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Table of Content

RESERVE BANK OF INDIA SUGGESTS NEW SAFETY MEASURES TO PREVENT DIGITAL FRAUDS

Context

- In order **to curb digital fraud,** the Reserve Bank of India has released a discussion paper suggesting **additional measures to prevent digital fraud.**

The RBI Measures:

- **A time lag of 1 hour** for the completion of digital payments of more than 10 thousand rupees.
  - During this period, the payer's bank would provisionally debit the customer's account, and the Customer would retain the option to cancel the transaction for any reason.
- **Additional authentication by a trusted person** for senior citizens or for divyang. This trusted individual will act as another layer of authentication for high value transactions.
- **Customers can be provided with digital payment controls** which would consist of a 'switch on/off' facility for any digital payment mode as well as for setting limits for different transaction types at the account level.
  - This would allow customers to control the debit transactions at the account level across any or all digital payment channels.
- **To curb Mule Accounts:** In order to control the use of bank accounts as "mules" to route money proceeds of Digital Frauds, RBI has suggested capping annual credits at around 25 lakh for accounts that have not undergone enhanced due diligence.
  - Funds exceeding the prescribed threshold may be parked as "shadow credits" and released only after the bank is satisfied about their legitimacy
- **Kill Switch:** The RBI has proposed a 'kill switch' that would allow customers to disable all digital payments in their accounts at one stroke.
  - Once the kill-switch is enabled, disabling the feature to re-activate digital payments can be permitted either through digital modes after taking proper authentication measures or through a physical visit to a bank branch by the account holder.

Need for these Measures

- **As per National Cyber Crime Reporting Portal Data,** around 28 lakh cyber frauds were reported in the year 2025, amounting to 22,931 crore rupees.
- **Increased Digital Transactions:** Digital transaction volumes have increased 38-fold, while transaction values have more than tripled.
  - The significant growth of the digital payment ecosystem has been backed by systems such as UPI, IMPS, and NEFT.
- **Evolving Nature of Fraud:** A typical fraud today may not involve technical compromise of systems, but fraudsters are deploying various tactics, such as bogus call centres, deepfake-driven impersonation scams and mule account networks.
- **The instant nature of digital payments** further increases the risk, as the scope for timely intervention and recovery of funds becomes limited.

Initiatives by Government of India to Prevent Cybercrimes

- **Indian Computer Emergency Response Team (CERT-In):** CERT-In is the **national nodal agency** for responding to cybersecurity incidents.
  - It provides proactive and reactive cybersecurity support and plays a crucial role in ensuring the security and resilience of the country's cyber infrastructure.
- **National Critical Information Infrastructure Protection Centre (NCIIPC):** NCIIPC is responsible for protecting critical information infrastructure from cyber threats.
  - It identifies and designates critical sectors and advises organizations in these sectors on enhancing their cybersecurity measures.
- **Cyber Crime Prevention against Women & Children (CCPWC) scheme:** The Ministry of Home Affairs has provided financial assistance to all the States & UTs under the scheme to support their efforts for setting up of cyber forensic-cum-training laboratories, training, and hiring of junior cyber consultants.
- **Indian Cyber Crime Coordination Centre (I4C)**: It provides a framework and ecosystem for Law Enforcement Agencies (LEAs) to deal with cyber crimes in a comprehensive and coordinated manner.
  - 'Joint Cyber Coordination Teams' have been constituted for seven regions at Mewat, Jamtara, Ahmedabad, Hyderabad, Chandigarh, Visakhapatnam and Guwahati under the I4C.

- **National Cyber Crime Reporting Portal**: It is launched to enable the public to report incidents pertaining to all types of cyber crimes.
  - **A toll-free number 1930** has been operationalized to get assistance in lodging online cyber complaints.
  - The **Citizen Financial Cyber Fraud Reporting and Management System** module has also been launched for immediate reporting of financial frauds and to stop siphoning off funds by the fraudsters.
- **Cyber Swachhta Kendra (Botnet Cleaning and Malware Analysis Centre):** This initiative is aimed at creating awareness about **botnet and malware infections** and providing **tools for detection and cleaning**.
  - It also provides cyber security tips and best practices for citizens and organisations

Source: TH

IMPORTANCE OF BIOTECHNOLOGY IN TRADITIONAL FARMING PRACTICES

Context

- With the agriculture industry projected to grow 2.5 times by 2033, biotech experts underscored the **growing importance of agri-biotechnology in the coming years.**
  - Scientists have warned that with **every one degree Celsius** increase in temperature, India's wheat yield could decline by **6% to 10%.**

What is Climate-resilient Agriculture (CRA)?

