Today's Prelims Topics

Fossil Leaves Reveals Monsoon Evolution

Context

- Fossil leaves from Nagaland reveal how Antarctica shaped the Indian monsoons.
    - Researchers found this using a method called CLAMP (Climate Leaf Analysis Multivariate Program)

Insights from the Findings

- The **formation of Antarctic ice sheets (~34 million years ago)** influenced global wind and rainfall patterns, shaping the **early evolution of the Indian monsoon system**.
- Growth of Antarctic ice caused the **Intertropical Convergence Zone (ITCZ)** (a key tropical rain belt) to shift towards the tropics.
- The Antarctic region once had a **much warmer and wetter climate** compared to today.

Note -

✓ **Antarctica is the name of the continent**, which is the southernmost and fifth-largest continent in the world. **Antarctic** is **an adjective used to describe anything related to Antarctica.** In short, Antarctica is a place, while Antarctic is a characteristic associated with that place.

CLAMP Method (Climate Leaf Analysis Multivariate Program)

- A scientific technique to **reconstruct past climates** by analyzing the **morphology (shape, size, structure)** of fossilized leaves.
- **Principle**: Leaf traits (like size, margin type, shape) correlate strongly with climate variables (temperature, rainfall, humidity).
- **How it works**:
    - Fossil leaves are collected and their features documented.
    - These are compared with modern leaf–climate datasets.
    - Statistical models generate estimates of past **temperature, precipitation, and humidity**.
- Provides **quantitative and reliable climate data** for periods millions of years old, where no instrumental record exists.

Source: PIB

United Nation General Assembly (UNGA)

Context

India voted **in favour** of a **UN General Assembly resolution** (introduced by France) that endorses the **New York Declaration** on peaceful settlement of the Palestine issue and the **Two-State Solution**.

What is the New York Declaration?

- The **New York Declaration on the Peaceful Settlement of the Question of Palestine** was circulated at a **high-level UN conference (July 2025)**, co-chaired by **France and Saudi Arabia**.
- It commits the international community to:
    - **End the war in Gaza** through collective action.
    - Achieve a **peaceful and lasting settlement** of the Israeli-Palestinian conflict.
    - Implement the **Two-State Solution** (Israel and Palestine living side by side in peace and security).
    - Ensure **self-determination for Palestinians** while guaranteeing peace and security for Israelis.

- The **Two-State Solution** is the internationally backed proposal to resolve the Israel–Palestine conflict by creating **two sovereign states**:
    - **Israel**: existing state.
    - **Palestine**: comprising the **West Bank, Gaza Strip, and East Jerusalem** as its capital.

UNGA (United Nations General Assembly)

- It is the **main deliberative, policymaking, and representative organ** of the **United Nations**.
    - All **193 member states** of the UN are represented, each with **one vote**.
- **Functions**:
    - Discusses and makes recommendations on **international peace and security**, **admission of new members**, and **budgetary matters**.
    - Elects non-permanent members of the **UN Security Council**, members of other UN bodies, and the **Secretary-General (on Security Council's recommendation)**.
    - Adopts declarations, conventions, and resolutions (non-binding but politically significant).
- **Sessions**:
    - Meets **annually** in regular session (September to December in New York).
    - Special or emergency sessions can be convened.
- **Powers & Limitations**:
    - Resolutions are **not legally binding** (unlike the **UN Security Council**), but carry **moral, diplomatic, and political weight**.

- Can influence global opinion and set international norms.

- **Structure**:
  - President of the General Assembly (**PGA**) is elected annually.
  - Has **six main committees** (Disarmament, Economic & Financial, Humanitarian, Special Political, Administrative & Budgetary, Legal).

