IQRA IAS
An Institute for Civil Services

WEEKLY UPDATES

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POLITY & GOVERNANCE

The 'Quota-Within-Quota' System

Syllabus: GS Paper II – Polity & Social Justice - Topics: Reservation Policy, Social Equity, Social Welfare

Context

- **Current Debate**: Recent Supreme Court rulings have reignited discussions on whether a **'quota-within-quota'**system is needed to ensure **equitable access** to reservations among **Scheduled Castes (SC)** subgroups.
- **Key Shift**: The **2024 Supreme Court ruling** overturned the **2004 E V Chinnaiah** case, allowing States to create subcategories within SC and ST groups to better target marginalized sections.

Existing Reservation Quotas in India

1. **Scheduled Castes (SC)**: **15%** reservation in education and employment.
2. **Scheduled Tribes (ST)**: **7.5%** reservation.
3. **Other Backward Classes (OBC)**: **27%** reservation with "**creamy layer**" exclusion.
4. **Economically Weaker Sections (EWS)**: **10%** reservation, irrespective of caste.

Constitutional Articles and Key Judgments on Subcategorization

- **Article 15(4)** and **Article 16(4)**: Empower the State to make **special provisions for backward classes**.
- **2004 E V Chinnaiah Case**: Held that **SC/ST categories** should remain homogenous without subdivisions.
- **2024 Verdict**: Allowed States to subcategorize SCs and STs to **enhance social justice** by focusing on the most disadvantaged within these groups.

Case Study: Punjab's SC Quota Subdivision

- **Punjab SC Quota Model**:
  - Introduced in **1975** to subdivide the SC quota, specifically for **Balmiki** and **Mazhabi Sikh** communities.
  - **Impact**: Improved representation of marginalized SC groups in **education** and **employment**, though **continuous monitoring** and **data updates** were crucial for assessing its effectiveness.

Advantages of the Quota-Within-Quota System

1. **Targeted Assistance**:
   - Ensures that **benefits reach the most marginalized** subgroups within SC/ST, addressing disparities in access among subgroups.
2. **Reduces Monopolization**:
   - Prevents more dominant subgroups from dominating reservation benefits, fostering a **fairer distribution**across communities.
3. **Enhanced Representation**:
   - Focuses on **marginalized subgroups** within SC/ST, improving their presence in **education** and **employment**.
4. **Flexible Policy Design**:
   - Allows States to **tailor affirmative action policies** according to regional socio-economic conditions.
5. **Promotes Social Justice**:
   - By bridging disparities within SC/ST categories, it contributes to a **more equitable** model for social upliftment.

Limitations of the Quota-Within-Quota System

1. **Data Deficiency**:
   - Lack of recent **caste-based data** hampers the identification of subgroups most in need, making effective implementation difficult.
2. **Political Influence**:
   - Potential for **political misuse**, where subquotas could be used for electoral gains, affecting objective allocation.
3. **Implementation Challenges**:
   - Managing multiple subquotas can lead to **administrative complexity** and potential inefficiencies.
4. **Dilution of Reservation Impact**:
   - Dividing quotas within a group may **dilute reservation impact**, creating competition among subgroups rather than collective upliftment.
5. **Increased Social Fragmentation**:
   - Subcategorization may deepen **divisions within SC/ST** communities, potentially undermining social unity.

Way Forward

1. **Strengthen Access**:
   - Enhance administrative efforts to ensure **equal reservation access** across all eligible SC groups.
2. **Updated Census Data**:
   - Conduct a comprehensive **caste-based Census** to enable data-driven policy formulation.
3. **Transparent Criteria**:
   - Develop **clear guidelines for subcategorization** to mitigate risks of political influence.
4. **Public Awareness**:

- Raise **awareness on rights and eligibility** within SC communities to bridge reservation accessibility gaps.

5. **Monitoring and Evaluation**:
   - Regularly assess the **impact of quota policies** to address new inequalities and ensure continuous improvement.

Supreme Court's Ruling on Aligarh Muslim University: Affirming Minority Status of National Institutions

Syllabus: GS Paper II – Polity- Topics: Minority Rights, Educational Institutions, Constitutional Provisions for Minorities

Context

- **Supreme Court Verdict**: The Supreme Court reaffirmed that **Aligarh Muslim University (AMU)**, as an institution of national importance, can retain its **minority character** under **Article 30** of the Indian Constitution. This ruling addresses the compatibility of **national and minority characteristics** in educational institutions.

What is a Minority Institution?

1. **Constitutional Provisions**:
   - **Article 30(1)**: Grants **religious and linguistic minorities** the right to **establish and administer educational institutions** of their choice.
   - **Article 28**: Prohibits religious instruction in state-funded institutions, but **permits it in minority institutions**.
2. **Legal Safeguards**:
   - **National Commission for Minority Educational Institutions Act, 2004**: Provides **legal recognition and protections** for minority institutions.
   - **Supreme Court Interpretation**: Recognizes these rights for **religious and linguistic minorities**, reinforcing autonomy in establishment and administration.

Supreme Court's Judgement on the AMU Case

1. **Key Outcome**:
   - **Dual Identity**: Institutions of **national importance** can retain **minority status**, with both identities being compatible rather than conflicting.
   - **Preservation of Rights**: Minority communities retain the right to **establish and administer institutions**, upholding **Article 30(1)** rights, independent of parliamentary declarations under **Entries 63 and 64**.
2. **Significance**:
   - **Protection of Dual Identity**: Ensures AMU's role in promoting **national interest** while preserving its **minority character**.
   - **Strengthened Autonomy**: Enhances the **independence and autonomy** of minority institutions in India.

Notable Judgements on Minority Institutions

1. **St. Stephen's College v. University of Delhi (1992)**:
   - **Outcome**: Affirmed minority institutions' rights to **determine admission policies** while ensuring **quality education** standards.
2. **T.M.A Pai Foundation v. State of Karnataka (2002)**:
   - **Outcome**: Provided guidelines on **minority status determination** and clarified the **extent of administrative autonomy**.
3. **Pramati Educational and Cultural Trust v. Union of India (2014)**:
   - **Outcome**: Exempted minority institutions from the **Right to Education (RTE) Act's reservation provisions**, preserving administrative independence.

Criteria for Classification as a Minority Institution

1. **Establishment and Administration**:
   - Must be **established and administered** by a **religious or linguistic minority**.
2. **Purpose**:
   - Intended primarily to benefit the **minority community**.
3. **Administration**:
   - While non-exclusive, administration should **reflect minority interests**.
4. **Funding**:
   - Minority status is **unaffected by state funding** or contributions from other communities.
5. **Historical Context**:
   - Institutions established **pre-Constitution** may claim **minority status** under Article 30(1).

Role of Minority Institutions in India

1. **Promoting Education**:
   - Provide **educational access** to disadvantaged groups.
   - *Examples*: **St. Xavier's College (Kolkata), Jamia Millia Islamia (New Delhi)**.
2. **Cultural Preservation**:
   - Serve as **cultural hubs** for preserving **linguistic and religious diversity**.
   - *Examples*: **Aligarh Muslim University, Gurukul Kangri Vishwavidyalaya**.
3. **Fostering Inclusivity**:
   - Contribute to **nation-building** by supporting marginalized communities.
   - *Example*: **Madrasas** offering secular and religious education.
4. **Skill Development**:
   - Equip minority communities with **vocational skills** for socio-economic advancement.
   - *Example*: **Christ University (Bengaluru)** offers vocational programs.

Impacts of Social Media on Children Under 16 and the Need for Regulation

Context

- **Legislative Move**: The Australian government has announced plans to introduce legislation restricting **social media access for children under 16** to address the potential risks posed by online platforms to young users.

Key Issues Posed by Social Media for Children Under 16

1. **Mental Health Concerns**:
   - **Anxiety and Depression**: Social media platforms often lead to **comparison and validation-seeking** behaviors, which can result in feelings of inadequacy and anxiety.
   - **Low Self-Esteem**: Constant exposure to others' curated, idealized lives can lead to self-doubt and dissatisfaction with one's own life.
2. **Exposure to Idealized Realities**:
   - **Unrealistic Standards**: Social media often showcases **idealized lifestyles and appearances**, creating pressure to conform to unrealistic standards, which can harm self-worth and create body image issues.
3. **Cyberbullying and Online Exploitation**:
   - **Persistent Bullying**: The anonymity and reach of social media can make **cyberbullying** relentless and pervasive, impacting the mental well-being of young users.
   - **Risk of Exploitation**: Young users are vulnerable to manipulative or harmful content and online predators, leading to potential **safety risks**.
4. **Exposure to Inappropriate Content**:
   - **Accidental Access**: Social media can expose children to **violent, explicit, or age-inappropriate material**, which may lead to trauma or desensitization to inappropriate behaviors.
5. **Academic and Social Impacts**:
   - **Academic Performance**: Excessive social media use can distract children from academics, leading to reduced focus and **lower academic performance**.
   - **Impact on Real-World Social Skills**: Over-reliance on digital communication can hinder **face-to-face social interactions**, impacting communication skills, social relationships, and **cognitive development**.

INTERNATIONAL RELATIONS

India as a 'Vishwamitra' – Navigating Diplomacy in a Multipolar World

Syllabus: GS Paper II – International Relations- Topics: India's Foreign Policy, Diplomacy, Geopolitics, Ethics in Public Administration

Context and Minister's Vision

- **Multipolar Diplomacy**: **External Affairs Minister S. Jaishankar** emphasized India's vision of being a **Vishwamitra** (friend to all) in a multipolar world.
- **Key Statement**: "Friendships are no longer exclusive in a multipolar world; India aims to be a 'Vishwamitra' – a friend to all."

