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To The Point

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GS Paper 2 – Polity and Governance

Presidential Reference to Supreme Court: Clarifying Time Limits on Assent to State Bills


Context: In a landmark constitutional development, **President Droupadi Murmu** has invoked **Article 143** of the Indian Constitution, seeking the **Supreme Court's advisory opinion** on whether the **President and State Governors** must adhere to specific **timelines** while acting on **State Legislature Bills**.

Background: Delay in Assent and the 'Pocket Veto' Dilemma

Traditionally, **Governors** and the **President of India** are **not constitutionally bound** by a strict timeframe to assent to or return a Bill passed by a **State Legislature**. This has often led to **indefinite delays**, a practice informally known as a **"Pocket Veto"**—a term not mentioned in the Constitution but used widely in political and legal discourse.

Recent Supreme Court Verdict:

In a recent judgment, the **Supreme Court** addressed this ambiguity and ruled that **Governors cannot withhold or delay assent indefinitely**, especially after a Bill has been **re-passed** by the State Assembly.

Timelines Set by the Court:

- **One month** to act on **re-passed Bills**.
- **Three months** to act when **withholding assent** contrary to the **State Cabinet's advice**.

This ruling has triggered a deeper debate about the **judicial enforceability** of timelines on constitutional authorities and whether the **Supreme Court**, under **Article 142**, can compel the executive to act within set periods.

Article 142: Ensuring Complete Justice

Article 142 grants the Supreme Court the authority to **pass any decree or order** necessary to ensure **complete justice** in any case before it.

Significance of Article 142:

- Allows the Court to **fill legislative or executive gaps** in the interest of justice.
- Empowers the Court to protect **public interest**, **human rights**, and **constitutional values**.
- Enhances the Supreme Court's position as the **guardian of the Constitution**.

Criticism:

Some experts argue that **Article 142** can potentially **blur the separation of powers**, inviting concerns of **judicial overreach**.

Article 143: Presidential Consultation with the Supreme Court

Article 143 empowers the **President** to seek the **Supreme Court's advisory opinion** on **questions of law or fact** that are of **public importance**.

Key Features of Article 143:

- **Article 143(1)**: President may refer legal questions for the SC's opinion.
- The **Court's response is advisory**—not binding but carries **significant moral and legal weight**.
- Hearings must be conducted by a **Constitution Bench** of at least **five judges** (as per **Article 145(3)**).

Historical Context:

This provision has its roots in the **Government of India Act, 1935**, and has been used by the President **at least 15 times** since **1950**, including in high-stakes cases like:

- **The Ayodhya Land Dispute (1993)**
- **Punjab Termination of Agreements Act (2004)**

Why This Reference Matters: A Federal Turning Point:

This move is **not merely legal**—it is a **constitutional inflection point** for Indian federalism. It raises critical questions:

- Can the **judiciary impose accountability** on **constitutional functionaries**?
- Should there be **defined timeframes** for **executive decisions** on legislative actions?
- How can **democratic mandates** of state legislatures be safeguarded from **executive inaction**?

Conclusion: Shaping the Balance of Power

This Presidential reference to the Supreme Court under **Article 143** could **redefine the contours of executive discretion**, bolster **legislative sanctity**, and reinforce the **judiciary's role** in **upholding democratic processes**.

The **Supreme Court's opinion**, while not binding, could shape future legislation, encourage **governance reforms**, and set a precedent for **time-bound accountability** in state-centre relations.

GS Paper 2 – International Relation

India Raises Concern Over Pakistan's Nuclear Arsenal

Context: In a recent development, **India's Defence Minister** has raised serious concerns over the **security and accountability** of **Pakistan's nuclear arsenal**, urging that it be placed under the watch of the **International Atomic Energy Agency (IAEA)**. This move reflects growing regional and global anxieties about **nuclear safety** and the risk of **proliferation**.

Pakistan's Nuclear Posture: A Threat Without Restraint

Unchecked Expansion:

Pakistan became a **declared nuclear power in 1998**, following India's own nuclear tests. Since then, it has **rapidly expanded** its nuclear capabilities, with an estimated **170 nuclear warheads** today.

Unlike India, which adheres to a **No-First-Use (NFU) policy**, **Pakistan has no such declared restraint**, making its nuclear doctrine **opaque and unpredictable**.

Outside Global Norms:

Pakistan remains **outside the Nuclear Non-Proliferation Treaty (NPT)**, raising red flags globally, particularly because of:

- Past **nuclear proliferation links**, including the A.Q. Khan network.
- Lack of formal commitment to **disarmament principles** or **international verification mechanisms**.

NPT: A Framework Pakistan Rejects

The **Treaty on the Non-Proliferation of Nuclear Weapons (NPT)**, signed in **1968** and in force since **1970**, aims to:

- **Prevent nuclear weapon spread**.
- Promote **peaceful nuclear energy**.
- Facilitate **nuclear disarmament**.

Only five nations are recognized as **Nuclear Weapon States (NWS)** under this treaty. **India, Pakistan, Israel**, and **North Korea** have **not signed** the NPT, citing its **discriminatory nature**.

IAEA: Global Nuclear Watchdog

About the IAEA:

The **International Atomic Energy Agency**, established in **1957**, is the world's foremost body promoting **safe, secure, and peaceful use of nuclear energy**.

- **Headquarters**: Vienna, Austria
- **Members**: 180 countries (as of November 2024)
- **Motto**: *"Atoms for Peace and Development"*

Core Functions:

- **Safeguards & Verification**: Ensures that **nuclear materials are not diverted for weapons**.
- **Nuclear Safety & Security**: Supports nations in improving **nuclear standards** and countering **nuclear terrorism**.

- **Technical Cooperation**: Helps developing countries harness **nuclear technology** for health, agriculture, and energy.

The IAEA plays a vital role in **non-proliferation diplomacy**, especially in **inspections and monitoring** (e.g., in Iran's case).

India's Commitment to Responsible Nuclear Conduct:

India, though not an NPT signatory, has taken several steps to demonstrate **nuclear responsibility and transparency**:

- **Ratified the Additional Protocol (2014)**: Allows greater IAEA access to **India's civil nuclear program**.
- **Signed item-specific safeguards agreements** with the IAEA.
- **Joined key export control regimes**:
  - **Missile Technology Control Regime (MTCR)** – Joined in 2016.
  - **Wassenaar Arrangement** – Joined in 2017.
  - **Australia Group** – Joined in 2018.

India has also aligned its export controls with the norms of the **Nuclear Suppliers Group (NSG)**, although it remains **outside the group**, alongside Pakistan and Israel.

India-Pakistan Nuclear Installation Agreement:

In an effort to reduce nuclear risks, India and Pakistan signed the **Non-Nuclear Aggression Agreement (NAA)** in **1988**, effective from **1991**.

Key Provisions:

- **Annual exchange** of nuclear facility locations.
- Prevents **attacks on each other's civilian nuclear installations**.

However, this agreement:

- **Does not mandate** transparency in terms of **activities or capabilities**.
- **Lacks depth** in preventing broader military confrontations.

India has repeatedly called for **expanding the agreement** to include **civilian and economic infrastructure**, but **Pakistan has consistently refused**.

Why India is Concerned:

- **Strategic Instability**: Pakistan's lack of a **No-First-Use policy** heightens the risk of a **nuclear first strike** in a crisis.
- **Nuclear Brinkmanship**: Islamabad often uses its nuclear capability as a **deterrent** to **offset India's conventional military edge**.
- **Terror Risks**: Concerns persist about **internal security** in Pakistan, raising fears that **non-state actors** could potentially access nuclear materials.

Conclusion: A Call for Oversight and Dialogue

India's demand for **IAEA supervision** over Pakistan's nuclear arsenal is not just about bilateral rivalry—it is a **global call for accountability**. In an age where **nuclear risks** are rising due to **geopolitical tensions** and **terror threats**, greater **transparency, dialogue, and regional arms control** are essential for **long-term peace** in South Asia.

GS Paper 3 – Indian Economy

Account Aggregators: Laying the Foundation for India's Consent-Based Data Economy

Context: With the advent of the **Digital Personal Data Protection (DPDP) Act, 2023**, and the draft **DPDP Rules, 2025**, India is taking a transformative step toward **empowering individuals with control over their personal data**. A key pillar of this initiative is the **Account Aggregator (AA)** framework, which now serves as a **blueprint for developing Consent Managers (CMs)** under the new data protection regime.

What is an Account Aggregator (AA)?

An **Account Aggregator** is a **Non-Banking Financial Company (NBFC-AA)** regulated by the **Reserve Bank of India (RBI)**. It acts as a **digital bridge** between institutions that hold your financial data and those that need access to it — all based on your **explicit consent**.

Key Features:

- Operates on a **real-time, consent-based, and encrypted data-sharing system**.
- Acts as a conduit between:
  - **Financial Information Providers (FIPs)**: e.g., banks, mutual funds, insurance firms.
  - **Financial Information Users (FIUs)**: e.g., lenders, wealth advisors, insurers.
- **Does not store, modify, or analyze data** — it merely facilitates secure transfer.

How it Works:

1. A user links their bank accounts to an AA.
2. Provides **consent** to share specific data (e.g., bank statements) with a **FIU**.
3. The AA fetches the data from the relevant **FIP** and delivers it securely to the FIU.

Examples of Licensed AAs:

- **CAMS FinServ** – Backed by Computer Age Management Services.
- **PhonePe AA** – A subsidiary of PhonePe, utilizing its vast digital ecosystem.

Transitioning to the Consent Manager (CM) Framework under DPDP

The **DPDP Act, 2023** introduces the concept of **Consent Managers (CMs)** — entities entrusted with managing an individual's **consent lifecycle** in the data-sharing ecosystem.

Role of Consent Managers:

- Facilitate **consent collection, modification, and withdrawal**.
- Ensure secure data transfers between **Data Principals** (individuals) and **Data Fiduciaries** (organizations using data).
- Act as **trusted intermediaries**, much like AAs, but across all sectors, not just financial services.

Draft DPDP Rules, 2025: Key Proposals for Consent Managers

To build an effective and scalable CM ecosystem, the draft rules propose several foundational elements:

1. **Mandatory Registration:** Consent Managers must register with the **Data Protection Board (DPB)** to ensure oversight and regulatory compliance.
2. **Sector-Specific Consent Managers:** Encourages development of **domain-specific CMs** (e.g., for health, finance, education), provided they adhere to **common APIs and technical protocols**.
3. **Commercial Flexibility:** Allows CMs to **enter into business arrangements with Data Fiduciaries**, enabling sustainable business models while preserving user trust.

Why a Unified Consent Infrastructure Matters:

1. **Avoids Redundancy:** Aligning the **AA and CM frameworks** avoids duplication and unnecessary complexity across sectors.
2. **Boosts Efficiency:** Leverages the **proven efficiency** of the AA model, accelerating the nationwide rollout of **Consent Managers**.
3. **Fosters Innovation :** Empowers startups, fintechs, and public platforms to **develop secure, user-centric data-sharing services**.
4. **Supports Digital Public Infrastructure (DPI) :** Strengthens India's vision for a **secure, interoperable, and citizen-first digital ecosystem**, building on success stories like **UPI** and **DigiLocker**.

India's Moment to Lead in Data Empowerment:

India stands at the cusp of redefining global standards in **data protection and empowerment**. By **harmonizing the Account Aggregator model with the Consent Manager regime** under the DPDP framework, the country can establish a **scalable, transparent, and inclusive data governance system**.

This unified approach not only safeguards personal data but also unlocks massive potential for **digital innovation**, **financial inclusion**, and **user autonomy** in the digital age.

GS Paper 3 – Environment, Ecology, Biodiversity and Climate Change

Back From the Brink: Blyde Rondavel Flat Gecko Rediscovered After 34 Years

Context: In a thrilling breakthrough for conservation biology, the **Blyde Rondavel Flat Gecko**, a species that had gone unrecorded for over **three decades**, was **rediscovered in April 2025** in the rugged **Blyde River Canyon** of **Mpumalanga Province**, **South Africa**. This marks the first confirmed sighting of the elusive lizard since its initial discovery in **1991**.

About the Blyde Rondavel Flat Gecko:

- This **flat-bodied gecko** reaches a length of **8–9 cm** when fully grown.
- It is likely **rock-dwelling**, specially adapted to **cliff habitats and isolated rocky outcrops**, which contributes to its **elusiveness** and difficulty in detection.
- After its original discovery, the gecko vanished from all records, sparking fears of **extinction** and even **doubts about its taxonomic validity**.
- Due to the absence of sufficient data, it had been listed as **"Data Deficient"** by the **International Union for Conservation of Nature (IUCN)**.

Rediscovery Confirmed by the Endangered Wildlife Trust (EWT):

The rediscovery was made during a targeted **research expedition** by the **Endangered Wildlife Trust (EWT)** to an **inaccessible rocky escarpment** of the canyon—precisely the site where the species was first found.

This marks the **fifth successful rediscovery** of a species by EWT in recent years, joining an impressive list of once-thought-lost creatures, including:

- A **dune mole**, rediscovered after **80 years**,
- A **rare butterfly**,
- An **unrecorded lizard**, and
- A **frog species**, all of which had similarly disappeared from scientific sight.

A Victory for Conservation and Biodiversity:

The reappearance of the Blyde Rondavel Flat Gecko is a **testament to the importance of sustained fieldwork** in even the most inaccessible habitats. It also reaffirms the critical value of **protected ecosystems like the Blyde River Canyon**, which serve as refuges for unique and often overlooked species.

This rediscovery contributes to a growing list of so-called **"Lazarus species"**—organisms presumed extinct that reemerge, surprising scientists and conservationists alike.

Looking Ahead:

The find is expected to lead to:

- **New ecological studies** on the gecko's behavior and habitat,
- **Updated conservation assessments** by the IUCN, and
- **Heightened interest** in protecting other potentially hidden species in remote ecosystems.

It also serves as a **beacon of hope** for biodiversity conservation, proving that even in a rapidly changing world, **nature still holds secrets waiting to be uncovered**.

GS Paper 1 – Geography

India's Largest Conservation Reserve Declared in Himachal: Tsarap Chu Joins the Biodiversity Map

Context: In a significant step towards ecological preservation, the **Himachal Pradesh government** has officially **notified the Tsarap Chu Conservation Reserve** in the **Lahaul-Spiti region**, making it **India's largest conservation reserve** with an area of **1,585 sq. km**.

Strategic Location in the Cold Desert Biodiversity Hotspot:

Nestled in the remote trans-Himalayan terrain, **Tsarap Chu Conservation Reserve** shares its boundaries with:

- The **Union Territory of Ladakh** to the **north**,
- **Kibber Wildlife Sanctuary** and the **Malang Nala-Lungar Lungpa stretch** to the **east**,
- **Kabjima Nala** to the **south**, and
- The famed **Chandratal Wildlife Sanctuary** to the **west**.

This ecologically vital zone lies at the **confluence of the Unam River and Charap Nala**, acting as a **critical catchment area** for Charap Nallah.

Wildlife Corridor with Rich Biodiversity:

The reserve plays a **pivotal role as a wildlife corridor**, linking **Kibber** and **Chandratal** wildlife sanctuaries—ensuring **genetic flow** and **safe movement** of species across habitats.

It is recognized as one of **Himachal Pradesh's high-density snow leopard zones**. Alongside the elusive **snow leopard**, the region is home to:

- **Tibetan wolf**
- **Bharal** (*blue sheep*)
- **Himalayan ibex**
- **Kiang** (*Tibetan wild ass*)
- **Tibetan argali** (*Great Tibetan sheep*)

The skies of Tsarap Chu are no less impressive, featuring rare high-altitude avian species such as the:

- **Rose Finch**
- **Tibetan Raven**
- **Yellow-billed Chough**

Community-Driven Conservation Governance:

The reserve will be overseen by a **Conservation Reserve Management Committee**, which includes:

- **Forest department officials**
- **Wildlife experts**
- **Local Panchayat representatives**

This participatory model aims to **balance conservation goals with the livelihood needs** of the local communities, many of whom follow traditional **nomadic pastoralism**.

A Boost to Eco-Tourism and Scientific Research:

Given its unique landscape and rich fauna, the reserve is poised to:

- **Promote responsible eco-tourism**
- **Support high-altitude biodiversity studies**
- Encourage **youth-led conservation efforts** through community involvement and awareness campaigns.

Conclusion: A Landmark for India's Cold Desert Conservation

The creation of the **Tsarap Chu Conservation Reserve** marks a **new era in Himalayan ecosystem preservation**, showcasing how **biodiversity conservation, indigenous involvement, and ecological connectivity** can go hand in hand. It not only protects fragile mountain ecosystems but also strengthens **India's commitment to global biodiversity targets** under frameworks like the **Kunming-Montreal Global Biodiversity Framework (GBF)**.

GS Paper 3 – Science and Technology

India to Dive into the Depths: 'Samudrayaan Mission' Set for Launch by End of 2026

Context: In a landmark announcement, the **National Institute of Ocean Technology (NIOT)** has confirmed that **India's Samudrayaan Mission** will be launched by the **end of 2026**. This ambitious venture is part of the broader **Deep Ocean Mission (DOM)** and marks **India's entry into elite global club** of countries capable of **manned deep-sea expeditions**.

So far, only **five nations—the U.S., Russia, China, France, and Japan**—have achieved such underwater milestones.

Unveiling Matsya-6000: India's Deep-Sea Chariot

At the heart of Samudrayaan is **'Matsya 6000'**, a **4th-generation human-rated submersible vehicle** capable of diving to a **depth of 6,000 metres** (6 km).

Key Features of Matsya 6000:

- Developed by **NIOT-Chennai**, under the **Ministry of Earth Sciences**.
- Successfully completed **wet testing**.
- **Endurance:** 12 hours of standard operation and **up to 96 hours** in emergency mode.
- Designed to carry **three humans**, supported by life systems and scientific equipment.
- Constructed with **titanium alloy pressure hull**, suitable for extreme deep-sea pressure conditions (over 600 times atmospheric pressure).