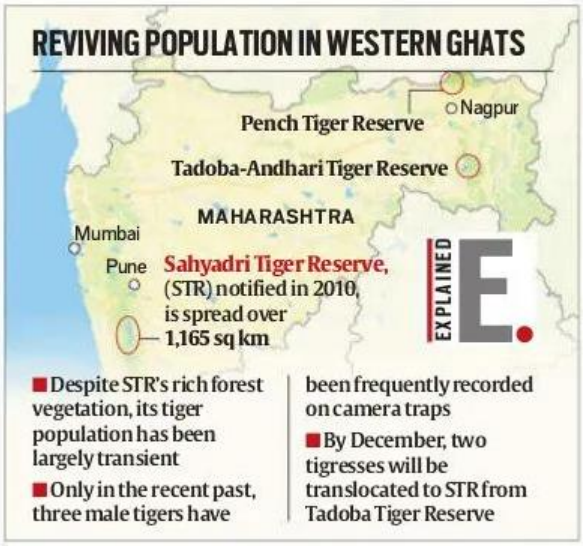
Source: The Hindu

Translocation of Tigers

Context

The Union Environment Ministry has approved the capture and translocation of eight tigers from Tadoba-Andhari and Pench Tiger Reserves in Maharashtra to the Sahyadri Tiger Reserve (STR) in western Maharashtra.

Why is the Translocation happening?



- **Low Tiger Numbers in Sahyadri Reserve:** Despite rich forest vegetation, Sahyadri Tiger Reserve has had a **very small and transient tiger population**.
    - Only recently have a few male tigers been photographed in the area.
- **Revival of Tiger Population:** The translocation is part of the **long-term tiger recovery plan**.
    - It seeks to establish a **breeding population** in Sahyadri, which tigers never naturally colonised.
- **Suitable Habitat:** Studies by the **Wildlife Institute of India (WII)** and forest officials confirm that Sahyadri has the **capacity to host 20+ tigers** due to its prey base and large forest cover.
- **Ecological Importance:** Reviving tigers here will help **maintain connectivity** of habitats across the Western Ghats, including Goa and Karnataka.
    - Sahyadri is also part of the **catchment area** for major rivers (Koyna, Warna) crucial for livelihoods.

About Sahyadri Tiger Reserve (STR)

- **Location**: Spans parts of Kolhapur, Satara, Sangli, and Ratnagiri districts.
- **Size:** 1,165 sq km
- **Created**: In 2010 by combining the Chandoli National Park and Koyna Wildlife Sanctuary.

Tadoba–Andhari Tiger Reserve (TATR)

- **Location**: Chandrapur district, Maharashtra.
- **Size**: ~1,727 sq km (core 625.4 sq km + buffer ~1,101 sq km).
- **Created**: Declared a Tiger Reserve in **1995** by merging **Tadoba National Park (notified 1955)** and **Andhari Wildlife Sanctuary (1986)**.
- **Special Feature**: Oldest and largest national park in Maharashtra, rich in teak forests and famous for frequent tiger sightings.

Pench Tiger Reserve (PTR), Maharashtra

- **Location**: Nagpur and Chandrapur districts, adjoining Madhya Pradesh's Pench reserve.
- **Size**: ~741 sq km (core 257 sq km + buffer ~484 sq km).
- **Created**: Declared a Tiger Reserve in **1999**, after Pench National Park (notified 1975) and adjoining sanctuary areas were combined.
- **Feature**: Named after the **Pench River** flowing through it; forms part of a larger tiger habitat spread across MP and Maharashtra.

Source: **Indian Express**

Commonwealth Parliamentary Association

Context

Lok Sabha Speaker Om Birla inaugurated the 11th Commonwealth Parliamentary Association (CPA).

About Commonwealth Parliamentary Association (CPA)

- **Establishment:** Founded in **1911** as the *Empire Parliamentary Association*.
  - Renamed as the **Commonwealth Parliamentary Association (CPA)** in **1948**.
- **Headquarters:** London, United Kingdom.
- **Membership:** Over **180 national and sub-national legislatures** are members.
  - Includes **Parliaments, State Assemblies, and Provincial Legislatures**.
  - India's **Parliament and State/UT legislatures** are members.
- **Objectives:**
  - Promote **parliamentary democracy** and good governance.
  - Provide a **forum for dialogue and cooperation** among parliaments.
  - Support the **Commonwealth Charter values**: rule of law, human rights, transparency, separation of powers.
  - Build capacity of **legislators and parliamentary institutions**.
- **Key Activities:**
  - Organises **Commonwealth Parliamentary Conference (CPC)** annually.
  - Conducts **training, workshops, and youth/women parliamentarian programs**.
  - Publishes resources like the *Parliamentary Review* for knowledge sharing.