Quotes and Statements

- **Inclusivity in Diplomacy**:
  - **Multipolar Perspective**: In a multipolar world, friendships are inclusive rather than exclusive.
- **Respect for Sovereignty**:
  - **Diverse Viewpoints**: Acknowledges that "What one nation may see as freedom, another might perceive as interference."
- **Confidence in Non-Dogmatic Approach**:
  - **India's Global Stance**: Reflects India's **non-dogmatic, self-assured** approach in international relations.

Tumaini Festival in Malawi

- **Context**: An annual event in **Dzaleka Refugee Camp** celebrates refugee resilience and cultural diversity.

Key Facts

- **Founded**: 2014 by Congolese poet **Menes La Plume**.
- **Purpose**: Provides a **cultural exchange** platform through **music, art, and crafts**.
- **Visitors**: Attracts thousands from Malawi and neighboring countries like South Africa and Zimbabwe.
- **Significance**: Humanizes refugees, promoting **connections** and breaking stereotypes.

Dzaleka Refugee Camp

- **Location**: Near **Lilongwe, Malawi**.
- **Established**: 1994 for refugees from regional conflicts.
- **Capacity**: Originally 10,000; now houses over 60,000.

- **Populations**: Mainly from **DRC**, **Rwanda**, **Burundi**, **Ethiopia**, and **Somalia**.

DEFENCE & SECURITY

MAHASAGAR – Strengthening Maritime Security in the Indian Ocean Region

Context

- **Objective**: The Indian Navy conducted the **third edition of MAHASAGAR**, a virtual engagement aimed at strengthening maritime security cooperation among **Indian Ocean Region (IOR) nations**.

About MAHASAGAR

- **Meaning**: **"MAHASAGAR"** translates to "vast ocean" in Hindi and stands for **Maritime Heads for Active Security And Growth for All in the Region**.
- **Purpose**: Enhances cooperation on **maritime security** through **joint training** and **capacity-building** among IOR nations.
- **Participants**: Heads of Navies/Maritime Agencies from 10 IOR countries, including **Bangladesh, Maldives, Seychelles, Sri Lanka, and Tanzania**.
- **Initiative**: Launched in 2023, MAHASAGAR is conducted **bi-annually** as a virtual interaction platform.
- **Focus of Third Edition**:
  - Emphasis on **training collaboration** to develop skilled manpower and enhance collective responses to maritime security threats.

ECONOMY

India's Dedicated Freight Corridors: Driving Economic Growth and Logistics Efficiency

Context

- **Significance**: As India's economy expands, **Dedicated Freight Corridors (DFCs)** are critical for enhancing freight efficiency, rail revenue, and GDP growth by addressing congestion, reducing costs, and improving connectivity.

What are Dedicated Freight Corridors (DFCs)?

- **Definition**: DFCs are **specialized railway tracks** dedicated solely to freight transport, enabling faster transit through double-stack containers and heavy-haul trains.
- **Current Operational DFCs**:
  1. **Eastern Dedicated Freight Corridor (EDFC)**:
     - **Route**: **1,856 km** from **Ludhiana (Punjab)** to **Dankuni (West Bengal)**.
     - **Operations**: Fully functional, handling nearly **200 trains daily**, transporting goods like coal, steel, and agriculture.
     - **Impact**: Relieves congestion on passenger tracks, enhancing regional economic activity.
  2. **Western Dedicated Freight Corridor (WDFC)**:
     - **Route**: **1,504 km** from **Dadri (Uttar Pradesh)** to **Jawaharlal Nehru Port Trust (JNPT)** in Maharashtra.
     - **Operations**: **93% complete**, handling **125 trains daily** with full completion expected by **December 2025**.
     - **Impact**: Boosts port connectivity, reducing logistics costs for export-import traffic.

Need for Dedicated Freight Corridors

1. **Congestion Relief**:
   - Existing tracks, especially on the **Golden Quadrilateral**, handle over **50% of freight traffic** on only 16% of the network, causing delays and inefficiencies.
2. **Increasing Freight Share**:
   - DFCs aim to increase **Railways' freight share** from **30% to 45% by 2030**, fostering a more sustainable and efficient system.
3. **Economic Efficiency**:
   - Dedicated freight lines reduce logistics costs, helping lower commodity prices and promoting overall economic growth.

Present Status of DFCs (DFCCIL Report)

- **Freight Capacity**: DFCs now handle over **10% of Indian Railways' freight**.
- **Daily Operations**: An average of **325 trains** operate on DFC tracks daily, a **60% increase** over previous years.
- **Transported Goods**: DFCs have transported over **232 billion Gross Tonne Kilometres (GTKMs)** and **122 billion Net Tonne Kilometres (NTKMs)** since inception.

How DFCs Contribute to India's GDP

1. **Reduction in Logistics Costs**:
   - DFCs reduce freight transit time and costs, lowering commodity prices by up to **0.5%** and improving industrial competitiveness.
2. **Railways Revenue Growth**:
   - DFCs contributed **2.94% to Railways' revenue growth** from **FY 2018–19 to FY 2022–23**, boosting profitability.

3. **Boost to Export-Import Traffic**:
   - Faster transit on WDFC routes, particularly to major ports, supports higher trade volumes, fueling GDP growth.
4. **Employment and Investment**:
   - DFC construction and operation have generated jobs and attracted investments, directly contributing to economic activity.
5. **Enhanced Supply Chain Efficiency**:
   - By reducing congestion on passenger tracks, DFCs create a more efficient supply chain benefiting multiple sectors.

Challenges to Dedicated Freight Corridors

1. **Completion Delays**:
   - **WDFC** faces completion delays, with a final deadline now extended to **July 2025**, affecting projected timelines and efficiencies.
2. **Escalating Costs**:
   - Project delays have raised costs, with avoidable expenditures reported at **Rs 2,690 crore**, increasing the total to **Rs 94,091 crore** as of March 2024.
3. **Loss of Immediate Benefits**:
   - Delays impact the Railways' revenue and the immediate benefits of congestion relief and increased capacity.

Way Ahead for DFCs

1. **Timely Completion**:
   - Fast-track completion of ongoing DFC sections to avoid further delays and financial overruns.
2. **Expansion Plans**:
   - Expedite work on four proposed DFC corridors, including the **East Coast and East-West sub-corridors**, to extend benefits nationwide.
3. **Enhanced Efficiency**:
   - Invest in technology and infrastructure to maintain DFCs' efficiency and competitiveness in handling future freight demands.

Bibek Debroy Committee on Indian Railways (2015)

Context

- **Transformative Reforms**: The **Bibek Debroy Committee's 2015 report** proposed a series of reforms for **Indian Railways** to enhance **viability, efficiency, and competitiveness**. However, several key recommendations remain **partially or unimplemented**.

Key Recommendations and Implementation Status

1. **Liberalization (Not Privatization)**:
   - **Recommendation**: Allow private operators to enter the market to foster **growth and competition**.

- **Status**: Not fully implemented; **Public-Private Partnership (PPP)** projects are primarily limited to goods services.

2. **Empowering Field Officers**:
   - **Recommendation**: Delegate **decision-making powers** to **General Managers (GMs)** and **Divisional Railway Managers (DRMs)** to enhance autonomy.
   - **Status**: Partially implemented, with increased efforts toward **decentralization**.
3. **Railway Board Restructuring**:
   - **Recommendation**: Redesignate the **Chairman of the Railway Board** as the **CEO** to consolidate decision-making.
   - **Status**: Implemented in 2020 with the **restructured Railway Board**.
4. **Independent Rail Regulator**:
   - **Recommendation**: Establish the **Rail Development Authority (RDA)** to oversee **pricing and promote competition**.
   - **Status**: RDA was approved in 2017 but has **limited functionality**.
5. **Accounting Reforms**:
   - **Recommendation**: Transition to **accrual-based accounting** for enhanced financial transparency.
   - **Status**: Implemented across **Indian Railways**.
6. **Offloading Non-Core Activities**:
   - **Recommendation**: Offload responsibilities like **Railway Protection Force (RPF)**, medical, and educational facilities to focus on core services.
   - **Status**: Under consideration.
7. **Safety Upgrades**:
   - **Recommendation**: Establish the **Rashtriya Rail Sanraksha Kosh (RRSK)** with a corpus of **₹1 lakh crore**for safety asset renewal.
   - **Status**: Extended till **2027**, with an additional funding of **₹45,000 crore**.
8. **Technology Integration**:
   - **Recommendation**: Integrate advanced technologies, exemplified by initiatives like **Vande Bharat trains** and **KAVACH systems**.
   - **Status**: Actively implemented, with ongoing technological upgrades.

GEOGRAPHY

Urbanisation

Syllabus: GS Paper I – Geography & Social Issues, Topics: Urbanization, Issues in Urban Governance, Sustainable Development

Urbanisation in India: Pathways to Sustainable and Inclusive Growth

Introduction: World Cities Day and Urbanisation Context

- **World Cities Day (October 31)**: Highlights urban challenges and opportunities globally.
- **2023 Theme**: "Youth Climate Changemakers: Catalysing Local Action for Urban Sustainability" emphasizes youth-led sustainable urban development.

