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To The Point

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Global Drought Outlook: A Growing Crisis Demanding Urgent Action

Context: A **drought** is a period marked by **significantly below-average water availability**, caused primarily by **low rainfall**. These dry spells are intensified by **rising temperatures**, **strong winds**, and increasingly by **human activities** that disrupt the natural water cycle.

There are three major types of drought:

- **Meteorological Drought**: Prolonged periods of **reduced precipitation**.
- **Agricultural (Ecological) Drought**: **Insufficient soil moisture** affecting crops and vegetation.
- **Hydrological Drought**: **Declining water levels** in rivers, lakes, and groundwater reserves over time.

Key Findings from the OECD Report:

The **Organisation for Economic Co-operation and Development (OECD)** has issued a stark warning in its latest **Global Drought Outlook**:

- The **global area impacted by drought has doubled** between **1900 and 2020**.
- **40% of the Earth's surface** now experiences **more frequent and intense droughts**.
- Since 1980, **37% of global land** has suffered a **significant decline in soil moisture**.
- **62% of monitored aquifers** show **falling groundwater levels**, threatening long-term water security.
- **Climate change** made the **2022 European drought up to 20 times more likely**. In North America, it **increased drought probability by 42%**.

Causes of Drought: A Dual Force of Nature and Human Activity

Natural Drivers:

- **Climate variability** (e.g., **El Niño** and **La Niña**) disrupts global rainfall patterns.
- **Melting glaciers** and **reduced snowfall** limit freshwater replenishment.

Human-Induced Triggers:

- **Deforestation** and **land degradation** reduce soil's ability to retain water.
- **Urban sprawl** leads to **soil sealing**, preventing natural groundwater recharge.
- **Over-extraction of groundwater**, coupled with **inefficient irrigation**, exacerbates water scarcity.
- **Intensive agriculture** and **monoculture practices** stress already fragile ecosystems.

Far-Reaching Impacts: A Triple Threat

Environmental Damage:

- Ecosystem collapse in **forests**, **wetlands**, and **grasslands**.
- Loss of **biodiversity** and **declining carbon sequestration** ability.
- Increase in **wildfires**, desertification, and **soil erosion**.

Economic Fallout:

- Droughts reduce **agricultural productivity**, **hydropower output**, and **industrial efficiency**.
- **Fluvial trade routes** (rivers and canals) suffer from low water levels.
- Global **economic losses due to drought** are growing by **3% to 7.5% annually**.

Social Consequences:

- Rising **food and water insecurity**, particularly in **vulnerable regions**.
- **Livelihood loss** among smallholder farmers and pastoralists.
- **Migration** due to uninhabitable conditions and resource scarcity.
- Although droughts account for only **6% of all natural disasters**, they are responsible for **34% of disaster-related deaths**.

A Path Forward: Building Resilience Against Drought:

1. Smart Investment in Resilience:

- Every **USD 1** invested in drought resilience can yield **USD 2–3 in returns**—some projects offer **10x** the benefit.
- Investing in **early warning systems**, **climate-smart agriculture**, and **sustainable water management** is crucial.

2. Sustainable Land and Ecosystem Management:

- Restore **wetlands**, **forests**, and **grasslands** to improve **water retention** and **soil health**.
- Promote **drought-tolerant crops**, **regenerative farming**, and **agroforestry** to secure food supply chains.

3. Integrated, Cross-Sectoral Approach:

- Align drought strategies with **urban planning**, **transport**, **energy**, and **infrastructure development**.
- **Boost irrigation efficiency**—modern techniques could cut **global water use by 76%**.

Additional Insights & Global Perspective:

- By **2050**, nearly **5 billion people** could be living in areas with **inadequate access to water**.
- **Sub-Saharan Africa**, **South Asia**, and **the Mediterranean** are identified as **high-risk regions** for chronic drought.
- Innovative solutions like **desalination**, **cloud seeding**, **precision agriculture**, and **artificial aquifer recharge** are gaining attention.

Final Thoughts:

Drought is no longer a regional or seasonal issue—it is a **global challenge** with **environmental, economic, and social repercussions**. As the **climate crisis deepens**, a **proactive and holistic approach** to drought resilience is not just an option, it's a **necessity** for a sustainable and secure future.

GS Paper 1 – Geography

Sharavathi Lion-Tailed Macaque Wildlife Sanctuary: A Biodiversity Treasure Under Strain

Context: A **recent controversy** has brought the **Sharavathi Lion-Tailed Macaque Wildlife Sanctuary** into the spotlight. Farmers from **Sagar taluk** were reportedly caught entering the protected area with **country-made weapons**, leading to their **arrest and subsequent bail**. This incident has triggered **tension between local communities and forest authorities**, raising questions about enforcement, conservation, and livelihood conflicts around protected areas.

Sanctuary at a Glance: Where Nature and Biodiversity Thrive

Located in the **Sharavathi River Valley** in **Shivamogga district**, **Karnataka**, the **Sharavathi Lion-Tailed Macaque Wildlife Sanctuary** is a vital ecological zone that forms part of the globally significant **Western Ghats**, a **UNESCO World Heritage Site**.

- **Area**: Spanning approximately **431.23 sq. km**, the sanctuary includes the **Linganamakki Reservoir**, which alone covers **124 sq. km**.
- **Formation**: It was established by merging the former **Sharavathi Valley Wildlife Sanctuary**, the **Aghanashini Lion-Tailed Macaque Conservation Reserve**, and adjacent **reserve forests**.
- **Boundaries**: The sanctuary shares its **southwestern border with Mookambika Wildlife Sanctuary**, enhancing its ecological connectivity.

Diverse Terrain and Rich Vegetation:

The sanctuary's **terrain is highly varied**, ranging in elevation from **94 meters to 1102 meters**, creating multiple **microhabitats**. The region is home to **tropical evergreen**, **semi-evergreen**, **moist deciduous forests**, and stretches of **grasslands and savannas**.

Flora:

The forests are densely packed with native and ecologically significant tree species such as:

- **Dhoopa** (*Canarium strictum*)
- **Gulmavu** (*Mangifera indica*)
- **Surahonne**, **Mavu**, **Nandi**, and many others. These trees are critical not only for biodiversity but also for supporting **local forest-based livelihoods** and **traditional knowledge systems**.

Faunal Richness: Home of the Lion-Tailed Macaque

The sanctuary is renowned for being a **critical refuge** for the **endangered lion-tailed macaque (Macaca silenus)**, a primate **endemic to the Western Ghats** and classified as **Endangered** by the IUCN. This species is known for its **distinctive silver-white mane** and **arboreal lifestyle**, depending entirely on undisturbed rainforests for survival.

Other notable wildlife includes:

- **Big Cats**: **Tiger**, **Leopard**, and **Wild Dog (Dhole)**
- **Ungulates**: **Spotted Deer**, **Sambar**, **Barking Deer**, and **Mouse Deer**
- **Carnivores**: **Jackal**, **Sloth Bear**, and **Wild Pig**
- **Primates & Arboreal Mammals**: **Common Langur**, **Bonnet Macaque**, and the **Malabar Giant Squirrel**

Conservation Importance and Ecological Role:

- The sanctuary serves as a **key biodiversity corridor**, linking various protected areas of the Western Ghats.
- It supports **watershed services** crucial for the **Sharavathi River**, which feeds major hydroelectric projects like the **Sharavathi Hydroelectric Project**.
- The area also plays a vital role in **carbon sequestration**, **climate regulation**, and **monsoon dynamics** of peninsular India.

Way Forward: Balancing Conservation with Community Interests

Whie the sanctuary is a **haven for wildlife**, it also borders **human-inhabited landscapes** where **traditional farming** and **forest use practices** exist. The recent conflict underlines the **urgent need for participatory conservation models** where **local communities are integrated into protection efforts**.

Eco-development initiatives, **community-managed buffer zones**, and **alternative livelihood options** such as **eco-tourism** or **non-timber forest products** collection can help reduce friction and create **win-win solutions**.

Final Thought:

The **Sharavathi Lion-Tailed Macaque Wildlife Sanctuary** is not just a protected forest—it is a **living laboratory of evolution**, a **climate stabilizer**, and a **cultural landscape**. As pressures from both **human activities** and **climate change** grow, this sanctuary stands as a **critical stronghold for India's biodiversity** and a test of how wisely we choose to preserve our natural heritage.

GS Paper 3 – Economy and Infrastructure

FASTag Annual Pass Scheme: A New Era of Hassle-Free Highway Travel

Context: In a major move to enhance **ease of travel on Indian highways**, the **Union Minister for Road Transport and Highways** has unveiled a **FASTag-based Annual Pass Scheme**, priced at **3,000**, aimed at providing **seamless toll access** for private vehicle users. The initiative is expected to significantly **reduce congestion**, **streamline toll operations**, and **improve user convenience** across the National Highway network.

What is the FASTag Annual Pass Scheme?

The **FASTag Annual Pass Scheme** enables owners of **private cars, jeeps, and vans** to travel across **National Highways (NH)** and **National Expressways (NE) without paying tolls per trip**. Once activated, the pass allows up to **200 trips** or is valid for **one year**, whichever comes first.

Key Highlights:

- **No per-trip toll fee** at NH and NE fee plazas during the validity of the pass.
- Activated **electronically via FASTag**, ensuring a fully **cashless experience**.
- After **200 trips or one year**, the pass automatically **reverts to regular FASTag mode**.
- Users can **re-purchase** the pass **after 200 trips**, even if the year hasn't ended.
- The pass is **non-transferable** and linked to the **registered vehicle and FASTag**.

Who Can Use It?

The scheme is exclusively available for **private non-commercial vehicles**, specifically:

- **Cars**
- **Jeeps**
- **Vans**

It is **not applicable** for commercial vehicles, buses, or trucks.

How Does Trip Counting Work?

Depending on the **tolling system**, trips are calculated differently:

- **Point-based plazas**: Every crossing = **one trip**
- **Round trip (to and fro)** = **two trips**
- **Closed tolling systems** (entry-exit type): A complete journey = **one trip**

This structure is designed to ensure fair usage and accountability within the system.

Activation Process and Payment

To activate the FASTag Annual Pass:

1. Ensure your vehicle has a **valid and active FASTag**.
2. Visit the official **Rajmargyatra mobile app** or the **NHAI website**.
3. Complete **vehicle eligibility verification**.
4. Make a payment of **3,000** (for FY **2025–26**) to activate the pass.

Once verified and paid, the annual pass becomes immediately active on the respective vehicle's FASTag.

Why This Matters: Benefits for Travelers

- **Reduced Waiting Time**: Say goodbye to long toll queues.
- **Predictable Costs**: One-time payment for frequent highway users.
- **Eco-Friendly**: Fewer idling vehicles at toll plazas means **less fuel consumption and lower emissions**.
- **Supports Digital India**: Promotes **digital payments** and **smart mobility**.
- **Boosts Tourism and Road Trips**: Makes travel easier for holiday-goers and frequent interstate travelers.

Did You Know?

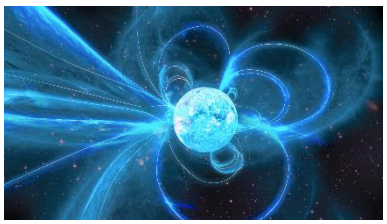
- **FASTag** was introduced in **2014** as a **pilot project**, and by **2021**, it became **mandatory** at all toll plazas across India.
- The system is operated by the **National Payments Corporation of India (NPCI)** and managed by the **National Highways Authority of India (NHAI)**.
- Over **7 crore FASTags** have been issued in India, processing **billions of toll transactions annually**.

Final Word:

The **FASTag Annual Pass Scheme** marks a significant step toward making **highway travel more efficient, affordable, and digital-first**. For frequent travelers, this new model brings both **economic savings** and **convenience**, aligning with India's broader vision of a **modern, tech-enabled transport infrastructure**.

GS Paper 3 – Science & Technology

Extreme Helium Stars: Rare Celestial Objects Reveal a New Mystery



Context: In a fascinating astronomical breakthrough, researchers have detected unusually high levels of **germanium** in a rare star named **A980**, classified under the **Extreme Helium (EHe) star** category. This marks the **first-ever detection of germanium** in such a star, revealing new and puzzling aspects of **stellar evolution** and **nuclear fusion processes** in the cosmos.

What Are Extreme Helium Stars?

Extreme Helium Stars are among the **rarest types of stars** known in our galaxy. These **low-mass supergiants** are unique because they are **almost completely devoid of hydrogen**—the most common element in the universe—and are composed primarily of **helium**.

Key Characteristics:

- Believed to form from the **merger of a carbon-oxygen white dwarf** with a **less massive helium white dwarf**.
- Extremely rare: **Only 21 such stars** have been identified so far in the **Milky Way**.
- Their **surface temperatures** range between **8,000 K and 35,000 K**, making them **hotter than the Sun** in many cases.
- The first EHe star, **HD 124448**, was discovered in **1942** at **McDonald Observatory** by astronomer **Daniel M. Popper**.

These stars serve as a **window into the final stages of stellar evolution**, particularly of binary systems, and provide vital clues about **elemental synthesis in stars**.

The Germanium Enigma: Why It Matters

The detection of **germanium (Ge)** in **star A980** is especially intriguing because this element has **never been observed** in an EHe star before. This could indicate **new or unusual nuclear reactions** taking place during or after the white dwarf merger event.

About Germanium:

- **Symbol**: **Ge**
- **Atomic Number**: **32**
- Belongs to **Group 14** of the Periodic Table, placed between **silicon** and **tin**.
- It's a **metalloid**—a substance with properties between **metals and nonmetals**.
- Possesses a **diamond-like crystal structure** and shares many traits with **silicon**, making it valuable in **semiconductor technologies**.

Chemical Stability:

- **Stable in air and water**.
- **Resistant to most acids and alkalis**, except **nitric acid**.

This discovery might suggest that **fusion pathways** or **nucleosynthesis processes** in merged stars are **more complex than previously understood**.

Global Germanium Production: Who Leads the Market?

While germanium is rare in the universe, it plays a **vital role in electronics and optics** on Earth.

Top Producers:

- **China**: Dominates the global market, contributing nearly **60% of total production**.
- Other producers include **Canada**, **Finland**, **Russia**, and the **United States**.

Germanium is extensively used in **infrared optics**, **fiber optics**, **solar panels**, and **semiconductors**, further underlining its scientific and industrial importance.

Why This Discovery is Groundbreaking:

The presence of **germanium in A980** not only adds a **new chapter to the study of EHe stars**, but also challenges current models of **element formation** and **stellar mergers**. This finding could pave the way for:

- Deeper understanding of **rare stellar types** and their internal mechanisms.
- Revisiting models of **post-white-dwarf-merger evolution**.
- Investigating the **role of exotic elements** in shaping stellar chemistry.

Final Thought:

The universe continues to **surprise us** with every telescope turn. With **A980's germanium-rich atmosphere**, **Extreme Helium Stars** have once again proven that **the cosmos holds more mysteries than we've yet imagined**. As technology advances and more sensitive instruments come online, we may soon uncover **even stranger elemental signatures** in the most **unexpected corners of the universe**.

India Climbs in Global FDI Rankings

Context: According to the **World Investment Report 2025**, published by the **United Nations Conference on Trade and Development (UNCTAD)**, **India has climbed to the 15th position** among the top foreign direct investment (FDI) destinations globally in 2024. This rise comes despite a **marginal decrease in total FDI inflows**, which stood at **$27.6 billion**, slightly lower than the **$28.1 billion** recorded in 2023.

About the World Investment Report:

The **World Investment Report** is a flagship annual publication by **UNCTAD**, offering a comprehensive analysis of **global and regional trends in FDI**. It tracks:

- **Global FDI flows**
- **Greenfield investments** and **international project finance**
- Sector-wise investment in **sustainable development**
- Policy measures affecting global investment patterns

The 2025 edition captures the **shifting investment dynamics** amid geopolitical uncertainty, digital transformation, and the green transition.

Key Global Highlights from the 2025 Report:

- **Global FDI flows** appeared to grow by **4% in 2024**, reaching **$1.5 trillion**. However, when excluding **volatile conduit flows** (mainly through tax-haven economies in Europe), actual **productive investment dropped by 11%**, marking a **second consecutive year of decline**.
- The **United States** retained its position as the **world's top FDI destination**, with inflows increasing to **$279 billion** from **$233 billion** in 2023.
- **China**, previously ranked second, saw a **sharp 29% decline**, falling to fourth place.
- **FDI to Africa surged by 75%**, driven by significant investments in energy and mining.
- **Southeast Asia** witnessed a record number of **greenfield project announcements**, indicating investor interest in manufacturing and electronics.
- In 2024, **developing Asia** attracted **$605 billion** in FDI, accounting for **40% of global FDI flows** and **70% of all investment into developing economies**.

