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**FEBRUARY
2025**

**SUMMARY STRUCTURE DEDICATED
TO UPSC EXAM PREPARATION**

**BIOMASS: AN ALTERNATE FUEL TO
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[February, 2025]

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COMMUNITY-BASED FOREST MANAGEMENT (CBFM)

Context

- Residents of 30 villages in Uttarakhand establish a model for public participation in saving forests from wildfires

About the Community-Based Forest Management (CBFM)

- It represents a paradigm shift in forest conservation, emphasizing the active participation and empowerment of local communities.
- It recognizes that the people living in and around forests are best positioned to manage and protect these vital ecosystems.
- By involving **communities in decision-making processes** and giving them a stake in the sustainable management of forest resources, CBFM aims to achieve both **ecological and socio-economic benefits**.

Importance of Forests

- Forests play a crucial role in maintaining ecological balance. They act as carbon sinks, absorbing carbon dioxide and mitigating climate change.
- They also provide habitat for countless species, maintain soil health, and regulate water cycles.
- The destruction of forests leads to biodiversity loss, increased greenhouse gas emissions, and disruption of local communities.

Need for CBFM

- Traditional top-down approaches to forest management often overlooked the knowledge and needs of local communities, leading to conflicts and ineffective conservation efforts.
- In contrast, CBFM acknowledges that local communities have a deep understanding of their environment and a vested interest in its preservation.

- It aims to harness this local knowledge and commitment to achieve sustainable forest management.

Key Principles of CBFM

- Participatory Decision-Making:** CBFM involves communities in the decision-making process, ensuring that their voices are heard and their knowledge is valued.
 - It fosters a sense of ownership and responsibility among community members.
- Empowerment and Capacity Building:** CBFM empowers communities by providing them with the necessary skills and resources to manage forest resources sustainably.
 - Capacity-building initiatives, such as training in sustainable practices and legal frameworks, are essential components of this approach.
- Benefit Sharing:** One of the **core principles** of CBFM is the equitable sharing of benefits derived from forest resources.
 - It includes not only financial benefits but also access to non-timber forest products, such as fruits, nuts, and medicinal plants.
- Sustainable Practices:** CBFM promotes sustainable forest management practices, such as agroforestry, reforestation, and controlled harvesting.
 - These practices help maintain the ecological balance of forest ecosystems while supporting the livelihoods of local communities.

Success Stories

- Joint Forest Management (JFM) in India:** India has implemented JFM programs in various states, involving local communities in the management and protection of forest areas.
 - These programs have led to improved forest cover, enhanced biodiversity, and increased incomes for participating communities.
- Community Forestry in Nepal:** Nepal's community forestry program has been highly successful, with thousands of community forest user groups managing vast forest areas.

- It has not only improved forest health but also contributed to poverty alleviation and social cohesion.
- **Participatory Forest Management in Tanzania:** In Tanzania, participatory forest management has empowered local communities to take charge of forest resources, leading to reduced deforestation rates and increased community resilience.

Challenges

- **Institutional Support:** Effective CBFM requires strong institutional support and legal frameworks to ensure the rights and responsibilities of communities are recognized and protected.
- **Resource Allocation:** Adequate funding and resources are essential for capacity-building and implementing sustainable practices.
 - Ensuring that communities have access to these resources is crucial for the success of CBFM initiatives.
- **Challenge of Wildfires:** Uttarakhand has been grappling with frequent wildfires, which have caused significant damage to its forest cover.
 - The state loses thousands of hectares of forest each year due to these fires, which are often exacerbated by human activities and climate change.
 - The traditional approach to firefighting has involved government agencies and external support, but the involvement of local communities has proven to be a game-changer.

Key Strategies

- **Fire Prevention:** The villagers have implemented preventive measures such as clearing dry leaves and branches, creating firebreaks, and conducting regular patrols to detect and address potential fire hazards.
- **Training and Awareness:** Community members have been trained in firefighting techniques and the use of equipment.
 - Awareness campaigns have been conducted to educate villagers about the importance of

forest conservation and the risks associated with wildfires.