Definition and Present Scenario of Urbanisation in India

- **Definition**: Urbanisation is the increasing concentration of population in urban areas, leading to their expansion and transformation.
- **Current Urban Population**:
  - India's urban population has reached **40%** (approximately **500 million** people) as per World Bank (2023).
- **Urban Growth Rate**:
  - Grew from **27.7% in 2001** to **31.1% in 2011** at an annual rate of **2.76%** (Census 2011).
- **Regional Distribution of Urban Population**:
  - **Maharashtra**: 13.5% of India's urban population.
  - **Tamil Nadu**: 9 million urban residents.
  - **Uttar Pradesh**: 4 million urban residents.
- **Shift to Medium-Sized Towns**:
  - Focus is moving from Tier-1 cities to medium-sized towns due to improved employment and lifestyle prospects (ADB, 2019).
- **Global Perspective**:
  - India's urban population significantly contributes to the global total of **4.7 billion** urban dwellers (UN projections to double by 2050).
- **Housing Demand**:
  - A deficit of **18.78 million** housing units, affecting low-income groups predominantly (Ministry of Housing and Urban Affairs, 2012-27).

Types of Urbanisation in India

1. **Natural Urbanisation**: Urban growth driven by natural population increase.
2. **Migration-Driven Urbanisation**: Rural to urban migration for better employment, services, and lifestyle.
3. **Peripheral Urbanisation**: Expansion of urban areas into nearby rural zones, creating peri-urban regions.
4. **Economic Urbanisation**: Development around industrial, business, and employment hubs.

Challenges in Urbanisation

- **Environmental Concerns**:
  - **Air Pollution**: 9 of the world's 10 most polluted cities are in India (World Air Quality Report, 2023).
  - **Urban Heat Islands**: Increasing temperatures in urban areas.
- **Inadequate Housing**:
  - Approximately **40%** of urban Indians live in slums.
  - Housing shortage estimated at **18.78 million** units.
- **Water Scarcity**:
  - Cities like **Bengaluru** and **Chennai** face frequent water shortages due to inadequate management.
- **Traffic and Mobility**:
  - Rising congestion with peak traffic speeds as low as **18 km/h** in cities like Bengaluru.
- **Waste Management**:
  - India produces **62 million tons** of waste annually, of which only **20%** is treated (CPCB).

Key Government Initiatives for Sustainable Urbanisation

- **Smart Cities Mission**:
  - Focus on sustainable, citizen-friendly urban infrastructure.
- **AMRUT (Atal Mission for Rejuvenation and Urban Transformation)**:
  - Improvement of basic city services, including water supply, sanitation, and transport.
- **Pradhan Mantri Awas Yojana-Urban (PMAY-U)**:
  - Tackling housing shortages in urban areas.
- **Swachh Bharat Mission-Urban**:
  - Emphasis on cleanliness and waste management in cities.
- **Deen Dayal Antyodaya Yojana – National Urban Livelihoods Mission (DAY-NULM)**:
  - Aims to reduce urban poverty and enhance livelihood opportunities.

Way Forward for Sustainable Urbanisation

- **Environmental Initiatives**:
  - Implement **Sponge City** concepts to mitigate urban flooding by managing rainwater effectively.
- **Digital Urban Planning**:
  - Use of **Urban Digital Twins** to facilitate data-driven urban planning and governance.
- **Smart Water Management**:
  - Employ technology for efficient water distribution and detection systems.
- **Cybersecurity for Urban Infrastructure**:
  - Protecting critical urban digital infrastructure against cyber threats.

Mount Lewotobi Laki-Laki Eruption – Impact, Safety Measures, and Ongoing Monitoring

Context

- **Location**: **Mount Lewotobi Laki-Laki**, a stratovolcano located on **Flores Island** in southeastern Indonesia, is part of the **Lewotobi twin volcano complex**, along with **Lewotobi Perempuan**. This region lies within the **Pacific "Ring of Fire"**, an area known for its intense tectonic and volcanic activity.

Recent Eruption Details

- **Date and Time**: The eruption occurred on **November 3, 2024**, around midnight.
- **Volcanic Activity**:
  - The volcano spewed **ash up to 2,000 meters** into the atmosphere.
  - Released **lava** and **flaming rocks**, causing widespread destruction.
- **Impact on Lives and Property**:
  - **Fatalities**: At least **10 people** were killed, including a child and a nun.
  - **Damage**: Nearby villages suffered severe damage, with **several houses** and a **convent** burned.
  - **Evacuations**: Approximately **10,000 residents** were affected, necessitating mass evacuations to safer areas.

Safety Measures and Government Response

1. **Alert Status**:
   - Authorities elevated the **volcano's alert status to the highest level** to address the ongoing danger.
2. **Exclusion Zone**:
   - A **7-kilometer exclusion zone** around the crater was established to ensure the safety of residents.
3. **Relocation Plans**:
   - The Indonesian government announced a **permanent relocation plan** for thousands of residents within the exclusion zone to minimize future risks.

Historical Context

- **Naming History**: Mount Lewotobi Laki-Laki has been historically known by various names, including **Lobetabi, Lovotivo, and Loby Toby**.
- **Twin Volcano**: Together with **Lewotobi Perempuan** (“Female”), Lewotobi Laki-Laki (“Male”) forms an important volcanic complex on Flores Island.

Geological Significance

- **Pacific "Ring of Fire"**:

- This volcanic complex lies in the **Pacific "Ring of Fire"**, an area of significant tectonic activity due to the movement of tectonic plates.
- The region is prone to **frequent earthquakes** and **volcanic eruptions** that can impact nearby communities and ecosystems.

Current Status and Monitoring Efforts

- **Alert Level**: As of **November 10, 2024**, authorities have maintained the **highest alert level** for Mount Lewotobi Laki-Laki.
- **Safety Advisory**:
  - Residents and visitors are advised to maintain a safe distance of at least **7 kilometers** from the volcano.
- **Ongoing Monitoring**:
  - Indonesian authorities are conducting **continuous monitoring and evacuation efforts** to protect communities and manage risks associated with the active volcano.

AGRICULTURE

Agrivoltaic Farming – Integrating Solar Energy and Agriculture

Context

- **Event**: At the **Seventh Session of the International Solar Alliance (ISA)**, agrivoltaic farming was highlighted as a sustainable practice for combining agriculture with **solar energy generation** on the same land.

About Agrivoltaic Farming

- **Definition**: Agrivoltaic farming enables simultaneous **crop cultivation and solar energy generation** by using raised solar panels on agricultural land.

How Agrivoltaic Farming Works

1. **Elevated Panels**: Panels are raised 2-3 meters, allowing crops to grow below with ample **light and air**.
2. **Angle and Spacing**: Panels are strategically angled and spaced to optimize **sunlight** for both solar generation and crop growth.
3. **Shade and Protection**: Provides **shade** to reduce heat stress and shield crops from extreme weather.
4. **Water Conservation**: Shade reduces evaporation, helping to **conserve soil moisture** and minimize water use.
5. **Greenhouse Integration**: Placing panels on greenhouse roofs allows sunlight/rain for crops while generating energy.
6. **Dual Harvesting**: Maximizes land use by producing both **solar energy and crops**.

Significance of Agrivoltaic Farming

- **Enhanced Land Use**: Efficiently combines **agriculture and solar power** on the same plot.
- **Climate Resilience**: Shields crops from excessive heat, reducing **water loss** and protecting against extreme weather.
- **Renewable Energy Generation**: Supports **solar expansion**, aligning with climate and energy goals.
- **Increased Food Security**: Promotes sustainable food production without needing additional land.
- **Economic Benefits**: Diversifies farmers' income through both **crop production and solar energy revenue**.

ENVIRONMENT & ECOLOGY

COP-16 Outcomes: Advancing Global Biodiversity Goals

Topics: Global Environmental Conventions, Biodiversity Conservation, Climate ChangeIntroduction: Context and Purpose

- **16th Conference of the Parties (COP-16)** to the **Convention on Biological Diversity (CBD)** took place in Cali, Colombia.
- **Objective**: Discussions on achieving global biodiversity targets, including the ambitious **30-by-30 goal** (conserving 30% of land and ocean areas by 2030).

About COP-16 and the Convention on Biological Diversity (CBD)

- **COP-16's Mission**:
  - Finalize mechanisms for implementing **Kunming-Montreal Global Biodiversity Framework (KMGBF)**targets.
  - Focus on biodiversity conservation, pollution reduction, and equitable benefit-sharing, especially concerning **Digital Sequence Information (DSI)**.
- **Convention on Biological Diversity (CBD)**:
  - **Origin**: Opened at the **1992 Rio Earth Summit**; in effect since **December 29, 1993**.
  - **Aim**: Conservation of biodiversity, sustainable use, and equitable benefit-sharing from genetic resources.
  - **Key Features**:
    - Ratified by **196 countries** (excluding the United States).
    - Three objectives: **conservation**, **sustainable use**, and **equitable benefit-sharing**.
    - Supplementary **Cartagena Protocol** on Biosafety and **Nagoya Protocol** on Access and Benefit-Sharing.

Key Outcomes from COP-16

1. **30-by-30 Commitment**:

- Goal to conserve **30%** of global land and ocean areas and restore **30%** of degraded ecosystems by **2030**.

2. **Indigenous Inclusion**:
   - Formation of a body dedicated to representing **Indigenous communities** in biodiversity decision-making.
3. **Digital Sequence Information (DSI)**:
   - Ongoing discussions on fair benefit-sharing for **genetic data** use, though a multilateral solution remains unresolved.
4. **Implementation Support**:
   - Agreement on **technical aid** to enhance **biodiversity mainstreaming**, manage **invasive species**, and strengthen **biodiversity-climate synergy**.