India's Performance: Rising Momentum Despite Minor Dip

- **FDI Inflows**: India received **$27.6 billion** in 2024, a **slight decline** from the previous year. Still, it moved **up to 15th position globally**, from 16th in 2023.
- **Greenfield Projects**: India ranked **4th globally** with **1,080 new greenfield project announcements**, indicating strong investor interest in **new business setups**.
- **Project Finance Deals**: The country ranked among the **top five economies**, with **97 international project finance transactions**, reflecting strong investment in **infrastructure and large-scale industries**.
- **FDI Outflows**: India's **outward investment surged** to **$24 billion**, moving up to the **18th position globally**, a significant jump from **23rd place** and **$14 billion** in 2023.

Sectoral Trends and Development Gaps:

- Investment in sectors aligned with the **Sustainable Development Goals (SDGs)**—including **renewable energy, water, sanitation, infrastructure**, and **agrifood systems**—fell by **25% to 33%** in developing countries. Only the **healthcare sector** saw modest growth.
- **FDI into the digital economy** rose by **14%**, but **80% of greenfield projects** in this sector were concentrated in just **10 countries**, leaving the majority of developing nations out of the **digital transformation wave**.

Why This Matters:

India's continued rise in global FDI rankings demonstrates its **resilience and growing strategic importance** in the global investment landscape. The country is attracting high levels of interest in **technology, manufacturing, infrastructure, and renewable energy**—sectors critical for sustainable and inclusive growth.

With improved **ease of doing business**, **ongoing economic reforms**, and **targeted sectoral incentives**, India is positioning itself as a **preferred destination for both capital and innovation** in the global south.

Did You Know?

- India's **production-linked incentive (PLI) schemes** have been a key driver in attracting greenfield investment in **electronics, pharma, and automotive sectors**.
- The country's **Digital Public Infrastructure**—including **Aadhaar, UPI, and DigiLocker**—is being studied as a model for **inclusive digital growth** by several developing economies.

Final Word:

The **World Investment Report 2025** sends a clear message: while **global FDI is facing headwinds**, **India remains a bright spot**. With strategic policy support and rising global investor confidence, India is well-placed to **build on its momentum** and emerge as a **leading investment destination** in the coming years.

GS Paper 3 – Environment and Energy

India's Green Hydrogen Mission: Strong Domestic Drive Amid Export Challenges

Context: India's **green hydrogen sector** is rapidly evolving with strong confidence among stakeholders about its vital role in the nation's clean energy future. While global export prospects face significant hurdles, India is pivoting decisively towards building a robust **domestic market** for this promising alternative fuel.

Domestic Momentum Accelerates as Global Demand Wanes:

Amidst **geopolitical tensions** and uncertain international policies, India is focusing heavily on nurturing **domestic demand, infrastructure development, and supportive policies** for green hydrogen. The government and industry leaders recognise its transformative potential in decarbonising hard-to-abate sectors like **fertilisers, steel, and shipping**—critical to India's climate goals.

National Green Hydrogen Mission: India's Flagship Initiative

Launched in 2023, the **National Green Hydrogen Mission** aims to establish India as a global powerhouse for green hydrogen production, utilization, and eventual export. With an ambitious **budget of Rs 19,744 crore**, the mission targets the development of **5 million metric tonnes (MMT)** of green hydrogen capacity by 2030.

Key components include:

- Promoting the **domestic manufacture of electrolysers** under the **SIGHT (Strategic Interventions for Green Hydrogen Transition)** program.
- Implementing a **measurement and certification framework** introduced by the **Ministry of New and Renewable Energy (MNRE)** in April 2025 to ensure transparency and quality standards in green hydrogen production.

Export Ambitions Confront Global Uncertainties:

Despite investments in export-oriented projects like **ReNew Power's green ammonia facility in Odisha**, India's green hydrogen exports face severe setbacks. Key reasons include:

- **Weakening global demand** due to geopolitical instability and shifting policies in major markets like the **US and EU**.
- The **potential rollback of the US Inflation Reduction Act (IRA)** under the so-called **"Big Beautiful Bill"**, undermining investor confidence in green fuel transitions.
- Lack of sufficient industry response to European tenders, such as Germany's **Hintco initiative under H2Global Foundation**, reflecting broader export market sluggishness.

Enhancing Global Market Access:

To overcome trade and logistical barriers, India is actively engaging with major European ports, including **Rotterdam and Antwerp**, aiming to streamline future shipments of green hydrogen and its derivatives. Trade negotiations, including Free Trade Agreement (FTA) discussions with Europe, are also exploring **import duty reductions** to enhance export competitiveness.

Domestic Demand: The New Growth Engine

In light of export uncertainties, India is doubling down on cultivating a **strong domestic green hydrogen market**:

- Recent tenders for the supply of **800,000 tonnes of green hydrogen** attracted full participation, signaling growing domestic interest.
- The **Solar Energy Corporation of India (SECI)** is managing another tender for **700,000 tonnes**, primarily targeting the **fertiliser sector**.
- Pilot projects in **transportation, steel, and shipping** sectors are underway, with hydrogen fuel cell buses currently tested in **five cities including Ladakh**.

Industry experts suggest that **mandatory green hydrogen sourcing** in sectors like fertiliser manufacturing could significantly accelerate adoption.

Cost Competitiveness: The Key Challenge

The main barrier to large-scale adoption remains the **high cost of green hydrogen**, currently priced at **$4–$5 per kg**, compared to **$2.3–$2.5 per kg for grey hydrogen**, which is derived from fossil fuels. Without supportive policies or mandates, green hydrogen is yet to achieve commercial viability.

A recent study by **CII, Bain & Company, and RMI** attributes the high cost to:

- Underdeveloped **supply chains**
- Elevated **financing expenses**
- Lack of **economies of scale**

The report recommends practical strategies to boost demand and reduce costs, including:

- **Blending green hydrogen with grey hydrogen or piped natural gas**
- Promoting its use in **specialized industries** like ceramics, chemicals, and glass
- Leveraging **public procurement policies**, especially for green steel projects, to drive scale and price reduction

Future Outlook: Balancing Ambition with Realities

India's vision for green hydrogen remains bold and forward-looking. However, the current scenario calls for a **recalibration of priorities**—shifting focus from immediate export ambitions toward **strengthening domestic infrastructure, demand creation, and cost reduction**.

If successful, India could emulate its remarkable **renewables growth story**, achieving **cost parity** in green hydrogen and positioning itself as a **global leader** in the clean fuel economy of the future.

Additional Insight:

Globally, green hydrogen is poised to play a pivotal role in achieving net-zero targets by 2050. Countries like Australia and Saudi Arabia are also investing heavily in green hydrogen export projects, underscoring the importance of international collaboration and competitive positioning for India in this emerging global market.

GS Paper 2 – International Relation

The 51st G7 Summit: India's Rising Global Role and the Quest for Collective Solutions

Context: Prime Minister **Narendra Modi** participated in the **51st G7 Summit Outreach Session** held in **Kananaskis, Canada**, marking his **sixth consecutive appearance** at the prestigious global gathering. The summit served as a vital platform for **strategic dialogue**, bringing together world leaders to address some of the most pressing challenges of our time.

Theme of the 2025 G7 Outreach: Shaping a Resilient Future:

The **2025 G7 Outreach Summit**, hosted by **Canada**, focused on three pivotal themes:

- **Protecting Communities Across the World**
- **Building Energy Security and Accelerating the Digital Transition**
- **Securing Future Partnerships**

This summit also marked **50 years of G7 partnership and cooperation**, highlighting the evolution of this informal bloc into a cornerstone of **multilateral diplomacy**.

India's Strategic Engagement at the Summit:

PM Modi addressed a critical session on **'Energy Security: Diversification, Technology and Infrastructure to Ensure Access and Affordability in a Changing World'**. India emphasized its commitment to:

- Ensuring **affordable**, **reliable**, and **sustainable energy**
- Promoting the voice and concerns of the **Global South**
- Strengthening global cooperation on **green energy** and **technological transformation**

In addition to the multilateral meetings, PM Modi engaged in **bilateral discussions** with the leaders of **Germany, Canada, Ukraine**, and **Italy**, reinforcing India's global partnerships.

Understanding the G7: A Key Global Power Bloc

The **Group of Seven (G7)** is an **informal consortium** of the world's most advanced economies, consisting of:

- **Canada**
- **France**
- **Germany**
- **Italy**
- **Japan**
- **United Kingdom**
- **United States**
- **European Union** (as an observer)

Founded in 1975 in response to the global oil crisis, the G7 has since evolved into a leading platform for **coordinating economic and geopolitical policies**.

In **1998**, **Russia** was temporarily added, forming the **G8**, but was suspended in **2014** following the annexation of Crimea.

The G7 now represents about **10% of the world's population**, but nearly **30% of global GDP**.

India and the G7: A Steadily Growing Partnership

Although **not a formal G7 member**, **India** has been a **regular invitee** to the G7 Outreach Sessions since **2003**, and has attended **every year since 2019**.

As the **world's fifth-largest economy**, India's participation highlights its rising geopolitical stature and leadership in representing the **Global South**.

India contributes actively on issues such as:

- **Climate change**
- **Clean energy**
- **Digital inclusion**
- **Global health**
- **Geopolitical stability**

Why the G7 Summit Matters Globally:

1. **Economic Powerhouse**: G7 nations collectively wield immense **economic influence**, shaping global **trade**, **investment flows**, and **financial regulation**.
2. **Crisis Response Hub**: The group plays a crucial role in crafting **coordinated responses** to global crises, including **pandemics**, **financial shocks**, and **armed conflicts**.
3. **Catalyst for Climate and Innovation**: The G7 leads global initiatives on **climate policy**, **energy transition**, **AI governance**, and **technology frameworks**.
4. **Symbol of Multilateralism**: It remains a symbol of **rules-based international order**, consensus-building, and democratic cooperation.

Did You Know?

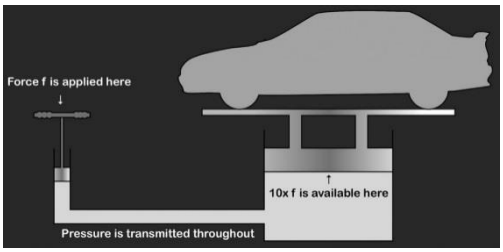
- The **first G7 summit** was hosted in **Rambouillet, France**, in **1975**.
- **Japan** will take over the presidency in **2026**, continuing the tradition of rotating leadership.
- The G7 does not have a **permanent secretariat**, making each presidency critical in setting the agenda.
- **India's inclusion** is often linked to its role as a **balancing power** between developed and developing economies.

Conclusion: A Platform of Promise and Partnership

The 51st G7 Summit reaffirmed the **power of dialogue**, **inclusivity**, and **shared responsibility**. With India playing an increasingly vital role, the summit demonstrated how global cooperation can be leveraged to build a **safer**, **greener**, and **more equitable world**. As we move into a future shaped by **energy transformation**, **digital innovation**, and **geopolitical flux**, forums like the G7 remain central to shaping a **collaborative global order**.

GS Paper 3 – Science & Technology

Hydraulic Systems: Powering Precision and Strength in Modern Engineering



Context: Hydraulic systems have revolutionized how we perform **heavy-duty tasks** across industries. By transforming energy into **smooth, controlled mechanical motion**, these systems make possible everything from lifting massive loads to executing intricate movements with **pinpoint accuracy**. With a global market worth over **$45–50 billion** and growing, hydraulics remain indispensable in the world of **advanced machinery**.

Understanding Hydraulic Systems: What Makes Them Work

- A **hydraulic system** uses **incompressible fluids** (usually oil) to **transmit force**. This principle enables **amplified power output** with minimal input, offering a **high power-to-weight ratio**, **efficient heat management**, and **precise control**. These systems are particularly vital in fields that demand **consistent and reliable mechanical force**.

The Science Behind It: Pascal's Law in Action

At the core of hydraulic operation is **Pascal's Law**, which states:

"Pressure applied to a confined fluid is transmitted undiminished in all directions."

In practice, this means that applying a small force on a small piston can generate a **much larger force** on a larger piston, thanks to the **uniform pressure distribution** in the fluid. This is what gives hydraulics their **incredible lifting power**.

In contrast, **pneumatic systems** use **compressible fluids** like air, making them suitable for lighter and faster operations, but generally **less powerful** than hydraulics.

Key Components of a Hydraulic System:

To deliver such efficient mechanical output, a hydraulic system is made up of the following **core components**:

- **Pump** – Converts mechanical energy into hydraulic energy by creating fluid flow.
- **Valves** – Direct, regulate, and control the flow and pressure of the hydraulic fluid.
- **Actuators (Cylinders or Motors)** – Convert fluid energy into **linear** or **rotary motion**.
- **Reservoirs and Pipes** – Store and transport the hydraulic fluid throughout the system.
- **Sensors and Control Units** – Monitor system performance and ensure **safety and responsiveness**.

Real-World Applications of Hydraulic Technology:

Hydraulic systems have become the **backbone** of many modern industries, thanks to their reliability and power:

- **Construction Machinery:** Used in **excavators**, **cranes**, **bulldozers**, and loaders to provide the **lifting**, **digging**, and **moving** capabilities essential on any construction site.

- **Aerospace and Aviation:** Aircraft utilize hydraulic systems in **landing gear**, **flaps**, **rudder control**, and **brake systems**, where **precise control** and **fail-safe operation** are non-negotiable.
- **Manufacturing and Automation**: Hydraulic presses, **injection molding machines**, and **robotic arms** rely on hydraulic power for repetitive, high-force operations that demand **speed and accuracy**.
- **Automotive Sector**: From **brake systems** in passenger cars to **hydraulic lifts** in service stations, these systems offer both **safety and functionality**.

Fun Fact: Hydraulics in Nature:

Hydraulic principles are even found in **nature**! For example, **spiders** use hydraulic pressure in their legs to extend and move swiftly—when they die, their legs curl up due to the loss of pressure!

Conclusion: The Future is Fluid-Powered

As industries continue to evolve toward **automation**, **precision**, and **energy efficiency**, **hydraulic systems** will remain at the forefront of innovation. Whether in **space exploration**, **smart manufacturing**, or **green energy solutions**, their unmatched capability to **control and amplify force** makes hydraulics an enduring foundation of **modern engineering excellence**.

GS Paper 3 – Environment & Ecology

India to Introduce Air Conditioner Temperature Guidelines for Energy Efficiency

Context: With temperatures soaring across the country, **air conditioners (ACs)** have become a household necessity in India. However, the unchecked use of ACs is significantly **increasing power demand**, straining the **national electricity grid** and the **environment**. In response, the Indian government is preparing to implement new **temperature guidelines** for ACs to promote **energy conservation** and **sustainable cooling**.

Rising Cooling Demand in India: A Growing Challenge

- **Cooling systems** currently account for nearly **50 GW**—or **20% of India's peak power demand**.
- With over **10 crore AC units** already in operation and **1.5 crore units** added each year, India is experiencing one of the **fastest-growing cooling demands** globally.
- Studies show that **every 1°C increase** in AC temperature setting can lead to approximately **6% energy savings**, showcasing the immense potential of optimized temperature regulation.

How Do Air Conditioners Work? Understanding the Cooling Cycle

An **air conditioner** works by transferring **heat from indoors to outdoors** using a **vapor-compression cycle**. This process relies on a **refrigerant fluid** and the interaction of four key components:

- **Evaporator** – Absorbs indoor heat and removes moisture.
- **Compressor** – Compresses vapor; it's the **most energy-intensive** part.
- **Condenser** – Releases the collected heat outside and condenses the vapor into liquid.
- **Expansion Valve** – Regulates pressure and temperature before recycling the refrigerant.

This entire cycle enables the AC to provide effective cooling—but at the cost of **significant electricity usage**.

Why Standardizing AC Temperatures Matters:

The **Bureau of Energy Efficiency (BEE)** has recommended a **default AC temperature setting of 24°C** in both residential and commercial buildings. This is based on scientific studies and **human comfort guidelines**:

- **Public spaces** often maintain ACs at **18–21°C**, which leads to **unnecessary energy consumption** and causes discomfort due to overcooling.
- According to global comfort standards, indoor temperatures up to **25°C** are **comfortable** when combined with **air circulation** and **moderate humidity**.
- The **World Health Organization (WHO)** advises maintaining indoor temperatures **above 18°C** to prevent health issues such as **respiratory illnesses**, **hypertension**, and **reduced cognitive function**.

Existing Challenges to Overcome:

Despite India's push toward energy efficiency, several **key issues** hinder progress:

- Only **20% of AC units** sold in India are **5-star rated**, meaning the majority are still **energy-inefficient**.
- BEE's **current rating standards** are outdated and need a **revamp by 2028** to meet global benchmarks.

- Implementation of the **Energy Conservation Building Code (ECBC)** remains **inconsistent**, especially in urban construction.
- There is limited use of **passive cooling techniques** like thermal insulation, natural ventilation, and reflective building materials.