- **Climate-resilient agriculture** uses a **range of biotechnology and complementary technologies** to **guide farming practices** and reduce dependence on chemical inputs, while maintaining or improving productivity.
- **Tools include:** Biofertilizers and biopesticides, and soil-microbiome analyses.
  - Genome-edited crops can be developed to withstand drought, heat, salinity, or pest pressures.
  - AI-driven analytics can integrate multiple environmental and agronomic variables to generate locally tailored farming strategies.

India's Bioeconomy

- India is among the **Top 12 destinations** for biotechnology worldwide and **3rd largest destination** for biotechnology in Asia Pacific.
- India's bioeconomy has grown sixteen-fold from **$10 billion in 2014 to an impressive $165.7 billion in 2024.**
- **Contributing 4.25%** to the national GDP, the sector has demonstrated a robust compound annual growth rate (CAGR) of **17.9%** over the past four years.
- India's Biotechnology sector is **categorised into Biopharmaceuticals, Bio agriculture, Bio IT and Bio Services.**
- **Future Goals:** Target of achieving a **$300 billion bioeconomy by 2030.**
  - India also seeks to lead globally in bio-pharma, including vaccines, diagnostics, and therapeutics.

Why does India need CRA?

- **Agricultural Economy:** India is an agricultural nation with a rapidly growing population, which places increasing pressure on the need for higher and more reliable farm productivity.
  - Around 51% of India's net sown area is rainfed, and produces nearly 40% of the country's food, making it especially vulnerable to climate variability.
- **Conventional Farming Methods are not enough:** These methods alone may not withstand the rising stresses of climate change.
  - Recent modelling suggests that by the end of the century, yields of staple crops like rice could fall by 3-22%, and in worst-case scenarios by more than 30%.
- **Enhanced Productivity:** Climate-resilient agriculture offers a suite of technologies that can enhance productivity while protecting environmental health.
  - It can also reduce India's reliance on food imports and strengthen the country's strategic autonomy in the food sector.

Global Scenario

- The U.S. integrates CRA into federal policy through the USDA Climate-Smart Agriculture and Forestry (CSAF) initiative, investing billions in climate-smart practices.

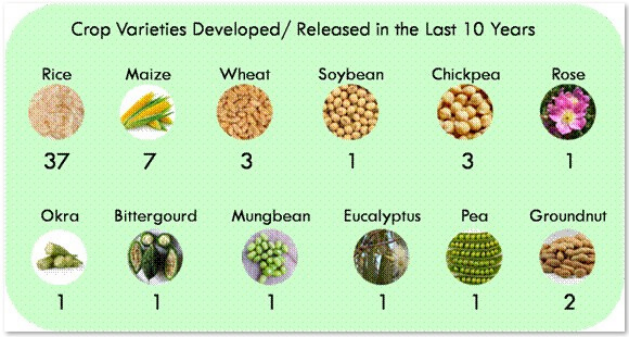
- CRA is embedded in the **EU Green Deal** and Farm to Fork Strategy, both aiming to reduce chemical inputs and enhance sustainability.
- **China's CRA strategy** centres on climate-tolerant crop breeding, large-scale water-saving irrigation, and agricultural digitalisation.
- **Brazil** leads in tropical climate-resilient crop development, driven by EMBRAPA's biotechnology research.

Challenges

- **Low Adoption:** CRA techniques adoption is low among small and marginal farmers due to limited access, awareness, and affordability, and quality inconsistencies in biofertilizers and biopesticides that undermine trust in biological alternatives.
- **Uneven Distribution:** The rollout of climate-resilient seeds remains slow, with the adoption of new tools such as gene editing still emerging and uneven distribution across States.
- **The digital divide** limits the reach of precision agriculture and AI-based decision tools.
- These challenges are compounded by **ongoing soil degradation, water scarcity, and accelerating climate volatility,** which may outpace current adaptation efforts.
- **Fragmented policy coordination** further risks slowing progress.