Mission Objectives: More Than Just Exploration

The **Samudrayaan Mission** will open up vast possibilities in:

- **Deep-sea scientific research**
- **Mapping of marine biodiversity**
- **Exploration of polymetallic nodules**, rare-earth metals, and hydrothermal vents
- **Survey of deep-living biological resources** with potential pharmaceutical value
- **Development of ocean observation technologies**
- **Laying the foundation for deep-sea tourism and robotics**

This initiative will greatly enhance India's efforts to sustainably harness its **blue economy potential**, which already contributes nearly **4% to the national GDP**.

Deep Ocean Mission (DOM): Driving India's Blue Economy

About DOM:

- **Launched:** 2021
- **Tenure:** 5 years
- **Nodal Ministry: Ministry of Earth Sciences (MoES)**
- **Goal:** Develop **deep-sea technologies**, promote **resource assessment**, and ensure the **sustainable use** of the ocean's unexplored depths.

Objectives of DOM Include:

- Deep-sea mining and exploration of energy resources

- Mapping the ocean floor and biodiversity
- Creation of advanced marine infrastructure and underwater robotics
- Development of climate change forecasting tools
- Coastal and island community development

Why Samudrayaan Matters for India:

- Enhances **India's strategic capabilities** in the Indian Ocean region
- Supports **self-reliance** in ocean exploration technology
- Boosts **scientific innovation and marine education**
- Helps mitigate climate and ecological challenges through better ocean data

Conclusion: A Giant Leap into the Blue Frontier

With **Samudrayaan**, India is not just diving into the ocean—it's **diving into the future**. By integrating cutting-edge technology, environmental sustainability, and strategic marine development, the mission will place **India on the global map of deep-sea exploration**. This milestone aligns with the broader vision of **Atmanirbhar Bharat** and propels the nation toward **scientific sovereignty in marine exploration**.

GS Paper 3 – Science & Technology

Air Defence Systems: Safeguarding the Skies of India and the World

Context: In a significant demonstration of military preparedness, **India recently repelled aerial attacks** launched from Pakistan along the western front. In a strategic counteroffensive, **Indian forces successfully neutralized an enemy air defence installation** near Lahore. These events underscore the crucial role played by **air defence systems** in ensuring national security and deterrence.

Understanding Air Defence Systems:

Air Defence Systems form the backbone of a nation's aerial security, tasked with the detection, tracking, and elimination of hostile aerial threats such as **enemy aircraft, missiles, and drones**. These systems are typically composed of a **layered defensive architecture**, incorporating cutting-edge technology like **radars**, **missile interceptors**, **electronic warfare systems**, and **command-control networks**.

Core Components of Air Defence Mechanisms:

1. Detection and Surveillance:

- **Radar Systems**: Utilize high-frequency electromagnetic waves to **identify incoming targets**, even at long distances.
- **Satellite and Infrared Sensors**: Provide **high-resolution imaging** and **thermal tracking** to spot **stealth aircraft** and **hypersonic threats**.
- **Tracking and Threat Classification**: Algorithms assess object **speed, altitude**, and **flight path** to determine whether the intruder is a **fighter jet, drone**, or **missile**.

2. Command and Control:

- **Combat Operation Centers**: Evaluate threat levels and coordinate a **multi-layered response**, including missile interception or electronic warfare.

3. Engagement and Elimination:

- **Surface-to-Air Missiles (SAMs)**: Serve as the primary tool to destroy aerial threats at various ranges.
- **Electronic Warfare Systems**: Include **signal jammers** and **spoofers** to confuse or disable enemy radars and communications.
- **Anti-Aircraft Artillery**: Offers **close-range defensive firepower**, crucial during **saturation attacks** or when SAMs are not feasible.

Classification of Air Defence Systems:

Short-Range Air Defence (SHORAD):

- Designed for **low-altitude, close-proximity threats** like drones and cruise missiles. **Example**: **Barak-8 Missile System**

Medium-Range Air Defence (MRAD):

- Provides protection over **broader zones**, effective against **fighter aircraft and tactical missiles**. **Examples**: **Patriot Missile System**, **S-400 Triumf**

Long-Range Air Defence (LRAD):

- Capable of intercepting threats over **hundreds of kilometers**, including **intercontinental ballistic missiles (ICBMs)**.

  Examples: **THAAD**, **Aegis BMD**

India's Air Defence Arsenal:

Akash Missile System:

- Indigenous **Surface-to-Air Missile** system.
- Can engage multiple airborne targets with **command-guided precision**.
- Effective against **aircraft, cruise missiles**, and UAVs.

S-400 Triumf (From Russia):

- Among the world's most advanced LRAD systems.
- Intercepts threats at distances up to **400 km**.
- Capable of engaging **stealth aircraft, ballistic missiles, and drones**.
- Also deployed by **China** and **Turkey**.

Barak-8 Missile System (India-Israel Collaboration):

- **Quick-reaction interceptor** for aerial targets.
- Deployed on naval vessels and land-based launchers.
- Offers **360-degree coverage** against **supersonic threats**.

Integrated Counter-UAS Grid:

- Specialized system against **unmanned aerial threats (UAVs)**.
- Combines **radar detection**, **electronic jamming**, and **kinetic weapons** for neutralization.
- Deployed along **sensitive borders**, including the **Line of Control (LoC)**.

Notable Global Air Defence Systems:

Patriot Missile System (USA):

- Multi-role air and missile defence system.
- Used by **USA, Germany, Japan, Saudi Arabia**.
- Capable of intercepting **ballistic and cruise missiles**.

Iron Dome (Israel):

- Designed for **short-range interception**, highly effective against **rockets and artillery**.
- Widely used to **defend urban areas and military bases**.

- Demonstrated over **90% success rate** in combat situations.

THAAD (Terminal High Altitude Area Defense) – USA

- Intercepts **ballistic missiles in terminal phase**.
- Operates at **exosphere altitudes**, enhancing strategic coverage.
- Deployed in **South Korea, Japan, and Guam** for **regional deterrence**.

Aegis Ballistic Missile Defense (USA):

- Sea-based missile defence system installed on **Aegis-class destroyers**.
- Utilizes **Standard Missile-3 (SM-3)** for high-altitude interception.
- Integral to **NATO and Indo-Pacific** security strategies.

Additional Insights and Emerging Trends:

- **Hypersonic Threats**: Nations are now developing countermeasures against **hypersonic glide vehicles (HGVs)**, which travel at speeds exceeding **Mach 5** and can evade traditional radar.
- **AI in Defence**: **Artificial Intelligence** is increasingly used for **threat assessment, radar signal processing**, and **autonomous targeting**.
- **Multi-Domain Integration**: Modern air defence is moving towards **integration with space, cyber, and naval assets** for real-time threat coordination.

Conclusion:

As aerial threats evolve—from **swarms of drones** to **stealth bombers** and **hypersonic missiles**—nations must continually upgrade their air defence capabilities. **India's robust and modernizing air defence network**, integrated with **indigenous systems** and **global technology partnerships**, plays a pivotal role in maintaining national sovereignty and strategic deterrence.

GS Paper 3 – Economic Development

CCI Overhauls Cost Regulations to Tackle Predatory Pricing in Digital Markets

Context: In a significant regulatory shift, the **Competition Commission of India (CCI)** has issued the **"Determination of Cost of Production Regulations, 2025"**, replacing the older 2009 framework. This new regulation marks a critical update in India's antitrust oversight, specifically targeting **predatory pricing and deep discounting**, particularly in **e-commerce** and **quick-commerce sectors**.

Understanding the Context: Predatory Pricing and Market Fairness

Predatory pricing refers to the strategy of **selling goods or services at prices below production cost** with the intent to **undermine competition or drive rivals out of the market**. Under **Section 4 of the Competition Act, 2002**, such conduct is considered an **abuse of dominant position** and is subject to strict scrutiny by the CCI.

The now-superseded **Cost Regulations, 2009**, were developed in a pre-digital era and struggled to address the **complex economics of modern, platform-based markets**, where **cross-subsidies**, **free services**, and **non-cash value** have become common.

Highlights of the 2025 Cost Determination Framework:

1. Adaptive and Sector-Neutral Design:

- Moves away from the rigid **one-size-fits-all** structure.
- Allows **case-specific evaluations**, recognizing the **distinct dynamics of digital, retail, telecom**, and **tech-driven platforms**.

2. Focus on Internal Production Cost:

- Establishes **internal cost of production** as the benchmark for pricing analysis.
- **Rejects the use of market value** as a benchmark due to its reliance on **consumer perceptions, subsidies, or branding**, which may not reflect actual cost.

3. Aligned with Global Best Practices:

- Incorporates insights from **international competition authorities** and **modern economic theory**.
- Builds on evolving jurisprudence on **platform economies, network effects**, and **dynamic pricing models**.

4. Clear Framework for Evidence-Based Investigations:

- Offers the CCI a **standardized yet flexible approach** to assess pricing practices.
- Enables deeper scrutiny of **pricing algorithms**, **subscription bundles**, and **freemium models**.

Why This Matters: Implications for India's Competition Ecosystem

Legal and Regulatory Clarity:

- The 2025 regulations provide a **more objective and economically sound method** to determine cost benchmarks.
- Enhances legal certainty for firms operating in **highly competitive and tech-driven sectors**.

Digital Economy Focus:

- The framework explicitly considers **cross-subsidization**, **high fixed costs**, and **non-linear pricing strategies**—hallmarks of **startups and digital giants**.
- Enables CCI to effectively assess **zero-price markets**, like those offering **free apps or services**.

Level Playing Field for MSMEs:

- Protects **Micro, Small, and Medium Enterprises (MSMEs)** from being priced out by **loss-leading strategies** of dominant players.
- Encourages **fair competition** and **innovation** by ensuring **market access** for smaller businesses.

Better Enforcement Capacity:

- Empowers CCI to conduct **more precise, consistent, and data-driven investigations** into alleged anti-competitive pricing.
- Strengthens India's regulatory readiness in the face of **rapidly evolving digital business models**.

Global Context and Comparative Insight:

- **European Union** and **United States** regulators have also faced similar challenges in defining cost metrics in platform economies.
- Countries like **Australia and Japan** have adopted **dynamic tools** to regulate pricing in sectors such as **ride-sharing, e-retail**, and **online food delivery**.
- India's 2025 regulation brings it in line with **mature jurisdictions**, reinforcing its role as a **progressive antitrust authority** in the **Global South**.

Conclusion:

The **2025 Cost of Production Regulations** represent a forward-looking approach to **maintaining fair competition** in a rapidly digitizing economy. By modernizing its toolkit, the **CCI is better equipped to curb exploitative practices**, preserve consumer welfare, and protect **India's competitive digital landscape** from monopolistic abuse.

GS Paper 3 – Environment and Ecology

Invisible Scars: The Growing Threat of Gully Erosion

Context: A recent study published in *Scientific Reports* warns that **gully erosion**, a severe form of land degradation, poses a direct threat to the achievement of at least **nine out of the 17 Sustainable Development Goals (SDGs)**. It particularly endangers efforts related to **Zero Hunger (SDG 2)**, **Clean Water and Sanitation (SDG 6)**, and **Climate Action (SDG 13)**. Despite its devastating impact, this form of erosion remains **largely invisible in mainstream environmental policy and discourse**.

What is Gully Erosion?

Gully erosion occurs when **runoff water** aggressively cuts through the soil, creating **deep, narrow channels (gullies)** in the landscape. These gullies grow in size over time, often turning into ravines that can stretch for kilometers.

What makes gully erosion especially dangerous is its:

- **Depth and speed of land degradation**
- **Unpredictable progression**
- **Extremely high soil loss per unit area**, surpassing other erosion types

Unlike sheet or rill erosion, gully erosion is **difficult to reverse** and leaves **permanent scars** on the land.

The Global and Indian Landscape:

Worldwide Impact:

- **51 countries** have reported disasters directly linked to gully formation.
- **Nigeria** stands out, with **15 major locations** severely affected by this hazard.

India's Erosion Hotspots:

- Gully-affected areas span across **19 states and the National Capital Territory of Delhi**.
- **Severely impacted states**: **Jharkhand, Chhattisgarh, Madhya Pradesh**, and **Rajasthan**.
- In regions like **Bundelkhand**, expanding gullies are turning once-arable land into barren badlands.

What Drives Gully Erosion?

1. Loss of Vegetation Cover:

- **Tree felling** and degradation of grasslands weaken soil structure.
- Without plant roots to bind the soil, intense rainstorms quickly carve gullies.

2. Erratic Weather Patterns:

- **Prolonged droughts** followed by **heavy downpours** create ideal conditions for runoff-induced erosion.
- Climate change is amplifying this cycle, particularly in **semi-arid and sub-humid regions**.

3. Poor Waste Management:

- Dumping of **solid waste into natural drainage channels** causes blockages, diverting water flow and creating **high-pressure zones** that deepen gullies.

4. Fragile Soil Types:

- Regions with **sandy, loose, or lateritic soils**, like those in **Chhattisgarh and Jharkhand**, are especially prone to erosion under water pressure.

The Devastating Impacts:

1. Loss of Fertile Topsoil:

- The topmost layer of soil, rich in nutrients, is washed away—**crippling agricultural productivity**.
- Once lost, **it may take hundreds of years to regenerate**, threatening **food security and farmer livelihoods**.

2. Water Scarcity and Drought:

- Erosion **reduces groundwater recharge** and increases **surface runoff**, worsening water shortages and disrupting **local hydrological cycles**.

3. Ecological Damage:

- Gullies **fragment habitats**, reducing biodiversity and disturbing **native flora and fauna**.
- Leads to **decline in pollinator species** and the spread of **invasive plants** in degraded lands.

4. Sediment Overload in Rivers:

- Displaced soil ends up clogging **rivers, lakes, and reservoirs**, leading to **siltation, reduced water storage**, and **flooding risks** downstream.

The Way Forward: Strategies for Resilience:

1. Reforestation and Vegetative Barriers:

- **Planting native species** in erosion-prone catchments helps **stabilize soil and reduce runoff**.
- **Vetiver grass**, with its deep root system, has proven highly effective in controlling gully spread.

2. Sustainable Land Use Practices:

- Promote **terracing, agroforestry, contour bunding**, and **cover cropping** to adapt land management to **terrain and soil characteristics**.

3. Structural Interventions:

- Constructing **check dams**, **gabion walls**, and **gully plugs** helps to **slow down water flow**, allowing **sediment deposition and soil recovery**.

4. Community Involvement and Education:

- Involving **local communities**, especially **tribal and farming populations**, in **watershed management** enhances long-term impact.
- Awareness programs about the **economic and ecological costs of gully erosion** can change local land-use behavior.

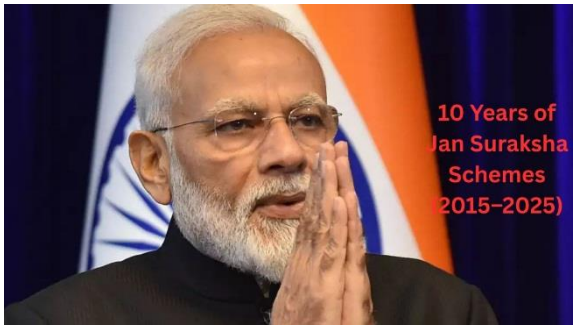
A National Call to Action:

India has pledged to restore **26 million hectares of degraded land by 2030** under its commitment to the **United Nations Convention to Combat Desertification (UNCCD)**. Addressing **gully erosion** must become a **central pillar of this restoration mission**.

This land degradation challenge is **invisible only until it is irreversible**. By integrating both **preventive and restorative approaches**, India can not only protect its landscapes but also secure **food, water, and livelihoods** for future generations.

GS Paper 2 – Governance, Social Justice, and Welfare Schemes

A Decade of Jan Suraksha: Strengthening India's Social Security Fabric



Context: India marks the **10th anniversary** of three path-breaking social security initiatives—**Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)**, **Pradhan Mantri Suraksha Bima Yojana (PMSBY)**, and **Atal Pension Yojana (APY)**. Launched in **2015** by **Prime Minister Narendra Modi**, these schemes have significantly advanced the goal of **universal financial protection**, especially for those in the **unorganised and economically vulnerable sectors**.

1. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY):

Empowering Families Through Life Insurance

- **Nature of Scheme**: A **one-year renewable life insurance scheme**, covering **death due to any cause**—natural or accidental.
- **Eligibility**: Open to individuals aged **18 to 50 years** who hold a **bank or post office account**.
    - Once enrolled before 50, coverage continues **until age 55**, subject to regular premium payments.
- **Benefits**:
    - **2 lakh** life cover
    - Annual premium: **436 only**
- **Impact**: With low premiums and broad eligibility, this scheme has become a **lifeline for low-income households**, ensuring **financial stability after the breadwinner's death**.
- **Fact Add-on**: Over **16 crore people** have enrolled in PMJJBY since its inception.

2. Pradhan Mantri Suraksha Bima Yojana (PMSBY):

Safeguarding Lives from Accidental Shocks

- **Nature of Scheme**: A **one-year renewable accidental insurance policy** providing coverage for **death or disability due to accidents**.
- **Eligibility**: Available to account holders aged **18 to 70 years**.
- **Benefits**:
    - **2 lakh** cover for accidental death or full disability
    - **1 lakh** for partial disability
    - Annual premium: **20 only**
- **Significance**: PMSBY ensures **quick financial assistance** in case of unforeseen accidents, especially vital for **daily-wage earners, farmers**, and those in **hazardous occupations**.
- **Fact Add-on**: PMSBY has seen **more than 34 crore enrollments** over the past decade.

3. Atal Pension Yojana (APY):

Pension for All: Security in Golden Years

- **Objective**: To provide a **guaranteed monthly pension** post-retirement to workers in the **unorganised sector** who lack formal pension coverage.