India's Contribution at COP-16

- **Financial Commitment**:
  - India presented an updated biodiversity plan, projecting a **₹81,664 crore** expenditure for 2025-30, building on **₹32,207 crore** spent from 2018-22.
- **Call for International Funding**:
  - India urged for **global finance** as per **KMGBF Target 19**, aiming to bolster national biodiversity goals beyond domestic funding.
- **National Biodiversity Strategy**:
  - Emphasis on the **National Biodiversity Strategy and Action Plan (NBSAP)**, showcasing India's commitment to targeted biodiversity actions.
- **Conservation Initiatives**:
  - Highlighted the creation of the **International Big Cat Alliance** for global big cat conservation.
- **Expansion of Ramsar Sites**:
  - India expanded Ramsar sites from **26 (2014)** to **85** and aims to reach **100**, showing dedication to **wetland conservation**.

Challenges and Drawbacks of COP-16

1. **Funding Deficit**:
   - Only a fraction of the **$200 billion** required annually for biodiversity goals has been pledged.
2. **Unresolved Financial Issues**:
   - No consensus on DSI fund contributions or mechanisms for financial and technical resource distribution.
3. **Non-Binding Targets**:
   - **KMGBF targets** are non-binding, risking weaker global adherence.

Way Forward for Biodiversity Conservation

- **Securing Financing**:
  - Mobilize international funds, as directed by **KMGBF Target 19**, to bridge the biodiversity financing gap.
- **Strengthening Implementation**:

- Develop robust frameworks for monitoring the **30-by-30 targets** and enforce compliance with biodiversity policies.

- **Fostering Collaborative Action**:
  - Build partnerships with **Indigenous communities** and local governments to promote sustainable biodiversity practices.

Conclusion

The **COP-16** underscored the need for **global cooperation** and substantial **financial support** to tackle the biodiversity crisis. Aligning actions with **Sustainable Development Goals (SDGs)** and India's sustainable focus as seen in **NITI Aayog's models**, all nations must work collaboratively to ensure a balanced ecosystem for future generations.

India's Green Leap: Transitioning from Fossil Fuels to Clean Energy

Context

- **Source**: Asia-Pacific Climate Report by the **Asian Development Bank (ADB)** commends **India's energy transition efforts**, highlighting substantial reductions in fossil fuel subsidies and reallocations toward renewable energy.

Key Findings in the Asia-Pacific Climate Report

1. **Reduction in Fossil Fuel Subsidies**:
   - **85% reduction** in subsidies for fossil fuels, from **$25 billion (2013)** to **$3.5 billion (2023)**, showcasing India's commitment to a cleaner energy future.
2. **Taxation for Renewable Energy**:
   - **Coal Cess (2010-2017)**: Funded projects like the **Green Energy Corridor** and the **National Solar Mission**by taxing coal production, demonstrating a strategic shift in funding towards clean energy.
3. **Targeted Subsidy Redirection**:
   - **Petrol and Diesel Tax Increases**: Reallocated funds toward renewable energy programs, with additional focus on improving **LPG access** for rural communities.
4. **Investment in Clean Energy**:
   - National initiatives, including the **Green Hydrogen Mission** and **PM-KUSUM**, aim to reduce emissions, build green infrastructure, and enhance **energy access**.
5. **Positive Impact on Climate Goals**:
   - The report recognizes India's movement toward its **2070 net-zero target**, positioning India as a model for sustainable energy practices.

Positives of India's Energy Transition

1. **Significant Subsidy Reduction**:
   - Redirecting fossil fuel subsidies to renewables marks a crucial step toward sustainability and aligns with India's environmental goals.
2. **Enhanced Rural Energy Access**:

- Improved **LPG access** and renewable energy resources for rural areas promote **social welfare** and support environmental goals.

3. **Investment in Emerging Technologies**:
   - Initiatives in **green hydrogen** and **solar energy** underscore India's commitment to next-generation, sustainable energy solutions.
4. **Strengthened Renewable Energy Infrastructure**:
   - Projects like the **Green Energy Corridor** bolster renewable energy transmission networks, enabling a robust infrastructure.
5. **Economic and Environmental Benefits**:
   - Reducing reliance on fossil fuels aids in lowering emissions, benefiting both the economy and the environment.

Limitations of India's Energy Transition

1. **Challenges in Tax Reallocation**:
   - **Post-2017 Coal Cess Funds**: Initially directed to clean energy, coal cess funds were reallocated to GST compensation, impacting renewable energy funding.
2. **Dependency on Fossil Fuels**:
   - Despite progress, **fossil fuels remain a significant part of India's energy mix**, indicating slow progress toward a full transition.
3. **Limited Access to Clean Energy Subsidies**:
   - Remote or underserved regions face disparities in accessing clean energy resources and subsidies.
4. **High Costs of Technology Transition**:
   - Advanced clean energy technologies require substantial initial investment, making them costly for widespread deployment.
5. **Political and Fiscal Adjustments**:
   - Shifting subsidies and modifying tax structures pose complex **political and fiscal challenges**.

Way Forward

1. **Strengthen Funding Mechanisms**:
   - Ensure **stable funding** for clean energy projects by reassessing cess allocations and reducing reliance on fossil fuel revenue.
2. **Scale Renewable Initiatives**:
   - Expand programs like **PM-KUSUM** to increase **solar and wind energy capacity** across more regions.
3. **Support R&D for Clean Energy**:
   - Invest in **research and development** for green technologies, including **hydrogen and advanced batteries**, to make them economically viable.
4. **Enhance Rural Access**:
   - Improve infrastructure for rural adoption of clean energy, ensuring **equitable access** to sustainable resources.
5. **Policy Consistency**:
   - Maintain a **consistent policy framework** to foster private investments in renewable energy.

Committees on Western Ghats Conservation

Context

- **Current Update**: The **Sanjay Kumar Committee** has been established by the Union Environment Ministry to assess eco-sensitive area (ESA) proposals from Goa and address state concerns on biodiversity conservation in the **Western Ghats**.

Key Committees on the Western Ghats

1. **Sanjay Kumar Committee (2024)**:
   - **Purpose**: Formed to review state objections on **ESA demarcations** and validate proposed exclusions based on field inspections.
   - **Responsibilities**:
     - Conduct field visits to verify exclusion demands.
     - Finalize ESA status for specific areas, aiming to **restrict activities harmful to biodiversity**.
2. **Madhav Gadgil Committee (2011)**:
   - **Background**: Commissioned by the UPA government to propose stringent protection measures for the **Western Ghats**.
   - **Recommendations**:
     - Suggested designating the **entire Western Ghats as ecologically sensitive**.
     - Proposed an ecological authority to **regulate developmental activities** and ensure robust conservation.
   - **Outcome**: Recommendations were considered too rigorous, and full implementation was not pursued.
3. **Kasturirangan Committee (2012)**:
   - **Purpose**: Created as a follow-up to provide a more balanced approach between **conservation and development**.
   - **Recommendations**:
     - Demarcated **37% of the Western Ghats** as ESA, focusing mainly on **forested areas**.
     - Allowed limited activity in specific areas, aiming for a balance between **biodiversity protection** and **developmental needs**.

Addressing Foam Formation in the Yamuna River: Causes, Defoaming Methods, and Challenges

Context

- **Issue**: Toxic foam in the **Yamuna River** surfaces yearly, especially during the **Chhath Pooja** festivities in Delhi, where devotees gather for rituals. This foam, posing ecological and health concerns, has sparked ongoing debates and responses to address river pollution.

Causes of Foam Formation in the Yamuna River

1. **Pollutant Accumulation**:
   - **Lean Water Flow in Winter**: Reduced river flow during winter limits the **dilution of pollutants**, allowing chemicals to accumulate and concentrate.
2. **Detergents**:
   - **Phosphates and Surfactants**: Key components in detergents from domestic and industrial use build up in the river, creating foam-forming **surfactants**.
3. **Industrial Effluents**:
   - **Chemical Discharge from Industries**: Factories and other industrial activities upstream release chemicals that contribute to foaming.
4. **Bacterial Activity**:
   - **Anaerobic Bacteria**: These bacteria act on pollutants, especially when water drops from heights, such as at the **Okhla barrage**, aiding foam production.
5. **Seasonal Effects**:
   - **Reduced Oxygenation in Winter**: Low temperatures decrease oxygenation in the river, worsening foam formation.

Defoaming Process for Foam Control

1. **Defoamer Solution**:
   - **Polyoxypropylene-based Defoamer**: A defoamer approved by the US FDA is applied to suppress foam without degrading water quality.
2. **Dilution Ratio**:
   - **1:100 Dilution**: This minimizes the potential for adverse effects from constituents like **silicone**, making the solution safer for the river.
3. **Ecological Safety**:
   - **Testing and Impact**: Tests confirm that the defoamer does not reduce dissolved oxygen levels, suggesting minimal ecological disruption.
4. **Temporary Solution**:
   - **Focused Application at Okhla Barrage**: Spraying is limited to areas like **Okhla barrage** for immediate foam control; however, it's a short-term solution rather than a comprehensive fix for pollution issues.
5. **Monitoring and Oversight**:
   - **National Mission for Clean Ganga (NMCG)**: Along with other stakeholders, NMCG monitors the defoaming process to ensure environmentally friendly practices.