- **Collaboration with Authorities:** The community has established strong ties with local forest departments and other relevant authorities.
 - It ensures that the efforts of the villagers are supported by professional expertise and resources.

BANKING ON FLAWED DRUG VOLUNTARY LICENCES

Context

- The Medicines Patent Pool is pushing for more voluntary licenses, but its bad deal with Novartis on a cancer drug shows the pitfalls

About

- The **concept of voluntary licences (VLs)** in the pharmaceutical industry is often hailed as a solution to improve access to essential medicines in low- and middle-income countries (LMICs).
- However, a closer examination reveals that the system is fraught with challenges and inefficiencies.

Illusion of Access

- Voluntary licences are agreements where patent holders allow generic manufacturers to produce and sell their drugs at lower prices in LMICs.
- While this sounds promising, the reality is often different. A case in point is the Medicines Patent Pool's (MPP) deal with Novartis on the **cancer drug nilotinib**.
- Despite the fanfare surrounding the deal, it was later revealed that nilotinib was no longer under patent protection, rendering the VL unnecessary.

Pitfalls of Voluntary Licensing

- **Patent Thickets:** Many new drugs are surrounded by multiple patents, making it difficult for generic manufacturers to navigate the complex intellectual property landscape.
 - It can delay the production and distribution of affordable medicines.

- **Secondary Patents:** Innovator companies often secure secondary patents to extend the exclusivity period of their drugs, further complicating the VL process.
- **Limited Scope:** VLs often cover only a fraction of the global market, leaving many patients without access to affordable medicines.
- **Regulatory Hurdles:** Generic manufacturers must navigate stringent regulatory requirements to gain approval for their versions of patented drugs, which can be time-consuming and costly.

Need for Compulsory Licences

- Compulsory licences (CLs) are a legal mechanism that allows governments to override patents in the interest of public health.
 - Unlike VLs, CLs can be issued without the consent of the patent holder and can cover a broader range of drugs.
- However, few developing countries have utilized CLs due to fear of retribution from wealthy nations where patent holders are based.

Moving Forward

- **Strengthening CL Mechanisms:** Governments should be encouraged to use CLs more effectively to ensure timely access to affordable drugs.
- **Enhancing VL Transparency:** The VL process should be more transparent, with clear criteria for selecting generic manufacturers and ensuring that the drugs covered are truly in need of licensing.
- **Global Collaboration:** International organizations and governments should work together to create a more equitable system for drug access, including addressing the root causes of patent thickets and secondary patents.

150 YEARS OF INDIA METEOROLOGICAL DEPARTMENT (IMD)

Context

- Recently, India Meteorological Department (IMD) celebrated its 150th anniversary on January 15, 2025.

Historical Background

- The roots of meteorology in India can be traced back to ancient times, with early philosophical texts discussing weather phenomena.
- However, modern meteorology gained scientific grounding in the 17th century with the invention of instruments like the thermometer and barometer.
- The establishment of **IMD in 1875** was a response to **the devastating cyclones that hit Kolkata and the Andhra coast in 1864**, highlighting the need for systematic weather monitoring.
 - IMD began its operations with **HF Blanford as the Imperial Meteorological Reporter**.
- Over the years, IMD has grown into a comprehensive organization with permanent observatories and automatic weather stations across the country.
- **Parent Ministry:** Ministry of Earth Sciences, Government of India.

Key Functions

- **Weather Forecasting:** Meteorological departments provide daily weather forecasts, including temperature, precipitation, wind speed, and humidity.
 - These forecasts are crucial for planning daily activities, agricultural practices, and outdoor events.
- **Climate Monitoring:** These departments monitor long-term climate trends and changes, providing valuable data for climate research and policy-making.
 - It helps in understanding global warming, sea-level rise, and other climate-related phenomena.
- **Severe Weather Warnings:** Meteorological departments issue warnings for severe weather events such as cyclones, hurricanes, thunderstorms, and heatwaves.
 - These warnings help communities prepare and take necessary precautions to minimize damage and loss of life.