- **Administered by**: **Pension Fund Regulatory and Development Authority (PFRDA)** under the **National Pension System (NPS)** framework.
- **Eligibility**:
  - Bank account holders aged **18 to 40 years**
  - Applicants must **not be income tax payers** (as per current norms)
- **Pension Benefits**:
  - Fixed monthly pension of **1,000 to 5,000** starting at age **60**, based on age and contribution amount.
  - **Spouse receives the pension** after the subscriber's death.
  - On the death of both, **the nominee receives the accumulated pension corpus**.
- **Flexibility on Early Death**: Spouse can continue contributions if the subscriber dies before 60, to **retain pension eligibility**.
- **Women-Centric Impact**: A notable proportion of APY subscribers are **women**, highlighting its role in **women's financial empowerment**.
- **Fact Add-on**: As of 2024, **over 6 crore subscribers** have joined APY, with **more than 45% being women**.

Why These Schemes Matter: Transformative Impact:

1. **Affordable Protection for All:** The schemes offer **life, accident, and pension coverage** at **minimal premiums**, making them **accessible to even the poorest households**.
2. **Deepening Financial Inclusion:** By leveraging the **Jan Dhan bank account ecosystem**, these schemes have expanded the **reach of formal financial services** in **rural and underserved areas**.
3. **Boosting Insurance Penetration:** India's insurance landscape, once limited to urban elites, now includes **crores of rural workers and homemakers**, contributing to **inclusive financial resilience**.
4. **Gender Empowerment:** Schemes like **APY have seen higher participation from women**, helping them **secure their future** and build **economic independence**.

Looking Ahead: Strengthening the Social Safety Net:

As India celebrates a **decade of Jan Suraksha**, the journey so far showcases the power of **policy-driven inclusion**. However, to ensure these schemes reach every eligible citizen:

- **Awareness campaigns** must be expanded in remote areas.
- **Premium collection mechanisms** should be streamlined.
- Digital integration can reduce **claim settlement delays**.
- Focus must also shift to **increasing contribution rates** in APY to ensure higher pension payouts.

Conclusion: The **Jan Suraksha schemes** are more than just insurance and pension programs—they are a **shield against life's uncertainties** for millions. Over ten years, they have laid the foundation of a **robust social protection architecture** for India's working class, especially in the unorganised sector.

As the nation moves forward, the goal must be to **consolidate achievements**, **address operational bottlenecks**, and **deepen coverage**, ensuring that **no citizen is left without a basic social safety net**.

Methane: The Silent Accelerator of Global Warming

Context: According to the **International Energy Agency's (IEA) Global Methane Tracker 2025**, the global **energy sector** released around **145 million tonnes (Mt)** of methane in **2024**. Of this, **oil and gas facilities alone contributed over 80 Mt**, making them the largest culprits in energy-related methane emissions.

What is Methane?

Methane (CH_4) is a **colourless**, **odourless**, and **highly flammable gas**, commonly referred to as **marsh gas**. Although it stays in the atmosphere for only about **10 years**, it is **over 80 times more potent than carbon dioxide (CO_2)** in terms of **global warming potential (GWP)** over a 20-year period.

Key Characteristics:

- **Short atmospheric lifespan**: ~10 years
- **Global Warming Potential**: ~80x more than CO_2 (over 20 years)
- **Primary sources**: ~60% from human activity, ~40% from natural sources like **wetlands**, **permafrost thawing**, and **volcanic activity**

Anthropogenic Sources of Methane Emissions:

1. Energy Sector – A Leading Contributor:

The **energy industry** accounts for **over 35%** of human-induced methane emissions, making it the **largest industrial source**.

Breakdown within the Energy Sector:

- **Oil production**: ~**45 Mt**
- **Natural gas operations**: ~**35 Mt**
- **Coal mining activities**: Over **40 Mt**, including **4 Mt** from **abandoned mines**
- **Abandoned oil & gas wells**: ~**3 Mt**
- **Bioenergy (traditional biomass)**: ~**18 Mt** — largely from **wood**, **dung**, and **charcoal** in developing countries
- **Modern bioenergy** (like **biogas**, **biofuels**, and **biomethane**): ~**2 Mt**
- **End-use equipment leakage**: Contributes an extra ~**2 Mt**

2. Agriculture – Livestock and Rice Cultivation:

Agriculture is another **major emitter** of methane, primarily through:

- **Enteric fermentation** in livestock (especially cattle)
- **Manure management**
- **Flooded rice fields**, which produce methane due to anaerobic conditions

India and China are among the **top agricultural methane emitters**, given their large livestock populations and extensive rice cultivation.

3. Waste Sector – Landfills and Wastewater:

- Organic waste in **landfills** and **wastewater treatment plants** decomposes anaerobically, emitting significant amounts of methane.

Methane's Role in Climate Change:

Methane is responsible for nearly **30% of global warming** since the **Industrial Revolution**. Its **atmospheric concentration is now 2.5 times higher** than pre-industrial levels and continues to **increase at an alarming rate**.

Studies show that methane concentrations are **rising faster than any other greenhouse gas**, underscoring its critical role in near-term climate action.

Tackling the Methane Challenge:

Mitigation Potential:

The IEA emphasizes that:

- **~70%** of fossil fuel-related methane emissions can be **prevented using existing technologies**.
- In the **oil and gas sector**, **~75% of emissions** could be cut by **fixing leaks**, improving infrastructure, and **plugging abandoned wells**.

Top Emitters from Fossil Fuels:

- **China**
- **United States**
- **Russia**
- **Iran**
- **Turkmenistan**
- **India**

Global Response:

- **Global Methane Pledge**: Over 150 countries, including India, have committed to collectively **reduce methane emissions by 30% by 2030**, relative to 2020 levels.
- **Technological Interventions**: Satellites like **GHGSat** and **Copernicus Sentinel-5P** are now being used to **track methane hotspots** and **support enforcement efforts**.

Conclusion: Urgency for Action

Methane may be invisible, but its impact on our climate is immense. With its **high warming potential** and **short lifespan**, cutting methane is one of the **fastest and most cost-effective ways** to slow down global warming in the near term.

To meet global climate goals, particularly the **1.5°C target** of the **Paris Agreement**, **governments, industries, and communities** must act swiftly to **monitor, regulate, and reduce methane emissions** across sectors.

Manas National Park: A Jewel of the Eastern Himalayas

Context: In a disturbing development, **three individuals have been arrested** for their alleged involvement in the **killing of three wild elephants** inside **Manas National Park**, Assam. The incident has sparked serious concern among conservationists, given the park's status as a critical wildlife habitat and UNESCO site.

Where Nature Meets Conservation: An Overview

Nestled in the **foothills of the Eastern Himalayas** in **Assam**, **Manas National Park** covers a sprawling area of **950 sq.km** and shares its northern boundary with **Bhutan's Royal Manas National Park**. The seamless ecosystem across international borders makes it a vital transboundary conservation zone.

The park derives its name from the **Manas River**, a major tributary of the **Brahmaputra**, which not only nourishes the ecosystem but also serves as the **international boundary between India and Bhutan**. As the river flows into the plains, it splits into the **Beki** and **Bholkaduba** rivers.

Unique Conservation Designations:

Manas is one of the **most prestigious protected areas in India**, having earned multiple conservation titles:

- **UNESCO Natural World Heritage Site** (since 1985)
- **Project Tiger Reserve** (since 1973)
- **Elephant Reserve**
- **Biosphere Reserve**
- **Important Bird Area (IBA)**

It is part of a vast **tiger conservation landscape**, interconnected with other reserves like **Buxa, Nameri, Pakke, and Namdapha**, along with Bhutan's and Myanmar's protected forests — forming a cross-border wildlife corridor.

Topography and Biodiversity:

The park's **altitude ranges from 60 to 1,500 meters**, creating a highly diverse landscape. From lush **tropical forests** to **riverine grasslands**, the variety of ecosystems supports an astonishing range of flora and fauna.

Flora:

Manas is botanically rich, featuring:

- **Sal forests** (Shorea robusta)
- **Semi-evergreen forests**
- **Deciduous forests**
- **Riparian vegetation**
- **Interspersed grasslands and scrublands**

Prominent tree species include **Hoolong**, **Amari**, **Dewa Sam**, **Garjan**, and **Himolu**. The buffer zones also contain patches of older plantations.

Fauna: A Sanctuary for Endangered Species

Manas is renowned for hosting **rare and endemic wildlife**, some of which are **critically endangered**:

- **Hispid Hare**
- **Pygmy Hog** (world's smallest and rarest pig species)
- **Golden Langur** (found only in Bhutan and Assam)
- **Asiatic Buffalo**
- **Indian Rhinoceros**
- **Clouded Leopard**
- **Sloth Bear**
- **Leopard Cat**
- **Bengal Florican** (critically endangered bird)
- **Tiger** (flagship species of the park)

It also supports over **450 bird species**, making it a haven for bird watchers and ornithologists.

Cultural Ties: Indigenous Communities and Conservation:

The park is home to **indigenous communities**, especially the **Bodo people**, who have long-standing ties with the forest. Their traditional knowledge and practices play a key role in **community-based conservation**. Efforts have been made to integrate local participation through **eco-tourism**, **anti-poaching units**, and **forest stewardship programs**.

Challenges and Conservation Efforts:

Despite its prestige, Manas has faced **poaching**, **encroachment**, and **militancy-related disruption**, particularly in the early 2000s. However, significant conservation efforts since then have **revived wildlife populations**, especially tigers and rhinos.

Recent Initiatives:

- Deployment of **smart patrolling systems**
- Collaboration with **WWF and local NGOs**
- Use of **camera traps** for monitoring tigers
- **Translocation of rhinos** from Kaziranga to Manas as part of the Indian Rhino Vision 2020

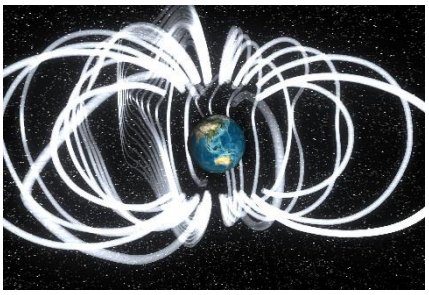
Conclusion: A Living Legacy That Must Be Protected

Manas National Park is more than just a biodiversity hotspot — it is a **symbol of India's conservation ethos** and **transboundary ecological cooperation**. As threats like **poaching and habitat degradation** continue to loom, it's crucial to strengthen community-led conservation, enhance patrolling, and implement stricter protection protocols.

Safeguarding Manas is not just about saving wildlife — it's about preserving the **ecological integrity of the Eastern Himalayas** for future generations.

GS Paper 3 – Science & Technology

Magnetic Flip-Flop: Earth's Magnetic Field in Flux



Context: Recent research has raised alarm bells across the scientific community as Earth's **magnetic field** continues to show signs of **weakening and shifting**. These fluctuations hint at the possibility of a **magnetic excursion** or even a **complete polarity reversal** — an event that could have widespread implications for our planet and its inhabitants.

What Powers Earth's Magnetic Field?

Earth's **magnetic field** originates from the **dynamo action** in the **liquid outer core**, where **molten iron and nickel** circulate due to **thermal and rotational forces**. This constant churning creates a **dipolar magnetic field**, with magnetic north and south poles roughly aligned with the planet's rotational axis.

- The **solid inner core** plays a stabilizing role, anchoring this dynamo effect.
- Earth's rotation enhances the **Coriolis effect**, further influencing the magnetic field's structure.

What Triggers a Magnetic Reversal?

Short-Term Variations:

- Caused by interactions with **solar winds** and **charged particles** from space.
- These changes occur over **milliseconds to days** and are typically localized.

Long-Term Variations:

- Result from **turbulent flows** in the outer core, influenced by **heat loss** from the inner core and **planetary rotation**.
- A **full reversal** occurs when the flow pattern in the outer core changes dramatically — potentially switching from **clockwise to anticlockwise** — altering the overall field orientation.

Magnetic Reversals vs. Excursions:

Magnetic Reversals:

- Involve a complete swap of the **magnetic north and south poles**.
- Have occurred **183 times in the last 83 million years**.
- The last known full reversal, the **Brunhes-Matuyama reversal**, happened approximately **780,000 years ago**.
- Reversals are **gradual processes**, typically taking **thousands to tens of thousands of years** to complete — average estimate: **22,000 years**.

Magnetic Excursions:

- Represent **temporary, incomplete shifts** in the magnetic field direction.
- Occur **ten times more frequently** than full reversals.
- Notable events include:
  - **Norwegian-Greenland Sea Excursion** (~64,500 years ago)
  - **Laschamps and Mono Lake Excursions** (~34,500 years ago)
  - **Bagwalipokar Excursions** (found in Uttarakhand, India): 15,500–14,700 years ago and 8,000–2,850 years ago.

Why Should We Be Concerned?

1. Atmospheric Exposure:

During weak phases, the **magnetic field's shielding capability diminishes**, making Earth's atmosphere more vulnerable to **solar wind**, **cosmic rays**, and **radiation storms**. This increases risks such as:

- **Ozone layer depletion**
- Enhanced **auroras at lower latitudes**
- Potential **climate disturbances**

2. Technological Vulnerabilities:

In our increasingly digital world, magnetic instability could:

- **Disrupt GPS**, satellite operations, and **radio communications**
- Affect **airline navigation** and **military systems**
- Cause **blackouts** in power grids due to induced currents from solar storms

3. Impact on Wildlife:

Many species use **geomagnetic cues** for navigation. A shifting or reversing field may:

- **Confuse migratory animals** like birds, turtles, and whales
- Disrupt breeding patterns and nesting behaviors
- Pose a threat to **ecosystem stability**

Did You Know?

- A region called the **South Atlantic Anomaly**, stretching from South America to Africa, is experiencing an **unusual weakening of the magnetic field**, possibly hinting at an ongoing excursion.
- The **magnetic north pole** is drifting at unprecedented speeds — moving from **Canada toward Siberia** at a rate of 50–60 km per year.
- Despite the concerns, fossil and geological records suggest that **life has persisted** through past reversals with **no mass extinctions** directly linked to them.

Conclusion: Preparing for the Unknown

Though **magnetic reversals** are a natural part of Earth's geological history, the **timing and triggers** remain difficult to predict. As we continue to unravel the mysteries of Earth's inner workings, it's vital to **monitor field behavior closely**, enhance our **technological resilience**, and invest in **space weather preparedness**.

In a world increasingly reliant on electromagnetic systems, understanding Earth's **invisible shield** is not just a scientific pursuit — it's a **necessity for global stability and security**.

GS Paper 2 – Governance & Social Justice

India's Total Fertility Rate Holds Steady at 2.0: A Demographic Turning Point

Context: According to the **Sample Registration System (SRS) Statistical Report 2021**, released by the **Registrar General of India (RGI)**, **India's Total Fertility Rate (TFR)** remained constant at **2.0** in 2021—unchanged from 2020. This marks a critical juncture in India's demographic journey as the country approaches **replacement-level fertility**.

The report was compiled using data from **8,842 sample units** across all Indian states, covering a population base of approximately **84 lakh people**.

Understanding the Sample Registration System (SRS):

The **Sample Registration System** is India's principal source for **vital statistics** such as **birth rate**, **death rate**, and **infant mortality rate**. Key features include:

- **Dual Record System**: Data is collected via continuous enumeration by part-time enumerators, followed by **six-monthly retrospective surveys** conducted by supervisors.
- **Sample-Based Approach**: Covers **rural villages and urban blocks**, making it **cost-efficient** and **statistically robust**.

What is Total Fertility Rate (TFR)?

Total Fertility Rate refers to the **average number of children** a woman is expected to have during her reproductive years (15–49 years). A TFR of **2.1** is considered the **replacement level**, which ensures a **stable population** in the absence of migration.

Key Findings of the 2021 Report:

1. State-Wise Variation:

- **Highest TFR**: **Bihar** at **3.0**
- **Lowest TFRs**: **Delhi** and **West Bengal** at **1.4**

2. Demographic Shifts (1971–2021):

- **Children (0–14 years)**: Declined from **41.2%** to **24.8%**, indicating a shrinking young population.
- **Working-age Population (15–59 years)**: Increased from **53.4%** to **66.2%**, offering a **demographic dividend**.
- **Elderly Population (60+ years)**: Rose from **6%** to **9%**; **Kerala** has the highest elderly proportion at **14.4%**.
- **Mean Age at Effective Marriage (Females)**: Increased from **19.3 years** in 1990 to **22.5 years** in 2021.

Why It Matters: The Significance of a 2.0 TFR

Population Stabilization:

- India is edging closer to **demographic equilibrium**, reducing future strain on **resources**, **infrastructure**, and the **environment**.

Harnessing the Demographic Dividend:

- With a larger **working-age population**, India is well-positioned for **economic expansion** and increased **labour productivity**, provided that job creation and skill development keep pace.

Improved Health Indicators:

Fewer childbirths per woman and delayed marriages contribute to:

- **Lower maternal mortality**
- **Healthier children**
- **Stronger family well-being**

Empowerment of Women:

- A declining TFR often reflects **higher female literacy**, **employment**, and **autonomy**, reinforcing progress toward **gender equality** and **social development**.

Challenges of a Declining Fertility Rate:

Rising Elderly Burden:

A growing **senior citizen population** means increased pressure on:

- **Pensions and retirement systems**
- **Healthcare services**
- **Social protection schemes**

Risk of Skewed Sex Ratios:

- In areas with **persistent gender bias**, falling fertility without social reforms may **intensify sex-selective practices**, resulting in **imbalanced demographics**.

Interstate Demographic Disparities:

The gap between **high-fertility** and **low-fertility** states may drive:

- **Migration surges**
- **Cultural and linguistic shifts**
- **Resource allocation conflicts**

Global and Historical Perspective:

- **Global Average TFR**: Around **2.4** as of 2020, according to the UN.
- Countries like **Japan (1.3)** and **South Korea (0.72)** now face **population decline** and **economic stagnation**, highlighting the long-term risks of sub-replacement fertility.
- **India's experience mirrors global trends**, but its **diversity across states** requires region-specific responses.

Conclusion: A Critical Window of Opportunity

India's stable **Total Fertility Rate of 2.0** signals the **onset of population stabilization**, a historic demographic transition. However, this milestone brings both **opportunities** and **risks**.