The Way Forward: Strategies for Sustainable Cooling

To ensure that India's cooling future is both **eco-friendly** and **economically viable**, the government and stakeholders must work together on multiple fronts:

Promote Passive Cooling Architecture

Encourage **climate-responsive building designs** that include:

- **Cross-ventilation**
- **Shaded facades**
- **Cool roofs** and **green cover**
- **Thermal mass insulation**

Conclusion: Regulating to Refresh India's Cooling Future

In a country like India, where **climate change** and **urbanization** are intensifying the need for cooling, **air conditioners** are no longer a luxury—they are a necessity. However, without regulation, their **energy footprint** could become unsustainable.

GS Paper 3 – Environment & Ecology

Kerala High Court Cracks Down on Single-Use Plastics in Ecologically Fragile Hill Stations

Context: In a **landmark move**, the **Kerala High Court** has enforced a **ban on single-use plastics** in **ecologically sensitive hilly tourist destinations** across the state. This decisive action also includes the **regulation of plastic bottle usage** during **mass gatherings** such as weddings, public celebrations, and **government-sponsored events**.

Importantly, the court has **excluded non-woven polypropylene bags** with a thickness of **60 GSM and above** from this ban, recognizing their **reusability and relatively lower environmental footprint**.

Why This Ban Matters: The Environmental and Public Health Impact

Hilly regions are **environmentally delicate ecosystems**. Plastic pollution in these areas has far-reaching consequences:

- **Biodiversity Threat**: Plastic debris contaminates soil and water, threatening **native flora and fauna** and **disrupting local food chains**.
- **Public Health Risks**: Stagnant plastic waste encourages **mosquito breeding**, leads to **water contamination**, and **diminishes the visual appeal** of scenic tourist spots.
- **Climate Vulnerability**: Plastics contribute to **microplastic contamination** and disrupt **carbon sinks** like forests and mountain soil.

The Real Challenge: Waste Governance in Mountain Terrains

Despite repeated attempts, managing waste in hilly regions remains a tough challenge due to:

- **Lack of Local Infrastructure**: Most hill towns **lack basic facilities** for waste segregation, collection, and disposal.
- **Weak Enforcement**: Though plastic bans exist in theory, in practice, there is **poor monitoring**, **low compliance**, and **limited alternatives** available for **local vendors and tourists**.
- **Low Awareness**: **Tourists often overlook** sustainable practices, and many businesses **lack awareness of their responsibilities** under **Extended Producer Responsibility (EPR)** regulations.
- **Geographic Isolation**: **Scattered settlements**, **steep terrain**, and **seasonal inaccessibility** make logistics complex and costly.

India's Broader Push Against Plastic Pollution:

Kerala's initiative aligns with **India's national strategy** to tackle the growing plastic menace:

- **Extended Producer Responsibility (EPR)**: Makes **plastic producers accountable** for post-consumer waste management.
- **Plastic Waste Management (Amendment) Rules, 2022**: Bans the use of plastic bags thinner than **120 microns** to reduce litter and increase recyclability.
- **Swachh Bharat Abhiyan**: A national mission focusing on **cleanliness and waste segregation**, including **plastic collection drives** in both urban and rural areas.
- **Plastic Parks**: India has established **dedicated zones** for **recycling and reprocessing plastic waste**, promoting **circular economy principles**.

- **Judicial Activism**: Indian courts, invoking **Article 21** (Right to Life), have increasingly intervened in cases of **environmental degradation**, reinforcing the **legal right to a clean and healthy environment**.

The Way Forward: Building a Sustainable, Mountain-Friendly Future

To protect India's fragile mountain ecosystems, a **multi-pronged strategy** is essential:

- **Tailored Waste Policies**: Formulate regulations that respect **local customs**, **geographic limitations**, and **ecological importance** of hill areas.
- **Community-Led Waste Management**: Encourage **decentralized, low-cost systems** rooted in **traditional practices** and **local governance**.
- **Eco-Tourism Mandates**: Implement **mandatory waste audits**, **zero-waste event protocols**, and **tourist education drives**, especially near **pilgrimage sites and water bodies**.
- **Green Incentives**: Offer **incentives for businesses** and tourists adopting sustainable practices — such as discounts for reusable containers or recognition programs for plastic-free accommodations.

Additional Insight: Global Parallels and Lessons

Countries like **Nepal and Bhutan** have also faced plastic waste crises in their mountainous regions. For instance:

- **Bhutan**, known for its **Gross National Happiness model**, banned plastic bags in 1999 and promotes **eco-tourism as a national policy**.
- In **Switzerland**, mountain resorts employ **underground waste suction systems** to minimize visual and environmental impact.

Kerala's new ban could serve as a **model for other Indian states** with hilly terrains such as **Himachal Pradesh, Uttarakhand, and Sikkim**, helping the country collectively move toward a **plastic-free and sustainable future**.

Conclusion: A Step in the Right Direction

The **Kerala High Court's intervention** is a timely reminder that **sustainable development** must respect **environmental limits**, especially in **climate-sensitive zones**. As plastic pollution continues to escalate, especially in tourist hotspots, **proactive legal measures**, **community engagement**, and **eco-conscious tourism** are no longer optional — they are imperative.

GS Paper 1 – Geography

Croatia in Focus: A Strategic European Partner in the Spotlight

Context: Croatia, a picturesque country nestled in **South-Eastern Europe**, has recently gained attention following a **high-level visit by the Prime Minister of India**. This visit marks a significant step in bolstering **bilateral relations**, particularly in the realms of trade, tourism, defence, and cultural exchange.

Political Ladscape: A Key Player in the Balkans

Situated on the **Balkan Peninsula**, **Croatia shares its borders** with five countries:

- **Hungary to the north**
- **Montenegro to the south**
- **Slovenia to the west**
- **Serbia and Bosnia & Herzegovina to the east**

With its **capital in Zagreb**, Croatia is a **member of both the European Union (EU) and the North Atlantic Treaty Organization (NATO)**. This dual membership underscores its strategic position in European security and economic networks.

Croatia joined the **EU in 2013**, becoming the **28th member**, and adopted the **Euro as its official currency in January 2023**, replacing the Croatian Kuna.

Geography and Climate: A Diverse Natural Landscape

Croatia boasts a stunning geographical mix that includes:

- **The Dinaric Alps**, a prominent mountain range running parallel to the Adriatic coast.
- A **long, scenic coastline along the Adriatic Sea**, featuring over **1,000 islands**, making it a hub for European tourism.
- Major rivers such as the **Sava** and **Drava**, which play vital roles in agriculture, transport, and hydropower.

The nation experiences two distinct climate zones:

- **Continental Climate**: Characterized by **hot summers and cold winters**, especially in inland areas like Zagreb.
- **Mediterranean Climate**: Along the coast, the weather remains **mild and sunny**, attracting millions of tourists every year.

Additional Insights: Croatia's Global Relevance

- Croatia has a **high Human Development Index (HDI)** and is known for its **excellent healthcare and education systems**.

- The country is famous for its **cultural heritage**, including **UNESCO World Heritage Sites** like the **Old City of Dubrovnik**, often referred to as the "Pearl of the Adriatic".
- It has made a name for itself in sports, particularly in **football**, with the national team finishing **second in the 2018 FIFA World Cup**.

Conclusion: Strengthening Partnerships Across Continents

Croatia's strategic location, **EU-NATO membership**, and **cultural ties with both Western and Eastern Europe** make it an important player on the international stage. India's recent diplomatic outreach signals a **growing partnership rooted in mutual interests**, from **economic cooperation to global security**.

As the world continues to shift toward **multi-polar global alliances**, engaging with nations like Croatia will be essential for India's expanding global footprint.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Bihar Pioneers E-Voting for Urban Elections: A Leap Towards Digital Democracy

Context: In a groundbreaking move towards **digitizing the electoral process**, **Bihar is set to become the first Indian state to introduce mobile-based e-voting** in its upcoming **urban local body elections**. This innovative initiative by the **Bihar State Election Commission** is poised to transform how citizens engage with the democratic process, making voting more **accessible, secure, and user-friendly**.

The **e-voting system**, scheduled for rollout later this month, will allow voters to cast their ballots through **Android-based mobile applications**—a major milestone in India's journey toward **electoral modernization**.

Key Features of Bihar's E-Voting System:

1. **Mobile-Based Voting:** The system uses two specialized **Android apps**—one developed by the **Centre for Development of Advanced Computing (C-DAC)** and the other by the **Bihar State Election Commission**. The apps will be available for verified voters to cast their votes remotely.
2. **Advanced Security Protocols:** Security is at the heart of this system. It incorporates:
   - **Blockchain technology** to ensure **tamper-proof data storage**
   - **Liveness detection** to verify that a real person is casting the vote in real time
   - **Facial recognition and matching** to confirm the voter's identity, including **live scans and photo comparisons**
3. **Transparent Audit Mechanism:** Like the **VVPAT system used with EVMs**, Bihar's e-voting platform will maintain an **audit trail**, enabling **vote tracking and verification**. This ensures **accountability and transparency**, boosting public trust in the system.

Why E-Voting Matters: The Advantages

1. **Greater Accessibility:** This system empowers traditionally underrepresented groups such as:
   - **Migrant workers**
   - **Senior citizens**
   - **Persons with disabilities**
   - **Voters living in remote or urban-transit areas**
2. **Youth Engagement:** With **India's youth making up over 50% of the electorate**, mobile e-voting appeals to their **digital fluency**, encouraging **first-time voters** to participate and build a **lifelong habit of voting**.
3. **Boosting Voter Turnout:** By eliminating the need to travel to polling booths, this system could significantly **increase voter turnout**, especially in urban areas where daily life is fast-paced and often mobility-restricted.
4. **Eco-Friendly Option:** E-voting can potentially reduce the use of **paper ballots, printed lists**, and **manual resources**, making elections more **sustainable and cost-efficient** over time.

Challenges and Concerns:

Despite its promise, e-voting raises several valid concerns:

- **Cybersecurity Risks:** Vulnerabilities to **hacking, data breaches**, and **system manipulation** remain key issues.
- **Digital Divide:** Those without smartphones, internet access, or digital literacy—often the **elderly and rural poor**—may face exclusion.
- **Coercion and Privacy Issues:** Voting from home or shared spaces may compromise the **secrecy and freedom** of individual choices.
- **Legal and Logistical Readiness:** There's a need for **clear legal frameworks**, **robust grievance redressal systems**, and **voter education campaigns** to support this shift.

Global Context: E-Voting Around the World

Countries like **Estonia** have already successfully implemented **nationwide internet voting** (i-voting) since 2005, with robust security protocols and high public trust. **Switzerland** and **Canada** have also experimented with online voting in select regions. Bihar's step aligns with **global trends** in making elections **digital, inclusive, and forward-looking**.

Conclusion: A Bold Step Towards Electoral Innovation

Bihar's adoption of mobile-based e-voting is a **historic initiative** that could serve as a **blueprint for the rest of the country**. If implemented effectively, it can **revolutionize the electoral landscape** by making it more **inclusive, efficient, and future-ready**.

However, the real test lies in ensuring **cybersecurity, accessibility, and voter confidence**. With the right safeguards, Bihar's model could herald a new era of **digital democracy in India**, where every eligible citizen has the **power to vote anytime, anywhere—securely and confidently**.

GS Paper 3 – Environment, Biodiversity, and Conservation

Cooking Oils Turn Green Chemists: A Sustainable Solution for Silver Recovery from E-Waste

Context: In a remarkable breakthrough, **Finnish researchers** have discovered a **green and sustainable chemical process** that uses **natural fatty acids** found in **vegetable cooking oils** to recover **silver** from **electronic waste (e-waste)**. This innovation aligns with the urgent global need to tackle e-waste and meet the surging demand for silver in various industries.

What is E-Waste and Why It Matters:

Electronic waste, or **e-waste**, includes discarded electronic and electrical devices such as **smartphones, laptops, TVs, and household appliances** that are no longer functional or have become outdated. With technological upgrades accelerating, e-waste is now one of the **fastest-growing waste streams worldwide**.

- **India ranks third globally** in e-waste generation, after **China and the United States**.
- According to the **World Silver Survey 2024**, **industrial usage** now accounts for over **50% of global silver demand**.
- However, **only 15% of silver** is currently **recycled**, causing massive wastage of this **non-renewable, precious metal**.

The E-Waste Problem in India: A Snapshot

Despite being a tech-savvy and digital-forward nation, **India's e-waste management system** is fraught with structural issues:

- **Limited Consumer Incentives**: There is a lack of financial or logistical motivation for individuals to return old electronics responsibly.
- **Inadequate Infrastructure**: Many **Tier-II and Tier-III cities** lack authorized e-waste collection centers.
- **Dominance of the Informal Sector**: Over **90–95% of e-waste** is processed by informal scrap dealers using **hazardous methods** like **acid leaching** and **open burning**, posing **serious health and environmental risks**.
- **Grey Imports**: Used electronics often enter India as "donations" or "refurbished" items, which eventually contribute to the **e-waste load**.

Silver Recovery Using Cooking Oils: A Green Game-Changer

Traditional silver extraction from e-waste involves **toxic chemicals** that generate hazardous residues. The new **eco-friendly method**, however, leverages **unsaturated fatty acids** such as **oleic acid** and **linolenic acid**—commonly found in **sunflower, groundnut, olive, and soybean oils**.

How the Process Works:

1. These fatty acids are combined with **30% hydrogen peroxide** to create a **green solvent**.
2. This solvent dissolves silver from circuit boards under **mild and safe conditions**.
3. **Ethyl acetate**, a **low-toxicity solvent**, is then used to **separate and recover pure silver**.

This method not only reduces environmental harm but also offers a **cost-effective and scalable alternative** for **developing countries** like India.

Policy & Government Action on E-Waste in India:

India has taken several notable steps to address its growing e-waste burden:

- **Extended Producer Responsibility (EPR)**: Under this, manufacturers and brands are held responsible for the **collection and recycling** of their end-of-life products.
- An **online EPR portal**, managed by the **Central Pollution Control Board (CPCB)**, facilitates registration and monitoring of producers, recyclers, and refurbishers.
- The **E-Waste (Management) Rules, 2022** replaced the 2016 rules with more stringent norms and accountability.
- **India's first e-waste clinic** was inaugurated in **Bhopal, Madhya Pradesh**, providing a dedicated facility for **collection, segregation, and processing** of electronic waste.

Global and Environmental Significance:

- Silver is a **critical component** in **solar panels, electric vehicles, medical devices, and consumer electronics**.
- With **global silver demand** projected to increase by **over 15% by 2030**, sustainable recovery methods are crucial.
- By integrating green chemistry into recycling, India can also move closer to **achieving the UN Sustainable Development Goals (SDGs)**, especially **Goal 12 (Responsible Consumption and Production)** and **Goal 13 (Climate Action)**

Way Forward: Turning Waste into Wealth

India stands at a crucial crossroads where its digital growth must be balanced with **ecological responsibility**. The cooking oil-based silver recovery method is not just a scientific innovation but a **symbol of circular economy thinking**—where waste becomes a resource.

The future of e-waste management lies not just in **containing the damage**, but in **extracting value**, **preserving human health**, and **fueling green economic growth**.

If adopted widely, such green technologies can play a pivotal role in building a **"Viksit Bharat"**—an India that is not only technologically advanced but also **environmentally resilient and globally responsible**.

GS Paper 3 – Agriculture and Biodiversity

Preserving India's Traditional Seeds: A Heritage of Resilience, Culture, and Food Sovereignty

Context: India's diverse agro-ecological heritage is deeply rooted in **traditional seed varieties** that have sustained farming communities for centuries. However, a recent study by the **Centre for Science and Environment (CSE)** has raised alarms over the gradual **erosion of indigenous seed knowledge**, particularly the weakening **intergenerational transfer** of this vital resource. As modern agriculture becomes increasingly commercialised, preserving our **native seeds** has become both an environmental and cultural imperative.

Why Traditional Seeds Matter More Than Ever:

1. **Genetic and Ecological Diversity: Traditional seed varieties** possess a **rich genetic base**, unlike modern monocultures that are vulnerable to pest infestations and diseases. These indigenous seeds naturally promote **resilient polycultures**, ensuring stability and yield even under stress conditions.
2. **Built-In Climate Resilience:** With **climate change** triggering extreme weather events like **droughts, floods, and cloudbursts**, traditional seeds act as **natural insurance**. In **mixed-cropping systems**, if one variety fails, others often thrive—ensuring **food security** for farming households.
3. **Sustainable and Chemical-Free Farming:** Many of these seeds are **open-pollinated and self-replicating**, perfectly suited for **organic farming practices**. Unlike commercial hybrids or genetically modified (GM) seeds, they do not require annual purchase or chemical inputs, lowering both **costs and ecological impact**.