- **Support for Various Sectors:** Meteorological data is essential for sectors like agriculture, aviation, and disaster management.
 - Farmers rely on weather forecasts for crop planning, while pilots use weather information for safe navigation.
 - Disaster management agencies use weather data to prepare for and respond to natural disasters.

Technological Advancements

- Modern meteorological departments utilize advanced technologies such as satellites, radar systems, and computer models to improve the accuracy of weather forecasts.
- These technologies enable real-time monitoring of weather conditions and provide detailed information on atmospheric phenomena.

Key Achievements

- A METOX Radio Theodolite ground system used in 1970, showcasing advancements in meteorological surveying techniques;
- On February 18, 1911, India's first flight from Allahabad to Naini was supported by IMD's weather information and forecasts;
- IMD adopted radar technology at Safdarjung Airport, New Delhi, in 1958, enhancing weather tracking and disaster preparedness;
- Thiruvananthapuram Observatory, established in 1853, is one of India's earliest centres for meteorological research;
- Pilot balloon observations, critical for wind data measurements, laid the foundation for modern atmospheric studies;

Major Initiatives

- **National Monsoon Mission (NMM):** Improves monsoon forecasts to help agriculture, water management, and disaster planning.
- **Mausam App:** A mobile app for weather updates, forecasts, and severe weather alerts.

- **Doppler Weather Radars (DWR):** Tracks storms, rainfall, and wind patterns for accurate weather predictions.
- **Agro-Meteorological Advisory Services (AAS):** Provides weather-based advice to farmers for better crop planning.
- **System of Air Quality and Weather Forecasting (SAFAR):** Monitors air quality and weather in major cities to guide pollution management.

Challenges and Future Directions

- Despite the advancements, meteorological departments face challenges such as funding constraints, data accuracy, and the need for continuous technological upgrades.
- To address these challenges, there is a need for increased investment in meteorological research, collaboration with international organizations, and public awareness campaigns to emphasize the importance of weather forecasting.

CIRCULAR ECONOMY & PLASTIC POLLUTION TREATY

Context

- The global community is increasingly recognizing the urgent need to address plastic pollution, a crisis that threatens ecosystems, human health, and the planet's future.
- A key component of the solution lies in embracing the principles of the circular economy within the framework of a comprehensive plastic pollution treaty.

World's Waste Problem is Growing Fast

- According to the **World Bank**, over 2 billion tonnes of municipal solid waste are produced each year, and this figure is expected to rise to **3.4 billion tonnes by 2050**.
- This rapid increase in waste poses significant environmental, economic, and public health challenges.

Causes of the Growing Waste Problem

- Rapid urbanization and industrialization have led to increased consumption and production of goods.
- In developing countries, the lack of reliable waste collection services and proper disposal infrastructure exacerbates the issue.
- Additionally, the proliferation of single-use plastics and non-biodegradable materials has added to the waste burden.

Environmental Impact

- Waste disposal in landfills and open dumps releases harmful greenhouse gases, particularly methane, which is 80 times more potent than carbon dioxide.
- Plastic waste, in particular, poses a major threat to marine ecosystems, with millions of seabirds and marine mammals falling victim to plastic debris each year.

Understanding the Circular Economy

- The circular economy is a sustainable economic model that aims to eliminate waste and the continual use of resources.
 - It contrasts with the traditional linear economy, which follows a '**take, make, dispose**' approach.
- Instead, the circular economy focuses on designing products for longevity, reuse, and recycling, keeping materials in use for as long as possible and regenerating natural systems.

Role of a Plastic Pollution Treaty

- A plastic pollution treaty, currently under negotiation at the United Nations, seeks to establish legally binding global rules to tackle plastic pollution comprehensively.
- This treaty aims to address the entire life cycle of plastics, from production to disposal, and promote sustainable practices.

Integrating Circular Economy Principles

- **Eliminate:** Reducing the production and use of unnecessary plastics.

- **Innovate:** Designing plastics that are easier to reuse, recycle, or compost.
- **Circulate:** Ensuring that plastics are kept in use for as long as possible through recycling and reuse.