International Solar Alliance (ISA) – World Solar Report Series

Context

- The **International Solar Alliance (ISA)** released the **3rd edition of the World Solar Report series** at its **7th Assembly**, focusing on solar growth, investments, technological advancements, and green hydrogen's role, particularly in Africa.

About the International Solar Alliance (ISA)

- **Established**: 2015 at COP21 by **India and France**.
- **Headquarters**: Gurgaon, India.
- **Mission**: Mobilize **$1 trillion in solar investments by 2030**, promote solar technology, and achieve carbon neutrality.
- **Membership**: **120 Member and Signatory countries**, primarily between the **Tropics of Cancer and Capricorn**.

Key Reports Released by ISA

1. **World Solar Market Report**
   - **Global Solar Growth**: Increased from **1.22 GW in 2000** to **1,418.97 GW in 2023**; projected to reach **7,203 GW by 2030**.
   - **Manufacturing & Affordability**: Solar manufacturing capacity expected to exceed **1,100 GW by 2024**, with module prices below **$0.10/watt**.
   - **Employment**: Solar industry supports **7.1 million jobs globally**, with 86% in ten countries.
2. **World Investment Report**
   - **Investment Trends**: Energy investments rose from **$2.4 trillion (2018)** to **$3.1 trillion (2024)**.
   - **Solar Dominance**: Solar accounts for **59% of renewable energy investments**, with APAC as the largest investor.
   - **Regional Investment Breakdown**: APAC **$223 billion**, EMEA **$91 billion**, and AMER **$78 billion** in 2023.
3. **World Technology Report**
   - **Efficiency & Innovation**: Solar PV efficiency at a record **24.9%**; 88% reduction in **silicon use since 2004**.
   - **Cost Reduction**: Utility-scale PV costs dropped 90% since 2010 to **$0.044/kWh**.
   - **Material Advancements**: Multijunction perovskite cells offer potential for enhanced efficiency at lower costs.
4. **Green Hydrogen Readiness in Africa**
   - **Decarbonization Potential**: Green hydrogen as a clean alternative for heavy industries.
   - **Renewable Production**: Hydrogen generated via renewable-powered electrolysis.
   - **Target Countries**: Focused on Egypt, Morocco, Namibia, and others for a green hydrogen economy.

Positives of Solar Energy and Green Hydrogen Expansion

- **Massive Capacity Growth**: Solar capacity has increased substantially, reaching **1,418.97 GW in 2023**.
- **Cost Reduction**: Solar PV costs are now **$0.044/kWh**, making solar power affordable.
- **Employment**: 7.1 million jobs globally, contributing to economic growth.
- **Green Hydrogen Potential**: Helps decarbonize industries, supporting clean energy transitions in regions like Africa.

Challenges

- **High Initial Investment**: Infrastructure for solar and green hydrogen requires significant capital.
- **Technological Dependency**: Continuous advancements are essential for solar efficiency.
- **Uneven Growth**: APAC leads in investments, with other regions lagging.
- **Resource Intensity**: Solar manufacturing remains resource-heavy, posing sustainability concerns.

Way Ahead

1. **Boost Regional Investments**: Encourage balanced solar investments, especially in EMEA and Africa.
2. **Focus on Innovation**: Prioritize R&D to improve efficiency and reduce resource needs.
3. **Promote Green Hydrogen**: Develop infrastructure in resource-rich regions for industrial decarbonization.
4. **Foster International Collaboration**: Utilize platforms like ISA for sharing best practices and reducing costs.

Enhancing Corporate Social Responsibility (CSR) Impact on Agriculture in India

Context

- **India's CSR Milestone**: As the **first country to mandate Corporate Social Responsibility (CSR)**, India has witnessed over **₹1.84 lakh crore** in CSR investments from 2014 to 2023. With agriculture employing nearly **47% of the workforce** and contributing **16.73% to GDP**, directing CSR funds toward **agricultural sustainability** has become increasingly vital.

About Corporate Social Responsibility (CSR) in India

1. **Definition**:
   - **CSR** entails corporate-led initiatives focused on **social, environmental, and economic development**, allowing companies to contribute positively to communities.
2. **CSR Framework in India**:
   - **Legal Basis**: Governed by **Section 135** and **Schedule VII** of the Companies Act, 2013, alongside **CSR Policy Rules (2014)**.
   - **Criteria for CSR**:
     - Mandatory for companies with:
       - **Net worth of ₹500 crore** or more.
       - **Annual turnover of ₹1,000 crore** or more.
       - **Net profit of ₹5 crore** or more.
     - Such companies must allocate **2% of their average net profits** over the past three years to CSR activities.
3. **Penal Provisions**:

- Companies failing to meet CSR obligations face fines between **₹50,000 and ₹25 lakh**. Officers may face **imprisonment (up to three years)** or fines between **₹50,000-₹5 lakh**.

4. **2019 Amendment**:
   - **Unspent CSR Funds**:
     - **Pre-2019**: Unspent funds could be carried over to the next fiscal.
     - **Post-2019**: Unspent funds must be transferred to a **Schedule VII fund** by year-end and utilized within three years; otherwise, they are transferred to a **government-specified fund**.

CSR's Role in Supporting Agriculture

1. **Employment Significance**:
   - Agriculture employs **47% of India's workforce**, underscoring its importance in **employment generation**and **livelihoods**.
2. **Economic Role**:
   - Agriculture contributes **16.73% to India's GDP**, making it central to **economic growth** and **sustainability**.
3. **CSR Initiatives in Agriculture**:
   - Corporations are directing CSR funds toward **sustainable agricultural practices** by supporting **grain banks, farmer education, sustainable irrigation, and water conservation** projects.
   - **Focus on Sustainability**: Increased support for **climate action** and **resource conservation** in agriculture aligns CSR with long-term environmental goals.

Challenges in Agriculture-Focused CSR

1. **Tracking Issues**:
   - Absence of a specific classification for agriculture in CSR reports complicates tracking and monitoring of **agriculture-related efforts**.
2. **Sector Overlap**:
   - CSR activities in agriculture often intersect with **multiple categories under Schedule VII**, diluting agriculture-specific reporting and transparency.
3. **Inadequate Reporting**:
   - Current CSR reporting does not prioritize agriculture, limiting the ability to **accurately assess CSR impact**on agricultural sustainability.
4. **Ambiguity in Schedule VII**:
   - **Broad categories** under Schedule VII make it challenging to track agriculture-specific CSR contributions, impacting transparency.

Way Forward

1. **Designate Agriculture as a Separate CSR Sector**:
   - Define agriculture clearly within CSR guidelines to ensure **targeted funding** and **transparent reporting** for agriculture-related projects.
2. **Revise Reporting Framework**:

- Shift to a **sector-based CSR reporting structure** to enhance accuracy in fund allocation and **impact assessment** for agricultural initiatives.

3. **Identify Critical Issues in Agriculture**:
   - Focus CSR funds on **key sustainability challenges** in agriculture, such as **water management, soil health, and crop diversity**, to maximize positive impact.
4. **Encourage Sustainable Practices**:
   - Use CSR to drive **sustainable agricultural practices** like conservation, agroforestry, and climate-resilient farming, supporting India's **environmental and economic goals**.

The Role of the Commission for Air Quality Management (CAQM) in Tackling Air Pollution

Context

- **Directive from the Supreme Court**: In response to repeated Supreme Court directives to tackle **stubble burning**, the **Commission for Air Quality Management (CAQM)** has increased fines for farmers engaged in this practice as part of stricter enforcement measures.

Revised Fines for Stubble Burning

1. **New Penalties**:
   - **Farmers with less than two acres**: Fine raised from **₹2,500 to ₹5,000** per incident.
   - **Farmers with two to five acres**: Fine doubled from **₹5,000 to ₹10,000**.
   - **Farmers with more than five acres**: Fine increased from **₹15,000 to ₹30,000**.
2. **Implementation**:
   - **Nodal Officers** in **Delhi, Punjab, Haryana, NCR regions of Rajasthan and Uttar Pradesh** are tasked with enforcing and collecting these fines as part of **environmental compensation** efforts.

About the Commission for Air Quality Management (CAQM)

1. **Origin and Purpose**:
   - **Established**: Under the **CAQM Act, 2021**, specifically for managing **air quality in the NCR and adjacent areas**.
   - **Mandate**: Replaces the **Environment Pollution (Prevention and Control) Authority (EPCA)**, with the goal of coordinating and overseeing efforts to **improve air quality, prevent pollution**, and manage environmental challenges in Delhi-NCR and nearby states.
2. **Jurisdiction**:
   - Covers **Delhi-NCR**, **Punjab**, **Haryana**, **Rajasthan**, and **Uttar Pradesh**, addressing **cross-state pollution**and ensuring cohesive regional management.
3. **Powers and Responsibilities**:
   - **Regulation of Activities**: Restricts actions that may deteriorate air quality.
   - **Research and Development**: Conducts studies and promotes **innovative solutions** for pollution control.
   - **Binding Directions**: Issues mandatory instructions to both **authorities and individuals**.

- **Enforcement and Compliance**: Takes preventive and corrective actions to ensure air quality standards are maintained.

4. **Composition**:
   - **Chairperson**: A high-ranking official at the **Secretary or Chief Secretary** level.
   - **Ex Officio Members**: Includes representatives from **Delhi, Punjab, Haryana, Rajasthan, and Uttar Pradesh**.
   - **Technical Members**: Three full-time members with expertise in air quality management.
   - **Other Members**: Representatives from **NGOs** and technical organizations like **CPCB, ISRO, and NITI Aayog**.