Community Seed Banks: A Grassroots Lifeline:

Community Seed Banks (CSBs) serve as vital hubs where farmers **borrow traditional seeds** and return double the quantity post-harvest. These local systems help maintain **seed sovereignty**, especially in **tribal and ecologically sensitive regions**. However, despite their importance:

- India **lacks a robust policy framework** to support CSBs.
- The **Seed Bill, 2019** remains **pending**, with **no formal recognition or integration** of community seed systems into the national strategy.

Challenges Facin Traditional Seed Conservation:

1. **Youth Disengagement:** Modern agricultural narratives glorify **hybrid and GM seeds** for their supposed high yields. As a result, **young farmers** are moving away from **ancestral seed practices**, creating a serious **knowledge gap**.
2. **Lack of Government Support:** Most CSBs are operated by **NGOs or self-help groups** and function with **limited funding**. They are **excluded from mainstream agricultural schemes**, receiving neither recognition nor incentives.
3. **Loss of Cultural Practices:** Seed-saving traditions like **"Rotiyaana" in Uttarakhand**—which blend cultural rituals with farming wisdom—are slowly disappearing. The **oral and family-based knowledge transfer** system is under threat.
4. **Legal Loopholes and Biopiracy Risks:** Even with frameworks like the **Protection of Plant Varieties and Farmers' Rights Act (PPVFRA)**, poor documentation leaves **"common knowledge" varieties**

vulnerable. Unscrupulous individuals can **privatize traditional seeds**, risking **biopiracy** and **cultural theft**.

Inspiring Seed Conservation Models Across India:

- **Odisha's Niyamgiri Foothills**: Farmers practice **diverse cropping**—from millets to medicinal herbs—enhancing ecological resilience.
- **Uttarakhand's Barah Anaj System**: Revived by the **Beej Bachao Andolan**, it involves cultivating **12 traditional crops together**, reinforcing biodiversity.
- **Teeratha Village, Karnataka**: Through **Participatory Variety Selection (PVS)** under the **Sahaja Samrudha CSB Network**, youth actively test millet varieties in **"diversity blocks."**
- **Chizami, Nagaland**: A **women-led CSB** not only conserves seeds but also conducts **training for youth and schoolchildren**, reviving lost knowledge.
- In many parts of India, **women preserve seeds** in **mud pots, bamboo baskets**, or with **neem leaves**—a **chemical-free and time-tested storage technique**.
- The **Bharat Beej Swaraj Manch (BBSM)** has been hosting **seed festivals** in Mumbai, Pune, Kolkata, and Hyderabad since 2014, celebrating **seed sovereignty** as a **citizen-driven movement**.

The Road Ahead: From Conservation to Cultural Renaissance

1. Legal and Policy Reforms:

- **Fast-track the documentation** of traditional varieties.
- Prevent exploitation by recognizing **farmer-bred seeds as public heritage**.
- Ensure CSBs are formally integrated into **national seed policies**.

2. Engaging the Next Generation:

- Launch **award and grant schemes** for **young seed savers**.
- Include **seed-saving techniques in school curricula** and **rural skilling programmes**.
- Leverage platforms like **National Rural Livelihood Mission (NRLM)** to support young agro-entrepreneurs.

3. Decentralised Preservation Systems:

- Promote **in-situ conservation** in forests and home farms.
- Develop **cluster-based CSBs**—with one seed bank for every **100–200 villages** to ensure **localised biodiversity and accessibility**.

4. Cultural Revitalisation:

- Use **folk traditions, fairs, and community rituals** to reignite youth interest in indigenous seeds.
- Encourage **seed exchange festivals** to revive community participation and pride in heritage crops.

Conclusion: Seeds of the Past, Future of Our Agriculture

Preserving **India's traditional seed wealth** is not merely a scientific or agricultural task—it's a **cultural and civilisational mission**. These seeds embody **our history, our biodiversity, and our food future**. Through **community action, supportive policies, and youth engagement**, India can restore its rightful place as a **global leader in sustainable and sovereign agriculture**.

GS Paper 3 – Defence & Technology

SIPRI Annual Report 2025: Rising Tensions in a World of Expanding Nuclear Arsenals

Context: The **Stockholm International Peace Research Institute (SIPRI)** has released its much-anticipated **Annual Report 2025**, offering a comprehensive overview of the **current state of global military forces, nuclear arsenals**, and the **shrinking space for disarmament diplomacy**. The findings paint a picture of a world edging closer to a **renewed arms race**, with **nuclear-armed states expanding and modernising** at an unprecedented pace.

Global Nuclear Forces: Numbers That Raise Alarms

As of **January 2025**, the total number of **nuclear warheads** globally stood at **12,241**, of which:

- **9,614** are part of **military stockpiles**—either **deployed** or available for use.
- **3,912** warheads are **deployed**, actively mounted on missiles or stationed at military bases.
- **Approximately 2,100** warheads are on **high operational alert**, primarily controlled by the **United States** and **Russia**.

Country-Specific Warhead Estimates (2025):

- **India**: **180 stored warheads**
- **Pakistan**: **170 stored warheads**
- **China**: **600 warheads**, including **24 deployed**
- **USA & Russia**: Together hold about **90%** of global nuclear weapons

This data underscores a critical reality: while the Cold War may have ended, the **nuclear threat has not**.

Modernisatin and Arsenal Expansion: A Dangerous Trend

All nine nuclear-armed states—**United States, Russia, United Kingdom, France, China, India, Pakistan, Israel**, and **North Korea**—continued to **modernise and upgrade** their nuclear weapons and delivery systems in 2024.

- **India** made **modest additions** to its arsenal and invested in the development of **advanced missile systems** and delivery technologies.
- **Pakistan** continued accumulating **fissile material** and expanded its missile capabilities, signaling an intention to **scale up** its arsenal.
- **China** saw a **rapid expansion**, adding around **100 nuclear warheads annually** since 2023. At this pace, it could possess over **1,000 warheads by 2032**.

These developments suggest a shift from a **deterrence-based posture** to an **assertive display of nuclear capability**.

Global Military Expenditure Hits Record High:

In 2024, **global military spending** surged to a staggering **$2.7 trillion**, marking a **9.4% year-on-year increase**.

Top Military Spenders (2024):

- **United States**: $997 billion
- **China**: $314 billion

Top Arms Importers (2020–2024):

- **Ukraine**
- **India**
- **Qatar**
- **Saudi Arabia**
- **Pakistan**

Top Arms Exporters (2020–2024):

- **USA**: 43% of global arms exports
- **France**: 9.6%
- **Russia**: 7.8%

This massive investment highlights the **growing militarization** of international relations, where **hard power** continues to dominate over diplomacy.

The Shrinking Space for Arms Control and Disarmament:

One of SIPRI's most pressing concerns is the **erosion of global arms control frameworks**. Despite rhetorical commitments, **no major nuclear power** is showing **genuine intent** to reduce arsenals or halt modernization.

- The **New START Treaty**—the last major arms reduction pact between the **USA and Russia**—is set to **expire in February 2026**.
- Without a new agreement, the **number of deployed strategic warheads** could **rise sharply** post-2026.

Furthermore, technological innovations such as **Multiple Independently Targetable Reentry Vehicles (MIRVs)**, **canisterised launch systems**, and **AI-enabled command and control** are making nuclear weapons more **sophisticated—and more dangerous**.

Rising Nuclear Aspirations Beyond the Traditional Nine:

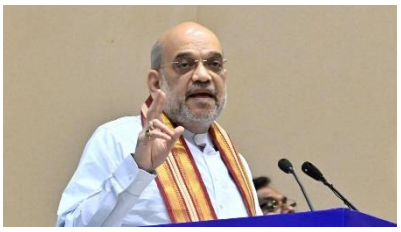
SIPRI notes a disturbing trend: **revived debates on nuclear armament** in **East Asia, Europe, and the Middle East**. With growing geopolitical uncertainties, some nations are reconsidering their **non-nuclear status** and may pursue **indigenous nuclear programs**, potentially leading to **proliferation beyond the current nine**.

Conclusion: At a Crossroads Between Security and Catastrophe

The **SIPRI 2025 Report** is a stark reminder that the **nuclear threat is not a relic of the past**, but an escalating challenge in today's geopolitical climate. Despite decades of disarmament dialogues, **modernisation, expansion, and a breakdown in diplomacy** are now the defining features of global security.

GS Paper 3 – Disaster Management & Environment

Harnessing Technology for Smarter Disaster Management in India



Context: In a significant step towards strengthening India's disaster preparedness, **Union Home Minister Amit Shah** recently unveiled three cutting-edge platforms designed to **enhance the speed, coordination, and accuracy** of disaster management efforts. These are:

- **Integrated Control Room for Emergency Response (ICR-ER)**
- **National Database for Emergency Management Lite 2.0 (NDEM Lite 2.0)**
- **Flood Hazard Zonation Atlas of Assam**

These platforms utilize **satellite data**, **digital mapping**, and **real-time analytics** to assist authorities in taking **quicker, data-driven decisions**, especially in high-risk areas.

India's High Disaster Risk: A Wake-Up Call

Due to its **diverse and dynamic geo-climatic profile**, India remains **highly vulnerable** to natural disasters:

- **58.6%** of landmass is prone to **earthquakes**
- Over **12%** is at risk from **floods and river erosion**
- Nearly **68% of cultivable land** is vulnerable to **drought**
- Coastal states regularly face **cyclones and tsunamis**
- Hilly terrains in the north and northeast are prone to **landslides**

This vulnerability demands a **robust, technology-driven, and community-centered disaster management system**.

India's Disaster Management Framework: From Reactive to Proactive

The **Disaster Management Act, 2005** laid the foundation for a **structured and institutional approach** to dealing with disasters. Key components include:

- **National Disaster Management Authority (NDMA)** as the apex body
- The **National Disaster Management Plan (NDMP)**, first issued in **2016** and revised in **2019**
- Integration with global frameworks like:
    - **Sendai Framework for Disaster Risk Reduction (SFDRR)**
    - **Sustainable Development Goals (SDGs)**
    - **Paris Climate Agreement**
    - **Prime Minister's 10-Point Agenda on Disaster Risk Reduction**

Major Initiatives and Ground-Level Progress:

India has made **remarkable progress** in recent years:

- **Zero casualties** in **Cyclone Biparjoy**, a dramatic shift from the **10,000 deaths in the 1999 Odisha super cyclone**
- **Aapda Mitra Scheme** trained **1 lakh community volunteers** in **350 multi-hazard districts**
- New **Yuva Aapda Mitra Scheme** launched with 470 crore to train an additional **1 lakh volunteers**, **20% of them women**

- **National Landslide Risk Mitigation Programme** implemented in **15 states**, including Kerala
- **Early warning systems**, **weather forecasting**, and **public awareness campaigns** have improved significantly
- Budgetary commitments:
    - **SDRF**: from 38,000 crore to 1.44 lakh crore
    - **NDRF**: from 28,000 crore to ₹84,000 crore
    - **Overall disaster fund**: increased to 2 lakh crore
    - **National Disaster Risk Management Fund**: 68,000 crore

India is also leading on the global stage with initiatives like:

- **Mission LiFE (Lifestyle for Environment)**
- **International Solar Alliance**
- **Coalition for Disaster Resilient Infrastructure (CDRI)**

Persistent Challenges and Critical Gaps:

Despite progress, **long-term resilience** remains a weak link:

- **Environmental sustainability** is often ignored in relief and recovery phases, leading to **pollution** and **resource degradation**
- Disasters in **Uttarakhand (2021)** and **Himachal Pradesh (2024)** exposed the need for **community-driven recovery strategies**
- **Over-dependence on central agencies** can weaken **local governance and response capacity**

The Way Forward: Building a Resilient India:

India's disaster management strategy has evolved into a **comprehensive, multi-phased system**—yet there's more to be done. Here's how we can strengthen it:

1. **Local Empowerment:** Train and equip **local leaders, panchayats, and community groups** with the resources and knowledge to respond independently and effectively.
2. **Eco-centric Recovery:** Use **eco-friendly shelters**, **green infrastructure**, and **sustainable waste management** systems during reconstruction.
3. **Nature-Based Solutions:** Protect and restore **natural buffers** like **mangroves, wetlands, and forests** to reduce the intensity of cyclones, floods, and landslides.
4. **Integrated Risk Planning:** Disaster response should be coordinated with **health emergencies**, **environmental crises**, and **infrastructure planning**.
5. **Technology with Inclusivity:** Ensure that new platforms like **ICR-ER** and **NDEM Lite 2.0** are accessible to **state and district-level responders**, not just national agencies.
6. **Education and Culture:** Incorporate **disaster risk education** into school curricula, promote **community awareness**, and revive **traditional coping mechanisms**.

Conclusion: From Preparedness to Resilience

India's journey in disaster management shows that **policy, preparedness, and people's participation** can save lives and protect livelihoods. However, the focus must now shift from merely responding to disasters to **building long-term resilience**—through **technology, environmental stewardship**, and **local empowerment**.

GS Paper 3 – Bio-Diversity, Environment, Security and Disaster Management

Lac Insect and Its Pigment Mystery Unveiled by IISc Researchers

Context: In a remarkable scientific breakthrough, researchers at the **Indian Institute of Science (IISc)** have decoded the biological enigma behind the production of **laccaic acid**—the vibrant red compound used in **lac pigment**. This pigment, extracted from the **lac insect**, is widely used in **food colouring, textiles, dyes, folk art, and handicrafts**.

The latest study reveals that the insect does not make laccaic acid entirely on its own. Instead, a **symbiotic, yeast-like fungus** inside the insect plays a vital role in its synthesis.

What is the Lac Insect?

The **lac insect** is a small, sap-sucking insect best known for secreting **shellac**, a sticky resin with multiple commercial applications.

- It is a **hemimetabolous insect**, meaning it undergoes **gradual metamorphosis**—passing through **egg**, **nymph**, **pupal**, and **adult** stages.
- Reproduction is **ovoviviparous**, where eggs hatch inside the female's body and young ones are released.
- The life cycle completes in about **six months**.
- These insects settle on **host trees** such as the **flame of the forest**, feeding on sugary sap and producing **lac resin**.

India has two major strains of lac insects:

- **Kusumi** (grows on *Kusum* trees)
- **Rangeeni** (grows on various other trees like *Ber* and *Palash*)

Species and Distribution:

- The most economically important species is **Laccifer lacca**, which belongs to one of the **six known genera** of lac insects, only **five of which secrete lac**, and **only one produces commercial-quality lac**.
- **India and Thailand** are the world's leading lac producers.
- In India, over **90% of lac production** comes from states like:
    - **Jharkhand**, **Bihar**, **West Bengal**
    - **Madhya Pradesh**, **Chhattisgarh**
    - **Northern Odisha**, **Eastern Maharashtra**

Uses of Lac Pigment:

Lac pigment is a **natural, eco-friendly dye** highly sought after for:

- **Food-grade colouring**
- **Traditional textiles and garments**
- **Handicrafts and lacquerware**
- **Folk painting and natural cosmetics**

Its organic nature makes it an attractive alternative to **synthetic dyes**.

Breakthrough in Understanding Laccaic Acid:

The IISc study brings attention to an unexpected contributor to the production of **laccaic acid**—a **symbiotic fungus** living inside the insect's body.

- The insect cannot synthesize one essential component—**tyrosine**, an amino acid needed for pigment production.
- This gap is filled by a **yeast-like fungus** that lives inside the insect's **haemolymph** (the insect equivalent of blood).
- The fungus **enters the egg cell (oocyte)** during development, ensuring it passes to the **next generation**.
- This relationship is **mutualistic**: the insect provides shelter and nutrients, while the fungus supplies **critical biosynthetic molecules**.

Such **symbiotic relationships** are common in nature—termites, aphids, and even some beetles host bacteria or fungi that help them digest food or produce essential compounds.

Why This Matters:

- The study opens the door to **biotechnological applications**, such as **bioengineering microbes** to produce natural pigments without relying on insects.
- Understanding the **microbiome-insect link** could also help improve **lac cultivation practices**, making it more sustainable and productive.
- It deepens our appreciation of the **complex ecosystems inside tiny organisms**, where even pigments are the product of **co-evolution** and **biological partnerships**.

Conclusion: A Tiny Insect with a Big Impact

The **lac insect**, though small in size, plays a **monumental role** in rural economies, traditional arts, and sustainable industry. With cutting-edge research shedding light on the **insect-fungus partnership** behind pigment production, India has an opportunity to lead in **eco-conscious dye technology** and **natural product innovation**.

6 Iran in Focus: A Strategic Power in the Crosshairs of Global Attention

Context: In a fresh escalation, the **International Atomic Energy Agency (IAEA)** confirmed damage to **uranium enrichment facilities** at Iran's **Natanz nuclear site**, following **Israeli airstrikes** conducted under **Operation Rising Lion**. The attack was verified through **high-resolution satellite imagery**, highlighting growing tensions over Iran's nuclear ambitions.