Use of Biotechnology in Agriculture

- The Department of Biotechnology's **Agriculture Biotechnology programme** supports innovative biotechnological research for achieving sustainable agriculture by leveraging the latest advances in technologies.
- **The main achievements include:**



- **Climate-Smart Crops:** A New Superior Climate Smart Drought Tolerant High-Yielding Chickpea Variety "SAATVIK (NC 9)" with enhanced yield under drought stress was notified recently.
- **Genome-Edited Crops:** Genome editing was employed to generate loss of function mutations in several rice genes that negatively regulate crop productivity.
- **Amaranth Genetic Resources:** The department of biotechnology has developed an Amaranth Genomic Resource Database, Near Infrared Spectroscopy (NIRS) techniques for screening nutritional qualities of amaranth grain, and a 64K SNP chip.
  - Amaranth accessions screened using the above resources have been shown to counteract high fat diet induced obesity.
- **Fungal Biocontrol:** A stable fungal enzyme nano-formulation from Myrothecium verrucaria has been developed for eco-friendly biocontrol of powdery mildew in tomato and grape.

Government Initiatives

- **National Innovations in Climate Resilient Agriculture:** In 2011, the Indian Council of Agricultural Research (ICAR) launched a flagship network project **'National Innovations in Climate Resilient Agriculture'**.
- **The National Mission for Sustainable Agriculture** has been formulated to enhance agricultural productivity, especially in rainfed areas, focusing on integrated farming, water use efficiency, soil health management, and synergising resource conservation.
- **The BioE3 policy** also positioned CRA as a key thematic area for the development of biotechnology-led solutions.
- **Leading companies** such as Biostadt, IFFCO, GSFC, NFL, and IPL Biologicals supply bio-inputs that improve soil health and reduce chemical dependence.
- India also has an **expanding digital agriculture sector,** with agritech startups offering AI-enabled advisories, precision irrigation, crop-health monitoring, and yield prediction tools.

Way Forward

- There is a need to accelerate the development and deployment of climate-tolerant and genome-edited crops.
- Financial incentives, climate insurance, and credit access are essential to support farmers during the transition.
- India needs a coherent national CRA roadmap under the BioE3 framework, aligning biotechnology, climate adaptation, and policies to deliver resilience at scale.

Source: TH

INDIA'S PAYMENT REVOLUTION

Context

- India's digital payment ecosystem hit a new milestone in January 2026, recording 21.70 billion transactions valued at 28.33 lakh crore, the highest ever logged.

Background

- The early 2000s marked the beginning of digital transformation with systems like **RTGS (Real-Time Gross Settlement-introduced in 2004)** and **IMPS (Immediate Payment Service-introduced in 2010)**.
- Although these systems enabled faster transactions, their benefits were limited to people already connected to the formal banking system.
- A large section of India's population lacked access to **formal financial services (banking, credit, insurance, savings)**.

JAM Trinity

- The **JAM Trinity (Jan Dhan, Aadhaar, Mobile – integrated digital financial framework)** formed the backbone of India's digital payment revolution.
  - **Pradhan Mantri Jan-Dhan Yojana (financial inclusion scheme for zero-balance accounts)** enabled millions to open bank accounts and enter the formal financial system.
  - **Aadhaar** ensured accurate identification and targeted delivery of services.
  - **Mobile connectivity** provided a real-time interface for transactions and communication.
- The JAM framework enabled **Direct Benefit Transfer** and reduced intermediaries, improved efficiency, and ensured transparency in welfare delivery.

UPI System

- The **Unified Payments Interface** was developed by **National Payment Corporation of India (NPCI)** in **2016**. It revolutionised digital payments in India.
- UPI allows instant money transfer using a **Virtual Payment Address** without sharing account numbers or IFSC codes.
- Transactions are **real-time,** available 24×7, and interoperable across banks and applications.
- It is the most successful real-time payment system globally, providing simplicity, safety, and security in **person-to-person (P2P) and person-to-merchant (P2M) transactions in India.**
- Through **UPI Lite X**, Users can both send and receive money offline through any compatible device that supports **Near Field Communication (NFC).**

Advantages of Digital Payments

- Digital payments have reduced reliance on cash, reduced transaction time and improved **economic efficiency.**
- They have enabled small businesses to expand their customer base and improve income opportunities.
- They improve **transparency**, reducing corruption and leakages.
- They strengthen **security** through authentication mechanisms.
  - The **Reserve Bank of India** has introduced **two-factor authentication.** This includes PINs, biometrics, or OTPs, ensuring higher protection against fraud.
- They increase convenience by enabling **anytime, anywhere transactions.**

Global Reach

- India's digital payment system has gained global recognition from institutions like the **IMF and World Bank.**
- UPI has been adopted or linked with countries such as **UAE, Singapore, Bhutan, Nepal, Sri Lanka, France, Mauritius, and Qatar**.