To fully leverage the **demographic dividend** and prepare for an ageing population, India must:

- Invest in **healthcare and social security**
- Strengthen **education** and **employment** avenues
- Promote **gender equality** and reduce **regional disparities**

The road ahead demands a **balanced and forward-looking approach**, ensuring that this demographic shift leads to a **resilient, inclusive, and prosperous future**.

GS Paper 1 – Geography

Democratic Republic of the Congo: Floods and Strategic Significance in Central Africa

Context: Recent **devastating floods** have struck the **eastern region** of the **Democratic Republic of the Congo (DRC)**, particularly near the shores of **Lake Tanganyika**. These floods have displaced thousands and underscored the region's **vulnerability to climate change**, poor infrastructure, and ongoing humanitarian challenges. The affected areas lie near the borders with **Burundi**, **Tanzania**, and **Zambia**, intensifying regional concerns.

Geopolitical Importance of the DRC:

Location and Borders:

Situated in the heart of **Central Africa**, the **Democratic Republic of the Congo** is the **second-largest country in Africa** (after Algeria) by land area. It shares land borders with **nine countries**:

- **North**: **Central African Republic (CAR)**, **South Sudan**
- **East**: **Uganda**, **Rwanda**, **Burundi**, **Tanzania**
- **South**: **Zambia**
- **West**: **Angola**, **Republic of the Congo (RoC)**

It also has a narrow strip of coastline along the **Atlantic Ocean**, giving it **maritime access**—a rare advantage for a mostly landlocked region.

Capital City: **Kinshasa**, one of the **largest French-speaking cities** in the world, lies on the banks of the **Congo River**, directly opposite **Brazzaville**, the capital of the **Republic of the Congo**.

Physical and Environmental Features:

Tropical Climate and Equatorial Position:

- The DRC experiences a **humid tropical climate**, as the **Equator runs through** the country. This leads to high rainfall, especially in the **Congo Basin**, and fosters some of the world's richest biodiversity.

The Congo River System:

- The **Congo River**, the second-longest river in Africa and the **deepest river in the world**, is vital for **transport**, **fishing**, and **hydroelectricity**. Notably, it **crosses the Equator twice**, a rare geographic feature.

The Congo Basin: Africa's Green Lungs:

The DRC lies at the core of the **Congo Basin**, the world's **second-largest tropical rainforest** after the Amazon. Spanning about **500 million acres**, the basin covers parts of six countries:

- **DRC**
- **Cameroon**
- **Central African Republic**
- **Republic of the Congo**

- **Equatorial Guinea**
- **Gabon**

It contains **the world's largest tropical peatlands**, crucial carbon sinks that store more than **30 billion tonnes of carbon**. The degradation of these ecosystems could dramatically accelerate **global warming**.

Natural Wealth and Strategic Minerals:

The DRC is endowed with a **vast range of natural resources**, making it a **global hotspot for mining and geopolitics**:

- **Cobalt**: The DRC produces over **70% of the world's cobalt**, a critical component for **lithium-ion batteries** used in **electric vehicles** and **renewable energy storage**.
- **Copper, Gold, Diamonds, Iron Ore, and Tin**: Abundant but often exploited through **informal or conflict-linked mining**.
- **Lithium and Rare Earths**: Gaining international attention as countries shift to **clean energy transitions**.

However, despite this mineral wealth, **poverty, political instability, and conflict** remain prevalent, especially in **eastern provinces**.

Additional Insights:

- The DRC is part of the **African Great Lakes region**, with lakes like **Tanganyika**, **Albert**, and **Edward** forming part of its eastern geography.
- The country is rich in **biodiversity**, hosting endangered species such as the **mountain gorilla**, **forest elephants**, and the **okapi** (a unique forest-dwelling giraffid found only in the DRC).
- The **Virunga National Park**, a UNESCO World Heritage Site, is Africa's oldest national park and a crucial sanctuary for **gorillas** and **other megafauna**.

Conclusion:

The **Democratic Republic of the Congo** remains a **geopolitically and environmentally pivotal nation**. While the recent floods near **Lake Tanganyika** highlight its **climate vulnerability**, its **strategic location**, **immense mineral wealth**, and **ecological significance** make it central to both **African development** and **global environmental sustainability**.

As the world moves toward a **green economy**, the DRC's future will increasingly shape global conversations on **resource justice**, **biodiversity protection**, and **sustainable development**.

GS Paper 3 – Economy & Agriculture

Why Indian Farmers Still Favour Rice and Wheat

Context: Despite rising discussions around **crop diversification** and environmental sustainability, a majority of Indian farmers continue to rely on **rice and wheat**. This preference is rooted in a complex blend of **economic security**, **government policy**, **ecological suitability**, and a **historical legacy** shaped by the **Green Revolution**.

India's Rice and Wheat Landscape (2024–25):

- **Wheat**: Estimated production stands at **122.7 million tonnes**, grown over **330.8 lakh hectares**.
    - Key wheat-producing states: **Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab, Haryana, Bihar, Gujarat**, and **Maharashtra**.
- **Rice**: Annual output exceeds **120 million tonnes**, with cultivation spread across **Kharif and Rabi seasons**.
    - Leading rice producers include **West Bengal, Uttar Pradesh, Punjab, Andhra Pradesh**, and **Tamil Nadu**.

Why Rice and Wheat Remain the Farmer's First Choice:

1. Government Support and Economic Assurance:

- **Minimum Support Price (MSP)**: Rice and wheat are among the few crops with **assured procurement**, ensuring **financial security** even when market prices are volatile.
- **Public Distribution System (PDS)**: Sustained demand for rice and wheat through welfare schemes like **PMGKAY** (Pradhan Mantri Garib Kalyan Anna Yojana) ensures a **stable market** for these grains.

2. Legacy of the Green Revolution:

- The 1960s Green Revolution introduced **semi-dwarf, high-yielding varieties** of wheat and rice, transforming these into **high-return crops**.
- These varieties responded exceptionally to **fertilizers and irrigation**, making them **low-risk and high-reward** for farmers, especially in **Punjab, Haryana**, and **western UP**.

3. Yield Stability and Irrigation Infrastructure:

- Both crops are extensively grown in **irrigated zones**, which reduces dependency on erratic monsoons.
- **Continuous research** and **public sector breeding programs** have improved their resilience to pests and diseases.
- Use of **hybrid rice varieties** and **mechanized farming** practices further boosts productivity.

4. Food Security and Strategic Importance:

- Rice and wheat are **cornerstones of India's food security framework**, forming the base of national buffer stocks and emergency reserves.
- Their strategic role in maintaining **price stability**, avoiding **food inflation**, and supporting **nutrition programs** keeps them in policy focus.

Technological Innovations: Making Rice More Sustainable

- India has developed **two genome-edited rice varieties** using **CRISPR-Cas9** techniques, improving:
  - **Yield potential**
  - **Drought resistance**
  - **Nitrogen-use efficiency**
- These varieties also aim to **cut methane emissions** and reduce **groundwater consumption**, making rice farming more **climate-smart**.

Challenges Confronting Rice and Wheat Cultivation:

1. Climate Vulnerability:

- Rising **temperatures**, **heat waves**, and **unseasonal rainfall** are threatening productivity.
- **Heat stress** during the flowering and grain-filling stages leads to **lower yields** and **grain quality deterioration**.

2. Water Crisis:

- **Rice** is extremely **water-intensive**, requiring over **3,000–5,000 litres of water per kg**.
- Continuous cultivation in **Punjab** and **Haryana** has led to **alarming groundwater depletion**.
- Wheat is also heavily dependent on **canal and tube well irrigation**.

3. Changing Food Preferences:

- Despite high production, **domestic cereal consumption has plateaued** at around **150 million tonnes** per year.
- Urban diets are shifting towards **protein-rich and diversified foods**, challenging the long-term demand projections for rice and wheat.

Why India Needs to Encourage Alternative Grains:

1. Climate Resilience and Environmental Gains:

- Crops like **millets**, **sorghum (jowar)**, **maize**, and **pulses** are more **drought-tolerant** and require less water.
- They emit **fewer greenhouse gases** compared to flooded rice fields, thus lowering **agriculture's carbon footprint**.
- Studies suggest that **reallocating some rice acreage** to climate-resilient crops could reduce **climate-induced production losses by up to 11%**.

2. Economic Incentives for Diversification:

- Farmers are **price-sensitive**, and shifting away from wheat and rice demands **assured returns** and **market access**.
- **Price support**, **insurance coverage**, and **direct procurement** of alternative crops are crucial to incentivize change.

3. Strengthening Supply Chains:

- Developing **processing units**, **cold chains**, and **storage infrastructure** for alternative grains can help build **stable markets** and reduce **post-harvest losses**.
- Public awareness campaigns and **branding of millets** as **nutri-cereals** can boost consumer demand, especially in urban areas.

Conclusion: A Balanced Path Forward:

While the dominance of **rice and wheat** in Indian agriculture is grounded in **security and familiarity**, the looming **climate crisis**, **water stress**, and **changing food patterns** demand a **rethinking of cropping choices**.

Policy makers must strike a balance: continue supporting essential cereals for food security while **actively promoting sustainable and climate-resilient crops** through **economic support**, **infrastructure development**, and **market creation**.

GS Paper 3 – Environment and Ecology

CAQM Rolls Out 19-Point Action Plan to Eliminate Stubble Burning in Delhi-NCR

Context: Each winter, the **Delhi-NCR region** faces a suffocating haze, with **stubble burning** in neighboring states being a key contributor. In response, the **Commission for Air Quality Management (CAQM)** has launched an ambitious **19-point action plan** aimed at permanently addressing this issue.

What Is the CAQM?

The **Commission for Air Quality Management in National Capital Region and Adjoining Areas Act, 2021** established CAQM as a **statutory body** to manage air quality through a **centralized, coordinated mechanism**. It covers **Delhi, Punjab, Haryana, Rajasthan**, and **Uttar Pradesh**, and aims to:

- Develop a **permanent and integrated framework** for pollution control.
- Replace the earlier fragmented system involving **multiple overlapping agencies**.
- Ensure **inter-state coordination**, especially during peak stubble-burning seasons.

Key Highlights of the 19-Point Strategy:

1. Comprehensive Farm-Level Monitoring:

- **Mapping of All Agricultural Fields** to monitor stubble management methods.
- Deployment of **one nodal officer for every 50 farmers** to ensure localized supervision and accountability.

2. Dual Approach to Stubble Management:

In-Situ Management (on-site treatment):

- Use of **bio-decomposers**, **happy seeders**, and **mulching machines** to decompose residue in the soil.

Ex-Situ Management (off-site use):

- **Baling, collection**, and **transportation** of paddy straw to **power plants**, **packaging industries**, **brick kilns**, and **paper mills**.
- Launch of a **pilot project** where a **common industrial boiler** using paddy straw will be tested to **supply steam**, creating a circular economy model.

3. Infrastructure and Logistics Planning:

- **Gap analysis** of Crop Residue Management (CRM) machinery at the state level.
- Creation of **district-level straw supply chains** to ensure effective transport and use.
- **Storage planning** to prevent losses from fire and decay of baled straw.

4. Crop Diversification and Long-Term Solutions:

- Encourage **crop diversification** to reduce dependency on **non-basmati paddy**, a major source of residue.
- Promote alternative crops like **maize**, **millets**, and **pulses**, which produce significantly less stubble and are **climate-resilient**.

Enforcement, Oversight, and Accountability:

5. Legal and Administrative Oversight:

- Formation of **state-level task forces** headed by **Chief Secretaries**, as directed by the **Supreme Court**.
- **Monthly compliance reports** starting **June 1, 2025**, to track progress.

6. Real-Time Digital Surveillance:

- Launch of a **real-time online platform** for **live crop residue data reporting**.
- Citizens empowered to report violations through **dedicated mobile applications**.

7. Creation of a 'Parali Protection Force':

- A special force at the **district and block level** comprising **police personnel**, **agriculture officers**, and **administrative officials**.
- **Intensified evening patrols** during the stubble-burning season.
- **Community-based reporting** and **reward mechanisms** for whistleblowers.

8. Penalties and Red Entries:

- Non-compliance will result in **monetary fines**, and farmers could face **'red entries'** in land records—a significant deterrent for repeat offenders.
- Escalation of penalties for repeat violations and establishment of **grievance redressal cells** for farmers with genuine concerns.

Why This Plan Matters: Broader Impact and Added Facts

- **Stubble burning contributes up to 35% of PM2.5 pollution** in Delhi during peak season, worsening respiratory health.
- India loses an estimated ₹**2 lakh crore annually** in productivity and healthcare due to air pollution.
- The move aligns with India's **climate commitments under the Paris Agreement**, as reducing crop-burning also helps cut **methane and carbon emissions**.

Conclusion: A Sustainable Step Toward Cleaner Air

The **CAQM's 19-point plan** marks a strategic shift from reactive firefighting to **proactive, systemic reform** in combating **agricultural residue burning**. By combining **technology**, **infrastructure**, **community engagement**, and **legal enforcement**, this initiative aspires to deliver **tangible air quality improvements** not only in Delhi-NCR but also across northern India.

6 Bhimgad Wildlife Sanctuary: A Biodiversity Haven Under Threat

Context: Conservationists are raising red flags over growing **human intrusion** into the **Eco-Sensitive Zone (ESZ)** surrounding the **Bhimgad Wildlife Sanctuary (BWS)** in Karnataka. This **unauthorized activity** not only violates environmental norms but also poses a grave risk to one of the **richest ecological landscapes** in the Western Ghats.

Understanding Eco-Sensitive Zones (ESZs):

Eco-Sensitive Zones serve as protective **buffer zones**—extending up to **10 km** from the boundary of protected areas like national parks and wildlife sanctuaries. These zones aim to **minimize the impact of human activities** on core ecosystems.

Declared under the **Environment (Protection) Act, 1986**, ESZs follow the **National Wildlife Action Plan (2002–2016)** and categorize activities into:

- **Prohibited**:
  - **Commercial mining**, **polluting industries**, large **hydroelectric projects**, **sawmills**, and **commercial use of timber**.
- **Regulated**:
  - **Tree felling**, construction of **hotels and resorts**, **commercial water extraction**, and **use of chemical pesticides**.
- **Permitted**:
  - **Traditional agriculture**, **organic farming**, **rainwater harvesting**, **use of solar and wind energy**, and **eco-friendly technologies**.

About Bhimgad Wildlife Sanctuary:

A Natural Treasure in the Western Ghats:

- **Location**: Situated in the **Belgaum district** of Karnataka, near the **Goa border**, Bhimgad lies within the ecologically rich **Western Ghats**, a **UNESCO World Heritage Site**.
- **Establishment**: It was declared a **Wildlife Sanctuary in December 2011**, aiming to protect endemic species and sensitive habitats.
- **Historical Legacy**: The sanctuary is named after **Bhimgad Fort**, built in the **17th century by Chhatrapati Shivaji Maharaj** as a strategic defense point against Portuguese invasions.
- **Area**: The sanctuary spans approximately **190 square kilometers**, and its landscape includes **evergreen forests, rivers, and caves**.

Ecological Significance:

Home to Rare and Endemic Species:

- **Avifauna Diversity**: The region supports vibrant birdlife such as the:
  - **Velvet-fronted Nuthatch**
  - **Malabar Grey Hornbill**
  - **Imperial Green Pigeon**

  - **Emerald Dove**
  - **Malabar Trogon** (an elusive forest-dwelling bird known for its vivid plumage)
- **Wroughton's Free-tailed Bat**: The **Barapede Caves** within Bhimgad are **the only known breeding site** for this **critically endangered bat species**, making the sanctuary a **global conservation priority**.
- **Aquatic & Forest Ecosystems**: Bhimgad includes the **Vajrapoha Waterfalls** and lies within the **catchment of the Mahadayi River**—a lifeline for downstream ecosystems and human settlements.

Emerging Threats and Conservation Concerns:

- **Public Intrusion** into the ESZ is disturbing natural habitats and could result in the **displacement of wildlife**, **soil erosion**, and **forest degradation**.
- Illegal **construction activities**, **unsustainable tourism**, and **unauthorized logging** are reported in the periphery.
- The **Mahadayi River**, originating in the sanctuary, is part of a **politically sensitive inter-state water dispute** between Goa and Karnataka. Any ecological damage here could impact water availability for multiple states.

The Way Forward: Strengthening Protection:

- **Enhanced Monitoring**: Use of **drones and satellite mapping** to track illegal activities in real time.
- **Community Involvement**: Promoting **eco-tourism**, **local guide employment**, and **awareness programs** to involve nearby communities in conservation.
- **Strict Enforcement**: Empowering the **Forest Department** and **local governance bodies** to implement ESZ guidelines with stricter penalties for violations.
- **Research and Habitat Restoration**: Funding studies on **species population trends** and initiating **reforestation drives** to restore disturbed patches.

Conclusion: Preserving a Natural Heritage

The **Bhimgad Wildlife Sanctuary** is not just a biodiversity hotspot but also a **critical ecological corridor** within the **Western Ghats**, linking several protected areas across Karnataka and Goa. Immediate attention and **coordinated conservation actions** are essential to preserve its **unique flora and fauna**, **water systems**, and **cultural heritage**.

Preserving Bhimgad today means securing a **resilient ecosystem** for generations to come.

GS Paper 3 – Environment and Ecology

India's Mounting E-Waste Crisis: Time to Rethink Management

Context: As India rapidly transitions into a digital powerhouse, it is facing a **mounting e-waste crisis**. The exponential growth in the use of electronic devices has led to a **surge in discarded gadgets**, making India the **third-largest generator of e-waste globally**, after **China and the United States**.

What is E-Waste?

Electronic waste (e-waste) includes **discarded electrical or electronic devices**—from **smartphones and laptops** to **televisions, refrigerators, and printers**—that are no longer usable due to **technological obsolescence** or physical damage.