Key Nuclear Facilities in Iran

Iran houses several critical nuclear installations, some of which are under continuous international scrutiny:

- **Natanz Enrichment Facility** – Main target of the recent strikes
- **Fordow Enrichment Facility** – Built deep underground for added protection
- **Bushehr Nuclear Power Plant** – Iran's first civilian nuclear plant
- **Isfahan Nuclear Technology Center** – Used for uranium conversion and fuel production

These facilities form the backbone of Iran's controversial **nuclear programme**, which it claims is for peaceful purposes, though Western powers remain skeptical.

Political Geography of Iran:

- **Capital**: **Tehran**
- **Region**: Located in the **Middle East**, Iran occupies a **strategic position** linking **Central Asia**, **South Asia**, and the **Arab world**.
- **Water Bodies**:
  - **South**: Borders the **Persian Gulf** and the **Gulf of Oman**
  - **North**: Touches the **Caspian Sea**, the world's largest inland body of water

Bordering Nations of Iran:

Iran shares land boundaries with **seven countries**, giving it immense geopolitical significance:

- **North**: **Armenia**, **Azerbaijan**, and **Turkmenistan**
- **West**: **Iraq**
- **Northwest**: **Turkey**
- **East**: **Afghanistan** and **Pakistan**

This positioning places Iran at the **nexus of major trade routes** and **security flashpoints**.

Geographical Landscape:

Iran is shaped by **diverse landforms** and **extreme terrains**, including:

- **The Iranian Plateau** – A dominant feature that covers much of the country
- **Deserts**:
  - **Dasht-e Kavir** (Great Salt Desert)
  - **Dasht-e Lut** – One of the hottest places on Earth, known for its stunning sand formations

- **Mountain Ranges**:
  - **Zagros Mountains** (West) – Natural barrier with Iraq
  - **Alborz Mountains** (North) – Home to **Mount Damavand**, the highest peak in Iran and the **tallest volcano in Asia**

Did You Know?

- **Iran** holds the **second-largest natural gas reserves** in the world and the **fourth-largest proven crude oil reserves**.
- **Mount Damavand**, standing at 5,610 meters, is not only a national symbol but also appears in **Persian mythology**.

The Strait of Hormuz, near Iran's southern coast, is a critical global oil chokepoint through which one-fifth of the world's petroleum passes.

Conclusion: Iran – A Nation at the Crossroads of Power, Pressure, and Potential

Iran's **strategic geography**, **rich natural resources**, and **nuclear trajectory** make it a focal point in global geopolitics. As international tensions rise and regional dynamics shift, Iran remains **a critical player** whose moves will shape the **future of Middle Eastern stability and global security**.

GS Paper 3 – Environment, Biodiversity, and Conservation

Two New Earthworm Species Unearthed in Tripura

Context: In a remarkable boost to India's biodiversity records, scientists have **discovered two new species of earthworms** in the state of **Tripura**, underscoring the ecological wealth of the **Eastern Himalaya–Northeastern Hill** region. These species — *Kanchuria tripuraensis* and *Kanchuria priyasankari* — are the latest additions to the **genus Kanchuria**, which is **endemic to Northeast India**. With these discoveries, the **total species count** within this genus has now reached **10**, and the number of **megadrile earthworm species documented in Tripura** climbs to **38**.

A Glimpse into the Species:

Kanchuria tripuraensis:

- Named after the state of **Tripura**, this species was found thriving in **rubber and pineapple plantations**, highlighting the rich **soil biodiversity** that persists even in **agriculturally transformed landscapes**. What sets this species apart is its **unique anatomical feature — single ventromedian spermathecae** located in **segments 7 and 8** — a characteristic previously unrecorded in its genus.

Kanchuria priyasankari:

- A heartfelt tribute to **Prof. Priyasankar Chaudhuri**, a pioneer in **earthworm taxonomy** whose four decades of research have brought national and international attention to Tripura's subterranean biodiversity. This species belongs to the **turaensis species group** and is noted for its **comparatively smaller body size** and a **distinctive spermathecal structure** that differentiates it from its close relative, *Kanchuria turaensis*.

Ecological and Scientific Significance:

- Tripura's emerging status as a **biodiversity hotspot for soil invertebrates** is now further strengthened. The discovery of these two species reinforces the importance of **microfauna in ecosystem health** and the **role of earthworms as ecological engineers**, improving **soil aeration**, **nutrient recycling**, and **plant productivity**.

Such findings are particularly important at a time when **concerns are rising** about the **impact of tourism** and **wildlife safaris** — such as those in the **Kali Tiger Reserve** — on sensitive ecosystems. Conservationists argue that greater emphasis should be placed on **soil biodiversity conservation**, which is often overlooked in mainstream environmental efforts.

India's Position in Global Earthworm Diversity:

India is home to **over 500 described species** of earthworms, many of which remain understudied. The **Northeast region**, especially the **Eastern Himalayan zone**, ranks as the **second-richest in earthworm diversity in India**, after the **Western Ghats**. These discoveries further highlight the need for **comprehensive soil biodiversity assessments**, particularly in lesser-explored regions like **Tripura**.

Final Thoughts: The identification of *Kanchuria tripuraensis* and *Kanchuria priyasankari* not only adds new names to taxonomy but also sends a powerful message about the **hidden diversity beneath our feet**. These discoveries highlight the urgent need to protect **below-ground biodiversity**, which supports life above the ground — from plants and animals to humans themselves.

GS Paper 1 – Geography

Kali Tiger Reserve: A Biodiversity Gem Under Tourism Pressure

Context: Recent efforts to promote **wildlife safaris** in **Kali Tiger Reserve** have sparked concern among **conservationists**, who fear that unchecked tourism could disturb its delicate ecosystem. While eco-tourism can be a tool for awareness and conservation funding, experts stress the need for **strict regulations** to avoid harming the sanctuary's rich biodiversity.

About Kali Tiger Reserve: A Jewel of Karnataka's Western Ghats

Previously known as the **Dandeli-Anshi Tiger Reserve**, the **Kali Tiger Reserve** lies in the heart of **Uttara Kannada district** in **Karnataka**. Spanning an area of approximately **834.16 sq. km**, this lush expanse is part of the **ecologically sensitive Western Ghats**, one of the **eight "hottest hotspots" of biodiversity in the world**.

Two Sanctuaries, One Wild Heart:

The reserve encompasses two contiguous protected areas:

- **Dandeli Wildlife Sanctuary**
- **Anshi National Park**

Together, they form a **single protected forest tract**, supporting an extraordinary range of flora and fauna.

Geography and Water Source:

Flowing through the reserve is the **Kali River**, a vital water lifeline for **Uttara Kannada**. It lends its name to the reserve and nourishes the **dense forest ecosystems** throughout the park.

To the north, Kali Tiger Reserve borders the **Bhimgad Wildlife Sanctuary**, which links to **Radhanagari** and **Koyna wildlife sanctuaries** in **Maharashtra**, forming a crucial **wildlife corridor**.

Forest Types and Rich Flora:

The reserve features a stunning blend of:

- **Moist deciduous forests**
- **Semi-evergreen zones**
- **Evergreen pockets**, especially in the deep valleys and westernmost parts

The vegetation includes:

- Majestic trees like **teak**, **Malabar tamarind**, and **silver oak**
- Rich undergrowth of **bamboo**, **lantana**, and other native shrubs

Fascinating Fauna: A Wildlife Enthusiast's Dream

Kali Tiger Reserve is home to an astonishing variety of wildlife, including:

- **Flagship species**: **Tiger**, **Leopard**, and the elusive **Black Panther**
- **Large mammals**: **Asian Elephant**, **Indian Bison (Gaur)**, **Sloth Bear**

- **Herbivores**: **Sambar**, **Spotted Deer**, **Wild Boar**
- **Primates**: **Hanuman Langur**, **Bonnet Macaque**
- **Predators**: **Wild Dogs (Dholes)**

The reserve is also a **birdwatcher's paradise**, hosting all **four species of hornbills** found in India, including one of the **largest populations of the Great Indian Hornbill** in the Western Ghats.

Did You Know?

- **Black Panthers**, though the same species as leopards, have a genetic mutation causing **melanism**, giving them their iconic dark coat.
- The **Kali River**, beyond supporting wildlife, is essential for **hydroelectric projects**, **irrigation**, and **drinking water**, making its conservation even more critical.
- The reserve is a significant part of the **UNESCO World Heritage-listed Western Ghats**, contributing to its global ecological value.

A Call for Balanced Conservation:

While tourism can foster awareness, the **fragile ecosystems** of places like **Kali Tiger Reserve** require **well-regulated ecotourism** that prioritizes **wildlife welfare** over commercial interests. With its dense forests, rare species, and vital ecological functions, **Kali** stands as a testament to India's **natural heritage**—one that must be protected for generations to come.

GS Paper 3 – Science & Technology

India Set to Test Its Most Advanced Hypersonic Weapon: The ET-LDHCM

Context: India is preparing to test a next-generation **hypersonic cruise missile**, the **Extended Trajectory–Long Duration Hypersonic Cruise Missile (ET-LDHCM)**, developed entirely by the **Defence Research and Development Organisation (DRDO)**. This advanced system marks a **significant milestone** in India's pursuit of **cutting-edge strategic capabilities** and could redefine the nation's role in global defense technology.

What is the ET-LDHCM?

The **ET-LDHCM** is an **indigenously developed hypersonic cruise missile** capable of **long-duration flight at extreme speeds**. Developed under a classified initiative called **'Project Vishnu'**, the missile represents one of the **most ambitious defense projects** undertaken by India to date.

- **Launch Platforms**: It is designed for **multi-platform deployment**—it can be launched from **land, sea, or air**, enhancing India's **operational flexibility**.
- **Global Standing**: Once fully operational, India will join a select group of nations—including the **United States**, **Russia**, and **China**—that have developed **deployable hypersonic weapon systems**.

Key Features and Capabilities:

- **Blazing Speed**: The missile is capable of reaching speeds up to **Mach 8** (approximately **11,000 km/h**), allowing it to outrun most **air defense systems**.
- **Striking Power**: It can carry **warheads weighing between 1,000 to 2,000 kg**, suitable for both **conventional and nuclear missions**.
- **Impressive Range**: The ET-LDHCM has an estimated **strike range of 1,500 km**, enabling **deep-penetration precision strikes**.
- **Advanced Maneuverability**: Unlike traditional ballistic missiles, it travels at **low altitudes** and features **mid-flight course correction**, making it **extremely difficult to detect and intercept**.
- **Propulsion Breakthrough**: Powered by an **air-breathing scramjet engine**, the missile uses **atmospheric oxygen** for combustion, eliminating the need to carry oxidizers and enabling longer, faster flight.
- **Thermal Resistance**: Constructed with **high-grade, heat- and oxidation-resistant materials**, it can withstand temperatures exceeding **2,000°C**, which is essential for sustained hypersonic flight.

Why This Matters:

- **Deterrence Capability**: With the ET-LDHCM, India significantly enhances its **second-strike and rapid-response capabilities**, reinforcing its **nuclear deterrent posture**.
- **Strategic Edge**: The missile's **speed, stealth, and precision** can decisively shift the balance in future **high-intensity conflicts**, particularly in contested regions like the **Indian Ocean** or **border zones**.
- **Tech Milestone**: Mastering **scramjet propulsion** and hypersonic glide technologies positions India among the **technological elite** in modern warfare.

Did You Know?

- **Hypersonic weapons** are defined as those that travel at speeds above **Mach 5**—five times the speed of sound.
- Unlike ballistic missiles, hypersonic cruise missiles like the ET-LDHCM can **navigate around terrain** and adjust course mid-flight, making them **less predictable** and more **survivable**.
- The **scramjet engine**, short for *Supersonic Combustion Ramjet*, operates only at very high speeds and represents a **significant advancement over traditional jet engines**.

Looking Ahead:

As India readies to test the **ET-LDHCM**, this development not only reflects the nation's growing **technological prowess** but also underscores its intent to build a **robust, future-ready defense infrastructure**. In an era of **next-gen warfare**, hypersonic missiles like the ET-LDHCM are set to become **game-changers** in both deterrence and combat strategy.

GS Paper 2 – International Relation

India's Prime Minister Honoured with Cyprus' Prestigious Grand Cross of the Order of Makarios III

Context: In a moment of diplomatic pride, the **Prime Minister of India** was recently awarded the **Grand Cross of the Order of Makarios III**, the **highest civilian honour** of the **Republic of Cyprus**. This prestigious recognition highlights the strengthening of ties between **India and Cyprus**, and acknowledges the Prime Minister's **global leadership and service to international cooperation**.

About the Order of Makarios III: Cyprus' Highest Honour

Named after **Archbishop Makarios III**, the **first President of Cyprus**, this distinguished award celebrates **exceptional service** that contributes to **Cyprus or the international community**.

- **Established** in **1991**, the order honours individuals whose work reflects **exemplary leadership**, humanitarian values, or contributions to **global peace and cooperation**.
- The **Grand Cross** is among the **topmost grades** within the Order, just below the **Grand Collar**, and is conferred by the **President of Cyprus**.
- It represents Cyprus's **highest level of gratitude** to global leaders who promote **diplomatic goodwill and international development**.

Significance of the Recognition:

Receiving the **Grand Cross of the Order of Makarios III** places the Indian Prime Minister in the esteemed company of world leaders who have been celebrated for their **visionary leadership**, **diplomatic outreach**, and **contribution to global progress**.

This recognition:

- Reflects **India's growing influence** on the world stage.
- Signals **Cyprus's appreciation** for India's **strategic partnership** and commitment to **multilateral cooperation**.
- Further strengthens the **historic and cultural ties** between the two nations.

Cyprus: A Nation at the Crossroads of Continents

Located at the **northeastern corner of the Mediterranean Sea**, **Cyprus** is a **Eurasian island nation** renowned for its **rich history, strategic importance**, and **cultural diversity**.

- **Capital**: **Nicosia**
- **Major Cities**: **Limassol**, **Larnaca**, **Famagusta**, and **Paphos**
- **Highest Peak**: **Mount Olympus** (**1,952 m**) in the **Troodos Mountains**
- **Third-largest island** in the Mediterranean, after **Sicily** and **Sardinia**

Cyprus is a **member of the European Union**, and despite its small size, it plays a **crucial role in regional diplomacy**, especially in the **Eastern Mediterranean**.

Did You Know?

- **Archbishop Makarios III** led Cyprus to independence in 1960 and became its **first elected president**, shaping its modern national identity.
- Cyprus is often described as the "**cradle of civilizations**" due to its **9,000-year-old history** and archaeological significance.
- The country has **two official languages**: **Greek** and **Turkish**, reflecting its **multicultural fabric**.

Honours Beyond Borders:

The conferment of the **Grand Cross of the Order of Makarios III** is more than a personal accolade—it's a testament to India's **growing global stature** and a celebration of **international friendship** built on shared values of **peace, democracy**, and **mutual respect**.

GS Paper 1 – Indian Heritage and Culture, History

Shipki La Pass Reopens for Domestic Tourists: A Gateway to Heritage, Trade, and Strategic Importance

Context: Shipki La Pass, located at an elevation of **3,930 meters** in the **Kinnaur district** of **Himachal Pradesh**, has now been **opened to Indian tourists**. This significant step aims to **revitalize border economies**, strengthen **strategic connectivity**, and promote **cultural tourism** in the region.

This high-altitude **motorable mountain pass** lies on the **India-China border** and is one of the **highest vehicle-accessible passes in India**. It serves as a **boundary post** on the **Line of Actual Control (LAC)** and holds immense **strategic and historical value**.

From Ancient Trade Route to Strategic Frontier:

The **Sutlej River**, known as **Langqen Zangbo** in Tibet, **enters India through Shipki La**, making it an important hydrological and geopolitical location. Historically, this pass was a part of the ancient **Indo-Tibetan trade route** that flourished for centuries.

In earlier times, **Shipki La was called Pema La**, or the "Shared Gate." The name was changed to **Shipki La** after the **1962 Sino-Indian War** by the **Indo-Tibetan Border Police (ITBP)**. It remained a crucial link between **India and Tibet** until trade activities were halted after the war, and later during the **Doklam standoff** and the **COVID-19 pandemic**.

The Lifeline of Ancient Himalayan Trade:

For centuries, Shipki La facilitated a **vibrant exchange of goods** between the Indian subcontinent and the Tibetan Plateau. **Imports** from Tibet included:

- **Wool**
- **Livestock**
- **Yak-based products**
- **Sacred religious items**
- **Precious minerals**

In return, India exported:

- **Grains and spices**
- **Tobacco**
- **Wood and timber**
- **Iron tools and handicrafts**

This trade wasn't just economic—it also fostered **cultural exchange**, spiritual ties, and **regional unity**.

Mountain Passes: Nature's Strategic Corridors:

Mountain passes like Shipki La are **natural low points** in rugged mountain terrains that **ease movement** across otherwise formidable regions. They are typically formed through **erosion**, **glaciation**, or **tectonic shifts**, serving as critical **connectors between valleys and civilizations**.