National Payments Corporation of India (NPCI)

- The **National Payments Corporation of India** was incorporated in **2008** as an umbrella organisation to **operate retail payment and settlement systems** in India.
- It was established under the **Payment and Settlement Systems Act, 2007** as a joint initiative of the **Reserve Bank of India** and **the Indian Banks' Association**.
- It has been incorporated as a **"Not for Profit" Company** under provisions **Section 8 of Companies Act 2013.**
- It has launched payment products such as **RuPay card, IMPS, UPI, BHIM, BHIM Aadhaar, Bharat BillPay etc.**

Source: TH

NEW FRAMEWORK FOR IDENTIFYING UPPER LAYER NBFCS (NBFC-ULS)

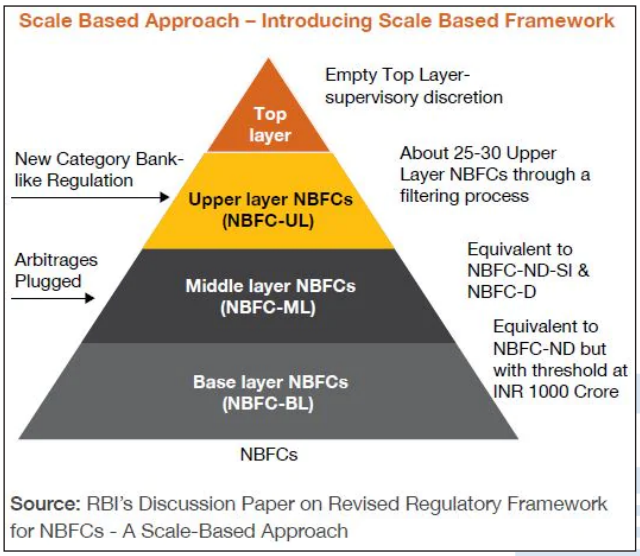
In News

- The RBI released draft amendment directions to **revise the methodology for identifying**

Non-Banking Financial Companies aiming to enhance transparency, simplicity, and regulatory parity.

About

- The current **Scale Based Regulatory (SBR) Framework** for NBFCs prescribes a two-pronged methodology for identification of NBFC-UL viz.,
  - Top ten eligible NBFCs by asset size and parametric scoring methodology.
- This **dual approach** has been criticised for **being complex and less transparent.**



- NBFC-UL are the **entities posing significant systemic risks due to their size**, complexity, and interconnectedness.
- **Top 10 NBFCs** by asset size + parametric scoring methodology like Bajaj Finance, Shriram Finance, Tata Capital, Aditya Birla Finance, LIC Housing Finance.

Proposed Amendments by RBI

- **Asset Size Threshold:** Single objective criterion, NBFCs with asset size ≥ 1,00,000 crore qualify as NBFC-UL, replacing the dual methodology. Reviewed every 5 years. Enhances predictability and ease of compliance.
- **Inclusion of Government NBFCs:** Currently placed in Base Layer (BL) or Middle Layer (ML), state-owned entities like NABARD, Exim Bank, and SIDBI will now be classified under Upper Layer based on size.
- **State Government Guarantees:** NBFC-UL entities may use state government guarantees as a credit risk transfer instrument without any cap (subject to conditions), providing greater flexibility in risk management.