INTERNATIONAL CARBON EXCHANGE

Context

- **Indonesia** launched its international carbon exchange, allowing foreign investors to buy carbon credits generated by activities that reduce carbon dioxide emissions.
 - The initiative is part of Indonesia's commitment **to achieving carbon neutrality by 2050 and closing coal power plants by 2040.**

About the International Carbon Exchange

- It involves the buying and selling of carbon credits, which represent a reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases.
- These credits can be generated from various projects, such as reforestation, renewable energy, and energy efficiency initiatives.
- By purchasing carbon credits, companies and individuals can compensate for their emissions and support climate-friendly projects around the world.

Key Players in International Carbon Exchange

- **United Nations Framework Convention on Climate Change (UNFCCC):** The UNFCCC oversees the **Clean Development Mechanism (CDM)**, which issues **Certified Emission Reductions (CERs)** for emission reduction projects in developing countries.
 - The UNFCCC also partners with platforms like the **AirCarbon Exchange** to promote carbon offsetting.
- **International Carbon Action Partnership (ICAP):** ICAP is a global forum for governments and public authorities that have implemented or are planning to implement **emissions trading systems (ETS)**.

- It provides a platform for sharing best practices and promoting the development of carbon markets.
- **Carbon Trade Exchange (CTX):** CTX is a digital carbon offsetting exchange that allows buyers and sellers to trade carbon credits in a transparent and secure manner.
 - It offers a wide range of certified carbon offsets and supports projects that contribute to global climate goals.
- **Down To Earth Carbon (DTEC):** DTEC focuses on ecosystem restoration and climate change mitigation through afforestation and reforestation projects.
 - It works with smallholder farmers and indigenous communities to restore degraded land and enhance carbon capture.

Benefits of International Carbon Exchange

- **Climate Mitigation:** By supporting emission reduction projects, carbon exchange helps mitigate climate change and reduce the overall carbon footprint.
- **Sustainable Development:** Carbon projects often bring additional benefits, such as job creation, improved air and water quality, and enhanced biodiversity.
- **Corporate Responsibility:** Companies can demonstrate their commitment to sustainability by offsetting their emissions and investing in climate-friendly projects.
- **Market Efficiency:** Carbon markets enable cost-effective solutions for reducing emissions, allowing entities to meet their climate targets in a financially viable manner.

Challenges and Future Outlook

- While international carbon exchange holds great promise, it also faces challenges such as ensuring the integrity of carbon credits, avoiding double counting, and promoting transparency in the market.
 - Addressing these challenges will be crucial for the continued growth and effectiveness of carbon markets.

- As the world moves towards a low-carbon future, international carbon exchange will play a vital role in achieving global climate goals. By fostering collaboration and innovation, carbon markets can drive significant progress in the fight against climate change.

PRELIMS

PRESIDENTIAL ACTIONS OF DONALD TRUMP AS 46TH POTUS

Context

- Just hours after his second (and final) term began on January 20, US President Donald Trump unleashed 46 presidential actions.
- Several of these are centred on the US' climate commitments, energy transition, migration and trade policies, and are likely to have negative global implications.

About

- **Climate Commitments:** Trump declared the withdrawal of the US from the 2015 global Paris agreement to limit global greenhouse gas emissions, and revoked the US International Climate Finance Plan.
 - The US would also withdraw from other international climate pacts and financial commitments under the UN Framework Convention on Climate Change.
- **Out of World Health Organization (WHO):** Trump withdrew the US from WHO citing reasons like the global health agency's failure to handle the novel coronavirus pandemic.
 - It could cost WHO \$130 million in annual funds and hinder global public health response.
- **Domestic Energy Push:** Trump declared a **national 'energy emergency'** and called for reviews and plans to counter activities that hinder domestic energy development, including from fossil fuels.
 - The orders halt some wind energy projects, revoke 12 clean energy initiatives launched during the Joseph Biden administration and

pause fund disbursement under the **Inflation Reduction Act**.