Historically, these routes have been lifelines for:

- **Trade caravans**

- **Pilgrims**
- **Migratory communities**
- **Military campaigns**

Prominent Indian passes include **Nathu La (Sikkim)**, **Rohtang Pass (Himachal Pradesh)**, **Zoji La (Ladakh)**, and **Jelep La (Sikkim)**—each with its own **strategic, economic, and cultural relevance**.

Why Shipki La Matters Today:

The reopening of Shipki La marks more than just a tourism initiative—it represents:

- A **reclaiming of India's cultural and strategic heritage**
- **Boosting local livelihoods** through tourism and infrastructure
- A renewed **focus on national security and border development**
- Potential for **reviving trans-Himalayan trade**, subject to geopolitical conditions

Did You Know?

- The region around Shipki La is home to **ancient Buddhist monasteries**, reflecting its spiritual link with Tibet.
- The nearby **village of Namgia** is the last Indian settlement before the LAC.

The pass lies within the **cold desert zone of the Trans-Himalayas**, where flora and fauna adapt to extreme conditions.

By opening Shipki La to Indian citizens, the government not only promotes **strategic tourism** but also rekindles the stories, spirit, and legacy of **India's ancient mountain corridors**.

GS Paper 3 – Environment, Biodiversity, and Conservation

Discovery of Portulaca bharat: A Unique Flowering Plant from the Aravallis

Context: A remarkable **new species of flowering plant**, named ***Portulaca bharat***, has been recently **discovered** in the **rocky and semi-arid terrain** of the **Aravalli Hills** near **Jaipur, Rajasthan**. This discovery adds a significant entry to the growing list of **Indian endemic flora**, underlining the rich but underexplored biodiversity of the Aravallis.

Key Highlights of *Portulaca bharat:*

- **Endemic to India**: This plant has so far been found **only in a single locality**, making it a **narrow endemic** species.
- **Unique Morphological Features**: *Portulaca bharat* displays **distinct physical traits** not observed in other known species of the genus.
- **Habitat Sensitivity**: Its specific **ecological requirements** make it **vulnerable to habitat degradation** and **climate change**.
- **Conservation Status**: As no additional populations are yet discovered, it has been **provisionally classified as "Data Deficient"** under the **IUCN Red List** guidelines.

About the Genus *Portulaca:*

- The **genus *Portulaca*** includes around **153 known species** across the globe.
- These are mostly **succulent plants**, adapted to survive in **extreme conditions** with **high drought resistance**.
- Known for their **water-storing tissues**, they flourish in **tropical and subtropical regions**.
- In **India**, there are currently **11 recognized species**, including **four endemic ones**, primarily inhabiting **dry and semi-arid zones**.

Why This Discovery Matters:

- ***Portulaca bharat*** not only enriches our **botanical heritage** but also emphasizes the importance of **microhabitats** in supporting **rare and endemic flora**.
- The discovery showcases the potential for more **undocumented species** in the Aravallis—one of the **oldest mountain ranges in the world**, often overlooked in biodiversity studies.
- It also highlights the urgency for **conservation efforts** in fragile ecosystems, especially in the face of **rapid urban expansion** and **climate variability**.

Did You Know?

- The name "*Portulaca*" is derived from the Latin word *portula*, meaning "little gate", referring to the lid-like structure that opens to release seeds.
- Many *Portulaca* species, such as *Portulaca oleracea* (common purslane), are edible and have **medicinal properties**.
- *Portulaca* flowers are also popular in **ornamental gardening**, thanks to their vibrant colors and drought tolerance.

A Call for Further Exploration:

The discovery of *Portulaca bharat* is a **reminder of the hidden treasures** in India's **ecological landscapes**. Continued **field research**, **botanical surveys**, and **conservation-focused studies** are essential to uncover and protect the full spectrum of India's **plant biodiversity**.

Eurasian Otter Spotted Again in Kashmir After Decades

Context: The **Eurasian Otter** (*Lutra lutra*), locally known as **"Vuder"** in Kashmir, has made a surprising return to the region after nearly **three decades** of absence. Once common in **Dachigam**, **Dal Lake tributaries**, **Rambiara stream**, and the **Lidder River in Pahalgam**, this elusive mammal had not been recorded in Kashmir for the past 25–30 years.

A Glimpse into the Eurasian Otter:

The **Eurasian Otter**, also known as the **Common Otter**, is a **semi-aquatic carnivorous mammal** that is native to **Eurasia**. It is a **keystone species**, meaning its presence is vital for maintaining the **health of river ecosystems**. Being highly sensitive to pollution, the otter's return is a **positive sign of improving water quality** and ecological health in Kashmir's freshwater bodies.

Key Features:

- **Taxonomy**: Belongs to the **genus Lutra**, **family Lutrinae**, **order Carnivora**.
- **Diet**: Primarily feeds on **fish**, **crustaceans**, and **amphibians**. It also eats **reptiles**, **birds**, **eggs**, **insects**, and **worms**.
- **Habitat**: Found in **clean freshwater ecosystems** like **rivers**, **lakes**, **streams**, and **wetlands**. Also occasionally inhabits **coastal regions**.
- **Behavior**: Generally **nocturnal**, **solitary**, and known to build **dens (holts)** near water. **Mothers** are sometimes spotted with their **cubs**.

Conservation Status:

- **IUCN Red List**: *Near Threatened*
- **Indian Wildlife Protection Act, 1972**: *Schedule II*
- **CITES**: *Appendix I* – indicating it is under the **highest protection** from international trade.

Otters in India:

India is home to three otter species:

1. **Eurasian Otter** (*Lutra lutra*) – **Himalayas, northeast India, Western Ghats**
2. **Smooth-coated Otter** (*Lutrogale perspicillata*) – **Widespread across India**
3. **Small-clawed Otter** (*Aonyx cinereus*) – **Himalayas and southern India**

The return of the **Eurasian Otter** to Kashmir reaffirms its historic distribution in the region and highlights the **urgent need for freshwater conservation**.

Additional Facts:

- Otters play a crucial role in **controlling fish populations**, preventing overpopulation of certain species.
- A group of otters is called a **"romp"**, though they are usually seen alone.

- Otters communicate using **chirps, whistles, and growls**, especially during mating or while caring for cubs.
- The presence of otters is used worldwide as a **biological indicator of river health**.

The recent sighting offers hope for **conservationists** and brings renewed attention to **habitat protection efforts**. Ensuring **clean rivers**, preventing **pollution**, and minimizing **human disturbance** are critical steps toward sustaining this **rare and sensitive species** in Kashmir and beyond.

GS Paper 3 – Environment and Ecology / Climate Change

Oceans Are Losing Their Light: A New Environmental Crisis Emerges

Context: A **new scientific study** has raised serious concerns about a phenomenon now referred to as **"Ocean Darkening"** — the gradual loss of sunlight penetration into ocean waters. According to recent findings, **more than one-fifth of the world's oceans** have significantly darkened over the past **20 years**, potentially threatening marine life and disrupting global climate patterns.

What Is Ocean Darkening?

Ocean Darkening refers to the **reduction in sunlight** reaching the ocean's **photic zone** — the sunlit upper layer of the sea, typically extending up to **200 meters deep**. This zone is vital for **photosynthesis**, which fuels the growth of **phytoplankton**, the microscopic plants that form the **foundation of marine food chains**.

Around **90% of marine species** depend directly or indirectly on this zone for survival. It is also key in **absorbing carbon dioxide**, **regulating global climate**, and supporting major **fishing industries** around the world.

What's Causing the Oceans to Darken?

The darkening is driven by **different factors** in coastal and open ocean areas:

- In **coastal regions**, the primary cause is **runoff from agriculture**, which includes **nutrients**, **organic matter**, and **sediments**. These substances flow into the sea during **rainfall**, promoting **harmful algal blooms** that block sunlight from entering deeper layers.
- In the **open ocean**, the drivers are more complex, including:
    - **Rising sea surface temperatures**
    - **Shifts in plankton populations**
    - **Changes in ocean circulation patterns**

These changes reduce the transparency of the water, effectively **shrinking the sunlit layer** over time.

Why It Matters: The Impact of Ocean Darkening:

The **contraction of the photic zone** could lead to **widespread changes** in ocean ecosystems:

- Species that rely on **light cues** for feeding, migration, hiding, or reproduction may be forced into **shallower, overcrowded layers**.
- This shift could trigger **increased competition** and **stress** across the food chain, from **microscopic plankton to large marine mammals**.
- Disruptions to **marine biodiversity**, **carbon cycling**, and **global fisheries** may intensify if the trend continues.

Many marine creatures also navigate and coordinate behaviors based on **sunlight and moonlight cues** — and losing this natural guidance could impact **reproduction patterns**, **predator-prey relationships**, and overall **ecosystem stability**.

Additional Insights: A Global Signal of Climate Change

Scientists are beginning to link ocean darkening with the broader effects of **climate change** and **ocean warming**. As sea surface temperatures rise, **stratification** increases — meaning layers of ocean water mix less, reducing oxygenation and light penetration even further.

Moreover, **reduced light penetration** may impair the ocean's ability to **sequester carbon dioxide** — a process largely driven by **photosynthetic plankton**, which could slow down the planet's natural climate regulation capacity.

Looking Ahead:

The phenomenon of **ocean darkening** may become a key indicator in **monitoring ocean health**, alongside metrics like **coral bleaching** and **acidification**.

Protecting coastal ecosystems, **reducing runoff pollution**, and **addressing climate change at its roots** are critical steps toward halting this trend. This darkening not only threatens marine biodiversity but also strikes at the heart of **global food security** and **climate balance**.

GS Paper 2 – Government Policies and Interventions

BCAS Cancels Turkish Firm's License Over Security Concerns

Context: The **Bureau of Civil Aviation Security (BCAS)**, functioning under the **Ministry of Civil Aviation**, has recently **revoked the license of Celebi Aviation**, a **Turkish ground-handling firm** operating at several major Indian airports.

The decision, rooted in **"national security concerns,"** comes after **Turkey's open support for Pakistan** following **India's Operation Sindoor**, which was launched in retaliation to the **Pahalgam terror attack**.

This move highlights India's firm stance on **aerospace security**, particularly in the backdrop of evolving **geo-strategic dynamics**.

Legal Framework Governing Aviation Licensing:

The action is backed by provisions in India's **aviation security regulations**:

- **Aircraft Rules, 1937** (under the **Bharatiya Vayuyan Adhiniyam, 2024**): Specifically, **Rule 92** mandates that ground-handling agencies must obtain **government clearance** to operate in India.
- **Aircraft Security Rules, 2022** (Rules **11 and 12**): These empower the **Director General of BCAS** to **suspend or cancel licenses** based on **non-compliance or national security threats**.

What Is the Bureau of Civil Aviation Security (BCAS)?

The **BCAS** serves as **India's apex regulatory authority** for **civil aviation security**. Headquartered in **New Delhi**, it is led by an officer of the rank of **Director General of Police (DGP)**.

- **Origin**: Established as a **cell within DGCA** in **January 1978** following recommendations from the **Pande Committee**, it was upgraded to an **independent department** under the **Ministry of Civil Aviation** in **1987**.
- **Functions**:
  - Lays down aviation security standards in line with **Annex 17 of the Chicago Convention**.
  - Oversees **implementation, inspection**, and **training programs**.
  - Conducts **surprise checks**, **mock drills**, and **security audits** across Indian airports.
- **DGCA vs. BCAS**:
  - While **BCAS handles security**, the **Directorate General of Civil Aviation (DGCA)** regulates **air transport services**, **safety**, and **airworthiness standards** within India.

International Context: ICAO & the Chicago Convention

The **International Civil Aviation Organization (ICAO)** is a **UN specialized agency**, founded in **1944** through the **Chicago Convention**. India is one of its **193 member states**.

- **ICAO's Role**:
  - Sets global standards for **safe**, **secure**, **efficient**, and **environment-friendly** air transport.
  - Provides frameworks for **airspace sovereignty**, **aircraft registration**, **tax exemptions on aviation fuel**, and **air safety protocols**.
  - Grants **Nine Freedoms of the Air** to facilitate international air traffic.
- **Headquarters**: Montreal, Canada.

India's Key Initiatives in the Aviation Sector:

India has launched several ambitious initiatives to expand and modernize its aviation ecosystem:

- **National Civil Aviation Policy, 2016**: Focuses on affordability, connectivity, and private sector involvement.
- **UDAN (Ude Desh ka Aam Naagrik)**: Promotes **regional connectivity** by making **air travel accessible** to tier-2 and tier-3 cities.
- **FDI Reforms**: Allows **100% Foreign Direct Investment (FDI)** in sectors like **air transport services** and **Maintenance, Repair, and Overhaul (MRO)** facilities.
- **Infrastructure Upgrades**:
    - **Digi Yatra**: Enables **paperless travel** and enhances **passenger convenience**.
    - **NABH Nirman**: Aims to expand airport capacity in line with growing demand.
- **Green Aviation Goals**:
    - Airports like **Delhi and Mumbai** have achieved **Level 4+ Carbon Accreditation**.
    - **73 airports** run entirely on **green energy**.
    - All new **greenfield airports** are being designed with **net-zero emission targets**.

The State of India's Aviation Industry:

India today is among the **top three domestic aviation markets globally**, trailing only the **United States and China**. It accounts for **69% of South Asia's air traffic**, and is expected to become the **third-largest air passenger market by 2030**.

- **As of FY25 (up to Sept 2024)**:
    - **Total passenger traffic**: 196.91 million
    - **Direct employment**: Over **369,000 people**
    - **Total economic contribution**:
        - USD **5.6 billion** (direct)
        - USD **53.6 billion** including tourism and linked industries
        - Nearly **1.5% of India's GDP**
- **Airport Growth**:
    - In 2014, India had **74 operational airports**.
    - By 2024, this number rose to **157**, with a target of **350–400 airports by 2047**.

Final Thoughts:

The cancellation of Celebi Aviation's license underscores India's **strong national security posture** in the **aviation sector**. As the country ascends as a **global aviation powerhouse**, balancing **growth, safety**, and **sovereignty** remains critical.

India's aviation journey is not just about **connecting cities**, but also about **defending borders**, **empowering citizens**, and **leading sustainable innovation** in the skies.

GS Paper 1 – Geography

India-Cyprus Relations in Spotlight as PM Makes Historic Visit

Context: The **Prime Minister of India** has embarked on a **five-day tour** of three nations, beginning with a **landmark visit to Cyprus**. This is the **first visit by an Indian Prime Minister** to the Mediterranean island nation in over **two decades**, underlining the growing strategic and diplomatic significance of **India-Cyprus relations**.

Where is Cyprus?

Cyprus is a **Eurasian island nation** located in the **northeastern Mediterranean Sea**, just south of **modern-day Turkey** (the Anatolian Peninsula). Though it lies **geographically in Western Asia**, Cyprus is **politically aligned with Europe**, and has been a **member of the European Union** since **May 1, 2004**.

- **Capital**: **Nicosia**
- **Major Cities**: **Limassol**, **Larnaca**, **Famagusta**, and **Paphos**
- **Total Area**: **9,251 sq. km** (making it the **third-largest island in the Mediterranean**, after **Sicily** and **Sardinia**)
- **Climate**: **Mediterranean** – featuring **dry summers** and **wet winters**
- **Highest Peak**: **Mount Olympus** (**1,952 meters** above sea level)

Cyprus is uniquely situated at the crossroads of Europe, Asia, and Africa—lying **southeast of Greece**, **south of Turkey**, **west of Syria and Lebanon**, and **north of Egypt and Israel**.

A Divided Island: The Cyprus Conflict

Cyprus has experienced a complex political history marked by **division since 1974**, when **Turkey invaded the northern part of the island** following a **military coup** backed by **Greece**.

- The island remains **partitioned** into:
    - The **northern third**, administered by the **Turkish Cypriots**, known as the **Turkish Republic of Northern Cyprus** (recognized only by Turkey)
    - The **southern two-thirds**, governed by the **internationally recognized Republic of Cyprus**, primarily led by **Greek Cypriots**
- The **United Nations** continues to patrol a **buffer zone** known as the **Green Line**, which separates the two communities.
- **Reunification talks** have been ongoing for decades, though progress has been slow due to deep-rooted political and ethnic divisions.

Political System and Languages:

Cyprus operates as a **presidential republic**, where the **President serves as both head of state and government**. The **official languages** are **Greek** and **Turkish**, reflecting the ethnic composition of the island.

The country's culture is deeply influenced by **Hellenic and Middle Eastern traditions**, and is distinctly split between the **northern Turkish-Cypriot region** and the **southern Greek-Cypriot area**.

A Modern and Developed Nation:

- **Cyprus is a developed country** with a **high Human Development Index (HDI)**.