Non-Banking Financial Company (NBFC)

- **Definition of NBFC:** A Non-Banking Financial Company (NBFC) is a company registered under the Companies Act (1956 or 2013) that primarily conducts financial activities like loans, advances, leasing, hire-purchase, and investment in securities.
  - NBFCs are prohibited by the Reserve Bank from associating with any unincorporated bodies
- **Excluded activities**: It does not include companies whose main business is agriculture, industry, trading goods (other than securities), services, or real estate activities.
- **Residuary NBFCs:** Companies that mainly collect money through deposits or instalment schemes also fall under NBFCs (called residuary non-banking companies).
- **Eligibility** : To register with the Reserve Bank of India (RBI) as a Non-Banking Financial Company (NBFC), a company must be incorporated under the Companies Act, 1956 or 2013 and have a minimum Net Owned Fund (NOF) of 10 crore.
  - However, higher capital requirements apply for specialised NBFCs, such as 300 crore for NBFC-IFCs and IDF-NBFCs, 100 crore for Mortgage Guarantee Companies, 20 crore for Housing Finance Companies, 150–250 crore for Standalone Primary Dealers depending on activities, and 2 crore for NBFC-AA and NBFC-P2P categories.

How NBFCs are Different from Banks?

- NBFCs cannot accept demand deposits.
- They cannot issue cheques or operate payment systems.
- Their deposits are not insured by DICGC.

Key Challenges

- **Regulatory Burden:** More entities under UL means higher compliance costs and stricter capital/governance norms.
- **Threshold Rigidity:** Sole reliance on asset size may ignore risk heterogeneity and qualitative factors like interconnectedness.
- **Government NBFC Impact:** Inclusion may limit operational flexibility of public sector entities.
- **Corporate Governance Conflicts:** Cases like Tata Sons highlight how regulatory changes can trigger ownership disputes and restructuring pressures.

Way Forward

- **Combine asset size with risk-based indicators** to avoid oversimplification.
- **Phased implementation for newly included entities**, especially government NBFCs.
- **Strengthen RBI's supervisory capacity** for a larger NBFC-UL pool.
- Issue clear listing guidelines to prevent regulatory arbitrage.

Source :TH

LIGHT POLLUTION: RISING THREAT FROM ARTIFICIAL LIGHT AT NIGHT (ALAN)

Context

- A study published in the **journal *Nature*** has found that artificial light at night increased by 16% globally between 2014 and 2022.
  - The sharpest rise has been observed in **Sub-Saharan Africa and Southeast Asia**, with **India and China** emerging as major contributors in Asia.

What Is Light Pollution?

- Light pollution is the human-made alteration of outdoor light levels from those occurring naturally. In practical terms, it refers to unwanted, inappropriate, or excessive artificial lighting, primarily caused by Artificial Light at Night (ALAN).
- It is increasingly recognised as an **anthropogenic environmental pollutant**. It is estimated that:
  - **Over 80% of the world's population** lives under light-polluted skies;
  - Around **23% of Earth's land area** is affected by skyglow.

Causes

- **Rapid urbanisation:** Today, about **55% of the global population lives in urban areas**, and this is projected to rise to **68% by 2050**, significantly increasing the demand for outdoor lighting.
- **Unregulated outdoor lighting**: In poorly regulated systems (unshielded streetlights, billboards, façade lighting), 30–50% of emitted light is wasted upward or sideways, directly contributing to skyglow.
- **Vehicle-induced light pollution:** Rapid growth in vehicle numbers increases headlight glare and roadway illumination.
  - India has over 30 crore registered vehicles, contributing significantly to urban night brightness.
- **Shift-based work:** Expansion of 24×7 services (IT, healthcare, transport, manufacturing) leads to continuous lighting demand.

Impacts

- **Human Health:** Exposure to artificial light at night suppresses melatonin production, leading to insomnia and other health issues.
  - Chronic exposure to light pollution has been linked to increased stress and reduced cognitive performance.
- **Environmental and Ecological:** Nocturnal animals, migratory birds, and insects rely on natural light cycles.
  - Birds living in brightly lit areas tend to sing earlier at dawn and later at dusk, disrupting their natural rhythms and negatively impacting migration, feeding, and breeding patterns.
  - Similar effects occur in species like fireflies, whose communication suffers. Artificial lighting confuses navigation and feeding patterns.
- **Astronomy and Scientific Research:** Brightening of the night sky hampers astronomical observations, especially near urban centers.
- **Energy Waste:** Billions of units of electricity are wasted annually due to poorly directed lighting, increasing carbon emissions.