Related Fact

- Om Birla serves as the ex-officio Chairperson of the CPA India Region Executive Committee.
- The Commonwealth Parliamentary Association has **9 geographic regions.**
  - **India** constitutes the **9th Region of the CPA,** comprising 31 State and Union Territory branches.

Source: PIB

BS-VII Norms

Context

The Indian government is planning to adopt **BS VII emission standards** and **CAFE III (Corporate Average Fuel Efficiency) norms**.

BS-VII Emission Norms

- Bharat Stage (BS) norms regulate pollutants emitted by vehicles in India.
- **BS-VII** will be the next stricter stage, aligned with European **Euro-7** standards.
- Key expected features:
    - Stricter limits on pollutants like **NOx (Nitrogen Oxides)**, **PM (Particulate Matter)**, **CO (Carbon Monoxide)**, and **HC (Hydrocarbons)**.
    - Likely **uniform limits across fuel types** (petrol and diesel).
    - **On-Board Monitoring (OBM)** and stronger **Real-Driving Emission (RDE)** testing.
    - Regulation of **evaporative emissions** and possibly **non-tailpipe emissions** (tyre/brake dust).

CAFE III Norms (Corporate Average Fuel Efficiency)

- CAFE norms regulate **fuel efficiency and CO_2 emissions** of an automaker's overall fleet.
- Unlike BS norms (which target toxic pollutants), CAFE norms aim to reduce **greenhouse gas emissions** and improve energy efficiency.
- Under CAFE, a manufacturer's **average CO_2 emissions per km** across all vehicles sold must stay within limits.
- Earlier phases:
    - **CAFE I** (2017): initial fuel efficiency targets.
    - **CAFE II** (2022): CO_2 emissions capped at **113 g/km** for passenger cars.
- **CAFE III** will tighten limits further, compelling manufacturers to adopt more **efficient engines, hybrids, and electric vehicles**.

Source: Livemint

Optical Computing Systems

Context

Researchers from Tampere University (Finland) and Université Marie et Louis Pasteur (France) show the potential of optical fibre–based computing for next-gen AI hardware.

What were the Experiments?

- **Optical fibres in the nonlinear light regime** can perform AI tasks like image recognition.
- Using an **Extreme Learning Machine (ELM)** model, they achieved **91–93% accuracy** in classifying handwritten digits — nearly matching electronic systems but with **higher speed and lower energy use.**

About Optical Computing Systems

- Optical (or photonic) computing systems are computers that use **photons (light particles)** instead of **electrons** to process, transmit, and store information.
- **How They Work:**
    - They rely on **optical components** such as **lasers, lenses, modulators, optical fibres, and photonic integrated circuits (PICs)**.
    - Information is encoded in light's properties — **intensity, phase, wavelength, or polarisation** — and manipulated to perform calculations.
- **Advantages:**
    - **Speed**: Photons travel at the speed of light.
    - **Energy efficiency**: Less heat generation compared to electronics.
    - **High bandwidth**: Can carry vast amounts of data simultaneously using different light wavelengths.
- **Applications:**
    - **Artificial Intelligence (AI)** – speeding up training and inference.
    - **Big data & high-performance computing**.
    - **Telecommunications & Internet** – already widely used in **optical fibres** for data transfer.
    - **Defense & scientific simulations** needing ultra-fast computation.

Source: The Hindu

Discovery of Biosignatures on Mars

Context

NASA announced that its **Mars rover Perseverance** has detected possible **"biosignatures"** in a rock sample called *Cheyava Falls*, studied in July 2024.

What are Biosignatures?

- Biosignatures are **substances, elements, molecules, or structures** that may indicate the presence of past or present life.
  They suggest a possible **biological origin**, though non-biological processes could sometimes mimic them.

