworm**.
- **Brazil and Australia:** Adopted **Bollgard-III**. **China:** Using **CRISPR-based gene editing** for cotton improvement.

- **India's textile industry** is among **largest in the world**.
- **Textile and apparel industry** contributes **13% to industrial production**, **12% to exports**, and about **2% to GDP**.
- **India is the 2nd largest producer of cotton** after China, accounting for **24% of global production**.
- **Cotton** mainly in **Gujarat, Maharashtra, Telangana.**
- **Countries:** China, India, Brazil, USA, Pakistan. Modern varieties brought to India by British.
- **Conditions:** Cotton cultivation requires a warm, sunny, frost-free climate with adequate heat (21-30°C) and 50-100 cm rainfall, needing moisture for growth but dry, sunny weather for ripening, and thrives in well-drained black, alluvial, or red soils, demanding a long, frost-free growing season (200+ days) for maturity.

Apple

- **Horticulture** is the **mainstay of Kashmir's economy**. Kashmir/(Some say Himachal Pradesh), known as the **"apple bowl of India,"** produces the **largest quantity of apples in the country**.
- In **2025**, the sector faced a **major setback due to incessant rain and severe flooding** across the Valley. **Flooding and waterlogging** damaged standing crops; many **apples rotted or fell prematurely**. **Prolonged standing water** could **damage tree root systems**, affecting **long-term orchard health**.
- Modern varieties brought to India by British.
- **States:** J&K (the largest producer), Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Nagaland, and Sikkim.
- **Countries:** Originated from Central Asia (Almati, Kazakhstan) and spread all over the world. China produces the world's largest number of apples, followed by the United States, Poland, Italy, and France.
- **Conditions:** Cool temperate climates with cold winters (for chilling hours) and moderate summers, well-drained, loamy soil (pH 5.5-6.5), ample sunlight, and sufficient moisture, with ideal conditions featuring specific temperatures (e.g., 15-25°C growing season) and avoiding excessive rain near harvest to ensure quality fruit.

Onion

- **Farmers from Maharashtra**, India's **largest onion-producing State**, have been holding a **protest** due to **falling prices.**
- Policy aims to **manage price volatility** through a **strategic buffer stock** under the **Price Stabilisation Fund (PSF)**.
- **Bangladesh and Sri Lanka**, once **major importers**, have **turned to other suppliers**.
- **States:** Maharashtra, Madhya Pradesh, Gujarat, Karnataka, and Rajasthan.
- **Countries:** China and India are the world's leading onion producers, together accounting for roughly half of global output, followed by US, Egypt, Turkey, Pakistan, and Bangladesh
- **Conditions:** Mild climates (15-20°C) with well-drained, loamy soils (pH 6.0-7.5) and full sun, cool weather for establishment and warm, dry conditions for ripening, consistent water (avoid waterlogging) and nutrients.
- Ancient traders from Central Asia / Persia brought to India.

Corn

- A key **area of disagreement between the U.S. and India** regarding trade is the **U.S. demand that India import U.S. corn**.
- **India's maize yield** is **below four tonnes per hectare**, while the **world average is six tonnes**. Despite low productivity, India has been **largely self-sufficient** and has **sometimes exported maize**.
- **Countries:** US, China, Brazil, and Argentina, European Union (as a bloc), India, Ukraine, and Mexico.
- **States:** Karnataka, Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan, Bihar, and Andhra Pradesh.
- **Conditions:** Warm weather (25-30°C), well-drained loamy soils with rich organic matter (pH 6.0-7.5), and moderate, consistent moisture, especially during flowering, requiring protection from waterlogging and salinity. It's typically a Kharif crop in India, needing 50-100 cm rainfall. Brought to India by **Portuguese**.