India's E-Waste Landscape: A Startling Surge

- **Growth Trajectory**: E-waste generation in India surged by a staggering **151%** in just six years—rising from **7.08 lakh metric tonnes in 2017–18** to over **17.78 lakh metric tonnes in 2023–24**.
- **Urban Centers as E-Waste Hubs**: **Mumbai, Delhi, Bengaluru, Chennai**, and **Hyderabad** are among the top cities contributing significantly to the e-waste burden.
- **Devices Driving the Surge**: Mobile phones, computers, routers, air conditioners, and LED TVs are the leading contributors to India's e-waste mountain.

Consequences of Poor E-Waste Management:

1. Environmental Damage:

- **Water Pollution**: Toxic chemicals like **cyanide, mercury, and sulphuric acid** leach into water bodies.
- **Air Pollution**: Burning plastics and metals releases **lead fumes** and **dioxins**, causing respiratory ailments.
- **Soil Contamination**: Heavy metals seep into soil, harming **agriculture, microbes**, and **local ecosystems**.

2. Social and Health Costs:

- **Informal Sector Dominance**: Nearly **95%** of India's e-waste is processed in the **unregulated informal sector**, often by **marginalized women and children**.
- **Toxic Exposure**: Workers face **chronic health risks**, with an **average life expectancy below 27 years** in some cases.

3. Economic Losses:

- India forfeits over **80,000 crore annually** in lost critical metals such as **gold, platinum, palladium, and rare earth elements**.
- The absence of a robust formal recycling ecosystem leads to **$20 billion in potential tax revenue losses** each year.

What's Holding India Back? Major Challenges

- **Lack of Public Awareness and Incentives**: Consumers lack **financial rewards** or **easy return mechanisms** for responsible disposal.

- **Inadequate Collection Infrastructure**: There's a **shortage of authorized collection centers**, particularly in **Tier-II and Tier-III cities**. Informal scrap dealers remain the **default recycling channel**.
- **Unsafe Recycling Techniques**:Informal recyclers use methods like **open-air burning**, **acid leaching**, and **manual dismantling without safety gear**, releasing toxic fumes.
- **Grey Market Imports**: Used electronics often enter India under the guise of **"donations" or "refurbished goods"**, adding to the domestic e-waste pile.

India's E-Waste Policy Framework:

1. Extended Producer Responsibility (EPR):

Under **E-Waste (Management) Rules, 2022**, manufacturers, producers, and importers are now **legally responsible** for the **entire lifecycle** of their products, including post-consumer disposal.

- **Digital Compliance**: The **Central Pollution Control Board (CPCB)** operates a digital **EPR portal** where stakeholders must register and report their e-waste management activities.

2. Formalized Collection and Disposal:

- **India's First E-Waste Clinic**: Launched in **Bhopal, Madhya Pradesh**, the clinic serves as a centralized facility for **safe collection, processing**, and **disposal of electronic waste** from both households and businesses.
- **E-Waste Parks**: Delhi and other metro cities are proposing **dedicated recycling parks** to house registered dismantlers and recyclers.

3. International Framework: The Basel Convention

India is a signatory to the **Basel Convention (1989)**, which controls the **transboundary movement of hazardous waste**. It helps India restrict illegal dumping of e-waste from developed nations.

Global Best Practices: Lessons for India:

- **Japan**: Employs a strict **home appliance recycling law**, where manufacturers are required to collect and recycle their products.
- **European Union**: Has implemented a **Circular Economy Action Plan**, incentivizing repair, reuse, and recycling of e-goods.
- **South Korea**: Uses **reverse logistics systems**, encouraging retailers to accept e-waste returns with government subsidies.

Path Forward: Building a Circular E-Economy:

1. Empower the Formal Sector:

- Scale up **eco-certified recycling units** with **government subsidies**.
- Encourage **urban mining**—extracting rare materials from e-waste—to reduce import dependency.

2. Educate and Engage Citizens:

- Launch **nationwide awareness drives** promoting safe disposal.
- Introduce **cash-back incentives**, e-waste kiosks, and mobile collection vans in cities.

3. Regulate the Grey Market:

- Enforce stringent **border checks** and **labelling norms** to curb e-waste imports disguised as refurbished goods.

Conclusion: Turning Trash into Treasure

India stands at a crossroads—between **technological progress** and **ecological responsibility**. The way forward lies not just in managing e-waste, but in **extracting value**, **ensuring worker safety**, and **fostering green growth**.

By embracing a **circular economy**, investing in **formal infrastructure**, and ensuring **policy enforcement**, India can transform its e-waste burden into a powerful tool for achieving its **Viksit Bharat (Developed India) vision**.

GS Paper 3 – Environment and Disaster Management

Geotubing: A Modern Solution to India's Coastal Erosion Crisis

Context: India's vast coastline is under threat from rapid **coastal erosion**, a phenomenon exacerbated by **climate change**, **unregulated development**, and **natural disasters**. However, a recent success story from **Poonthura, Kerala**, has put the spotlight on an innovative solution — **geotubing technology** — that is proving to be a **game-changer in shoreline protection**.

What is Geotubing?

Geotubes, or **geotextile tubes**, are large, durable fabric containers filled with **sand or dredged slurry**, strategically placed along vulnerable coastlines.

- These structures act as **wave energy absorbers**, reducing the intensity of incoming waves.
- They serve as **artificial dunes or sea walls**, preventing shoreline retreat.
- Their **multi-layered composition** allows long-term durability, even during high tides and storm surges.

Case in Point: The deployment of geotubes in **Poonthura, Kerala**, has significantly mitigated erosion and safeguarded local fishing communities.

India's Coastal Landscape: An Overview

- **Revised Coastline Length**: India's coastline has been updated to **11,098.81 km** (from 7,516.6 km) using **modern GIS-based measurement techniques**.
- **Coastal Composition**:
  - **43%** sandy beaches
  - **36%** muddy flats
  - **11%** rocky shores
  - **10%** marshy and estuarine zones
  - Includes **97 major estuaries** and **34 lagoons**
- **Geographical Spread**: 9 coastal states and 2 union territories, comprising **66 coastal districts**.

Erosion Patterns: A Cause for Concern

According to the **National Centre for Coastal Research (NCCR)**:

- **33.6%** of India's coast is **eroding**
- **26.9%** is witnessing **accretion** (land build-up)
- **39.6%** remains **stable**

Worst-Affected States:

- **West Bengal** – 60.5% of the coastline eroding
- **Kerala** – 46.4%
- **Tamil Nadu** – 42.7%

Why is India Losing Its Coastline?

Natural Causes:

- **Rising Sea Levels**: Due to **melting glaciers** and **thermal expansion**.
- **Cyclones and Storm Surges**: Increasing in frequency and intensity due to **climate change**.
- **Monsoonal Variability**: Seasonal wind patterns drastically affect sediment deposition and erosion.

Human-Induced Factors:

- **Sand Mining**: Unregulated extraction of sand from riverbeds and coastal zones.
- **Port Development**: Alters natural **littoral drift** and sediment transport.
- **Mangrove Clearance**: Removes natural bio-shields that absorb wave energy.
- **Urban Encroachment**: Shrinks the coastal buffer zones, exposing communities to sea intrusion.

Government's Response: Policy and Planning

1. Integrated Coastal Zone Management Project (ICZMP):

- **World Bank-assisted** initiative implemented in **Gujarat, Odisha, and West Bengal**
- Promotes **sustainable coastal livelihoods**, **marine biodiversity**, and **disaster preparedness**

2. Coastal Regulation Zone (CRZ) Notification, 2019:

- Categorizes coastal zones based on ecological sensitivity
- Establishes **No Development Zones (NDZs)** in ecologically vulnerable areas
- Emphasizes **Shoreline Management Plans** and **Local Participation**

3. Coastal Vulnerability Index (CVI):

- Developed by **INCOIS**, this tool maps **hazard zones** using parameters like elevation, slope, tidal range, and wave action.
- Helps prioritize **adaptive strategies** and **infrastructure planning**.

4. 15th Finance Commission Allocation:

- **2,500 crore** earmarked for **coastal resilience**, including **relocation** of affected communities and **infrastructure strengthening**.

Engineering and Nature-Based Solutions:

Geotube Installations:

- Used successfully in **Pentha Village, Odisha**, and now **Poonthura, Kerala**
- Provide immediate and **cost-effective protection**
- Flexible in design, **adaptable to local geography**, and **eco-sensitive**

Artificial Reefs:

- Installed offshore to **dissipate wave energy** and **support marine biodiversity**
- Mimic coral reef functions without ecological damage

Eco-Friendly Breakwaters:

- Constructed with materials that **blend with the marine ecosystem**
- Help avoid the negative visual and ecological impacts of conventional concrete structures

Mangrove Restoration and Shelterbelts:

- Natural vegetation like **Casuarina** and **mangroves** stabilizes coastal soil

- Acts as **green barriers** to high tides and cyclone surges

Looking Ahead: Building Climate-Resilient Coasts

With rising sea levels and intensifying weather patterns, India's coastal resilience must move beyond traditional barriers and embrace **hybrid solutions** — combining **engineering innovation** with **ecosystem restoration**.

The Way Forward:

- **Expand geotube deployment** in erosion hotspots
- **Integrate satellite-based monitoring** for real-time shoreline changes
- Encourage **community participation** in mangrove conservation
- Develop a **national shoreline protection strategy** linked to the **Blue Economy framework**

Conclusion: From Crisis to Coastal Conservation

India's battle against coastal erosion is both urgent and complex. **Geotubing**, supported by sound policy and environmental planning, offers a **sustainable model** for other vulnerable regions.

By investing in **science-driven interventions**, fostering **community awareness**, and upholding **regulatory safeguards**, India can turn the tide and ensure its coastlines remain **livable, resilient**, and **thriving for generations to come**.

GS Paper 3 – Economy

Centre Clears More FCI Rice for Ethanol: Fuel Ambitions vs Food Security

Context: In a bold push toward energy sustainability, the **Union Government** has sanctioned an **additional 2.8 million tonnes of rice** from the **Food Corporation of India (FCI)** stock for **ethanol production**. This brings the total rice allocation for the **Ethanol Supply Year (ESY) 2024–25** to a substantial **5.2 million tonnes**.

While hailed as a major step in India's biofuel journey, the move has sparked a debate about its **impact on food security**, **agricultural priorities**, and **ecological sustainability**.

Ethanol & The Ethanol Blended Petrol (EBP) Programme:

Ethanol is a **renewable alcohol-based biofuel**, typically derived from:

- **Sugar-rich crops** like sugarcane and sweet sorghum
- **Starchy crops** like maize and rice
- **Cellulosic materials** such as crop residues and agricultural waste

Launched in **2003** and fast-tracked since **2014**, the **Ethanol Blended Petrol (EBP) Programme** mandates the blending of ethanol with petrol to:

- **Reduce vehicular emissions**
- **Lower fossil fuel dependence**
- **Strengthen rural income streams**

Milestones Achieved:

- **E20 Target Achieved**: India has met the target of **20% ethanol blending** by **2025**, five years ahead of schedule.
- **Next Aim**: Achieve **30% blending** by **2030**, aligned with India's **climate goals** and **green energy roadmap**.

Why This Move Matters:

1. Energy Independence:

- Reduces India’s dependence on crude oil imports, saving **foreign exchange reserves**
- Strengthens domestic energy production capacities

2. Environmental Gains:

- Ethanol-blended fuel emits significantly **fewer greenhouse gases** than petrol
- Helps India meet its **Paris Agreement** commitments on emission reduction

3. Boost to Farmers:

- Creates a **market for surplus crops** like rice and maize
- Could enhance **income stability** for farmers in surplus-producing regions

4. Policy Alignment:

- Supports the **National Bio-Energy Policy**
- Advances the **"Green Growth" pillar** of the **Union Budget 2023**

Key Concerns: The Other Side of the Coin

1. **Food Security Implications:** Diverting **5.2 million tonnes of rice** from the **central food buffer stock** could weaken the **Public Distribution System (PDS)** during **droughts**, **natural disasters**, or **price shocks**.
2. **Pricing Distortions:**
   - Rice is supplied to distilleries at ₹**22.50/kg**, much below market rates.
   - Could lead to **inflated open market prices**, disproportionately affecting **low-income households**.
3. **Ecological Concerns:**
   - **Rice is highly water-intensive**, requiring over **3,000–5,000 litres of water per kg**.
   - Using it for fuel in **water-scarce states** may worsen **groundwater depletion** and **climate vulnerability**.
4. **Ethical and Efficiency Debates:**
   - Using **edible crops** for fuel raises ethical concerns in a country with existing **nutritional challenges**.
   - **Second-generation (2G) ethanol** from **non-food biomass** (e.g., bagasse, crop stubble) is more **efficient and sustainable**, yet remains underutilized.
5. **Agricultural Monoculture Risks:** Over-emphasis on ethanol-linked crops like **sugarcane, rice, and maize** can reduce **crop diversity**, deplete soil health, and increase **pest vulnerability**.

The Way Forward: A Balanced Biofuel Path

To ensure **biofuel ambitions do not compromise food security or ecological balance**, India must recalibrate its strategy:

1. Shift to 2G and Advanced Biofuels:
- Prioritize ethanol production from **agricultural waste**, **municipal solid waste**, and **industrial by-products**.
- Accelerate rollout of **2G ethanol plants** under the **Pradhan Mantri JI-VAN Yojana**.

2. Strengthen Regulatory Oversight:
- Establish **strict audit mechanisms** to monitor diversion of food grains and its **impact on PDS stocks**.
- Enforce **transparency in pricing and procurement** of grains for fuel use.

3. Promote Crop Diversification:
- Incentivize **multi-cropping systems** and **low water-requiring crops**
- Educate farmers on the long-term risks of monocultures linked to ethanol demand

4. Foster Public Dialogue:
- Engage civil society, farmers' groups, and environmentalists in shaping biofuel policies.
- Ensure an **inclusive debate** around food vs fuel choices in the public domain.

Conclusion: India's ethanol journey is pivotal for its **energy security**, **climate leadership**, and **rural prosperity**. However, this journey must not come at the cost of **nutrition security**, **ecological sustainability**, or **social equity**.

A **smart ethanol strategy** would balance **clean energy ambitions** with **ethical resource use**, ensuring that India's **biodiversity, food systems**, and **farmers' futures** are equally protected.

GS Paper 1 – Geography

Dongria Kondh: Guardians of the Sacred Niyamgiri Hills

Context: The **National Human Rights Commission (NHRC)** has recently called for an **Action Taken Report (ATR)** from the **Chief Secretary of Odisha** regarding the **dire living conditions** faced by over **10,000 families** of the **Dongria Kondh** community. The NHRC intervention highlights serious concerns over the **lack of basic amenities**, infrastructure, healthcare, and livelihood support in this **Particularly Vulnerable Tribal Group (PVTG)**.

Who Are the Dongria Kondh?

The **Dongria Kondh** are one of the most culturally rich and ecologically connected tribal communities in India. Classified as a **PVTG** by the Government of India, they inhabit the **Niyamgiri hills**, which straddle the districts of **Rayagada and Kalahandi** in southern Odisha.

Origin and Name:

- The term **Dongria** comes from *"dongar"*, meaning **hill** in the local dialect, signifying their deep-rooted connection with the mountains.
- They also refer to themselves as **Jharnia**, or **"keepers of the streams,"** emphasizing their role as custodians of the hilltop water sources.

Spiritual and Cultural Identity:

The **Dongria Kondh** have a unique **polytheistic animist belief system**, where **nature is sacred**. The **hilltops**, **forests**, and **streams** are revered as divine, with **Niyam Raja**, their mythical ancestral deity, considered the **protector and creator** of the Niyamgiri hills.

Cultural Symbols and Practices:

- Their **art and rituals** reflect the landscape, often featuring **triangular motifs** symbolizing the mountains.
- Religious practices are decentralized: every **village and clan** has its own **ceremonial figures**, including the **bejuni (female priest)** and **beju (male priest)**.
- They **do not follow centralized authority**—social cohesion is maintained through strong community bonds and traditional councils.

Language and Lifestyle:

- The community speaks two indigenous languages—**Kui** and **Kuvi**—both of which are **linguistically distinct** from **Odia**, the state language.
- Their dialects are a vital part of their identity and are passed down orally across generations.

Traditional Attire and Identity Markers:

- **Dongria women** wear multiple **nose rings** and **ear ornaments**, while **boys** typically wear **two nose rings**—a cultural marker of their community.
- They also practice **tattooing** and maintain unique **hairstyles**, reinforcing their distinctive visual identity.

Livelihood and Ecological Harmony:

The Dongria Kondh have an economy deeply entwined with **forests and mountains**. They are **traditionally horticulturists** and practice **Podu cultivation**—a form of **shifting agriculture**.

Major Sources of Livelihood:

- **Non-Timber Forest Products (NTFPs)**: They depend on the sustainable collection of products like **honey**, **tamarind**, **mango**, **jackfruit**, **sal leaves**, and **medicinal herbs**.
- **Terraced Farming**: On hill slopes, they grow **millets**, **turmeric**, **ginger**, and **banana**—maintaining an **agro-biodiverse food system**.

Struggles and State Neglect:

Despite their ecological contributions and cultural richness, the **Dongria Kondh** continue to face **institutional neglect**:

- **Lack of roads, schools, and healthcare facilities**
- **Malnutrition and poor maternal health outcomes**
- **Inadequate access to drinking water and sanitation**

These issues have now caught the attention of the **NHRC**, pressing the state government for **urgent and sustained intervention**.

Notable Resistance: The Vedanta Mining Case

The Dongria Kondh became globally known in the early 2000s for their **peaceful resistance against bauxite mining** by **Vedanta Resources**, which threatened their sacred hills.

Historic Victory for Indigenous Rights:

- In 2013, the **Supreme Court of India**, upholding **Gram Sabha consultations**, ruled against mining in **Niyamgiri**, acknowledging the **tribe's cultural and religious rights**.
- This set a **precedent in environmental justice and indigenous sovereignty**.