NTPC's CO_2-to-Methanol Conversion Plant

Context

- **Milestone Achievement**: **NTPC** (National Thermal Power Corporation), India's largest power producer, has launched the **world's first CO_2-to-methanol conversion plant** at its **Vindhyachal facility**. This innovative approach represents a major step in **carbon management** and **green fuel technology**.

About the CO_2-to-Methanol Conversion Process

1. **Carbon Capture**:
   - CO_2 emissions from industrial processes are **captured directly from flue gases**, allowing for efficient extraction of carbon dioxide at the source.
2. **Catalytic Reaction**:
   - The captured CO_2 is combined with **hydrogen** (sourced from renewable energy) and reacted using a specialized **catalyst developed by NTPC**.
3. **Methanol Synthesis**:
   - This reaction occurs under **controlled pressure and temperature** conditions, resulting in **methanol production**.
4. **Storage and Utilization**:
   - The synthesized methanol is stored and can be used as a **fuel** or as a **feedstock** for producing chemicals.

Significance of CO_2-to-Methanol Conversion

1. **Carbon Management**:
   - By **capturing and converting CO_2** into methanol, this process helps in **reducing CO_2 emissions**, effectively transforming waste carbon into a valuable resource.
2. **Green Fuel Production**:
   - Methanol produced through this method offers a **cleaner alternative to fossil fuels**, supporting India's shift to **green energy** and sustainable fuels.
3. **Indigenous Innovation**:
   - NTPC's development of **India's first indigenous methanol synthesis catalyst** fosters **self-reliance** in green technologies, reducing dependency on imported technologies.
4. **Industrial Applications**:

- **Methanol** can be utilized in various sectors, including:
  - **Fuel blending** for reduced emissions.
  - **Chemical production** as a precursor for other compounds.
  - **Hydrogen generation**, offering a sustainable pathway for energy storage.

5. **Sustainable Development**:
   - This initiative aligns with **global climate goals** and India's **commitment to reducing its carbon footprint**, promoting sustainable industrial practices.

CSE Assessment on Extreme Weather Events in India

Context

- **Key Data**: The **Centre for Science and Environment (CSE)** and **Down To Earth** report highlighted a surge in the frequency and severity of extreme weather events in 2024, with severe impacts on **vulnerable populations, agriculture, and infrastructure**.

Key Highlights of CSE Assessment

1. **Rising Frequency of Extreme Weather Events**:
   - **Occurrence**: Extreme weather events occurred on **255 of 274 days** in 2024, showing an increase from **235 days in 2023** and **241 days in 2022**.
2. **Impact on Lives**:
   - **Fatalities**: Deaths increased by **18% over three years**, with **3,238 fatalities** in 2024, up from **2,755 in 2022**.
   - **Regional Impact**:
     - Kerala recorded the highest fatalities (**550**), followed by Madhya Pradesh (**353**) and Assam (**256**).
3. **Agricultural Losses**:
   - **Crop Loss**: Crop loss rose by **74%**, with **3.2 million hectares** affected in 2024, compared to **1.84 million hectares in 2022**.
   - **State Impact**: Maharashtra experienced the largest crop loss, accounting for over **60%** of total losses.
4. **Infrastructure and Livestock Damage**:
   - **Housing**: **235,862 houses** were destroyed in 2024, up significantly from **80,293 in 2022**.
   - **Livestock**: **9,457 livestock** perished, compared to **92,519** the previous year.
5. **Regional and State Impact**:
   - **Central India** recorded the most extreme weather days (218 days).
   - **Madhya Pradesh** had the highest number of extreme weather days among states (176 days).
   - **Andhra Pradesh** reported the highest number of houses damaged.
6. **Broader Implications**:
   - **Heatwaves**: Claimed **210 lives** in 2024, with prolonged health impacts often underestimated.
   - **Compensation Systems**: The lack of a robust compensation system exacerbates **poverty and marginalization**, particularly for farmers.

Illegal Sand Mining in Assam and Meghalaya

- **Context**: Villagers in **Assam** and **Meghalaya** unite against illegal sand mining impacting ecosystems, road infrastructure, and agriculture.

Rivers in News

1. **Kolong River (Assam)**:
   - **Location**: Morigaon district, Assam.
   - **Significance**: Sand mining affects the **local ecosystem** and infrastructure; a major distributary of the **Brahmaputra**.
2. **Dudhnoi (Manda) River (Meghalaya-Assam border)**:
   - **Location**: Assam-Meghalaya border near Nokmakundi.
   - **Significance**: Sand mining causes **erosion** and **water scarcity**, affecting agriculture in North Garo Hills.
3. **Kulsi River (Assam)**:
   - **Location**: Kamrup district, Assam.
   - **Significance**: Habitat of the **Gangetic dolphin**; illegal sand mining disrupts the ecosystem.
4. **Morakolohi River (Assam)**:
   - **Location**: Chamaria area, Kamrup district.
   - **Significance**: Sand mining via **pump motors** threatens aquatic life and sustainability of the river.

BIOTECHNOLOGY & HEALTH

RNA Editing – A New Frontier in Precision Medicine

Context

- **Recent Advances**: Companies like **Wave Life Sciences** are pioneering **RNA editing technology**, marking its first clinical applications and potential breakthroughs in treating genetic disorders.

What is RNA Editing?

1. **Definition**:
   - **RNA editing** is the process of making precise changes to **RNA molecules** (which carry instructions from DNA for protein synthesis), allowing for the correction of **genetic errors** before they are translated into proteins.
2. **Mechanism**:
   - **Enzyme Action**: Enzymes like **adenosine deaminase acting on RNA (ADAR)** modify specific RNA bases (e.g., converting adenosine to inosine), allowing edited RNA to produce normal proteins.

- **Guide RNA (gRNA)**: Directs ADAR enzymes to specific **mRNA regions**, correcting mutations associated with genetic diseases.

RNA Editing vs. DNA Editing

1. **Permanency**:
   - **DNA Editing**: Introduces permanent changes in the genome.
   - **RNA Editing**: Changes are temporary, offering a lower long-term risk.
2. **Safety**:
   - **DNA Editing**: Often uses bacterial proteins (e.g., CRISPR), which may provoke immune responses.
   - **RNA Editing**: Utilizes **ADAR enzymes**, naturally present in humans, reducing the risk of immune reactions.
3. **Flexibility**:
   - **RNA Editing**: Effects are reversible, allowing treatments to stop if side effects occur.

Challenges in RNA Editing

1. **Specificity**:
   - **Unintended Edits**: ADAR enzymes may occasionally edit non-targeted mRNA regions, leading to side effects.
2. **Transient Effects**:
   - **Repeat Treatments**: Due to the temporary nature of RNA edits, **repeated treatments** are required for lasting effects.
3. **Delivery Limitations**:
   - **Transport Issues**: Current delivery methods, like lipid nanoparticles, are limited in delivering large molecules effectively.

Applications of RNA Editing in Medicine

1. **Genetic Disorders**:
   - Used to treat **single-point mutations** in diseases like **Huntington's disease**, **Duchenne muscular dystrophy**, and **alpha-1 antitrypsin deficiency**.
2. **Neurological Conditions**:
   - Potential treatment for **Parkinson's disease** and other neurodegenerative disorders.
3. **Oncology**:
   - Companies like **Rznomics** are exploring RNA editing to regulate **protein production** in liver cancer.
4. **Ophthalmology**:
   - Treats conditions like **ABCA4 retinopathy**, a genetic disorder affecting eye protein function.

First in the World Challenge" by ICMR: A Step Towards Global Health Innovation

Context and Objective of the Initiative

- **Initiative by ICMR**: The **Indian Council of Medical Research (ICMR)** has launched the "**First in the World Challenge**" to push the frontiers of health research and innovation.
- **Primary Goal**: Encourages **revolutionary research** in health to create globally pioneering solutions.

Key Aspects of the First in the World Challenge

- **Objective**:
  - **Fostering Unique Innovations**: Promotes **"first of its kind"** solutions aimed at **global health challenges**.
- **Scope of Innovation**:
  - **Health Technologies Focus**: Targets breakthrough developments in areas such as **vaccines**, **drugs**, **diagnostics**, and **interventions**.
  - **Out-of-the-Box Ideas**: Proposals must introduce **new concepts** rather than minor improvements on existing technologies.
- **Funding Criteria**:
  - **High-Risk, High-Reward Proposals**: Prioritizes projects with the potential for **global impact**, disregarding routine or incremental advancements.
- **Application Process**:
  - **Open to Researchers**: Individual researchers or collaborative teams (from one or multiple institutions) are eligible.
- **Selection Process**:
  - **Expert Evaluation Committee**: A panel of **innovators, top experts, and policymakers** will assess proposals based on their originality and global impact potential.

About the Indian Council of Medical Research (ICMR)

- **Origin and History**:
  - **Established**: Founded in **1911** as the **Indian Research Fund Association (IRFA)**, renamed **ICMR in 1949**.
  - **Ministry**: Operates under the **Ministry of Health and Family Welfare**, Government of India.
- **Core Objectives**:
  - **Advancing Biomedical Research**: Focused on **improving public health** through **innovative medical research** addressing national health priorities.
- **Functions of ICMR**:
  - **Research Formulation and Coordination**: Develops and coordinates **biomedical research** initiatives.
  - **Research for Societal Benefit**: Conducts and supports studies with direct benefits to public health.