- The nation has become a hub for **international business**, **shipping**, and **tourism**, especially among European travelers.
- It uses the **euro (EUR)** as its official currency.

India and Cyprus: Strengthening Ties

Cyprus and India have long maintained **warm bilateral relations**, especially in areas like:

- **Trade and Investment**: Cyprus is a significant **source of foreign direct investment (FDI)** in India.
- **Education and Diaspora**: A number of Indian students study in Cypriot universities, and a growing Indian community resides in the country.
- **Multilateral Cooperation**: Both nations share views on international issues such as **sovereignty**, **peacekeeping**, and **climate change**, and cooperate at forums like the **United Nations**.

The recent visit is expected to enhance collaboration in **defence**, **maritime security**, **tourism**, **culture**, and **renewable energy**.

Did You Know?

- **Cyprus is one of the few countries in the world where you can ski in the morning and swim in the afternoon**, thanks to the **Troodos Mountains** and **coastal proximity**.
- The city of **Nicosia** is the **only divided capital city in Europe**, split between the Greek and Turkish Cypriot zones.
- Cyprus is also famous for being the **mythical birthplace of Aphrodite**, the Greek goddess of love and beauty.

Conclusion:

The Prime Minister's visit to Cyprus is more than symbolic — it reaffirms **India's commitment to building strong, diversified international partnerships**. As **geopolitical dynamics evolve**, engaging with strategically located nations like Cyprus will be vital for **India's global outreach**, especially in the **Mediterranean and EU regions**.

GS Paper 2 – International Relation

Iran-Israel Conflict 2025: Escalation of Tensions Threatens Regional and Global Stability

Context: In a major escalation, **Israel launched "Operation Rising Lion"**, targeting **Iran's nuclear and military infrastructure**, including the **Natanz uranium enrichment facility**, **research centers in Tehran**, **military bases in Tabriz**, and a **missile storage site in Kermanshah**. These strikes were aimed at halting Iran's perceived march toward developing **nuclear weapons**.

Iran retaliated with "Operation True Promise 3", unleashing **ballistic missile attacks** that rocked **Jerusalem** and **Tel Aviv**, marking one of the most direct confrontations between the two nations in recent years.

What are the Key Reasons Behind the Iran-Israel Conflict?

- **Historical Hostility:** Relations between **Iran and Israel** have been hostile since the **1979 Iranian Revolution**, when Iran shifted from being a close ally of Israel under the Shah to an **Islamic Republic** vehemently opposed to its existence.
- **Religious and Ideological Clash:** Iran, a **Shia Islamic theocracy**, and Israel, a **Jewish democratic state**, are ideologically polar opposites. This divide has fed **deep-rooted animosity and mistrust** for decades.

Iran's Support for Anti-Israel Proxies:

- Iran provides financial and military support to groups like **Hamas** and **Hezbollah**, both designated as **terrorist organizations by Israel**. These proxy groups are active in **Gaza**, **Lebanon**, **Syria**, and **Iraq**, and are considered by Israel to be extensions of Iranian aggression.

Regional Power Struggle:

- Iran and Israel vie for **regional supremacy**. While Iran backs the **Assad regime in Syria** and **Houthi rebels in Yemen**, Israel seeks to curb Iran's expanding influence, especially near its borders.

Nuclear Tensions:

- Israel sees **Iran's nuclear programme** as an existential threat. It has consistently opposed the **Joint Comprehensive Plan of Action (JCPOA)** and conducted **cyber, covert, and overt operations** to derail Iran's nuclear ambitions.

What Does This Conflict Mean for India?

- **Threat to Energy Security:** India imports nearly **2 million barrels of oil daily**, much of it passing through the volatile **Strait of Hormuz**. A full-scale conflict could **disrupt supplies**, trigger **oil price shocks**, and cause **domestic inflation** and **fiscal stress**.

Indian Diaspora at Risk:

- Over **66% of India's 1.34 crore NRIs** live in **West Asia**, especially the **Persian Gulf**. Any escalation poses **serious safety risks** to Indians abroad, potentially requiring **emergency evacuation operations**, as seen during the **Gulf War (1991)**, **Libya (2011)**, and **Ukraine (2022)**.

Impact on Connectivity Projects:

- India's strategic infrastructure like the **Chabahar Port** in Iran, a vital link to **Afghanistan and Central Asia**, could be affected. Similarly, the ambitious **India-Middle East-Europe Economic Corridor (IMEC)** may face delays due to instability.

Disruptions in the Red Sea and Arabian Sea shipping lanes would raise **transport costs**, affect **global trade routes**, and hinder **India's trade goals**.

Diplomatic Tightrope for India:

India enjoys strong ties with both **Israel (defence and tech)** and **Iran (energy and connectivity)**. As tensions intensify, India must navigate a **delicate diplomatic balance**, resisting pressure to pick sides while advocating for **peace and de-escalation**.

What Steps Can Be Taken to De-escalate the Conflict?

Promote the Two-State Solution:

- A **peaceful resolution in Gaza**, in line with **UN resolutions**, remains critical. A **two-state solution**—ensuring **sovereignty for Palestine** alongside **security for Israel**—can serve as a long-term stabilizer for West Asia.

Encourage Dialogue and Diplomacy:

- Facilitated talks between Iran and Israel—mediated by **neutral actors like the UN or EU**—could build trust. Even **indirect backchannel diplomacy** may help prevent further escalation.

Address Nuclear Proliferation:

- Iran should **rejoin the JCPOA**, allowing **international inspectors** to monitor its nuclear activities. In return, Israel may offer **security guarantees** and recognize Iran's right to **peaceful nuclear energy**.

Strengthen Regional Engagement:

- Creating **regional dialogue platforms**—even informal ones—that involve both Iran and Israel, potentially with **GCC** or **Arab League** involvement, could lay groundwork for **mutual cooperation** on non-political issues like climate and disaster management.

Steps Toward Normalisation:

- Following the model of **Abraham Accords**, even symbolic steps like **cultural exchanges**, **track-2 diplomacy**, or **humanitarian collaborations** could foster future normalization between Iran and Israel.

Conclusion:

The **2025 Iran-Israel military flare-up** underscores the **fragility of West Asian geopolitics**. The conflict is rooted in decades of **ideological, historical, and strategic rivalry**, but its ripple effects are felt worldwide—especially in countries like **India** that are intricately linked to the region through **energy, diaspora, trade, and diplomacy**.

Moving forward, the global community must push for **dialogue, demilitarization**, and a renewed **commitment to peaceful coexistence**, as any further escalation could have catastrophic global consequences.

GS Paper 1 – Indian Economy / Budgeting

Centre Caps MGNREGS Spending: Fiscal Discipline or Legal Overreach

Context: In a move that marks a significant policy shift, the **Union Finance Ministry** has imposed a **spending cap** on the **Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)** for the first time. Under this directive, **only 60% of the total allocated budget** for FY 2025–26 can be utilized in the first six months. This brings MGNREGS under the ambit of the **Monthly/Quarterly Expenditure Plan (MEP/QEP)**, a financial monitoring mechanism introduced in 2017.

Why the Spending Cap? The Finance Ministry's Rationale

The Finance Ministry cites multiple **financial and administrative concerns** behind this decision:

- **Chronic Budget Overruns**: Historically, **over 70% of MGNREGS funds are exhausted by September**, necessitating **supplementary budget allocations** by December, which are often depleted within a month.
- **Mounting Pending Dues**: For the past five years, year-end **pending wage dues** have consistently ranged between **15,000 crore to 25,000 crore**. On average, **20% of the subsequent year's budget** is used just to clear previous backlogs.
- **Cash Flow Regulation**: The government aims to **prevent premature exhaustion of funds** and streamline cash flows through **MEP/QEP compliance**, thereby **avoiding mid-year fiscal disruptions**.

Current Financial Snapshot (As of June 2025)

- **Total MGNREGS Budget**: 86,000 crore
- **Funds Released So Far**: 28%
- **Pending Dues from FY 2024–25**: 19,200 crore
- **Pending Dues in FY 2025–26 (till June 12)**: 3,262 crore

Together, these arrears could consume **nearly 50% of the FY 2025–26 budget**, leaving limited space for new demand.

Key Concerns: Demand Suppression and Legal Violation

Despite its financial justifications, the cap has **raised alarm among legal experts, economists, and civil society**, who see it as **an erosion of statutory rights**.

1. Ignoring Seasonal and Climate-Driven Work Demand:

MGNREGS demand is **not linear**; it **fluctuates with agricultural seasons and weather patterns**:

- Rural labour demand **peaks in April–June** and again **post-Kharif in September**.
- Unforeseen events like **droughts or delayed monsoons** lead to **sharp spikes in work demand**.

For instance, in **2023**, delayed rains caused a **20% surge in job demand in July–August**. **Karnataka exhausted over 70%** of its allocation in the first half due to a **severe drought**. A rigid 60% cap **fails to**

accommodate such contingencies, undermining MGNREGS as a **rural safety net**.

2. **MGNREGS Is a Legal Entitlement, Not a Discretionary Scheme:** Unlike welfare schemes such as **PM-KISAN**, MGNREGS is **backed by law** — the **MGNREG Act, 2005**, which **guarantees 100 days of wage employment** to any rural household on demand.
    - **Section 3** of the Act mandates **work within 15 days of application**.
    - **Schedule II, Para 29** guarantees **wage payment within 15 days** after completion of work.

A cap on expenditure **constrains the government's ability to meet these legal obligations**, making it **a violation of statutory rights** rather than a mere policy decision.

Legal and Constitutional Dimensions:

The judiciary has repeatedly emphasized that **budgetary constraints cannot override legal and constitutional commitments**:

- **Swaraj Abhiyan v. Union of India (2016)**: The Supreme Court affirmed that **MGNREGS obligations must be met regardless of fund shortfalls**.
- **Municipal Council, Ratlam v. Vardhichand (1980)**: Public duties under law **cannot be evaded on financial grounds**.
- **Paschim Banga Khet Mazdoor Samity v. State of W.B. (1996)**: The **right to livelihood and minimum welfare** must be protected by the state, even in adverse economic conditions.

By capping funds, the Centre **risks judicial scrutiny** and possible litigation for undermining **legally guaranteed employment**.

Unresolved Questions and Systemic Risks:

The Finance Ministry has **not clarified** what happens when the 60% cap is breached before September:

- Will **states deny work** even if demand exists?
- Or will **workers continue working without timely wages**, further worsening the issue of **payment delays**?

Both scenarios could lead to **non-compliance** with MGNREG Act provisions and deepen **worker exploitation**.

Moreover, **existing systemic failures** such as:

- **Delayed wage payments**
- **Non-payment of unemployment allowance**
- **Inadequate compensation for delays**

...are already flagged by the **Supreme Court and CAG reports**. This cap may exacerbate these issues instead of resolving them.

The Bigger Picture: Undermining the Spirit of MGNREGS:

While fiscal prudence is essential, the **primary objective of MGNREGS is social protection**, not budget management. The scheme is designed as a **counter-cyclical instrument** to shield rural households from economic shocks and climate disruptions.

Restricting funds through arbitrary caps **dilutes its core mandate**, potentially turning a **rights-based programme** into a **rationed welfare handout**.

Additional Insight: International Comparisons

Globally, **public employment programmes** like MGNREGS are seen as **automatic stabilizers** during economic downturns. The **World Bank** has praised MGNREGS for its ability to **reduce poverty and boost rural incomes** during crises such as the 2008 financial crash and the 2020 pandemic.

In contrast, **India's move to cap demand-based welfare** stands out as **regressive** compared to international best practices.

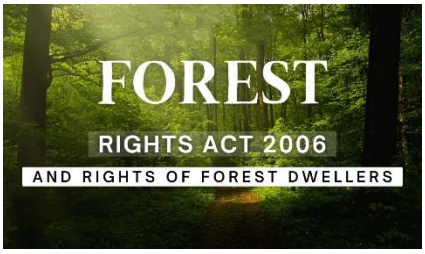
Conclusion: Balancing Fiscal Discipline and Legal Responsibility

The government's intent to manage public funds wisely is valid. However, it must be **carefully balanced against legal obligations and social responsibilities**. **Rights cannot be capped by budget lines**.

In a time of rising rural distress, **MGNREGS should be strengthened, not restricted**. The spending cap may offer short-term fiscal relief, but it risks **long-term legal and social costs** that the country cannot afford.

GS Paper 3 – Environment, Biodiversity, and Conservation

District & State-Level FRA Cells: Boosting Implementation of Forest Rights Act, 2006



Context: In a major move to **accelerate the implementation** of the **Forest Rights Act (FRA), 2006**, the **Union Ministry of Tribal Affairs** has approved the creation of **324 district-level** and **17 state-level FRA cells**. These have been established under the **Dharti Aba Janjatiya Gram Utkarsh Abhiyaan (DAJGUA)** — an administrative initiative aimed at strengthening tribal rights and improving grassroots governance in forest areas.

What Are FRA Cells?

The **FRA Cells** are **administrative support units** created to **facilitate and fast-track the implementation** of the Forest Rights Act. Though not formed under the FRA law itself, they function under the **supervision of the Ministry of Tribal Affairs**, with a primary role of supporting stakeholders at various levels of the claim process.

Key Functions of FRA Cells:

- **Assist claimants and Gram Sabhas** in filing and processing **individual and community forest rights claims**
- **Maintain and manage FRA-related data** at the district and state level
- **Support capacity building** of stakeholders including SDLCs, DLCs, and state officials
- **Accelerate the disposal of pending claims**, especially those stuck after **District Level Committee (DLC)** approvals
- Ensure administrative **coordination without interfering** with the statutory roles of **Gram Sabhas, SDLCs, DLCs, or state authorities**

Why FRA Cells Are Crucial Now:

As of now, approximately **14.45% of the 51.11 lakh FRA claims** filed across **21 states and Union Territories** remain pending. The new FRA cells are meant to focus especially on **states with high pendency**, such as:

- **Assam**: Over **60%** of claims still pending
- **Telangana**: Around **50.27%** claims yet to be processed

In contrast, states like **Chhattisgarh, Madhya Pradesh, Maharashtra, and Jharkhand** have demonstrated better performance, with **relatively low pendency**.

The **highest number of district-level FRA cells** has been sanctioned in:

1. **Madhya Pradesh**
2. **Chhattisgarh**
3. **Telangana**
4. **Maharashtra**
5. **Assam**
6. **Jharkhand**

About the Forest Rights Act (FRA), 2006:

The **Forest Rights Act**, officially titled the *Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act*, was enacted in **2006** to address the **historic injustices** faced by forest-dwelling communities.

Key Provisions:

- Grants **legal recognition** to **individual and community forest rights**
- Empowers **Scheduled Tribes (STs)** and **Other Traditional Forest Dwellers (OTFDs)** to access, manage, and conserve forest resources
- Covers nearly **150 million people**, **40 million hectares** of land, and over **1.7 lakh villages**

Challenges and Concerns:

While the initiative has been welcomed for its intent, experts have raised several **critical concerns**:

- **Parallel Governance Structure**: FRA Cells operate **outside the statutory framework** of the FRA, creating a risk of **dual authority** that could **dilute accountability**.
- **No Legal Backing**: Unlike **Sub-Divisional Level Committees (SDLCs)** and **District Level Committees (DLCs)** constituted under the Act, FRA cells **lack statutory legitimacy**.
- **Bureaucratic Overlap**: Potential for **duplicated roles** and confusion between **administrative and legal responsibilities**.

Additional Insights and Way Forward:

- **Digital Tools and Data Management**: FRA Cells can help usher in **digitization of claim records**, creating **centralized dashboards** for monitoring progress and **ensuring transparency**.
- **Training and Outreach**: These cells can play a pivotal role in **educating tribal communities** about their rights and simplifying the claim process.
- **Environmental Significance**: By recognizing community rights, FRA promotes **community-based forest conservation**, an approach increasingly recognized as **key to climate resilience** and **sustainable forest governance**.

Conclusion:

The launch of FRA Cells under the **Dharti Aba Janjatiya Gram Utkarsh Abhiyaan** marks a proactive step towards ensuring **speedier and more efficient implementation** of the **Forest Rights Act, 2006**. However, the **success of this initiative** will depend on how well it complements the **statutory mechanisms**, respects the authority of **Gram Sabhas**, and maintains **transparency and accountability**.

GS Paper 3 – Economic Development, Agriculture

Agri Stack & Digital Agriculture Mission: Transforming Indian Farming Through Data

Context: The **Ministry of Agriculture & Farmers' Welfare** recently organized a **National Conference on Agri Stack** under the umbrella of the **Digital Agriculture Mission (DAM)**. The event aimed to highlight the evolving role of **digital infrastructure** in transforming India's agricultural landscape and ensuring **precision-driven governance** in the farm sector.

What is Agri Stack?