Way Forward: Preserving People, Culture and Nature

To ensure the **well-being and survival** of the Dongria Kondh, the following measures are crucial:

- **Strengthening the implementation** of the **Forest Rights Act, 2006**
- Promoting **community-led development** respecting their cultural ethos
- Facilitating **mother-tongue education** and preservation of **linguistic heritage**
- Recognizing them as **key stakeholders** in biodiversity conservation and forest governance

Conclusion: The Hills, The People, The Legacy

The **Dongria Kondh** are not just another tribal group—they are **guardians of one of India's last remaining ecological and cultural frontiers**. Protecting their rights, lifestyles, and traditions is **not only a matter of justice**, but also a step toward **sustainable development**, **cultural diversity**, and **environmental resilience**.

US-China 90-Day Tariff Truce: Key Highlights, Origins, and Global Impact

Context: In a major move aimed at de-escalating trade tensions, the **United States and China** have agreed to a **90-day tariff truce** after two days of high-level diplomatic talks in **Geneva**. Both nations have decided to **temporarily suspend high tariffs and non-tariff barriers** imposed since early April, with the aim of paving the way for broader trade negotiations.

Backdrop: The Origins of the US-China Tariff War

What Sparked the Trade Dispute?

- The conflict gained momentum when the **US began imposing tariffs** on Chinese imports from **February 1**, citing the **illicit export of fentanyl**—a deadly synthetic opioid—as a primary concern. This marked the beginning of a trade spiral that rapidly intensified.

April 2: "Liberation Day" Tariff Surge:

- Labelled as **"Liberation Day"** by then-President Donald Trump, **April 2** saw the US raise tariffs dramatically—**an additional 34%** on all Chinese goods, aimed at countering what the US called "unfair trade practices."

China's Retaliation:

China quickly hit back with **its own counter-tariffs**, diverging from the measured responses of other trading partners. What followed was a rapid **escalation**:

- **By April 10**, US tariffs on Chinese goods had surged to **145%**
- China imposed **125% tariffs** on US imports

For instance, a Chinese product priced at $100 would now cost **$245** in the US due to tariffs alone.

Beyond Tariffs: China's Non-Tariff Responses

China also employed several **non-tariff barriers**, including:

- **Export restrictions** on **rare earth minerals**, crucial for US tech industries
- **Regulatory probes** and **investigations** into major US corporations operating in China

Why Tariffs? Understanding the US Rationale

Trade Deficit Concerns:

- The **US Trade Representative** pointed to a staggering **$1.2 trillion trade deficit** as justification. The US imports significantly more than it exports, particularly from China.

Accusations of Unfair Practices:

The Trump administration accused China of:

- **Subsidizing domestic firms**
- **Shielding them from global competition**
- **Blocking foreign market access for US companies**

With the **trade deficit rising by over 40%** since 2020, the administration claimed **tariffs were the only viable tool** after diplomatic efforts failed.

Post-Truce Trade Landscape: What's Changing?

Reduction in Tariff Rates:

After the truce:

- **Base tariffs** on each other's goods were **reduced to 10%**
- However, the **US maintains an additional 20% tariff** on Chinese goods **linked to fentanyl concerns**

Effective US tariff on Chinese goods: 30%

Effective Chinese tariff on US goods: 10%

Non-Tariff Measures Lifted:

- In a goodwill gesture, **China has suspended all non-tariff restrictions** imposed after April 2, easing pressure on American companies operating within its borders.

Why the Truce Now? Driving Factors Behind the Decision

Consumer Impact Outweighing Producer Gains:

- While **tariffs were meant to protect domestic industries**, they significantly **increased consumer prices**, causing widespread discontent. The benefits were concentrated among a few producers, while **consumers bore the economic burden**.

Price Surge Across Sectors:

- Retailers, including giants like **Walmart**, reported **rising prices and supply chain disruptions**. The result was increased pressure on household budgets and inflationary trends across the board.

Economic Contraction and Recession Fears:

- The **US economy contracted in Q1 2025**, even before the full effects of the tariff regime could be realized. Economists warned of a looming **recession**, defined by two consecutive quarters of negative GDP growth.

Stagflation on the Horizon:

- A dangerous combination of **rising inflation and stagnating economic growth**—known as **stagflation**—emerged as a real threat, prompting urgent policy re-evaluations.

Conclusion: A Fragile Pause, Not a Resolution

While the **90-day truce** signals a **positive shift in tone**, it is by no means a **comprehensive trade agreement**. The **origin of the Geneva talks remains unclear**, underscoring the **deep mistrust** that persists between the two powers.

The **upcoming negotiations** are expected to be **difficult, complex, and high-stakes**, with **no guaranteed resolution** at the end of the 90-day window.

Tapti Basin Mega Recharge Project: A Landmark Water Collaboration Between MP and Maharashtra

Context: In a significant development, the states of **Madhya Pradesh (MP)** and **Maharashtra** have signed a **Memorandum of Understanding (MoU)** to jointly execute the **Tapti Basin Mega Recharge Project**—the **world's largest groundwater recharge initiative**. The project aims to ensure sustainable use of river water for **irrigation and drinking needs** in water-stressed regions of both states.

What is the Tapti Basin Mega Recharge Project?

About the Project:

The **Tapti Basin Mega Recharge Project** is a **major inter-state water management initiative** involving **groundwater recharge** through optimal use of the **Tapti River** and its tributaries. The project focuses on **three Tapti streams** that originate from **Multai** in Madhya Pradesh.

This marks **MP's third inter-state river collaboration**, following:

- The **Ken-Betwa Link Project** (with **Uttar Pradesh**)
- The **Parbati-Kalisindh-Chambal Link Project** (with **Rajasthan**)

Key Features of the Project:

- **Water Diversion and Allocation**: The project will divert water from the **Tapti River** for dual purposes—**drinking water in northeastern Maharashtra** and **irrigation support in southern and southeastern MP**.

  Water Usage Breakdown:
  - **Total planned usage**: **31.13 TMC** (Thousand Million Cubic Feet)
  - **Madhya Pradesh**: **11.76 TMC**
  - **Maharashtra**: **19.36 TMC**
- **Infrastructure Development**:
  - A **diversion weir** will be constructed at the **MP-Maharashtra border**
  - **Right and left bank canals** will be built in both states to ensure proper distribution
- **Land and Environmental Aspects**: The project spans **3,362 hectares** in MP, but **does not require displacement or rehabilitation**, making it a **sustainable and community-friendly model**.

Beneficiary Regions:

The project will benefit several **drought-prone districts**:

- **In Madhya Pradesh**: **Burhanpur** and **Khandwa**
- **In Maharashtra**: **Akola**, **Amravati**, and **Buldhana**

These districts have long struggled with **groundwater depletion** and **unpredictable monsoons**, making this project a **critical step toward long-term water resilience**.

Understanding the Tapti River System:

Geographical Significance:

The **Tapti River** is India's **second-longest west-flowing river** after the **Narmada**. It travels through **Madhya Pradesh, Maharashtra,** and **Gujarat**, before draining into the **Arabian Sea** via the **Gulf of Khambhat**.

It is one of only **three major Indian rivers** that **flow westward**—the others being the **Narmada** and **Mahi**.

Basin Characteristics:

- The **Tapi basin** is flanked by:
  - The **Satpura Range** (north)
  - **Mahadeo Hills** (east)
  - **Ajanta and Satmala Hills** (south)
  - **Arabian Sea** (west)
- It runs **parallel to the Narmada River**, separated by the **core ridge of the Satpura Range**, creating a **unique hydrological zone**.

Tributaries of the Tapti:

The river is fed by **14 major tributaries**:

- **Right-bank (4)**: **Vaki**, **Aner**, **Arunawati**, **Gomai**
- **Left-bank (10)**: **Nesu**, **Amravati**, **Buray**, **Panjhara**, **Bori**, **Girna**, **Waghur**, **Purna**, **Mona**, **Sipna**

Purna River is the **most significant left-bank tributary**, offering a **perennial water supply** crucial to the basin's ecology.

Major Dams and Projects on the Tapti

- **Ukai Dam** in **Gujarat**
- **Hathnur Dam** in **Maharashtra**

These existing projects play a key role in regional water storage and flood control.

Conclusion: A Step Toward Sustainable Water Security

The **Tapti Basin Mega Recharge Project** is not just an engineering feat—it represents **cooperative federalism**, **climate resilience**, and **sustainable groundwater management** in action. By uniting two states in a shared mission, this initiative has the potential to **revive agriculture, secure drinking water,** and **alleviate water stress** for generations to come.

GS Paper 2 – International Relation

India Extends $50 Million Treasury Bill to Support Maldives' Economy

Context: In a significant move to reinforce regional cooperation, **India has extended the maturity of a $50 million Treasury Bill** to aid the **Maldives**, offering timely economic relief to its financially stressed island neighbor. The **State Bank of India (SBI)** facilitated this extension, signaling India's continued commitment to regional stability despite occasional diplomatic strains.

What Are Treasury Bills?

Treasury Bills (T-Bills) are **short-term debt instruments** issued by governments to address **immediate fiscal needs**. Rolling over a T-Bill implies **postponing its maturity**, allowing the borrowing nation—in this case, the Maldives—to defer repayment without defaulting.

Why This Move Matters:

- The **Maldives is facing mounting economic pressure**, aggravated by debt and global economic uncertainties.
- India's assistance comes **amid fluctuating bilateral ties**, but reinforces India's long-term vision of maintaining peace and stability in the **Indian Ocean Region (IOR)**.
- The support aligns with India's foreign policy frameworks—**Neighbourhood First** and **Vision MAHASAGAR** (**Mutual and Holistic Advancement for Security and Growth Across Regions**).

India–Maldives Bilateral Relationship: An Overview

Strategic and Diplomatic Ties:

India views the **Maldives as a vital maritime neighbor** and a **strategic pillar** in maintaining balance in the Indian Ocean. Both nations are founding members of:

- **South Asian Association for Regional Cooperation (SAARC)**
- **South Asian Economic Union**
- **South Asia Free Trade Agreement (SAFTA)**

Economic Cooperation:

- A **bilateral trade agreement**, signed in 1981, enables **export of essential commodities** to the Maldives.
- **Bilateral trade milestones**:
  - **$300 million** in 2021
  - **$548 million** in 2023
- India is among the **top investors** in the Maldives and a key partner in **infrastructure and development projects**.

Defense and Security Partnership:

- Since the **1988 attempted coup**, **defense collaboration** has remained a cornerstone.
- Joint patrols, capacity building, and training of security forces are part of ongoing cooperation.

Connectivity and Tourism:

- The **Greater Male Connectivity Project (GMCP)** links **Male to Thilafushi** and is a flagship Indian-funded infrastructure initiative.
- In **2023**, India was the **largest source of tourists** to the Maldives, holding an **11.8% share**.
- The **Open Skies Agreement** (March 2022) further boosts tourism and air connectivity.

Why Maldives Matters to India:

Geostrategic Location:

- Situated at a **strategic crossroads** in the **Indian Ocean**, the Maldives is crucial for **India's maritime security** and trade.
- Nearly **50% of India's external trade** and **80% of its energy imports** pass through nearby sea lanes.

Countering China's Influence:

- The Maldives provides a key platform for **India to counterbalance China's rising presence** in the region, which includes **large infrastructure investments** and **debt-driven diplomacy**.

Regional Diplomacy and IOR Leadership:

- Strong ties with the Maldives enhance India's **leadership role** in regional platforms like the **Indian Ocean Rim Association (IORA)**.

Challenges in the India-Maldives Relationship:

Political Volatility:

- **Frequent regime changes** in the Maldives create **uncertainty in long-term projects**, sometimes reversing previous diplomatic commitments.

Rising Chinese Footprint:

- China's **economic influence** continues to grow, challenging India's **traditional strategic space** in the Maldives.

Security Threats:

- **Non-traditional threats** like piracy, drug trafficking, and terrorism require close cooperation.
- **Religious extremism and radicalization** remain serious security concerns, needing sustained **counter-radicalization efforts**.

Trade Imbalance:

- The **unbalanced trade relationship**, with India exporting far more to the Maldives than it imports, has led to **calls for diversification** in Maldivian economic circles.

The Road Ahead: Towards a Stronger Partnership

The evolving India–Maldives relationship is shaped by **shared geography, strategic priorities, and economic interdependence**. While challenges exist, **India has consistently shown willingness to support** the Maldives, even under complex diplomatic climates.

By addressing mutual concerns and **building trust through cooperation**, the two countries can **forge a resilient, future-ready partnership** anchored in **peace, prosperity, and shared regional goals**.

GS Paper 3 – Investment and Economic Development

Revitalizing Inland Water Transport in India: A New Wave of Connectivity

Context: In a transformative move, the **Inland Waterways Authority of India (IWAI)** has launched a **regional office in Srinagar** and committed ₹**100 crore** to develop **three National Waterways** in Jammu & Kashmir:

- **Chenab River (NW-26)**
- **Jhelum River (NW-49)**
- **Ravi River (NW-84)**

This marks a significant step towards **enhancing water-based transport and tourism** in northern India.

Key Developments and Infrastructure Boost:

- A **Memorandum of Understanding (MoU)** has been signed between **IWAI and the J&K Government** to promote **river cruise tourism**.
- **Ten floating jetties** will be installed at strategic locations like **Akhnoor, Reasi, Pantha Chowk, Zero Bridge, Amira Kadal**, and **Safa Kadal**.
- IWAI will also develop **landside infrastructure** to facilitate **passenger and cargo movement**.
- **Dredging operations** are planned to maintain **navigable fairways** for safe vessel traffic.

Overview of Inland Waterways in India:

The **National Waterways Act, 2016** declared **111 inland waterways** as **National Waterways (NWs)** to promote shipping and navigation.

- These waterways span **20,275 km across 24 states**.
- Operational routes currently include stretches along:
  - **Ganga-Bhagirathi-Hooghly**
  - **Brahmaputra and Barak rivers**
  - **Goa's rivers, Kerala's backwaters**, and the **Godavari-Krishna delta**

About IWAI: The Pillar of Waterborne Logistics

The **Inland Waterways Authority of India** was established in **1986**, under the **Ministry of Ports, Shipping and Waterways**, following the **National Transport Policy (1980)** recommendations.

- **Headquarters**: Noida, Uttar Pradesh
- **Regional Offices**: Patna, Kolkata, Guwahati, Varanasi, Bhubaneswar, Kochi
- **Sub-Offices**: Located in major riverine hubs including **Prayagraj, Haldia, Dibrugarh**, and **Vijayawada**

Core Responsibilities:

- **Developing and regulating National Waterways**
- Conducting **hydrographic surveys**
- Providing **navigational aids**
- Promoting **river tourism and ferry services**

India's Major National Waterways:

- **NW-1**: Ganga-Bhagirathi-Hooghly (Haldia to Prayagraj, **1,620 km**)
- **NW-2**: Brahmaputra (Dhubri to Sadiya, **891 km**)
- **NW-3**: West Coast Canal (Kottapuram to Kollam, **205 km**)
- **NW-4**: Godavari-Krishna-Buckingham Canal (**1,095 km**)
- **NW-5**: Brahmani-Mahanadi-East Coast Canal (**623 km**)
- **NW-16**: Barak River (**121 km**)

Why Inland Water Transport (IWT) Matters:

Economic Efficiency:

- **Lowest cost per ton-km**:
  - 1 litre of fuel moves **24 tonnes** by road
  - **95 tonnes** by rail
  - A remarkable **215 tonnes** via IWT

Decongesting Road & Rail:

- India's **highways and railways** are heavily burdened.
- IWT serves as an effective **supplementary transport mode**, improving overall cargo efficiency.

Eco-Friendly Alternative:

- IWT has the **lowest carbon footprint** among transport modes.
- Reduces **air pollution**, **traffic congestion**, and **urban noise levels**.

Expanding the Horizon: Beyond Freight

Ro-Ro (Roll-on/Roll-off) Services:

- Enables **vehicles and freight** to travel across waterways, easing **road congestion**.

River Tourism:

- Promotes **houseboats, cruises**, and **eco-tourism**, creating **rural employment** and enhancing **local economies**.

Passenger Ferry Services:

- Offers **affordable and efficient travel**, particularly in **remote or underserved areas**.

Key Government Initiatives:

Jal Marg Vikas Project (JMVP):

- Focused on **developing NW-1** for cargo transport
- Includes **multi-modal terminals**, **navigational locks**, and **fairway upgrades**

Jalvahak Scheme:

- Offers **cost incentives** to encourage **cargo owners** to shift to water routes
- Aims to **increase IWT's share** from **2% to 5%** by 2030

Green Shipping Revolution:

- **Hybrid Electric and Hydrogen Vessels** are being developed for sustainable water navigation
- **Coastal Green Shipping Corridor** initiated from **Kandla to Tuticorin**

New Regulatory Framework:

- **National Waterways (Construction of Jetties/Terminals) Regulations, 2025** aim to streamline infrastructure development and promote efficient usage of waterways

Vision Ahead: A Blue Economy Pathway

The Ministry of Ports, Shipping and Waterways targets **150 inland and maritime projects by September 2025**, as part of a broader **Blue Economy vision**.

The **Harbour Craft Green Transition Programme** and green corridors highlight India's commitment to **environmentally sustainable transport**.

Challenges and Roadblocks:

- **Seasonal water levels** and **river depth variations** hamper navigation
- **Insufficient infrastructure** like modern jetties and terminals
- **Low private sector participation** due to regulatory and financial constraints

Conclusion: Unlocking India's Waterways Potential

With strategic investment, innovation, and regulatory reforms, **India's inland waterways** can become a **game-changer for sustainable and affordable transport**.

By strengthening inland water connectivity, promoting tourism, and reducing dependence on fossil fuels, India is paving the way for a **cleaner, cheaper, and more inclusive transport ecosystem** aligned with its **Blue Economy and Green Growth goals**.

GS Paper 3 – Environment & Ecology

India Moves Toward Natural Farming Revolution with Nationwide Certification

Context: In a progressive step towards promoting **sustainable agriculture** and boosting **consumer confidence**, the **Government of India** is set to roll out a **Natural Farming Certification System (NFCS)** across the country. This initiative aims to **standardize practices**, increase **farmer incomes**, and offer **premium market access** for natural produce.