Tapioca

- Two years after scientists from the **National Bureau of Agricultural Insect Resources (NBAIR)** under **ICAR** released a **tiny parasitic wasp** into South India's **tapioca fields**, the crop that once faced **near devastation** is now **thriving again**.
- This marks a **rare success** in controlling a major agricultural pest **without chemicals**.
- **Cassava (tapioca)**: **Tamil Nadu and Kerala** contributing **more than 90%** of total production.
- The **mealybug** arrived in **Thrissur, Kerala**, in **2020** and by 2021. The pest fed on plant sap, causing **leaf curling, stunted growth**, and **poor tuber formation**, with no effective local predators.
- ICAR–NBAIR scientists turned to **classical biological control**, introducing a **natural enemy** from the pest's native region. Scientists identified **Anagyrus lopezi**, a **tiny parasitic wasp** that **specifically targets cassava mealybug**.
- The wasp lays its eggs inside the pest, and the developing larvae **consume it from within**.

- It is native to Brazil and was primarily introduced to India by Portuguese.

Coffee

- **Karnataka's coffee heartland**, Chikmagaluru, Coorg, and Hassan districts, has suffered **heavy crop losses** due to **incessant rainfall**, **extreme cold**, and **lack of sunlight**.
- **Black rot disease (fungal infection)** and **berry droppings** have become **uncontrollable**.
- Early and excessive **monsoon rains** coincided with the blossom and fruit-setting stages, further reducing yields.
- Both **Arabica** and **Robusta** varieties have been adversely affected.
- **Diseases reported:** Black rot, Leaf rot, Fruit rot, Berry drop, Stalk rot.
- The western coffee-growing belt of Karnataka accounts for **over two-thirds of India's coffee output**.
- **Coffee Board of India** is conducting extensive awareness and capacity-building programmes to increase grower registrations on its mobile app for **EU Deforestation Regulation compliance** that took effect on **December 30, 2025**, for **large exporters**, and from **June 30, 2026**, for **small growers**. The regulation mandates proof that coffee is not linked to deforestation after December 31, 2020.
- **Coffee exports in 2024–25** crossed the $1,000 million mark for the fourth consecutive year.

Civet Coffee

- **Civet-processed robusta coffee (Kopi Luwak)** shows differences in fatty acid methyl esters and total fat content compared to naturally harvested robusta beans, supporting the **unique aroma, flavour, and nutritional qualities** of **civet coffee** produced from the **excreta of the Asian palm civet (Paradoxurus hermaphroditus)** after the animal consumes ripe coffee cherries.
- The pulp is digested, and the beans undergo natural fermentation in the civet's gut, before being excreted intact and collected for processing. Civet-processed beans are larger and have higher fat content.

Related News:

- Few Coffee regions: **Chikmagalur, Coorg, Hassan** (Karnataka) & **Pulney, Shevaroy, Nilgiri, Annamalai** (TN).
- The story of Indian coffee began in **1600 AD** when **Baba Budan** planted seven **'Mocha'** seeds on **Baba Budan Giris in Karnataka**. **Commercial coffee plantations** in India started in the **18th century**.
- Coffee is traditionally grown in the **Western Ghats** across **Karnataka, Kerala, and Tamil Nadu**. Cultivation is expanding in **Andhra Pradesh, Odisha**, and **Northeast states**.
- Coffee is **export-oriented**, with **70%** of production exported to **120+ countries.**
- India grows two main coffee varieties: **Arabica** and **Robusta**. **Arabica** is mild, **more aromatic**, and has **higher market value**. **Robusta** has **more strength** and is used in blends. Arabica grows at **higher altitudes**, with optimal temperatures **15°C–25°C**. Robusta prefers **hot and humid climates**, with temperatures **20°C–30°C**.
- Arabica suits **large holdings**, while Robusta suits **farms of any size**. Arabica is harvested from **November to January**; Robusta from **December to February**. Arabica is **more susceptible** to pests/diseases such as **white stem borer** and **leaf rust**, and requires **more shade** than Robusta.
- **Brazil** is the **world's largest coffee producer** (~40%). **Vietnam** is the **second-largest coffee producer**.