- **Curbs on Immigration:** The slew of orders announced include a revoke of birthright citizenship, closure of borders, strengthened policies to trace illegal immigrants and restrict visas, and realigning refugee resettlement in the US.
 - Separately, Trump **imposed 25% tariffs on imports from Canada and Mexico**, saying the two countries failed to tackle the illegal movement of people and narcotics into the US.
- **Stance on Gender:** With an aim to reverse practices and ideologies that hinder women’s safety, all federal documents, policies and practices must recognise only two genders, “male” or “female”, in adherence with biological definitions.
- **Foreign Trade and Policies:** A number of orders were announced, including a 90-day halt in US foreign aid and withdrawal from the **Organisation for Economic Co-operation and Development’s Global Tax Deal**, which calls for a universal minimum corporate tax.
 - US foreign policies are directed to follow an “America First” approach.

MARBURG VIRUS DISEASE

Context

- Recently, the World Health Organization (WHO) announced a suspected outbreak of Marburg virus disease in Tanzania’s Kagera region, which claimed eight lives.

About the Marburg Virus Disease (MVD)

- The **Ebola-like virus (*Filoviridae family*)**, which causes symptoms such as *high fever, headache, diarrhoea and bleeding*, has a **high fatality rate of 89%**.
- First identified in 1967 in Marburg and Frankfurt, Germany, and Belgrade, Serbia, MVD has since caused sporadic outbreaks across sub-Saharan Africa.

Transmission

- Direct contact with the bodily fluids of infected individuals, contaminated surfaces, or handling of infected animals, such as fruit bats of the Pteropodidae family.
- Human-to-human transmission occurs through close contact with infected individuals’ blood, saliva, vomit, or urine.

Prevention and Control

- Avoiding contact with infected individuals or animals, using personal protective equipment, and adhering to strict hygiene practices.
- Early supportive care, such as rehydration and symptom management, improves survival rates.

TRIBAL MINISTRY DIRECTS STATES TO CREATE FRA COMPLIANCE MECHANISM

Context

- Recently, the Union Ministry of Tribal Affairs issued a directive, urging states to establish mechanisms for compliance with the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (FRA), 2006**.
- It comes in response to growing complaints about illegal evictions of forest dwellers, particularly from tiger reserves

Background and Directive

- The directive calls for state tribal departments and forest departments to implement institutional mechanisms for upholding the rights of forest dwellers as mandated by the FRA and other relevant laws.
- The ministry emphasized the need to recognize and address the rights of these communities, especially in light of recent evictions from tiger reserves.

Concerns Over Evictions

- The directive follows a 2024 directive by the **National Tiger Conservation Authority (NTCA)**, which ordered the relocation of villagers from tiger reserves.

- It impacted 89,808 families across 848 villages across the country, calling for their relocation on a 'priority basis' with time-bound action plans.
- So far, 257 villages, comprising 25,007 families, have been relocated, but 591 villages, home to 64,801 families, remain within notified core areas.

Legal Protections Under FRA

- The FRA provides legal protections for forest-dwelling **Scheduled Tribes and Other Traditional Forest Dwellers (OTFDs)**, recognizing their rights to land and resources.
- Section 4 (5) of the Act prohibits the eviction or removal of forest-dwelling communities until their rights have been recognized and verified.
- The FRA also mandates obtaining **free, prior, and informed consent (FPIC)** from Gram Sabhas before any resettlement or relocation is undertaken.

Grievance Redressal Mechanism

- The ministry's directive also calls for the establishment of a grievance redressal framework to address complaints related to eviction and relocation efforts transparently.
- It aims to ensure that the rights of forest dwellers are upheld and that any resettlement is carried out with their informed consent and participation.

DEMOISELLE CRANES

Context

- According to state authorities, some **33 migratory Demoiselle cranes** died after **contracting the H5N1 avian influenza virus** in Jaisalmer, Rajasthan.

About the Demoiselle Cranes (*Grus Virgo*, aka 'Kurja' in India)

- These are **one of the smallest crane species**, known for their long migratory journeys.