    - **Translational Research**: Bridges **research findings** with practical health applications for **public welfare**.
- **Vision Statement**:
    - **"Translating Research into Action for Improving the Health of the Population"**: Aims to convert **research outcomes** into actionable health solutions.

Vaccine-Derived Poliovirus and Polio Eradication Challenges

Context

- **WHO Transparency Concerns**: Recent scrutiny on the **World Health Organization's** (WHO) handling of polio data, especially on **vaccine-derived poliovirus** (VDPV) cases.
- **India's Recent Case**: The **ICMR-NIV Mumbai unit** confirmed a type 1 vaccine-derived poliovirus case in **Meghalaya**, India.

Overview of Poliovirus

1. **Definition of Polio**:
    - **Polio** is a highly contagious viral disease affecting mainly children under five, leading to **paralysis** and sometimes death by attacking the **nervous system**.
2. **Types of Poliovirus**:
    - **Wild Poliovirus (WPV)**:
        - **WPV1**: The only remaining strain in circulation.
        - **WPV2**: Declared eradicated globally.
        - **WPV3**: Officially eradicated in **2019**.
    - **Vaccine-Derived Poliovirus (VDPV)**:
        - Occurs when the **weakened virus in the Oral Polio Vaccine (OPV)** mutates back to a virulent form, posing a risk in **under-immunized populations**.

Types of Polio Vaccines

1. **Oral Polio Vaccine (OPV)**:
    - Contains a **weakened virus**, administered initially at birth, followed by doses at **6, 10, and 14 weeks**, with a **booster** at **16-24 months**.
2. **Inactivated Polio Vaccine (IPV)**:
    - Given as part of the **Universal Immunization Programme (UIP)** along with **DPT** for enhanced immunity as a booster.

Types of Vaccine-Derived Poliovirus (VDPV)

1. **Circulating VDPV (cVDPV)**:
    - Arises when the vaccine strain mutates and spreads in **under-immunized populations**.
2. **Immune-Deficiency VDPV (iVDPV)**:
    - Develops in **immune-deficient individuals** who can carry and excrete the virus for extended periods.
3. **Ambiguous VDPV (aVDPV)**:
    - Cases that do not clearly fit into cVDPV or iVDPV categories.

Transmission of Poliovirus

- **Fecal-Oral Route**: The virus multiplies in the intestine, allowing it to invade the **nervous system** and spread, especially in areas with poor sanitation.

Global Eradication Efforts

- **High Immunization Rounds**: Multiple rounds of OPV are essential to prevent cVDPV transmission.
- **High-Quality Campaigns**: **WHO** and global health partners recommend strong immunization campaigns to maintain immunity levels and prevent outbreaks.

India's Polio Status

- **Polio-Free Status**: India was declared **polio-free** by **WHO in 2014**, with the last wild polio case recorded in **2011**

Tuberculosis (TB) Elimination Efforts in India

Context

- **Progress**: India has achieved a **17.7% decline in TB incidence** from 2015 to 2023, outpacing the global average as it strives to meet its **2025 TB elimination target**.

Strategies and Targets for Ending Tuberculosis in India

- **SDG Goal 3.3**:
  - India aims to **end TB by 2025**, five years before the global 2030 deadline.
  - **Key Targets**:
    - **80% reduction in TB incidence** from 2015 levels.
    - **90% reduction in TB mortality**.
    - **Zero TB-affected households** facing catastrophic expenses.
- **India's Approach**:
  - **National Tuberculosis Elimination Programme (NTEP)**:
    - Implements the **National Strategic Plan (NSP) 2017–2025**.
  - **Diagnosis Expansion**:
    - Increased access to **sputum smear** and **nucleic acid amplification tests**.
  - **Treatment Support**:
    - **Direct Benefit Transfer (DBT)** via **Ni-kshay Poshan Yojana**; incentives for **ASHA workers**, **TB champions**, and **family caregivers**.
  - **Community Engagement**:
    - **Pradhan Mantri TB Mukt Bharat Abhiyaan (PMTBMBA)** involves over 1.5 lakh **Ni-kshay Mitras**for community support.
  - **Holistic Care**:
    - Focus on coexisting health issues like **malnutrition, diabetes, HIV**, and **substance abuse** through inter-ministerial collaboration.

Challenges

1. **High TB Burden**:
   - India continues to bear the highest TB burden globally.
2. **Resource Constraints**:
   - Limited healthcare infrastructure, particularly in remote areas.
3. **Awareness and Stigma**:
   - Social stigma and low awareness affect treatment adherence.
4. **Drug Resistance**:
   - The rise of **drug-resistant TB strains** complicates treatment.

Way Forward

1. **BCG Studies**:
   - Research into adult **BCG vaccination** for TB prevention.
2. **Expanded Preventive Therapy**:
   - Scale up **Tuberculosis Preventive Therapy (TPT)** with new, shorter regimens.
3. **Improved Diagnostics**:
   - Broaden access to **molecular diagnostic tests**.
4. **Decentralized Care**:
   - Deliver TB services through **Ayushman Arogya Mandirs**.
5. **Enhanced Community Support**:
   - Strengthen community-based care via **PMTBMBA**.

SCIENCE & TECHNOLOGY

LignoSat: The First Wooden Satellite

- **Context**: A pioneering effort by Japanese scientists to advance **sustainable space exploration** using a wooden satellite.

Key Details

- **Developers**: **Kyoto University** and **Sumitomo Forestry** in Japan.
- **Launch**: Scheduled for launch on a **SpaceX rocket** next week, bound for the **International Space Station (ISS)**.
- **Mission Purpose**:
  - **Material Testing**: To assess the durability of **Japanese honoki wood** (magnolia) in space conditions over six months.
- **Material Advantages**:
  - **Lightweight** and **resistant to shattering**.
  - **Eco-Friendly**: Wood doesn't create hazardous particles on re-entry, burning up harmlessly in Earth's atmosphere.
- **Future Vision**:

- Potential for **wooden structures** in space, supporting sustainable habitats on the **Moon and Mars**.

India's ADITYA-L1 Mission Achieves Milestone with Visible Emission Line Coronagraph Observations

Context

- **Recent Achievement**: The **Visible Emission Line Coronagraph (VELC)** onboard **ADITYA-L1** has provided India's first scientific observation from its solar mission. VELC successfully captured a **Coronal Mass Ejection (CME)** event, marking a significant step in India's solar research capabilities.

Key Observations from VELC on ADITYA-L1

- **First Scientific Result**:
  - On **July 16**, VELC observed and accurately estimated the **onset time of a CME** close to the Sun's surface. This capability is unique as CME events are usually observed from a greater distance.
- **Scientific Breakthrough**:
  - VELC's ability to capture CMEs **near the Sun's surface** enables more detailed analysis of these solar phenomena, enhancing our understanding of solar dynamics.

About Visible Emission Line Coronagraph (VELC) on ADITYA-L1

1. **Purpose**:
   - Designed to observe the **solar corona** and study **Coronal Mass Ejections (CMEs)** along with the **solar wind**to improve understanding of solar activity.
2. **Structure and Components**:
   - **Coronagraph**: Blocks direct sunlight to view the fainter corona.
   - **Spectrograph**: Measures the spectrum of light for chemical and physical analysis.
   - **Polarimetry Module**: Analyzes the polarization of light to study magnetic fields.
   - **Detectors and Auxiliary Optics**: Captures continuous, high-resolution images.
3. **Capabilities**:
   - **Simultaneous Imaging, Spectroscopy, and Spectro-polarimetry**: Allows multi-dimensional data capture near the Sun's surface.
   - **Continuous Monitoring**: Provides real-time data for studying the corona, essential as the Sun reaches the peak of **Solar Cycle 25**.
4. **Development**:
   - Built by the **Indian Institute of Astrophysics (IIA)** at its **CREST campus** in Hosakote, Karnataka, in collaboration with **ISRO**.

Significance of VELC Observations

- **Advancing Solar Science**:

    - VELC's ability to monitor CMEs close to the Sun offers valuable insights into **solar weather patterns** and **space weather prediction**, contributing to global efforts in solar research.
- **Application in Solar Cycle Studies**:
    - The data provided by VELC will help model solar activity as the Sun reaches its **Solar Cycle 25 peak**, enabling better understanding and forecasting of solar storms that can impact satellite operations and Earth's geomagnetic field.

Russia-Iran Space Collaboration

Context

- **Event**: A Russian **Soyuz rocket** launched two Iranian satellites, **Kowsar** and **Hodhod**, into orbit from the **Vostochny Cosmodrome**, showcasing deepening **Russia-Iran collaboration**.

About Russia-Iran Partnership

- **Strategic Partnership**:
    - Moscow and Tehran are working towards a **comprehensive strategic partnership** involving **defense, technology, and energy**, with plans to formalize this during Iranian President Masoud Pezeshkian's upcoming visit to Russia.
- **Military Allegations**:
    - Both countries face Western allegations that **Iran has supplied Russia with explosive drones** for the Ukraine conflict, which both deny.

About Iranian Satellites

- **Kowsar**:
    - Developed for **Earth observation**, supporting **environmental monitoring** and **agriculture**.
- **Hodhod**:
    - Focused on **data collection for research** to strengthen Iran's **private space sector**.
- **Previous Launches**:
    - Iran launched **Khayyam** and **Pars-1** in 2022 and 2023 as part of its national space expansion aimed at civilian applications.

Proba-3 Space Satellite – India-EU Collaboration

Context

- **Mission**: India, in collaboration with the **European Union**, will launch the **Proba-3 Space Satellite** for solar observation in December 2024.