Mars 2020 Perseverance Rover Mission

- **Launched by**: NASA (United States)
- **Mission Duration**: Planned for at least **1 Martian year (~687 Earth days)**, extended indefinitely
- **Objectives:**
  - **Search for Signs of Ancient Life:** Detect potential **biosignatures** in rocks and soil.
  - **Collect and Cache Samples:** Store rock and regolith samples in sealed tubes for future **Mars Sample Return mission**.
  - **Study Mars' Geology & Climate:** Understand history of water and habitability on Mars.
  - **Test Technologies for Future Human Missions:** Including oxygen production from CO_2 in the atmosphere.

Major Instruments & Features

- **SHERLOC** (Scanning Habitable Environments with Raman & Luminescence for Organics and Chemicals): detects organic compounds.
- **PIXL** (Planetary Instrument for X-ray Lithochemistry): provides detailed chemical analysis of rocks.
- **MOXIE** (Mars Oxygen In-Situ Resource Utilisation Experiment): produced oxygen from Martian CO_2.
- **SuperCam**: studies rock composition using laser spectroscopy.
- **Ingenuity Helicopter**: small drone that performed the **first powered flight on another planet**.

Source: Indian Express

News In Short

INS Aravalli	**News?** The Indian Navy commissioned INS Aravali. **What is it?** ● It is a new naval support base. ● Located in Gurugram, Haryana. ● It will act as an **information and communication hub**, supporting command, control, and surveillance functions critical for India's maritime security. **Other Key Naval Bases** ● INS Kadamba (Karwar, Karnataka) ● INS Vajrakosh (Karwar, Karnataka) ● INS Kalinga (Visakhapatnam, Andhra Pradesh) ● INS Baaz (Great Nicobar Island, A&N Islands) ● INS Varsha (Rambili, Andhra Pradesh – under development)
Diella - AI Minister 	**News?** Diella is the world's **first AI-powered minister**, appointed by **Albania.** **About it** ● Designed to fight corruption and ensure transparency in public spending, especially in government tenders and contracts. ● Initially launched in **January 2025** as a **voice assistant** on the **e-Albania platform** to guide citizens through government services. **About Albania**  ● **Location:** Balkan Peninsula, Southeastern Europe. ● **Borders:** Montenegro (NW), Kosovo (NE), North Macedonia (E), Greece (S), Adriatic & Ionian Seas (W). **Source:** TOI
Exercise Siyom Prahar	**News?** The Indian Army successfully conducted Exercise Siyom Prahar in Arunachal Pradesh.

	What is it? ● A **major field training exercise** of the Indian Army to validate the use of **drone technology** in modern tactical operations. ● **Focus**: ○ Persistent **surveillance & reconnaissance**. ○ **Target acquisition & precision strikes**. ○ Developing new **tactics, techniques, and procedures (TTPs)** for integrating drones with conventional firepower. **Source:** TOI
Parliament of World's Religions	**News?** September 11, 2025, marked 132 years since Swami Vivekananda's historic speech at the Parliament of World's Religions in Chicago. **What is the Parliament of World's Religions?** ● Held in **Chicago from September 11–27, 1893** as part of the World's Columbian Exposition. ○ Brought together **representatives of major world religions** for dialogue on faith and coexistence. ● **Aim**: ○ Promote **interfaith understanding, tolerance, and cooperation**. ○ Showcase religion as a unifying force rather than a divisive one. ● **Participants**: ○ Featured speakers from **Christianity, Judaism, Buddhism, Hinduism, Islam, and other traditions**. ○ Swami Vivekananda's speeches on **Vedanta and religious harmony** became the highlight of the event. ● **Legacy**: ○ Marked the **first formal interfaith dialogue** on such a global scale. ○ Continues to be held periodically in different cities (e.g., Chicago 1993, Barcelona 2004, Chicago 2023). **Source:** Indian Express

Places in News

Pugad Island

News? The Philippine Island of Pugad is facing **severe land subsidence (up to 11 cm/year) and rising sea levels.**

About Pugad Island

- **Location:** A small island (about 7 hectares) in Manila Bay, at the **mouth of the Angat–Pampanga River Delta, Bulacan, Philippines.**

Mains Topics

Gaps in India's Critical Research Ecosystem

Context

While India has a strong STEM talent pool and ranks among the top five in several critical technologies, structural gaps in funding, infrastructure, and talent retention hinder its ability to achieve global breakthroughs.