Coffee Board of India:

- During the **1940s**, India's coffee industry faced severe challenges due to the WW-2. To address this crisis, the GoI established **Coffee Board** through the **Coffee Act VII of 1942**, under the **Ministry of Commerce and Industry**.
- With **liberalisation in the 1990s**, the Coffee Board's **monopoly over marketing and exports** was abolished.
- Its core activities include **R&D**, **technology transfer**, **quality improvement**, **development support**, and **promotion of coffee** in domestic and export markets.
- The Board has **33 members**, including the **Chairman** and the **Secretary & CEO**, and is headquartered in **Bengaluru**. The Board functions through **six statutory committees**, each appointed for a **one-year term**.
- The Board also has one **non-statutory committee**, the **Audit Committee**, which handles matters related to **annual accounts** and financial review.

Tea

- **India** is the **second-largest producer and consumer of tea**, and the **third-largest exporter** globally.
- **Kenya** remains the **largest exporter**, shipping almost **its entire production**. **China**, the **second-largest exporter**, consumes a **large share of its own production locally**.
- **India's per capita tea consumption** is currently **840 grams per year**, compared to **Turkey's 3 kg per year** (highest).
- **Conditions:** Warm, humid, frost-free climates with well-distributed rainfall (150-300cm/year) and well-drained, acidic soil (pH 4.5-5.5), needing consistent moisture but not waterlogging; ideal temperatures are 20-30°C, with protection from frost and excessive heat, often found in tropical/subtropical highlands with high humidity (80-90%).
- **States:** India's major tea-producing states are Assam (Climate change is disrupting Assam's traditional seasonal cycle, with persistent heat, delayed rainfall, and higher night-time temperatures affecting tea cultivation), West Bengal, Tamil Nadu (Nilgiris), Kerala, and Karnataka, with Assam being the largest producer. Introduced/commercialized by British.
- China > India > Kenya > Sri Lanka, together representing 81% of world tea production.
- **FSSAI** issued a **stern warning** to **food business operators** against using the word **'tea'** for **herbal infusions and plant-based blends** not derived from **Camellia sinensis**, terming it **misbranding and misleading practices**.

- **Food business operators** were marketing products such as **'herbal tea'** and **'flower tea'** not obtained from the **Camellia sinensis plant**. As per **FSSAI regulations**, the term **'tea'** can be used on **packaging and labelling** only if the beverage is derived from **Camellia sinensis**.

- Tea is one of the industries that falls under the **control of the Union Government** by an **Act of Parliament**.
- The origins of the **Tea Board India** trace back to **1903**, when the **Indian Tea Cess Bill** was enacted to levy a cess on **tea exports**, with the proceeds directed towards **promoting Indian tea** domestically and internationally.
- The present **Tea Board** was established under **Section 4 of the Tea Act, 1953**, and was **constituted in 1954**.

Pokkali paddy

- **GI-tagged saltwater tolerant Pokkali paddy,** from the **Pizhala island near Kochi**, is a **traditional rice variety from Kerala** known for its **remarkable saltwater tolerance**. It grows in **saline and waterlogged fields**.
- The cultivation follows a **unique system** where rice is grown during the **low salinity monsoon season (June–November)** and the fields are used for **prawn and fish farming** during high salinity months (**November–April**). This creates an **integrated rice–fish farming ecosystem**.
- **Pokkali cultivation** is **eco-friendly and climate-resilient**, enabling **rainwater harvesting**, reducing **salinity pressure** through percolation, and maintaining **ecological balance** in wetland agroecosystems.

Related News

- **US was ranked 13th** with an estimated output of **7.05 mn tonnes (mt)**, which was way below **150 mt of India**, **world's number 1 producer**. Even with its relatively **low production**, the **US exported 3 mt** and **imported 1.6 mt of rice**.
- US imports were mostly from **Thailand** & **India** & comprises **aromatic varieties**, fetching **high prices** (**Fragrant Thai Hom Mali** and **Jasmine rice).**
- The argument holds even more so when the **imports are mainly of premium aromatic rice varieties**.
- **India is the world's largest producer as well as exporter of rice**.
- According to the **US Department of Agriculture**, **India's total rice exports in 2024-25** were at **22.5 mt**.
- **Basmati exports** go to **West Asia**, with **Saudi Arabia, Iraq, Iran and UAE** being **bigger markets than the US**.
- In the case of **non-basmati rice**, the biggest market for Indian grain is **Africa** especially countries like **Benin, Togo, Côte d'Ivoire, Liberia, Sierra Leone, Guinea and Senegal**.