About Proba-3 Space Satellite

- **Objective**: Focused on **solar corona dynamics**, studying space weather to understand solar behavior.
- **Collaboration**: A joint effort by the **European Union and India**, enhancing **international cooperation** in scientific research.

- **Launch Date**: Scheduled for **early December 2024** from **Sriharikota, India**.
- **Significance**:
  - The third Proba satellite launch by **ISRO for the EU**, building on successful Proba-1 and Proba-2 missions.
  - Equipped with high-resolution imaging for advancements in **solar corona research**.

India's Path to Global Leadership in 6G Technology: An In-depth Analysis

Context

- **Bharat 6G Mission**: India is setting ambitious goals to establish itself as a **global leader in 6G technology by 2030**. Following the rapid deployment of 5G, covering 98% of districts within 21 months, India aims to advance digital innovation and connectivity through the **Bharat 6G Mission**.

Features of 6G Technology

1. **Terahertz (THz) Frequencies**:
   - 6G will operate in the **THz range**, supporting much higher data transmission compared to 5G, enabling ultra-high-speed data transfer across broader bandwidths.
2. **Massive MIMO (Multiple Input Multiple Output)**:
   - Uses numerous antennas to support multiple device connections, enhancing **data transmission and reception** for dense networks.
3. **Network Slicing**:
   - Facilitates **specialized networks** for different applications (e.g., video streaming, automation), improving performance and efficiency.
4. **Enhanced Security**:
   - 6G incorporates **advanced encryption** and **authentication** for protecting sensitive data, addressing evolving cybersecurity needs.
5. **Ultra-Reliable Low Latency Communication (URLLC)**:
   - Offers extremely low latency, essential for **mission-critical applications** such as VR/AR and industrial automation.
6. **Integrated Intelligent Reflecting Surfaces (IIRS)**:
   - Enhances signal quality in areas with poor reception, promoting connectivity across difficult terrains and structures.
7. **High-Speed Data Transfer**:
   - Supports data rates over **hundreds of GHz or THz frequencies**, facilitating faster and seamless communication.

Government Initiatives for 6G Development

Bharat 6G Vision and Strategy

- **Vision Statement**: To **design, develop, and deploy 6G technologies** ensuring secure, intelligent, and global connectivity.

- **Core Principles**: Affordability, sustainability, and **ubiquity**, aligning with India's **Atmanirbhar Bharat** initiative.
- **Goals**:
  - Promote **R&D** in 6G through startups, academia, and industry.
  - Develop **affordable telecom solutions** for India and the global market.
  - Generate global IP and patents, establishing India as a leader in telecommunications.

Technology Innovation Group (TIG) on 6G

- **Establishment**: Formed on **November 1, 2021**, to devise a roadmap for 6G in India.
- **Task Forces**: Includes six task forces focusing on **multidisciplinary solutions, spectrum management, devices and networks, international standards, and R&D funding**.

Bharat 6G Alliance

- **Collaboration**: Brings together industry, academia, and research institutions to advance 5G, develop 6G products, and produce patents.
- **Global Alignment**: Engages with global alliances, such as the **Next G Alliance (US), 6G Flagship (Finland), and South Korea's 6G Forum**.

Applications of 6G Technology

APPLICATION AREA	DESCRIPTION
HEALTHCARE	Real-time patient monitoring with AI-connected devices and intelligent ambulances.
AGRICULTURE	IoT and AI integration for crop health monitoring and predictive systems for irrigation.
DEFENSE & SECURITY	Dynamic battlefield communication, enhanced surveillance, and unmanned operations.
DISASTER RESPONSE	Instant high-volume communication and precision networks for emergency response.
TRANSPORTATION	Supports urban air mobility and intelligent traffic management with low latency.
EDUCATION	Facilitates remote learning with high-speed video transfer and immersive AR/VR classrooms.
METAVERSE	Enables 3D holographic displays and virtual interactions with reliable connectivity.
INDUSTRIAL AUTOMATION	Powers smart factories with ultra-reliable low-latency communications (xURLLC) for enhanced efficiency.
SMART CITIES	Connects urban infrastructure for real-time monitoring and efficient management.
ENTERTAINMENT & MEDIA	Delivers high-quality streaming, gaming, and immersive content with increased bandwidth.
ENVIRONMENTAL MONITORING	Provides real-time data from sensors, aiding resource management and conservation efforts.

Challenges Associated with 6G Technology

1. **Technical Complexity**:
   - Development of **advanced components** and subsystems increases technical challenges, impacting deployment timelines.
2. **Infrastructure Costs**:
   - 6G deployment requires **significant investment and regulatory support** for infrastructure upgrades, posing financial challenges.
3. **Spectrum Allocation**:
   - Limited spectrum availability and competing demands necessitate careful **allocation and management** for effective 6G operations.
4. **Security Concerns**:
   - High-speed data transmission heightens vulnerability to **cyber-attacks**, necessitating robust security mechanisms.
5. **Standardization Issues**:
   - Achieving **global consensus on standards** for interoperability can be complex, potentially delaying international deployment.
6. **Global Collaboration**:
   - Effective **international cooperation** is required to ensure aligned technological and regulatory frameworks.

SCHEMES AND INITIATIVES IN NEWS

PM Vidyalaxmi Scheme – Supporting Access to Higher Education

Context

- **Objective**: Approved by the Union Cabinet, the **PM Vidyalaxmi Scheme** aims to provide financial support to **meritorious students** in India, ensuring financial limitations do not restrict access to quality higher education.

About PM Vidyalaxmi Scheme

- **Eligibility**: Available to students enrolled in **top 860 HEIs** (as per NIRF rankings), covering **22 lakh students**annually.
- **Loan Features**:
  - **Collateral-Free Loans**: Offers **guarantor-free education loans** with a digital, user-friendly application process.
  - **Credit Guarantee**: The government provides a **75% credit guarantee** on loans up to ₹7.5 lakhs, aiding banks in expanding loans.
  - **Interest Subvention**:

  - **3% Interest Subvention**: For families with incomes up to ₹8 lakhs on loans up to ₹10 lakhs.
  - **Full Interest Subvention**: For students with family incomes up to ₹4.5 lakhs under the **PM-USP scheme**.
- **Unified Portal**: Accessible through the **PM-Vidyalaxmi portal**, allowing seamless loan applications, interest processing, and support via **e-vouchers and CBDC wallets**.
- **Complementary Schemes**: Complements schemes like **CSIS** and **CGFSEL**, supporting students in technical and professional courses at approved HEIs.

Millimeter Wave Transceiver Technology for 5G Connectivity

Context

- **Collaboration**: The **Centre for Development of Telematics (C-DOT)** and **IIT Roorkee** have partnered to develop a **Millimeter Wave Transceiver** aimed at improving **5G connectivity in rural areas** under the **Telecom Technology Development Fund (TTDF)** scheme.

About Millimeter Wave Transceiver Technology

ASPECT	DESCRIPTION
DEFINITION	A device used to transmit and receive signals in the **millimeter wave (mmWave)** frequency range (30-300 GHz), allowing **high-speed wireless communication** for applications like 5G.
WORKING PRINCIPLE	Uses **small cells** to emit high-frequency mmWaves that support **fast data rates over short distances**. Small cells are grouped to ensure continuous coverage.
ADVANTAGES	- **High data rates** and **bandwidth** - **Low latency** for real-time communication - **Reduced interference** with other systems - Compact **antennas** compatible with IoT - **Increased data capacity**
DISADVANTAGES	- Limited range; **blocked by physical objects** - Prone to **signal degradation** from rain and humidity - **Higher manufacturing costs** and need for clustered cells for effective coverage

About Telecom Technology Development Fund (TTDF)

- **Origin**: Formerly the **Universal Service Obligation Fund Scheme**, established under the **Indian Telegraph (Amendment) Act, 2003**.
- **Aim**: To support **R&D in telecom technologies** and make broadband and mobile services affordable in **rural and remote areas**.
- **Ministry**: Operated by the **Department of Telecommunications, Ministry of Communications**.
- **Features**:
  - Provides **grants** for telecom innovations and indigenous manufacturing.

- Promotes **IP creation, co-innovation**, and **reduced imports**.
- Supports the telecom ecosystem through **standards development, prototyping, and testing**.

Gravity Energy Storage – A Sustainable Solution for Power Grid Stability

Context

- **Relevance**: As climate change necessitates a shift to **renewable energy**, **gravity energy storage** offers a sustainable alternative to battery systems for stabilizing power grids.

About Gravity Energy Storage

ASPECT	DESCRIPTION
DEFINITION	A renewable energy storage technology that utilizes **gravitational force** to store and release energy, ideal for **grid-scale applications**.
WORKING MECHANISM	- During excess energy, a **heavy mass** (like water or concrete) is lifted, converting electrical energy into **potential energy**. - When demand rises, the mass is released, driving a turbine to generate electricity.
ADVANTAGES	- **Longevity**: Can last for decades with minimal maintenance - **Eco-friendly**: Avoids harmful chemicals, reducing environmental impact - **Cost-effective**: Lower lifetime costs for large-scale use - **Flexible Deployment**: Suitable for areas not ideal for pumped-hydro or large battery setups
LIMITATIONS	- **Early Development Stage**: High initial costs and regulatory hurdles - **Geographic Constraints**: Requires specific locations for infrastructure - **Lower Energy Density**: Effective for grid storage but less efficient for compact applications compared to batteries