Government Initiatives to Curb Light Pollution

- **Energy Conservation Building Code (2017):** The ECBC is a set of standards established by India's Bureau of Energy Efficiency (BEE) to promote sustainable design and reduce energy consumption by 25–50% in new commercial buildings.
- **Street Lighting National Programme (SLNP):** Launched in 2015, to replace conventional street lights with smart and energy-efficient LED streetlights across the country.
- **Smart Cities Mission:** Adaptive lighting is a core component of India's Smart Cities Mission, designed to optimize energy consumption and reduce light pollution by dynamically adjusting street lamp intensity based on real-time traffic and time conditions.
- **Environmental Protection Act 1986:** Provides umbrella power to the Central Government to regulate environmental pollution of all kinds.

- Light pollution is not explicitly defined, but can be regulated as a form of environmental disturbance.

Conclusion

- Light pollution is an emerging environmental challenge driven by rapid urbanisation and unregulated artificial lighting.
- There is a need to formally recognise Artificial Light at Night (ALAN) as an environmental pollutant and integrate light pollution standards into urban planning, Environmental Impact Assessment (EIA), and biodiversity conservation frameworks.
- A balanced approach between development and ecological protection is essential, ensuring that night skies remain a shared natural heritage while safeguarding human health and biodiversity.

Source: TOI

NEWS IN SHORT

CONSTITUTION OF INDIA IN SINDHI LANGUAGE

In News

- Recently, the Vice-President released the latest version of the **Constitution of India in the Sindhi language** in both **Devanagari and Persian scripts.**

About Sindhi

- It is an **Indo-Aryan language spoken** in Pakistan and in India, with smaller communities worldwide.
- It was officially included in the **Eighth Schedule of the Constitution of India** by the **21st Constitutional Amendment Act 1967.**
- It is one of the oldest and most melodious languages with a rich literary tradition blending Vedantic and Sufi philosophies that promote unity, love, and brotherhood.

Original Language of the Constitution

- **Drafted originally in English**, a Translation Committee under **Ghanshyam Das Gupta produced** the official Hindi version.
- Both English and Hindi versions were signed by **Constituent Assembly members and submitted to Rajendra Prasad on 24 January 1950.**

Source :Air

JUSTICE VARMA RESIGNS AMID PROCEEDINGS FOR REMOVAL

Context

- Recently, Justice Yashwant Varma, an Allahabad High Court judge submitted his resignation to the President of India..

About Judiciary in India

- India has a **single unified judiciary** (unlike the US dual system).
  - **Supreme Court of India** (Top level); **Articles 124–147**
  - **High Courts** (State level); **Articles 214–231**
  - **Subordinate Courts** (District & lower courts); **Articles 233–237**
- This structure ensures **uniform interpretation of law** across the country.

Key Features of Indian Judiciary

- Independence of Judiciary (basic structure doctrine)
- Judicial Review, as it can strike down unconstitutional laws
- Separation of Powers
- Rule of Law

High Court Judges

- High Court judges are governed mainly by:
  - **Article 214**: High Courts for States
  - **Article 216**: Constitution of High Courts
  - **Article 217**: Appointment & conditions of office
  - **Article 218**: Application of provisions of removal (same as SC judges)
  - **Article 219**: Oath or affirmation
  - **Article 220–224:** Other provisions (practice restrictions, additional judges, etc.)
- **Appointment of High Court Judges [Article 217(1)]:** By the **President of India,** after consultation with the Chief Justice of India (CJI), Governor of the State, and Chief Justice of the High Court (for other judges).
- **Qualifications:** A person must be a **citizen of India.** Held judicial office for **10 years**, or been an advocate of a High Court for **10 years.**
- **Tenure (Term of Office):** Holds office until **age of 62 years** (Article 217(1))
- **Oath or Affirmation (Article 219):** Judge must take oath before the **Governor of the State;** Oath

includes upholding Constitution, and performing duties without fear or favour.

Removal of High Court Judges

- **Grounds**: Proved misbehaviour & Incapacity;
- **Procedure (Impeachment-like):** Motion introduced in Parliament; supported by special majority (majority of total membership, and 2/3rd of members present & voting), address sent to President and President orders removal.
- **Resignation:** Judge may resign by writing to the **President of India.**

Source: News On AIR

COMMONWEALTH PARLIAMENTARY ASSOCIATION (CPA)

Context

- Recently, the Commonwealth Parliamentary Association (CPA) India Region Zone VII Conference concluded in Goa.