What is Natural Farming?

Natural Farming is a **chemical-free, traditional farming method** enriched by modern ecological knowledge. It emphasizes the use of **on-farm resources**, **zero synthetic inputs**, and **soil-friendly techniques**, making it a highly **sustainable alternative** to conventional agriculture.

Key Features of Natural Farming

- **Zero Budget Natural Farming (ZBNF):** A widely recognized approach pioneered by **Subhash Palekar**, focusing on **drastic reduction of input costs**.
- **Core Practices Include:**
  - **Beejamrit**: Natural treatment of seeds using cow dung and urine.
  - **Jeevamrit**: Fermented microbial culture to enrich soil health.
  - **Mulching** and **Waaphasa**: Techniques for moisture retention and soil aeration.
- **Low Cost, High Sustainability:** It eliminates dependency on **chemical fertilizers**, promoting **cost-effective farming**.

Why Natural Farming Matters:

Economic Benefits:

- **Lower Input Costs:** Reduces dependency on market-bought fertilizers and pesticides.
- **Higher Profit Margins:** Allows farmers to earn more from **natural produce premiums**.

Health and Nutrition:

- **Chemical-Free Food:** Natural farming ensures **pesticide-free crops**, reducing **health risks**.
- **Nutrient-Rich Produce:** Yields **more nutritious food**, improving **public health outcomes**.

Environmental Advantages:

- **Soil Health Restoration:** Boosts soil biodiversity and natural fertility.
- **Water Efficiency:** Encourages **judicious water usage**.
- **Lower Emissions:** Reduces **carbon and nitrogen footprints**, supporting **climate resilience**.

Need for a Certification System:

As natural farming practices gain popularity, a **robust certification mechanism** becomes essential to:

- **Build Consumer Trust:** Assure buyers about the **authenticity** of naturally grown produce.
- **Access Premium Markets:** Enable farmers to reach **high-value domestic and export markets**.
- **Standardize Practices:** Establish **uniform protocols** across regions.
- **Enable Traceability:** Ensure **transparency and accountability** in production processes.

Major Challenges in Scaling Natural Farming:

Despite its benefits, natural farming faces several roadblocks:

- **Initial Yield Drops:** Many farmers experience a **temporary dip in productivity** during the transition.
- **Limited Research Support:** A lack of **long-term scientific studies** across various agro-climatic zones.
- **Weak Institutional Backing:** Insufficient coordination among **agriculture departments, research bodies**, and **rural institutions**.
- **Market Linkages:** Many farmers struggle to access **organized and remunerative markets**.

Government's Push: National Mission on Natural Farming (NMNF)

The government is aggressively promoting natural farming through the **National Mission on Natural Farming**, focusing on mass adoption and support systems.

Key Components of the Mission:

- **Targeted Outreach:** Aiming to reach **1 crore farmers** across India through awareness and capacity building.
- **Cluster-Based Implementation:** Around **15,000 clusters** in **Gram Panchayats** will serve as hubs for promoting natural farming.
- **Bio-Input Resource Centers (BRCs): 10,000 BRCs** to be set up to provide **locally available, organic inputs** for easy farmer access.
- **Model Demonstration Farms:**
    - **2,000 model farms** will be created at **Krishi Vigyan Kendras (KVKs)**, **Agricultural Universities**, and **farmer fields**.
    - These will be run by **experienced Master Trainers** to guide new practitioners.
- **Market and Certification Support:**
    - **Simplified certification** mechanisms will be introduced.
    - Dedicated **branding and marketing channels** to promote natural farming products both **domestically and internationally**.81

Conclusion: Toward a Greener Agricultural Future

The upcoming **Natural Farming Certification System** represents a **landmark policy intervention** to legitimize and mainstream **eco-friendly agriculture**. By empowering farmers, protecting the environment, and ensuring **safe, nutritious food**, India is moving decisively towards a **resilient and sustainable farming future**. With continued support, **natural farming** could become the cornerstone of India's **agricultural transformation**.

GS Paper 3 – Science & Technology

Denmark Launches World's First Commercial e-Methanol Plant

Context: In a groundbreaking move for **green energy**, **Denmark** has inaugurated the **world's first commercial-scale e-methanol plant** in **Kassø**. Developed through a partnership between **European Energy (Denmark)** and **Mitsui & Co. (Japan)**, the plant is set to produce **42,000 metric tonnes** of **e-methanol** annually, marking a significant leap in **carbon-neutral fuel** production.

Understanding Methanol: The Fuel of the Future

Methanol (CH_3OH) is a **colorless, volatile, and flammable alcohol** traditionally derived from **natural gas and coal**. It serves as a critical component in the **chemical industry**, **fuel production**, and **manufacturing of plastics**.

Types of Methanol:

- **Conventional Methanol:** Produced using fossil fuels like coal and natural gas.
- **Bio-Methanol:** Derived from **biomass** and organic waste.
- **E-Methanol (Green Methanol):** Produced using **renewable electricity**, **green hydrogen**, and **captured carbon dioxide (CO_2)**—a truly **carbon-neutral alternative**.

Applications of Methanol:

Methanol is emerging as a versatile fuel with widespread industrial use:

- **Shipping and Maritime Fuel**
- **Fuel Cells for Power Generation**
- **Feedstock in Plastics and Chemicals**
- **Alternative Fuel for Automobiles**

Barriers to E-Methanol Adoption:

Despite its potential, **e-methanol** faces several challenges:

- **High Production Costs:** Still **more expensive than fossil fuels**; **price parity** is expected by **2035**.
- **Limited Production Infrastructure:** Current global capacity is **insufficient for large-scale demand**.
- **CO_2 Capture and Utilization:** Requires **reliable and sustainable technologies** for **CO_2 sourcing**.
- **Storage and Transportation:** Needs **dedicated logistics infrastructure** and **new safety protocols**.

India's Methanol Economy: A Step Towards Energy Independence

To reduce its dependency on imported crude and promote **clean energy**, India has launched the **Methanol Economy Programme**, spearheaded by **NITI Aayog**.

Objectives of the Programme:

- **Cut Oil Imports:** Targeting a **10% reduction** in crude oil imports by **2030**.
- **Reduce Pollution:** Methanol is a **clean-burning fuel** that emits fewer pollutants than conventional alternatives.
- **Utilize Domestic Resources:** Encourages methanol production from **coal, biomass**, and **municipal waste**.

Key Government Initiatives:

- **Methanol Economy Research Programme (MERP):** Led by the **Department of Science and Technology (DST)** to support **R&D in methanol production** and usage.
- **Fuel Blending: 15% methanol-blended petrol (M15)** has been notified, and **testing standards** are underway.
- **National Biofuels Policy 2018:** Recognizes **methanol and dimethyl ether (DME)** as **approved alternative fuels**.

Conclusion: A Greener Tomorrow Begins Today

The launch of the **e-methanol plant in Denmark** represents a **significant shift towards low-carbon fuels**. As global efforts intensify to **combat climate change**, e-methanol offers a promising alternative to fossil fuels in hard-to-decarbonize sectors. With India's proactive steps under the **Methanol Economy Programme**, the country is positioning itself as a **key player** in the **future of sustainable fuel**.

India's Right to Repair Movement: Empowering Consumers and Promoting Sustainability

Context: In a significant move towards **consumer empowerment** and **eco-conscious electronics**, the **Department of Consumer Affairs (DoCA)** has received a report proposing a **"Repairability Index Framework"** for mobile phones and electronic appliances. This initiative aligns with India's efforts to strengthen the **Right to Repair Movement** and support a **circular economy**.

A New Era in Consumer Protection:

India's **Right to Repair initiative** marks a major step forward in redefining **consumer rights**, **product longevity**, and **sustainable consumption**. By introducing a **Repairability Index (RI)**, the government aims to provide consumers with **clear information** about how easily a product can be repaired—putting power back in the hands of buyers.

What Is the Repairability Index?

The **Repairability Index** is designed to rate electronic products based on how easily they can be fixed. It will help consumers compare products beyond just brand and price.

Key Factors Considered in the Index:

- **Availability and cost of spare parts**
- **Access to repair manuals and service documentation**
- **Ease and cost of repair services**
- **Software support**, including availability of updates

This scoring system will apply to items such as **smartphones, refrigerators, washing machines**, and other consumer electronics—encouraging **transparency and better product design**.

Why Repairable Products Matter:

Consumers today are frustrated by **frequent product breakdowns** and the **high cost of repairs**—often designed intentionally through **planned obsolescence**. Additionally:

- **Low durability** is being linked to a **decline in material quality**, particularly as manufacturers reduce **metal content** to cut costs.
- **India's dependence on imported metals** like copper has made it harder to maintain the durability of appliances.

Repairability Supports Key National Goals:

- **Reduces electronic waste (e-waste)**
- Promotes a **circular economy**
- Minimizes the use of newly mined ("virgin") metals
- Increases **product lifespan and consumer savings**

The Right to Repair in India:

The **Right to Repair** is a global concept that ensures **consumers can choose** how and where their devices are repaired. In India, the **DoCA launched the Right to Repair Portal**, which includes:

- A directory of **manufacturer-authorized service centers**
- **Repair guides and manuals** for consumers

Although India currently emphasizes **authorized service networks**, the participation of **consumer rights advocates** signals a possible shift towards **greater repair freedom**. There is a growing push against denying repairs for older products, which many believe violates the **consumer's right to choice**.

Global Perspective: How India Compares

In the **United States**, the Right to Repair movement has led to:

- **Legal requirements** for access to spare parts and manuals
- Opposition to **software locks** that prevent independent repairs
- Scrutiny of **exclusive service arrangements**, such as McDonald's deal with Taylor for ice cream machine repairs

In contrast, **India's approach is more collaborative**, involving **both industry representatives and consumer bodies** in policy formation. The framework is still evolving, but it aims to balance **business innovation** with **consumer protection**.

Challenges That Lie Ahead:

While the introduction of a Repairability Index is a forward-thinking move, several hurdles remain:

- **Industry resistance** from manufacturers that profit from closed repair ecosystems
- Need for **robust enforcement mechanisms**
- Ensuring **safe and quality repair services** from third parties
- Preventing **corporate influence** in the policy, as the drafting committee is largely made up of industry stakeholders

Conclusion: A Step Towards Smarter and Greener Choices

India's **Right to Repair framework** is not just about fixing gadgets—it's about **fixing the system**. By making **repair information accessible** and encouraging **durable product design**, the government is pushing for a future where consumers have more **control**, **choice**, and **sustainability**.

With continued advocacy and smart regulation, India can become a **global leader** in **consumer-centric and environmentally responsible electronics**.

GS Paper 3 – Defence Technology

India's Multilayered Air Defence Shield: IACCS, Akashteer, and the Future of National Security

Context: In a recent briefing on **Operation Sindoor**, the **Indian Air Force (IAF)** showcased its cutting-edge **Integrated Air Command and Control System (IACCS)**—a robust digital network that offers **real-time monitoring** of India's airspace. The system coordinates inputs from radar systems, fighter jets, and missile units to **neutralise aerial threats** like drones, enemy aircraft, and ballistic missiles.

What is the IACCS?

A Game-Changer in Aerial Command and Control:

The **Integrated Air Command and Control System (IACCS)** is a state-of-the-art command and control infrastructure developed by **Bharat Electronics Limited (BEL)** for the IAF. It forms the **nerve centre** of India's air defence architecture by integrating:

- **Ground and airborne radars**
- **Civilian air traffic radar systems**
- **Communication networks**
- **Command and control centres**

Key Features of IACCS:

- **Real-time situational awareness** for operational commanders
- Centralised command with **decentralised execution** for faster response
- **Overlapping radar and communication coverage** for minimal blind spots
- Optimised **deployment of air defence assets** in high-threat zones

Akashteer: Army's Eye on the Battlefield Skies

A Complementary System for Ground-Based Defence:

The **Akashteer system**, developed by **BEL** for the **Indian Army**, is designed to monitor and defend **low-altitude airspace** over battlefields. It serves as the Army's dedicated air defence command network.

Highlights of Akashteer:

- **Real-time battlefield airspace surveillance**
- **Integration of multiple weapon systems** like guns and missiles
- Ongoing efforts to **synchronize Akashteer with IAF's IACCS** for seamless joint operations

India's Multilayered Air Defence Architecture:

India employs a **comprehensive, multi-tiered air defence strategy**, aimed at detecting and intercepting threats at various stages of incursion—ranging from drones to cruise missiles.

Key Components of the Air Defence Shield:

- **Point Defence**: Small arms, low-level anti-aircraft guns, and MANPADS
- **Aerial Defence**: Fighter jets, short and long-range surface-to-air missiles

- **Surveillance Grid**: Ground radars, **AWACS** (Airborne Warning and Control System), and **AEW&C** (Airborne Early Warning & Control), all networked via IACCS

The Four Defence Layers Explained:

1. **Layer 1**: Counter-drone systems and **Man-Portable Air Defence Systems (MANPADS)**
2. **Layer 2**: **Short-Range Surface-to-Air Missiles (SR-SAM)** and close-in weapon systems
3. **Layer 3**: **Medium-Range Surface-to-Air Missiles (MR-SAM)** for broader coverage
4. **Layer 4**: **Long-Range SAMs (LR-SAM)** capable of intercepting high-altitude threats

The Road Ahead: Future of IACCS and Air Defence

Strengthening the National Shield:

- The **IAF is rapidly expanding the IACCS network** by deploying more **radars** and **Surface-to-Air Guided Weapon (SAGW)** systems, especially around sensitive military zones.

Towards Unified Defence Operations:

- With warfare becoming increasingly complex, the IACCS will be pivotal in enabling **tri-service coordination**—uniting the **Army, Navy, and Air Force** under a **shared command network** for real-time responses.

Infusion of Next-Gen Technology:

- Future upgrades of IACCS will harness **artificial intelligence (AI)** and **data analytics** to enhance threat prediction, asset deployment, and **situational awareness**, ensuring India stays ahead in **aerospace warfare technology**.

Conclusion: A Fortress in the Sky

India's **layered air defence ecosystem**, anchored by **IACCS and Akashteer**, offers a formidable shield against diverse aerial threats. With ongoing integration, innovation, and modernization, India is laying the foundation for a **future-ready air defence grid**—one that is smart, responsive, and impenetrable.

GS Paper 1 – Human Geography

Sharp Decline in Birth Rates in Tamil Nadu, Kerala, and Delhi: Twice the National Average

Context: Recent data from the **Sample Registration System (SRS) Statistical Report 2021**, released by the **Registrar General of India**, reveals a stark divergence in birth rate trends across Indian states. Notably, **Tamil Nadu, Kerala, and Delhi** are witnessing a decline in birth rates at **twice the pace of the national average**, signaling an accelerating demographic transition in these regions.

Understanding the Crude Birth Rate (CBR):

The **Crude Birth Rate (CBR)** refers to the number of **live births per 1,000 individuals** in a population within a year. It is a crucial metric in assessing population growth and planning public resources.

Key Findings of the Report:

- **India's Total Fertility Rate (TFR)** in 2021 remained steady at **2.0**, the same as in 2020. A TFR of **2.1 is considered the replacement level**, needed to maintain population stability.
- The **national crude birth rate** in 2021 was **19.3 per 1,000**, declining annually by **1.12%** from 2016 to 2021.
- In comparison, birth rates declined much faster in:
  - **Tamil Nadu**: ↓ **2.35% annually**
  - **Delhi**: ↓ **2.23% annually**
  - **Kerala**: ↓ **2.05% annually**
- Other states with faster-than-average declines include:
  - **Maharashtra** (1.57%), **Gujarat** (1.24%), **Odisha** (1.34%), **Himachal Pradesh** (1.29%), **Haryana** (1.21%), and **Jammu & Kashmir** (1.47%).
- **States with the slowest decline** include:
  - **Rajasthan** (0.48%), **Bihar** (0.86%), **Chhattisgarh** (0.98%), **Jharkhand** (0.98%), **Assam** (1.05%), **Madhya Pradesh** (1.05%), **West Bengal** (1.08%), and **Uttar Pradesh** (1.09%).
- **Increase in registered births** was noted in 11 states and UTs, including **Bihar, Rajasthan, Uttar Pradesh, Uttarakhand, West Bengal, J&K, Ladakh**, and several northeastern states.

Fertility and Reproduction Trends:

- **TFR above national average** was observed in **Bihar, Uttar Pradesh, Rajasthan, and Madhya Pradesh**, indicating sustained high fertility rates.
- **Gross Reproduction Rate (GRR)** for India stood at **1**, meaning each woman is, on average, having one daughter who survives to reproductive age.
- **States with higher GRR** than the national average include **Bihar, Rajasthan, MP**, and **UP**, reflecting persistent high fertility.

Major Concerns:

1. **Uneven Demographic Transition:** States such as **Bihar, Uttar Pradesh, and Madhya Pradesh** show a **slow decline in birth rates**, leading to **regional population imbalances**. This may result in **strain on resources**, infrastructure, and public services.

2. **North-South Population Divide:** Southern and western states are nearing or falling **below replacement fertility levels**, while northern and eastern regions remain above, causing a **"two-speed" demographic transition** in the country.
3. **Aging Population in Low-Fertility States:**

States like **Kerala and West Bengal** face the challenge of **rapid aging**, potentially leading to:

- **Shrinking workforce**
- **Increased burden on healthcare and pensions**
- **Need for revised economic and social support systems**

4. **High Fertility Persists in Underserved Regions:** Despite a national TFR of 2.0, high fertility in **Bihar (3.0)** and **Uttar Pradesh (2.7)** points to gaps in **education, healthcare, and awareness**, especially in rural areas.

Way Forward: Policy Recommendations:

- **Prepare for an Aging Society:** Low-birth-rate states must prepare for **elder care**, **pension reforms**, and **health infrastructure for the elderly**.

Reduce Regional Inequalities:

- Invest in **job creation**, **education**, and **infrastructure** in high-growth states to balance national development.