Agri Stack is an integrated **digital ecosystem** designed to unify and streamline agricultural services through the power of **data and technology**. It brings together key data elements like:

- **Farmer Identity**
- **Land Ownership Records**
- **Crop Data**
- **Scheme Benefits**

By integrating these datasets, Agri Stack aims to deliver **personalized and targeted support** to farmers, improving efficiency and transparency across various government schemes.

Key Integrations:

- **PM-KISAN** (income support)
- **PMFBY** (crop insurance)
- **Kisan Credit Card (KCC)**
- **MSP Procurement Systems**

This system allows for **seamless verification**, reduced duplication, and faster benefit delivery.

Highlights from the Conference:

- The Ministry emphasized **digitization of land records** and **Aadhaar seeding** as essential for **accurate farmer identification**.
- Introduction of the **Digitally Verifiable Credential (DVC)** or **Kisan Pehchan Patra**, enabling farmers to generate authenticated digital credentials tied to specific **land parcels and crop cycles**.
    - These DVCs are **integrated with DigiLocker** and are **dynamically updated** with changes in land ownership.
- Launch of **Special Central Assistance (SCA) Guidelines**, earmarking ₹**6,000 crore** to support states:
    - 4,000 crore for **Farmer Registries**, including mechanisms for **legal heir succession**
    - 2,000 crore for **Digital Crop Surveys**, distributed on a **first-come, first-served basis**
- Unveiling of an **AI-powered multilingual chatbot** trained on Agri Stack data, built using **Google Gemini**, to address farmer queries with precision.

Digital Agriculture Mission (DAM): The Broader Vision

The **Digital Agriculture Mission** is a government initiative to modernize Indian agriculture through **cutting-edge digital tools** and **data-based decision-making**. It acts as an **umbrella framework**, supporting digital initiatives at both the **central and state levels**.

Two Core Pillars of DAM:

1. **Agri Stack** – a **farmer-centric Digital Public Infrastructure (DPI)** to deliver targeted services
2. **Krishi Decision Support System (Krishi-DSS)** – an analytical system combining:
    - **Satellite data**
    - **Soil, weather, and water resource mapping**
    - **Remote sensing-based crop health monitoring**

These systems will together enable **informed decision-making**, better **resource allocation**, and enhanced **risk management**.

Benefits of the Digital Agriculture Mission:

- **Digital Authentication**: Enables farmers to access services without physical documentation or multiple visits.
- **Greater Transparency**: Ensures **accurate targeting** of schemes like crop insurance, subsidies, and loans.
- **Improved Crop Monitoring**: Real-time data on crop health and yield aids in **disaster response**, **insurance processing**, and **agricultural planning**.
- **Tailored Advisory Services**: Supports **customized guidance** for sowing, pest control, irrigation, and crop management using real-time inputs.
- **Efficient Value Chains**: Strengthens **supply chain management** by integrating farm-level data with market access and logistics.

Additional Insights: Global Context

India's Agri Stack vision aligns with global trends in **AgTech** (Agricultural Technology), where countries are increasingly investing in:

- **Digital land registries**
- **AI-based crop prediction**
- **Blockchain for traceability**
- **IoT-enabled precision farming**

India's push for **Digital Public Infrastructure (DPI)** in agriculture could make it a **global leader** in **data-driven farming governance**, especially benefiting **small and marginal farmers** who comprise over **85%** of the farming community.

Conclusion:

The Agri Stack, backed by the **Digital Agriculture Mission**, is set to **redefine the future of Indian agriculture** by placing **data at the heart of governance**. As technology increasingly bridges the gap between the government and farmers, initiatives like these hold the potential to **empower millions**, boost **rural incomes**, and ensure **climate-resilient, sustainable agriculture** for years to come.

GS Paper 3 – Science and Technology

Rudrastra Drone: India's Next-Gen Battlefield Game-Changer

Context: India's indigenous military capabilities took a leap forward with the successful **test of the Rudrastra drone** by the **Indian Army**. Developed by **Solar Aerospace and Defence Limited (SDAL)**, this advanced **hybrid VTOL drone** is now being hailed as a **force multiplier** in future warfare scenarios, particularly in challenging terrains and high-risk zones.

What is Rudrastra?

Rudrastra is a state-of-the-art **hybrid Vertical Take-Off and Landing (VTOL) drone**, designed for **precision strike missions**, **surveillance**, and **real-time battlefield intelligence**. Combining the agility of a helicopter with the speed and range of a fixed-wing aircraft, Rudrastra represents a new class of **multi-role unmanned combat aerial systems (UCAS)**.

Key Features of Rudrastra:

- **Hybrid VTOL Design**: Capable of **vertical take-off and landing** like a chopper, but cruises like a plane—allowing it to operate in **rugged or confined areas**.
- **Stealth and Versatility**: Low acoustic signature and compact form make it **hard to detect**, ideal for **covert missions**.
- **Armed with Smart Warheads**: Specifically designed for **anti-personnel roles**, enabling **high-precision targeting** of enemy troops, bunkers, and camps.
- **Combat Range**: Can **engage targets over 50 km** away, ensuring safe distance operations.
- **Extended Range and Endurance**: Achieved a **maximum range of 170 km** and an impressive **flight time of nearly 90 minutes** during trials at the **Pokhran test range**.
- **Real-Time Surveillance**: Equipped with **high-resolution live video relay systems** for **real-time intelligence** and situational awareness.
- **Airburst Munition Capability**: Successfully demonstrated a **low-altitude airburst**, effective for **wide-area damage**—ideal for disrupting enemy formations or destroying entrenched positions.
- **Autonomous Return Function**: Returns safely to base even after completing complex missions, minimizing operational risks.

Strategic Importance of Rudrastra:

Rudrastra is a **tactical stand-off weapon** that allows **deep-strike capability** without putting soldiers in harm's way. It is specially designed to penetrate **hostile environments**, strike high-value targets like:

- **Enemy artillery units**
- **Terrorist camps**
- **Forward operating bases**

The drone's ability to conduct missions **deep inside enemy territory** makes it a **game-changer for asymmetric and hybrid warfare**.

Additional Insights: Rudrastra in Global Context

With increasing global interest in **combat drones**, India's Rudrastra places it among countries like the **US (MQ-9 Reaper)**, **Israel (Heron TP)**, and **Turkey (Bayraktar TB2)** in terms of **advanced unmanned aerial systems**. However, Rudrastra's **hybrid VTOL advantage** offers superior **deployment flexibility**, especially in **mountainous and border regions** where runway-based drones face limitations.

Conclusion:

The **Rudrastra drone** showcases India's growing capability in **indigenous defense technology** and **unmanned warfare solutions**. By merging **innovation, autonomy, and lethal precision**, Rudrastra is set to play a crucial role in **modern battlefield dynamics**, enhancing India's preparedness in both **conventional and unconventional conflict zones**.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Totapuri Mangoes: The Iconic South Indian Fruit Facing Fresh Borders Dispute

Context: In a recent move that has stirred interstate tensions, the **Andhra Pradesh government** has **banned the entry of Totapuri mangoes** from other states into **Chittoor district**, a major mango hub. This decision has sparked objections from **Karnataka**, where Totapuri cultivation is also widespread. The restriction is seen as an attempt to **protect local farmers and mango processing industries**, but it has also triggered concerns about **market competition and supply chain disruptions**.

About Totapuri Mangoes: A Juicy South Indian Favorite

The **Totapuri mango**, often recognized by its **distinct beak-like tip** (inspired by the "tota" or parrot), is a **signature mango variety** of **South India**. It is cultivated primarily in the **Chittoor district of Andhra Pradesh**, as well as in **border regions of Karnataka and Tamil Nadu**.

Other Names:

- **Ginimoothi**
- **Sandersha**
- **Banglora**

Known for its **elongated shape**, **fibrous pulp**, and **tangy-sweet taste**, Totapuri is not typically eaten ripe like Alphonso or Banganapalli. Instead, it is **valued for its juice and pulp**, making it the **preferred variety for processed mango products** such as:

- Mango drinks (e.g., Maaza, Frooti)
- Concentrates and squashes
- Mango puree exports

Climatic and Soil Requirements:

Totapuri mangoes flourish in **specific agro-climatic conditions**, making certain regions of South India especially suited for their cultivation:

- **Soil**: Prefers **well-drained loamy soils** with a **neutral to slightly acidic pH**
- **Climate**: Thrives in **tropical climates** with **moderate to high temperatures**, and a defined **dry spell before flowering**

This climate profile makes southern peninsular India ideal for Totapuri farming.

Nutritional Benefits of Totapuri Mangoes:

Totapuri mangoes are not just delicious—they're also **nutrient-rich**, offering a range of health benefits:

- **Vitamin C**: Boosts **immunity**, aids in **iron absorption**, and promotes **skin health**
- **Vitamin A**: Essential for **eye health** and supports the **immune system**

- **Minerals**: Contains **potassium, calcium, and magnesium**, important for **heart function**, **bone strength**, and **muscle activity**
- **Antioxidants**: Helps fight **free radicals**, supports **cell repair**, and slows down **skin aging**

Economic Significance and Market Reach:

Totapuri mangoes are a **backbone of India's mango processing industry**. A significant share of India's **mango pulp exports**—especially to the **Middle East, Europe, and the U.S.**—comes from Totapuri. The fruit is harvested in **bulk**, making it ideal for:

- **Agro-industrial processing**
- **Juice manufacturing**
- **International trade**

Chittoor district alone processes **hundreds of thousands of metric tonnes** of mangoes each year, with **Totapuri accounting for a large portion** of the supply.

Conclusion: The **Totapuri mango** is more than just a summer delight—it's a **cornerstone of South India's agricultural economy** and a vital ingredient in India's **global fruit export identity**. As Andhra Pradesh and Karnataka navigate the current trade tensions, it's crucial that **interstate cooperation prevails** to ensure farmers, industries, and consumers all continue to benefit from this **beloved and versatile mango variety**.

Surinsar-Mansar Wildlife Sanctuary: A Natural Gem of Jammu & Kashmir

Context: In a significant conservation step, the **Jammu and Kashmir government** has recently **constituted a Divisional Level Committee** to oversee and monitor the **Eco-Sensitive Zone (ESZ)** around the **Surinsar-Mansar Wildlife Sanctuary**. This move aims to protect the fragile ecosystem surrounding the sanctuary and ensure **sustainable development** in its vicinity.


Surinsar Mansar Wildlife Sanctuary

About Surinsar-Mansar Wildlife Sanctuary:

The **Surinsar-Mansar Wildlife Sanctuary** is one of the most picturesque and ecologically rich protected areas in the **Union Territory of Jammu and Kashmir**. The sanctuary derives its name from the **twin lakes—Surinsar** and **Mansar**—that lie about **16 km apart**, forming natural landmarks at either end of the sanctuary.

Spread across the districts of **Jammu**, **Udhampur**, and **Samba**, the **major portion** of the sanctuary falls within **Jammu district**. These twin lakes were also recognized as **Ramsar Wetlands of International Importance** in **2005**, highlighting their global ecological value.

Geography and Landscape:

- The sanctuary is characterized by a **hilly terrain**, consisting of **moderate to steep slopes**, interlaced with **seasonal streams and drainage channels**. It is a vital part of the **Tawi River catchment area**, playing an essential role in **groundwater recharge and watershed conservation** in the region.

Rich and Diverse Vegetation:

The sanctuary is a botanical treasure trove, featuring a variety of forest types such as:

- **Northern dry mixed deciduous forests**
- **Himalayan sub-tropical scrub forests**
- **Subtropical pine forests**
- **Lower Siwalik Chir Pine forests**
- **Dodonea-dominated scrub forests**

Major Plant Species:

- *Pinus roxburghii* (Chir Pine)
- *Acacia catechu* (Khair)
- *Mallotus philippensis* (Kamala tree)
- *Cassia fistula* (Indian laburnum)
- *Zizyphus jujuba* (Ber)
- *Dalbergia sissoo* (Indian Rosewood)
- *Emblica officinalis* (Amla)

These forest types not only support biodiversity but also **act as carbon sinks**, helping in **climate regulation**.

Wildlife: A Refuge for Iconic Species

The sanctuary shelters a variety of **wild fauna**, many of which are **ecologically important** or **threatened**. Key animal species include:

- **Blue bull (Nilgai)** – the largest Asian antelope
- **Indian jackal**
- **Indian barking deer**
- **Leopard** – apex predator of the region
- **Wild boar**
- **Indian fox**

This diversity makes the sanctuary an important corridor for wildlife movement and **habitat conservation** in the Shivalik range.

Ecological Importance and Ramsar Recognition:

Both **Surinsar and Mansar lakes**, located within and adjacent to the sanctuary, are **natural freshwater bodies** that support a variety of **aquatic life**, **migratory birds**, and **local livelihoods** through fishing, tourism, and religious activities. Their **designation as Ramsar sites** reflects their **international significance** in wetland conservation.

Additional Insights:

- The sanctuary is not only a **biodiversity hotspot**, but also a **cultural and religious site**, with Mansar Lake being associated with Hindu mythology.
- The area is popular for **eco-tourism**, **boating**, and **nature trails**, drawing visitors from across North India.
- Its protection is crucial for maintaining the **ecological balance** of the Siwalik region and promoting **sustainable tourism**.

Conclusion:

The **Surinsar-Mansar Wildlife Sanctuary** stands as a symbol of **nature's resilience and beauty** in Jammu & Kashmir. With rich biodiversity, scenic landscapes, and crucial ecological roles, it serves both as a **wildlife haven** and a **cultural landmark**. The government's move to monitor and protect its **eco-sensitive zones** is a step in the right direction to ensure that **development and conservation go hand in hand**.

Emperor Penguins: Antarctica's Majestic Birds on the Brink

Context: A recent scientific study has once again raised alarms for the **Emperor Penguin**, revealing that this **iconic Antarctic species** is increasingly at risk due to **climate change**. As rising global temperatures continue to **melt Antarctic sea ice**, these resilient birds are losing the very platform they depend on for breeding, nurturing their young, and survival.

About Emperor Penguins: The Giants of the Penguin World

The **Emperor Penguin (*Aptenodytes forsteri*)** is the **tallest and heaviest penguin species** on Earth, uniquely adapted to thrive in one of the **harshest climates** on the planet. They are the **only penguins** that breed during the **Antarctic winter**, braving sub-zero temperatures and ferocious blizzards.

- **Evolutionary History**: These penguins evolved nearly **one million years ago**, adapting over millennia to extreme cold.
- **Distribution**: Native to **Antarctica**, they are found across the continent and nearby **sub-Antarctic islands**.

Breeding & Habitat:

- **Breeding Season**: Emperor penguins breed between **April and November**, forming large colonies on **sea ice** between **66° to 78° south latitude**.
- **Ice Dependency**: They are the **most ice-adapted** of all penguin species, spending their entire lives **on and around the Antarctic ice shelf** and surrounding **Southern Ocean**.

Unique Physical and Behavioral Traits:

- **Appearance**: Adults are marked by a sleek **black-and-white body** with elegant patches of **yellow and orange** on the **head, neck, and upper chest**.
- **Size and Weight**: Males are typically heavier, with adults standing up to **1.2 meters (4 feet)** tall and weighing between **20 to 40 kg**, depending on the season.
- **Thermal Adaptation**:
    - Two thick layers of feathers
    - A generous **fat reserve**
    - **Shorter flippers and beaks** to reduce heat loss
- **Social Behavior**: To endure extreme cold, they **huddle in massive groups**, often shifting positions so each bird gets a turn in the warmer center.
- **Diving Ability**: They are **record-holders among birds**, diving to **depths of up to 550 meters (1,800 feet)** and remaining underwater for over **20 minutes** in search of fish, krill, and squid.

Lifespan and Reproduction:

- **Lifespan**: Typically **15 to 20 years**, though some may live longer in the wild.

- **Parental Roles**: After laying a single egg, **females transfer it to the male**, who incubates it on his feet under a flap of skin while the female returns to sea to feed—an extraordinary act of **parental endurance**.

Conservation Concerns:

- **IUCN Status**: Currently listed as **Near Threatened** on the **IUCN Red List**.
- **Primary Threat**: **Melting sea ice** due to **global warming** is the greatest danger to Emperor Penguin populations.
- **Habitat Loss**: With **sea ice forming later and melting earlier**, chicks may perish before they can fledge. Reduced ice also affects **krill populations**, the penguins' primary food source.

Did You Know?

- Emperor Penguins can tolerate temperatures as low as **–60°C (–76°F)** and wind speeds exceeding **200 km/h (124 mph)**.
- In 2023, satellite images revealed **mass chick deaths** across several colonies due to **early ice breakup**.

Conclusion:

The **Emperor Penguin**, with its regal stature and extreme survival skills, is a **symbol of Antarctica's wilderness**. Yet, even these remarkable birds are not immune to the **escalating impacts of climate change**. Protecting their fragile habitat is not only crucial for their future but also serves as a **powerful indicator** of the health of our planet's **polar ecosystems**.