Chakhao Rice

- A **pact** was signed by **APEDA** during the **1st BIRC conference** to allow **Manipur** to introduce another variety of **Chakhao (white sticky rice)** to the **international market** after exporting **black sticky rice**.
- **Chakhao** is a **Black Rice variety** grown in **Manipur**. It is **glutinous rice** with a **pleasant aroma and nutty flavour**.
- It is considered one of the **healthiest superfoods** due to **medicinal and nutritional values**, rich in **antioxidants, protein, iron, fibre and other essential nutrients**.
- The **Government of India** awarded **Chakhao (black variety)** the **Geographical Indication Tagging** in **2020**.

Avacados

Why in news: A **growing health-conscious consumer base** is increasing Indian interest in **international food and fruits**. **India is a high-potential market** for **Australian avocados**. With **Tanzanian avocados dominating** market, Australia is promoting **consistent quality, superior taste, year-round availability**.

- The avocado is a highly nutritious, single-seeded fruit (botanically a large berry) known for its creamy, buttery texture and mild, nutty flavor. It is native to the **Americas** and widely consumed for its health benefits, including heart-healthy **monounsaturated fats and high fiber** content.
- **Varieties:** Hass, Fuerte and Reed. Used in Guacamole and Salads.

Honey

- **Ramhama**, a village in **Budgam district** of central Kashmir, has earned the title of **"Honey Village"** for Apiculture.
- **Acacia honey** is supplied to several States across India.
- India is the world's **7th largest honey producer**, with production spread across distinct agro-climatic zones. As of late 2025, five states account for nearly 70% of national output **(UP>WB>Punjab>Bihar>Rajasthan).**
- **India's first mono-floral lavender honey** has been produced by the **CSIR-IIIM** in Pulwama, Kashmir, making India a new player in the global lavender honey market, alongside countries like **France**, **Spain**, and **Italy**.
- **Lavender cultivation** in Jammu and Kashmir began in the **1970s**, with a major push for lavender plantation in **2014**. Lavender has become part of **Purple Revolution** in the region cultivating lavender on **750 hectares of land**. **Its antifungal**, **antimicrobial**, **anti-bacterial properties** protect apple orchards, reducing the need for pesticides.

Beetle-Fungi vs Rubber

- Rubber plantations in **Kerala** are facing threat from **ambrosia beetle (Euplatypus parallelus)** and its associated **Fusarium fungi**, causing **leaf fall, trunk drying, and latex loss**. Ambrosia beetles carry **Fusarium ambrosia** and **Fusarium solani**, marking the **first report** of F. solani with adult beetles.

- Trees suffer **leaf fall, xylem blockage, trunk drying**, and sometimes death; latex production drops sharply.
- Ambrosia beetles are **native to Central and South America**; first reported in India (Goa, 2012). They attack **dead, infected, or stressed trees**, sensing ethanol released by stressed trees. It is invasive and can infest over **80 broadleaf species** including **cashew, teak, coconut, coffee**.
- Fungal infections are hard to treat as fungi reside in **deep tissues**, beyond reach of fungicides or insecticides. Fusarium fungi spread via **soil and insect vectors** and modulate local microbiomes, making eradication complex.
- Kerala produces **90% of India's rubber**; India is the **6th largest producer** globally and **2nd in productivity**.
- Infection endangers not just rubber but also **coffee, cashew, mango, and coconut** plantations.
- Fusarium fungi can infect humans, posing **health risks for plantation workers**.
- Boosting domestic rubber production is a **national priority**, especially for the **tyre industry**.
- **Inverted duty structure** on natural rubber is a **key challenge** to competitiveness.