Current Status of India's Research Profile

- **Limited Global Impact**: India contributes **2.5% of highly cited papers** and accounts for only **2% of top global researchers** (Stanford–Elsevier).
- **Relative Strengths**: India ranks in the **top five globally in 29 critical technologies** but struggles to maintain quality and consistency.
- **Strong Talent Base**: Indian-origin scientists excel globally, but many remain outside India due to lack of opportunities at home.
- **Dependence on Imports**: India still relies on foreign supply chains for semiconductors, defence tech, and advanced materials.
- **Restrictive Tech Transfers**: Both the US and China impose **explicit/implicit restrictions** on high-tech exports to India.
- **Global Comparisons**: While China dominates **37 of 44 critical technologies (ASPI)**, India's output is fragmented and less impactful.

Opportunities for India

- **Global Talent Surplus:** Budget cuts in US science agencies and tighter visa rules have created a **surplus of highly skilled researchers**, including many of Indian origin, looking for opportunities.
- **Government Push in R&D:** India has announced unprecedented investments - ₹1 lakh crore R&D fund and Anusandhan National Research Foundation - creating a supportive policy environment.
- **Strategic Moment:** The global order is shifting, with the US and China in competition and other

powers seeking **diversified tech partnerships.** India can position itself as a trusted democratic partner in technology supply chains.

- **Demographic Leverage:** India already produces a large pool of STEM graduates. By combining local talent with returning diaspora scientists, it can build a world-class research ecosystem.
- **Mission-Oriented Focus:** Emerging sectors like semiconductors, quantum, hypersonics, and synthetic biology are still in their early stages worldwide - offering India a level playing field if it acts quickly.

Gaps in India's Ecosystem

- **Talent Attraction and Retention:** India produces large numbers of STEM graduates but struggles to **retain top-tier researchers**.
    - **Brain drain:** Many Indian-origin scientists prefer working abroad due to better pay, labs, and career progression.
- **Inadequate Funding and Resource Allocation:** India spends **~0.7% of GDP on R&D**, compared to 2-3% in China and 3-4% in advanced economies.
- **Weak Infrastructure:** World-class laboratories and testing facilities are scarce. Many universities lack cutting-edge equipment, making collaboration with industry difficult.
- **Fragmented Institutional Structures:** Lack of Focused Research Organisations (FROs) dedicated to mission-oriented research in critical tech. Research spread thinly across IITs, CSIR labs, and universities with **duplication and weak coordination**.
- **Limited Global Collaboration:** No large-scale structured programme to attract **foreign scientists to Indian labs**. Participation in global mega-projects (like CERN or ITER) is limited in scope.
- **Short-Termism**: Many programmes are ad hoc or scheme-based, lacking **long-term continuity and predictability**.

Recent Government Steps

- **Anusandhan National Research Foundation (ANRF)**: Established to fund high-quality research, foster collaborations, and attract global talent.
- **₹1 Lakh Crore R&D Innovation Fund**: Largest ever investment in India's scientific research ecosystem, aimed at promoting frontier research.
- **Ease of Doing Science**: Simplified approval processes, increased autonomy for researchers, and digital platforms for grant applications.
- **National Missions**: Programmes in areas like **semiconductors, quantum communication, AI, and space technologies**.
- **Fellowship Schemes**: Initiatives such as Ramanujan, Ramalingaswami, and INSPIRE fellowships to support early-career scientists.
- **Industry Partnerships**: Push towards linking academia and industry for applied research (e.g., collaborations between IITs and DRDO/ISRO).