- These birds are found in **central Eurosiberia, ranging from the Black Sea to Mongolia and Northeast China.**
- They migrate to the Indian subcontinent during the winter, making it a significant wintering ground for these graceful birds.
- **Khichan, a village in Rajasthan, India,** is a notable wintering site for these cranes, attracting around 20,000 birds annually.
- Conservation efforts are crucial to protect their habitats from threats like habitat loss, human disturbance, and collisions with power lines.

Status:

- IUCN Red List: Least Concern
- CITES: Appendix II; CMS II

Cultural Significance

- In India, Demoiselle Cranes hold symbolic significance and are celebrated in local culture.
- The village of Khichan has become a haven for these birds, thanks to the dedicated efforts of its residents who feed and care for the cranes.

NATIONAL EDIBLE OIL CONSUMPTION SURVEY

Context

- Recently, the Union Ministry of Agriculture and Farmers Welfare launched its first-ever national survey to assess edible oil consumption patterns in the country.

About the National Edible Oil Consumption Survey

- It aims to capture the **consumption patterns and preferences** of edible oils across the country, and gather critical data to support the implementation of the **National Mission on Edible Oils-Oilseeds (NMEO-Oilseeds)**.
- The survey aims to address this issue by providing up-to-date data on consumption patterns, which will be crucial for policy decisions and public health initiatives

Significance of the Survey

- **India is the world's largest consumer and importer of edible oils**, with **per capita annual consumption** rising to **over 20 kg**, significantly exceeding the recommended limits of **12 kg by the Indian Council of Medical Research (ICMR) and 13 kg by the World Health Organisation (WHO)**.
- The survey aims to address this issue by providing up-to-date data on consumption patterns, which will be crucial for policy decisions and public health initiatives.

NMEO-Oilseeds Mission

- It, with a financial outlay of ₹10,103 crore **over seven years**, aims to increase domestic oilseed production from 39 million tonnes in 2022-23 to 69.7 million tonnes by 2030-31.
- The mission focuses on boosting the production of oilseed crops like soybean, groundnut, mustard, and palm oil, and promoting self-reliance in edible oil production.

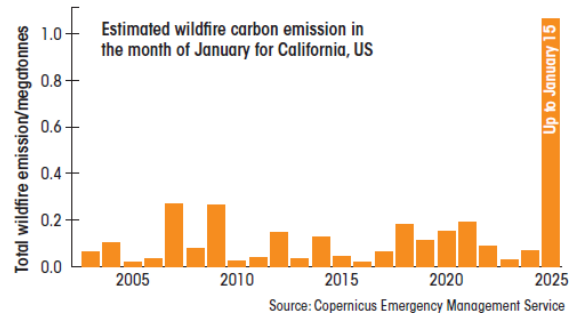
HYDROCLIMATE WHIPLASH

Context

- The three wildfires that have devastated large parts of the Los Angeles city and surrounding areas in the United States, occurred **due to rare meteorological conditions enhanced by global warming** and consequent climate change, mainly **due to a 'hydroclimate whiplash'**.

UNPRECEDENTED BLAZE

California wildfires in January 2025 hit unprecedented intensity, with carbon emissions surpassing 22 years of records



Understanding Hydroclimate Whiplash

- **Hydroclimate whiplash** refers to the **rapid swings between intensely wet and dangerously dry weather patterns**.
- It has been exacerbated by climate change, leading to more frequent and severe weather extremes.
- In the case of Los Angeles, the region experienced two consecutive wet winters, followed by an exceptionally dry summer and early fall.
- This sequence of events created the perfect conditions for wildfires.

Role of Climate Change

- As global temperatures rise, the atmosphere's ability to evaporate, absorb, and release water increases, leading to more extreme weather patterns.
- In California, this has resulted in periods of heavy rainfall followed by prolonged droughts.
- The excessive rainfall promotes the growth of vegetation, which later dries out and becomes highly flammable during dry periods.

Impact on Wildfires

- The wet winters of 2022-23 led to abundant grass and brush growth.
- However, the record-hot summer and dry start to the 2025 rainy season turned this vegetation into tinder-dry fuel for wildfires.
- The combination of dry vegetation and strong Santa Ana winds created the perfect conditions for the fires to spread rapidly.