About Commonwealth Parliamentary Association (CPA)

- It is an international community of Commonwealth parliamentarians, working to promote parliamentary democracy, good governance, and the rule of law.
- It originated in **1911** as the *Empire Parliamentary Association*, and was **renamed** as **Commonwealth Parliamentary Association in 1948** after decolonisation.
- Membership consists of **national, state, provincial, and territorial parliaments** of Commonwealth countries.
  - Membership is **institutional (parliaments), not individual countries alone**.
- It has more than **180 branches** (legislatures) across the Commonwealth.
- The CPA is organised into **Regions** (9 geographic regions) and Branches (individual legislatures).
- Key bodies include the **General Assembly** (supreme authority), **Executive Committee and CPA Headquarters Secretariat (London).**

India & CPA

- India is an **active member**.
- The **Parliament of India** and **State Legislatures** function as CPA branches.

Source: News On AIR

KEYTRUDA

Context

- Recent investigations exposed a dangerous counterfeit market for **Keytruda** in India, fuelled by hospital-level supply chain breaches.

What is Keytruda?

- Brand name for **Pembrolizumab**, a revolutionary **immunotherapy / checkpoint inhibitor** drug for advanced and aggressive cancers.
- Manufactured by Merck & Co. (USA) known as MSD outside the US and Canada.
- Unlike traditional treatments that attack tumours directly, **Keytruda empowers the body's own immune system to identify and destroy cancer cells.**

Immunotherapy

- Immunotherapy is a type of medical treatment that **uses the body's own immune system to fight diseases.**
- **While chemo and radiotherapy** directly kill cancer cells and some healthy cells along with it, **immunotherapy pushes the body's own immune system** to recognise and kill cancer cells.
  - Being **highly targeted,** immunotherapy spares healthy cells.
- These therapies have been shown **to extend life even in patients with aggressive forms of cancer.**

Other Types of Immunotherapy for Cancer Treatments

- **CAR-T cell therapy** involves collecting a patient's own T cells, engineering them to create chimeric receptors, multiplying these modified cells, and returning them to the patient.
  - These engineered T cells can then identify, attach to, and destroy cancer cells that would normally evade immune detection.
- **mRNA vaccines for cancer are** currently under development.
  - Unlike vaccines for infections given to healthy individuals, cancer vaccines are administered to patients who already have certain cancers to prevent relapse.
  - These vaccines train the immune system to identify proteins called neoantigens found only in cancer cells.
  - Once recognised, the immune system remembers these markers for years,

continuing to fight cancer and prevent recurrence.

Implications for India's Cancer Fight

- **Rising Burden:** India's cancer cases projected to surge by nearly 74% by 2045 making access to drugs like Keytruda critical.
- **Affordability Crisis:** Extreme cost creates a dual-tier health system, only the wealthy or specially insured can access top-tier immunotherapy.
- **Counterfeit Risk:** Price-driven desperation has opened the door to fake drug markets, with hospital supply chains as weak links posing lethal risks to patients.

Source: IE

SENTINEL SPECIES

Context

- **Emperor Penguin (Aptenodytes forsteri)** upgraded from Near Threatened to Endangered on the IUCN Red List, driven by climate-induced sea-ice loss.
  - As a **sentinel species**, its decline signals broader Antarctic ecosystem stress, populations projected to halve by the 2080s.

What is a Sentinel Species?

- It is a **plant or animal** whose health reflects the **overall condition of the ecosystem** it inhabits.
- They **respond quickly and visibly to environmental stressors** such as pollution, disease, and climate change.
- They act as **early warning systems**, allowing detection of ecological imbalance before it becomes widespread.

Examples of Sentinel Species

- **Amphibians (Frogs):** Frogs have **permeable skin**, making them highly sensitive to pollutants and pathogens. Decline in frog populations is often an **early indicator of ecosystem stress**.
- **Canaries in Coal Mines:** Historically used to detect **carbon monoxide poisoning**. They showed distress before humans due to faster metabolism.
- **Honeybees:** Used to monitor **agricultural chemicals and pesticide loads**. Decline in bee populations signals **ecosystem imbalance and pollination crisis**.
- **Polar Bears:** Indicators of **Arctic ecosystem health and contaminant accumulation**. Reflect impacts of **climate change and ice loss**.