Centre-State Collaboration:

- Ensure **coordinated population policy efforts**, with **flexible funding** mechanisms to support state-specific needs.

Conclusion:

India's demographic future is unfolding in **two contrasting directions**—with **southern and western states stabilizing or shrinking**, and **northern and eastern states continuing to grow**. Effective planning, inclusive policies, and data-driven decisions will be essential in navigating this complex population landscape.

GS Paper 2 – Polity and Governance

Justice B.R. Gavai Takes Oath as the 52nd Chief Justice of India

Context: Justice Bhushan Ramkrishna Gavai was officially sworn in as the **52nd Chief Justice of India (CJI)** on May 14, 2025. The oath was administered by **President Droupadi Murmu** at Rashtrapati Bhavan. Justice Gavai succeeds **Justice D.Y. Chandrachud**, and his appointment is notable not only for his legal acumen but also for his background—he is **only the second Dalit to become the CJI**, following **Justice K.G. Balakrishnan**.

Constitutional Basis for Appointment:

The **Constitution of India** provides the framework for the judiciary but **does not specify a detailed procedure for the appointment** of the Chief Justice of India.

- **Article 124(1)** states: "There shall be a Supreme Court of India consisting of a Chief Justice of India and other judges."
- **Article 124(2)** authorizes the **President** to appoint **Supreme Court judges**, including the CJI.
- However, **no formal mechanism or selection process** is laid out in the Constitution for appointing the CJI.

Established Convention for Appointment:

In the absence of constitutional procedure, **long-standing convention governs the appointment** of the Chief Justice:

- The **outgoing CJI recommends the name of the senior-most judge** of the Supreme Court as their successor.
- **Seniority is determined** not by age but by the **length of service in the Supreme Court**.
- This **convention of seniority** has been consistently followed to maintain the **independence and impartiality** of the judiciary.

Eligibility Criteria for Appointment:

As per **Article 124(3)** of the Constitution, a person is qualified for appointment as a **Supreme Court judge**, and thereby as CJI, if they:

- Are a **citizen of India**; and
- Have been a **High Court judge for at least five years**, or
- Have been an **advocate in a High Court for at least ten years**, or
- Are deemed a **distinguished jurist** in the opinion of the President.

Tenure and Age of Retirement:

- The **Chief Justice of India** does not have a fixed tenure.
- All **Supreme Court judges retire at the age of 65**.
- Justice Gavai, born on **November 24, 1960**, is expected to serve as CJI for **approximately six months**, retiring in **November 2025**.

Removal Procedure for Chief Justice of India:

A **Chief Justice or judge of the Supreme Court** can be removed only through a **rigorous impeachment process**:

- As per **Article 124(4)** and the **Judges (Inquiry) Act, 1968**, removal requires:
    - A **motion in Parliament**, supported by **a special majority** in both the Lok Sabha and Rajya Sabha.
    - Grounds for removal include **"proved misbehaviour or incapacity."**
    - No Chief Justice of India has ever been successfully impeached.

Additional Facts: A Milestone in Representation

- Justice Gavai hails from **Maharashtra** and has served as a judge of the **Bombay High Court** before being elevated to the Supreme Court in 2019.
- His elevation is seen as a **step toward greater diversity** and inclusion in the **higher judiciary**.
- His legal career spans over **three decades**, and he is known for his judgments in **constitutional law, criminal justice**, and **public interest litigation**.

Looking Ahead:

Justice B.R. Gavai's tenure, though brief, is expected to focus on:

- **Speeding up judicial reforms**
- **Improving case disposal rates**
- **Promoting transparency and digitalisation** in the justice delivery system

His appointment reaffirms the commitment to **upholding constitutional values, judicial independence**, and **social inclusivity** within India's highest court.

GS Paper 3 – Indian Economy

India's Major Ports Set New Benchmark in FY 2024-25

Context: India's **Major Ports** have achieved a **historic performance milestone** in **FY 2024-25**, recording a **cargo handling capacity of approximately 855 million tonnes**, up from **819 million tonnes** in the previous fiscal year. This marks an **annual growth of 4.3%**, showcasing the growing strength and modernization of India's maritime sector.

Key Performance Highlights:

Boost in Operational Efficiency:

- **Average Turnaround Time (TRT)** for vessels has been reduced to **49.5 hours**, a remarkable **48% improvement** from **96 hours in FY 2014-15**.
- The **operating ratio** improved significantly, falling from **64.7% to 42.3%**, reflecting greater cost-effectiveness and optimized port operations.

Financial Growth:

- The **total income** of major ports has **more than doubled over the past decade**, recording a **7.5% CAGR** (Compound Annual Growth Rate).
- This financial success is largely attributed to improved port operations and increased private sector involvement.

Private Sector Participation:

- **Public-Private Partnership (PPP) investments** have **tripled**, playing a crucial role in infrastructure upgrades, digitalisation, and innovation across ports.

India's Maritime Sector: A Strategic Asset

- India has **13 Major Ports** (under the central government) and **217 Non-Major Ports** (managed by state governments).
- The sector is overseen by the **Ministry of Ports, Shipping and Waterways**.
- Located along some of the **world's busiest trade routes**, India's ports serve as a vital link in global maritime logistics.

Trade and Ranking:

- The sector handles **95% of India's trade by volume** and **70% by value**.
- India's position in the **Global Port Performance Index** improved from **54th in 2014 to 38th in 2023**.
- **Nine Indian ports** now rank among the **top 100 globally** for performance and infrastructure.

Sectoral Growth and Strategic Vision:

Cargo Capacity Growth:

- From **2014-15 to 2023-24**, major ports increased their annual **cargo-handling capacity by over 87%**.

Vision for 2035:

- India aims to invest **US$ 82 billion** in port infrastructure by 2035.

- Plans include establishing a **national shipping company** to add **1,000 ships** over the next decade to expand fleet capacity and reduce dependence on foreign vessels.

Challenges Hindering Maritime Expansion:

Despite impressive growth, several structural and operational challenges persist:

- **Infrastructure Gaps**: Some ports still lack modern facilities, limiting potential throughput.
- **Congestion**: Heavy traffic at major ports causes delays and increases turnaround time.
- **Environmental Issues**: Emissions and pollution from port activities raise sustainability concerns.
- **Inefficient Connectivity**: Poor road and rail links hinder smooth cargo transportation.
- **Security and Cyber Threats**: Ports are vulnerable to smuggling, piracy, and cyberattacks due to inadequate security protocols.

Government Initiatives Driving Transformation:

Sagarmala Programme:

- Focuses on **modernising port infrastructure**, enhancing coastal economic zones, and improving port-road-rail connectivity.
- Provides financial support for coastal berths, **fishing harbours**, cruise terminals, and connectivity projects.

Maritime India Vision 2030 (MIV 2030):

- Aims to transform India into a **top-10 global shipbuilding nation**.
- Comprises **150+ initiatives** across sectors like port modernization, shipbuilding, skill development, and logistics.

Inland Waterways Development: 26 new national waterways have been added to promote **sustainable and cost-effective transport**.

Green Tug Transition Program (GTTP): Targets **100% transition to eco-friendly fuel-based harbour tugs by 2040** to reduce carbon emissions and support the green port initiative.

Sagarmanthan Dialogue: An annual strategic platform positioning India as a **global maritime thought leader**, bringing together policymakers, industry experts, and academia.

Financial Incentives and Support:

- **Maritime Development Fund** worth 25,000 crore launched for long-term investment in ports and shipping.
- **Shipbuilding Financial Assistance Policy (SBFAP 2.0)** upgraded to make Indian shipyards globally competitive.

The Road Ahead:

India's maritime sector is poised for a **new era of global leadership**, driven by:

- Continued **mechanisation** and **digitalisation** of port processes.
- Expansion of **multi-modal logistics hubs** for seamless cargo flow.
- Promotion of **green and sustainable practices** to meet global environmental standards.

Conclusion: FY 2024-25 stands as a **landmark year** for India's port sector—defined by record-breaking performance, global recognition, and forward-looking reforms. With strategic investments and a strong policy push, India is on course to become a **leading maritime power** in the coming decades.

GS Paper 3 – Science & Technology

India's Bold Leap into 6G Technology

Context: India has marked a significant milestone in global telecom leadership. At the **Bharat 6G International Conference**, the **Union Minister of State for Communications** announced that **India is now among the top six countries worldwide** in filing **patents related to 6G technology** — a testament to its rising stature in the high-tech innovation ecosystem.

India's Rising Leadership in 6G Research:

India's 6G push is backed by strategic investments, global partnerships, and deep research capabilities:

- Over **111 government-funded R&D projects** with a total value exceeding **300 crore**.
- International collaborations with tech-advanced nations like **Japan, Finland, and Singapore** to co-develop cutting-edge solutions.
- Breakthroughs in **terahertz communication**, **AI-native networks**, and **intelligent infrastructure**.
- The economic potential of 6G is immense—expected to contribute up to **US$1 trillion (~85 lakh crore)** to India's economy by **2035**.

Bharat 6G Vision: A Roadmap to Digital Leadership

The **Bharat 6G Vision**, launched by the Government of India, envisions a **globally competitive, inclusive, and secure digital future**.

Strategic Goals:

- Position India as a **leader in 6G technology** by **2030**.
- Ensure **affordable and scalable access** to 6G networks.
- Bridge the **digital divide** and promote equitable development across all regions.

Two-Phase Development Approach:

1. **R&D Phase (2023–2025)**: Focused on core technology development, **network architecture design**, and **pilot testing**.
2. **Deployment Phase (2025–2030)**: Aims for **large-scale rollout**, with integration into national digital infrastructure and **support for new-age industries**.

What 6G Brings to the Future:

6G is not just an upgrade—it's a revolution:

- **Sub-millisecond latency**: Enabling real-time control for critical applications like remote surgery and autonomous vehicles.
- **AI-native and self-healing networks**: Offering adaptive and intelligent infrastructure.
- **Volumetric Connectivity**: Extending networks beyond earth to **underwater** and **aerospace realms**.
- **Terahertz Band Communication**: Allowing ultra-high-speed data transfer, thousands of times faster than 5G.

5G vs 6G: What's the Difference?

Feature	5G	6G
Peak Speed	10 Gbps	100 Gbps+
Latency	~1 ms	<0.1 ms
Network Intelligence	Limited AI	Fully AI-native
Coverage	Terrestrial	Air, Sea, Space
Use-Cases	Smart Cities, AR/VR	Holographic Telepresence, Digital Twins, Industrial Automation

Technology Innovation Group on 6G (TIG-6G):

To shape India's 6G trajectory, the **Department of Telecommunications (DoT)** has established the **TIG-6G**, which includes:

- **Top industry players**
- **Premier academic institutions**
- **Leading research organizations**

This body is responsible for drafting the **national 6G roadmap** and formulating policies to keep India at the forefront of telecom innovation.

Spectrum Allocation and Global Coordination:

India is actively participating in international regulatory efforts led by the **International Telecommunication Union (ITU)**. The **IMT2030** initiative is studying frequency bands for global 6G use:

- **4400–4800 MHz**
- **7125–8400 MHz**
- **14.8–15.35 GHz**

These bands are under evaluation for allocation at the **World Radiocommunication Conference (WRC) in 2027**.

India has also identified several frequency bands for **IMT (International Mobile Telecommunications)** services, including:

Industry Collaboration and the Bharat 6G Alliance:

To deepen collaboration and build a **robust innovation ecosystem**, India plans to launch the **Bharat 6G Alliance (B6GA)**. This initiative will bring together:

- **Startups and industry leaders**
- **Academic and research institutions**
- **Government and private sector stakeholders**

B6GA aims to ensure that India's 6G technologies are **globally competitive**, **secure**, and **inclusive**.

India's Global 6G Journey: Looking Ahead

India's push into 6G isn't just about faster networks—it's about **shaping the future of digital civilization**. With strategic vision, global collaboration, and grassroots innovation, India is poised to become a **key driver of 6G development** worldwide.

Plastic Menace in the Himalayas: A Growing Ecological Crisis

Context: The pristine Himalayan ecosystem is under increasing threat from **plastic pollution**, with a recent report revealing that **over 84% of plastic waste collected** in the region is **non-recyclable**, raising serious environmental and systemic red flags.

The Himalayan Cleanup 2024: Troubling Findings

The **Himalayan Cleanup (THC) 2024**, an extensive environmental audit conducted across **nine Himalayan states**, exposed alarming statistics:

- Over **1.2 lakh waste items** were examined — **88% were plastic**.
- **84.2% of the plastic waste** was linked to **food and beverage packaging**.
- Shockingly, **71% of this packaging** was **non-recyclable**, single-use plastic.

Top Polluters by Volume:

- **Sikkim** and **Darjeeling (West Bengal)** ranked highest.
- Followed by **Ladakh**, **Nagaland**, and **Uttarakhand**.

Environmental Impact of Plastic Waste in the Himalayas

Tourism-Driven Pollution:

- Plastic waste is concentrated around **tourist hotspots**, **riverbanks**, and **protected areas**.
- Unregulated tourism and **lack of sustainable infrastructure** amplify the crisis.

Threat to Climate and Biodiversity:

- Plastic degrades slowly, leading to **soil and water contamination**.
- Disrupts **biodiversity**, damages local **agriculture**, and threatens **water sources**.

Public Health Hazards:

- Improper disposal near habitations causes:
  - **Vector-borne diseases**
  - **Water pollution**
  - **Air toxicity** from open burning of plastic

Systemic Challenges in Himalayan Waste Governance:

Lack of Infrastructure:

- **Mountain villages and towns** lack basic facilities for **waste collection, segregation**, and **processing**.

Weak Enforcement of Plastic Ban Policies:

- Despite state-level **bans on single-use plastics**, enforcement remains **inconsistent and ineffective**.
- Limited availability of **eco-friendly alternatives** discourages compliance.

Awareness and Responsibility Gaps:

- **Tourists and local businesses** are often unaware of their role in plastic pollution.

- Producers frequently ignore their obligations under **Extended Producer Responsibility (EPR)**.

Topographical & Logistical Barriers:

- **Remote terrain**, **dispersed settlements**, and **extreme weather** conditions complicate waste management.

India's Initiatives to Curb Plastic Pollution:

Extended Producer Responsibility (EPR):

- Mandates that **producers and brand owners** manage the lifecycle of plastic products, including post-use collection and recycling.

Plastic Waste Management Rules, 2022:

- Prohibits plastic bags **below 120 microns** in thickness.
- Aims to restrict **manufacture, import, and sale** of low-grade plastic products.

Swachh Bharat Abhiyan:

- The nationwide cleanliness campaign includes **plastic waste collection and awareness** drives.

Plastic Parks Scheme:

- Dedicated zones for **plastic recycling and processing**, promoting a **circular economy** approach.

The Way Forward: Towards Sustainable Waste Solutions

1. Mountain-Sensitive Waste Policies:

- Design policies that respect **geographical, cultural, and ecological realities**.
- Incentivize **eco-alternatives** suitable for cold and remote terrains.

2. Decentralized Waste Management:

- Promote **community-led initiatives** using **traditional ecological knowledge**.
- Set up **low-cost, modular waste processing units** across villages.

3. Eco-Friendly Tourism Practices:

- Implement **mandatory waste audits** at tourist sites.
- Enforce **carry-in, carry-out policies**, especially around **pilgrimage routes** and **rivers**.

Did You Know?

- **Plastic takes 500–1,000 years** to decompose in cold environments like the Himalayas.
- **Microplastics** have now been found in **glacial meltwater**, threatening **Himalayan river systems** that sustain over a **billion people downstream**.

India stands at a critical juncture to **preserve the fragile Himalayan ecosystem**. By combining **policy innovation**, **community engagement**, and **eco-conscious tourism**, the nation can lead by example in tackling mountain plastic pollution before it becomes irreversible.

Colombia Joins China's Belt and Road Initiative

Context: China and Colombia have officially signed a **Belt and Road cooperation pact**, marking a significant step in strengthening diplomatic and economic ties between Asia's largest economy and one of South America's most strategically located nations.

This move aligns Colombia with China's ambitious **Belt and Road Initiative (BRI)**, a global infrastructure and investment strategy aimed at enhancing regional connectivity and trade across continents.

About Colombia: A Strategic South American Nation

Capital: Bogotá

Geographical Location:

Situated in the **northwestern region of South America**, **Colombia** enjoys a **unique strategic position** as the only South American country with coastlines on **both the Caribbean Sea and the Pacific Ocean**.

Political Borders:

Colombia shares its borders with:

- **Panama** to the northwest
- **Ecuador** and **Peru** to the south
- **Venezuela** to the east
- **Brazil** to the southeast

Geographical Highlights:

- The **Andes Mountains** stretch across its western territory, shaping much of its landscape and climate.
- The **Amazon rainforest** covers the southeastern regions, contributing to its rich biodiversity.
- Home to the **Magdalena River**, Colombia's main waterway that supports inland trade.

Natural Wealth and Resources:

Colombia is endowed with a wealth of **natural resources**, making it an attractive partner for international trade and investment:

- **Petroleum** and **natural gas**
- **Coal** and **iron ore**
- **Nickel**, **copper**, and **gold**
- World-renowned for **emeralds**, with some of the finest quality stones globally
- Strong **hydropower potential**, providing over **two-thirds of the country's electricity**

Why This Partnership Matters:

- **Colombia's inclusion in the BRI** strengthens China's economic footprint in **Latin America**, a region increasingly influenced by Chinese trade, finance, and infrastructure development.
- It opens up potential Chinese investment in **Colombian infrastructure, energy, mining**, and **digital connectivity**.

- Colombia could gain better access to **Asian markets**, advanced technology, and diversified development financing options.

Did You Know?

- Colombia is one of the world's **top five producers of emeralds**, accounting for over **70% of global supply**.
- The country has **more bird species than any other nation**, making it a global biodiversity hotspot.

This strategic cooperation under the **Belt and Road Initiative** is expected to enhance **bilateral economic development**, boost **connectivity**, and foster **greater geopolitical alignment** between **China and Latin America**.