Cherrapunji Eastern Craft Gin

Why in news: Cherrapunji Eastern Craft Gin has become the **first alcohol label from Northeast India to be exported**. It is currently available in parts of European Union, and will soon be marketed in Japan, Thailand, UK.

- The gin is distilled from naturally harvested rainwater sourced from **Sohra and Mawsynram**, the two wettest places on Earth. Includes local ingredients such as **kaji nemu (Assamese lemon), Khasi mandarin, Sohmarit pepper, smoked black cardamom, and pine-smoked tea**.
- The gin is produced using **traditional copper stills**. The product is packaged in a **military-grade stainless steel bottle**, designed for reuse, challenging the **throwaway culture of luxury packaging**.
- Has won 13 international spirits awards, including a 'Master' medal at the **Global Spirits Masters 2023** and a silver at the World Gin Awards.
- Government support, especially from **Meghalaya**, played a key role in enabling this venture.

Misc

Coastline

Why in news: In **2024**, the **MHA**, via its **2023–24 annual report**, stated that India's **coastline increased** from **7,516.6 km to 11,098.8 km.** The earlier figure from the **1970s** was based on **low-resolution mapping.** The **increase is not due to territorial expansion**. The revision was based on **better measurement technology**, not new geography.

- Measurement done by **National Hydrographic Office (NHO)** and **Survey of India.**
- **Technology involved**: GIS, satellite altimetry, LIDAR-GPS, drone imaging.
- Coastline length varies with **measurement scale**, a problem known as the **coastline paradox.** At **coarser scales**, smaller features like **creeks, estuaries, ridges** are missed. **Finer scales** capture more detail, **increasing total length.**
- **Paradox** identified by **Lewis Fry Richardson.** Popularised by **Benoît Mandelbrot** in 1967 as **fractal-like geometry. Fractal dimension** measures how **complex a shape becomes as one zooms in.** The **smaller the measuring unit**, the **longer the calculated coastline.**

Sagarmatha Sambaad

Why in news: Union Minister for Environment, Forest and Climate Change represented India at the inaugural session of the **Sagarmatha Sambaad** in **Kathmandu, Nepal**.

- **Sagarmatha Sambaad** is a multi-stakeholder dialogue forum focused on addressing **global, regional**, and **national significance** issues. Theme of the summit was **'Climate Change, Mountains, and the Future of Humanity'**.
- India outlined a **five-point call** for global action to tackle **ecological challenges** in **mountainous regions**.

NCOPR Celebrates 25 Years

- **National Centre for Polar and Ocean Research** was established in **1998** (dedicated to country in 2000) as an autonomous institution under the **Ministry of Earth Sciences**. It consists of **13 members** representing the leadership in **Polar** and **Ocean Sciences**, with the **Secretary of the Ministry of Earth Sciences** as the ex-officio chairman.
- Supports India's stations in **Antarctica** (Maitri and Bharati), **Arctic** (Himadri), and the **Himalayas** (Himansh).
- Finance Ministry has **approved Maitri II**, India's newest research station in **eastern Antarctica**. Once built and ready by **2029**, **Maitri II** will become **India's fourth research base** in Antarctica with **Dakshin Gangotri** serving as a supply base.
- **Leads the Deep Ocean Mission**: A flagship initiative focused on exploring **deep-sea mineral resources**.
- **Aids in implementing India's Arctic Policy (2022)** and the **Indian Antarctic Act (2022)**:
  - The **Indian Antarctic Act** provides the legal framework for India's activities in Antarctica and establishes the **Committee on Antarctic Governance and Environmental Protection (CAG-EP)** to monitor international laws.
  - Arctic Policy is based 6 six pillars: Science & Research, Climate & Environmental Protection, Economic & Human Development, Transportation & Connectivity, Governance & International Cooperation, National Capacity Building.