About IUCN

- Created in 1948.
- **Headquarter:** Gland, Switzerland
- It is a **membership union,** and works closely with international frameworks.
  - **India, a State Member since 1969.**
- It is an **intergovernmental and NGO network (hybrid organisation)**

Source: TH

IMPROVED COOKSTOVES

In News

- Amid the LPG crisis, modern biomass stoves, often called improved cookstoves (ICS), represent a major step up from traditional cooking methods.

Modern Biomass Cookstoves

- **Modern biomass cookstoves (improved cookstoves)** are a cleaner and more efficient alternative to traditional chulhas, cutting fuel use by up to two-thirds and reducing smoke and pollution.
- They achieve much **higher thermal efficiency (38–45%)** compared to traditional stoves (~10%) by improving airflow and reducing harmful emissions.

Importance

- Firewood cooking can be made sustainable if biomass is harvested responsibly and paired with efficient stoves that reduce overall wood consumption.
  - These stoves can also use alternative fuels like pellets and agricultural waste, reducing dependence on raw firewood.
- Operating costs are lower due to high efficiency, potentially reducing fuel use by over 50% and making firewood cheaper than LPG during supply or price crises.

Adoption status

- Widespread adoption depends on affordability and financing, with options like microfinance, CSR funding, and carbon credits helping reduce upfront costs (2,000–20,000 range).
- Large-scale adoption does not require heavy investment in fuel supply chains, since biomass is already widely available. Instead, success depends on strong distribution networks, last-mile delivery, user awareness, and reliable after-sales support.

Biomass

- It is **renewable organic material from plants and animals** that can be used directly for heat or converted into fuels for electricity, heating, and transport.
- It is widely used, especially in developing countries, for cooking and heating.
- **Key sources include wood and wood waste** (firewood, pellets, sawdust), agricultural crops and residues (like corn, sugarcane, and switchgrass), organic municipal waste (food, paper, yard waste), and animal manure or sewage used to produce biogas.

Source :TH

QUORUM SENSING

In News

- Scientists from UT Southwestern Medical Centre in Texas (USA) have found that male sex hormones (androgens like testosterone) can make skin infections more severe by enhancing bacterial communication in Staphylococcus aureus called **quorum sensing.**

Quorum sensing

- It is a microbial communication system where bacteria and **some fungi release signaling molecules (autoinducers)** that accumulate with cell density and trigger coordinated gene expression.
- It regulates key functions like virulence, biofilm formation, bioluminescence, and antibiotic production.
- **Originally discovered in Vibrio fischeri**, it is now known across many microbes, including pathogens like Pseudomonas aeruginosa and Candida albicans.

Androgens

- They are **steroid hormones** that regulate many body functions, including metabolism, muscle and bone maintenance, brain development, and reproductive processes.
- Testosterone is the most **important androgen and can be converted into estrogen**, allowing it to support multiple physiological systems in both sexes.
- Hormone balance is controlled by complex feedback systems involving the brain, pituitary, and gonads, and is influenced by age, health, and metabolism.

Source :TH

OAK TREES

Context

- The Uttarakhand High Court **stayed the felling of oak trees in Mussoorie** for construction by the Municipal Council.

About

- Oak belongs to the **genus Quercus** in the **Fagaceae family** and holds immense social and ecological importance in the Indian Himalayan regions.
- **Oaks can be separated into three groups,** sometimes considered subgenera: white oaks, red and black oaks.
- **Oak trees are mature at 75 years** and have an average lifespan of 150-250 years. However, the oldest oak trees are over 1,000 years old.
- **Climate Requirements:** Oak trees generally thrive in temperate climates.
- **Oak Trees in India:** In the Himalayas, **35 species of oaks** have been reported between 800 and 3,000 metres above sea level.
- **Oaks found in Uttarakhand** are Banj oak, Moru oak, Kharsu oak, Rianj oak, and Phaliath oak.
- **Significance:** Oak forests assist watershed protection by promoting the recharge of springs.
  - Their trees host lichens, bryophytes, pteridophytes (all three being moss-like plants), orchids, and other flowering plants, creating layered **microhabitats.**
  - Birds and mammals such as jays, Himalayan langurs, red giant flying squirrels, and Asiatic black bears feed on oak leaves and acorns, often caching them for leaner periods.
  - Oak is used as fuel wood and fodder by locals from the forests near their settlements.
- **Threats:** Excessive lopping, grazing, and wood use for fuel and fodder consumption.

Source: IE

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