Way Forward

- **Focused Research Organisations (FROs):** Establish **mission-oriented FROs** embedded in Institutes of National Importance.
    - Attract **500+ top global researchers in 5 years**, especially postdocs and young faculty.
- **Competitive Compensation & Funding:** Pool resources from industry and state to provide globally benchmarked salaries and grants.
- **Infrastructure & Ecosystem Strengthening**: Build world-class labs, testing facilities, and collaborative platforms. Encourage **public–private–academic partnerships** for innovation.
- **Strategic Focus Areas**: Prioritise sovereign capability in semiconductors, propulsion, synthetic biology, quantum communication, and hypersonics.
- **Permanent Institutional Structures**: Design FROs as **Section 8 companies** with at least 51% industry participation. Ensure continuity beyond political cycles through predictable, permanent frameworks.

Global Examples

- **China ⟶ Thousand Talents Program (2011-17)**
    - Attracted **3,500 early-career scientists** with competitive pay, labs, and housing.
    - **Result:** China rose from having **1 to 8 of the top 10 global institutions** (Nature Index 2024).
    - Strong focus on **mission-oriented projects** (hypersonics, AI, semiconductors).
- **United States ⟶ DARPA Model**
    - Created permanent, mission-driven agencies (e.g., DARPA, ARPA-E) with stable funding and autonomy.

Source: The Hindu

Technological Shifts in Indian Warfare (10th–18th Century)

Context

From the 10th century, horse-breeding groups from Afghanistan and Central Asia invaded India, bringing not just cultural and religious changes but also transformative military technologies. These innovations reshaped India's warfare for centuries and ultimately paved the way for British dominance.

Contrast in Military Culture

- **Rajputs**: Valued *shakti* (strength) and *bhakti* (devotion), glorified **death over dishonour**, and considered tactical trickery (*yukti*) dishonourable. They glorified open combat and even noble defeat.
- **Afghans & Turks**: Adapted to survival in **Central Asian steppes**, relied on horse-based strategies and tactical manoeuvres. They emphasized clever war strategies over brute force.

Military Innovations of Afghans and Turks

- **Parthian Shot:** Technique where mounted archers, while riding away, twisted back to shoot at pursuers.
  - Rajputs saw it as **cowardice** (since retreating implied dishonour).
  - Central Asians saw it as a **brilliant ambush tactic** developed for steppe survival.
- **Logistical Mastery:** Mahmud of Ghazni's campaign to Somnath involved **30,000 camels carrying water and fodder**, enabling desert routes and surprise attacks.
- **Encirclement (Negre):** Mongol hunting technique ⟶ cavalry surrounded enemies like hunters trapping prey.
- **Siege Warfare Tools** (introduced by Khiljis):
  - **Catapults (Maghrabis)**: Hurled projectiles at fort walls.
  - **Mounds (Pasheb)**: Raised platforms to approach fortresses with engines and soldiers.
  - **War Elephants**: Deployed as battering rams to smash gates and terrify defenders.

Mughal Military Innovations

- **Cannons:**
  - Rendered elephants obsolete as battering rams.
  - Introduced new **artillery-centric warfare**.
- **Mobile Capital (Urdu-e-Mualla):**
  - Emperor's travelling camp functioning as a **mobile city of 100,000 people**.
  - Projected **imperial power, pomp, and pageantry** across regions.

Later Developments

- **Zamburak (18th century, Ahmad Shah Abdali):** Small swivel cannons mounted on camels for mobility.
- **Indian Resistance to Firearms**
    - Despite the introduction of guns in the 16th century, **Vijayanagar Nayakas** resisted adopting them, relying on cavalry.
    - Old matchlocks were clumsy and hard to use on horseback.

The British Transformation

- Introduced **flintlock muskets** - faster, more reliable, easier to use.
- Created **disciplined infantry formations**, overpowering cavalry-dominated armies.
- Marked the **end of 800 years of cavalry supremacy** in India.

Analysis: Technology and Culture

- Each phase of India's history shows how **technological change reshaped not only the battlefield but also cultural attitudes.**
- Rajputs equated strategy with dishonour, Central Asians saw it as survival, Mughals projected pomp through mobile capitals, and the British institutionalised discipline through firearms.
- Warfare innovations reflected deeper **civilisational values and adaptations** to shifting political realities.

Source: Indian Express