Addressing the Challenge

- To mitigate the impact of hydroclimate whiplash and reduce the risk of wildfires, it is crucial to adopt a co-management approach that addresses both extreme rainfall and droughts.
- It includes implementing measures to manage vegetation growth, improving water storage and conservation practices, and enhancing early warning systems for extreme weather events.

HOLLONGAPAR GIBBON SANCTUARY

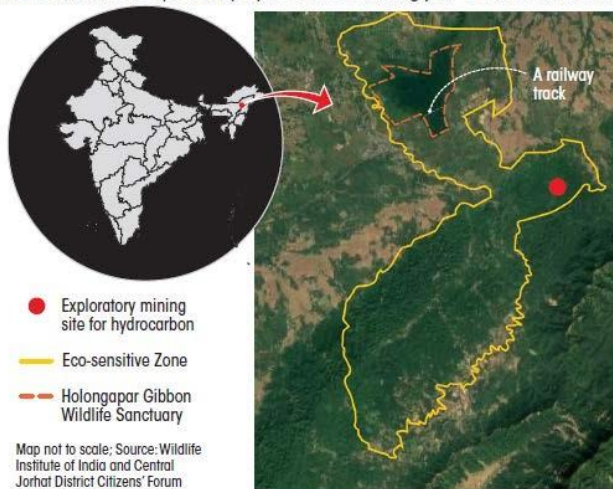
Context

- In a controversial decision, the **Standing Committee of the National Board for Wildlife (NBWL)** has approved exploratory drilling for oil and gas within the **eco-sensitive zone (ESZ)** of the **Hollongapar Gibbon Wildlife Sanctuary in Assam**.

About

Double whammy

In 2024, the National Board for Wildlife approved the Railways' plan to electrify the 1.26-km railway stretch cutting through the sanctuary, and also sanctioned exploratory hydrocarbon mining just 13 km south of it



- The **Hollongapar Gibbon Wildlife Sanctuary**, named after the **country's only ape species, the Hoolock gibbon**, is a vital refuge for biodiversity.
- **Gibbons** are the **smallest and fastest of all apes**.
- The hoolock gibbon, **unique to India's northeast**, is one of 20 species of gibbons found in tropical and subtropical forests in Southeast Asia.

- They are **diurnal and arboreal**. They are **omnivorous**.



- **Types in India:** Eastern and Western hoolock gibbons.
- **Threats:** The primary threat to the hoolock gibbon is the deforestation caused by infrastructure projects.
- **Conservation Status:**
 - **IUCN Status:**
 - Western hoolock gibbon **Endangered**
 - Eastern hoolock gibbon **Vulnerable**
 - **Schedule I** of Wildlife Protection Act 1972

STEEL SLAG

Context

- With simple curing, steel slag can be used in construction activities to replace river sand and natural aggregates

About the Steel Slag

- Steel slag, often perceived as a waste product from steel manufacturing, is a byproduct that holds immense potential for environmental sustainability.
- Steel slag is generated during the steelmaking process, where impurities are separated from molten steel. The production of virgin steel typically follows a two-step process:
 - **Blast Furnace (BF) Process:** Pig iron is extracted from iron ore in a blast furnace, producing molten slag.
 - **Basic Oxygen Furnace (BOF) Process:** Pig iron is refined in a basic oxygen furnace to

produce steel, with slag generated as a byproduct.

- According to the ‘**Indian Minerals Yearbook 2022**’ by the Union Ministry of Mines, producing one tonne of **pig iron generates 300 to 540 kg of blast furnace slag**, while producing one tonne of **liquid steel results in 150 to 200 kg of BOF slag**.

Innovative Uses of Steel Slag

• Construction Materials:

- **Bhilai Steel Plant:** This plant in Chhattisgarh, India, is conducting trials to replace river sand with steel slag in runners. If successful, this initiative could save the plant Rs 29 million annually and conserve 25,000 tonnes of river sand.
- **Paver Blocks:** The plant also initiated a pilot project to produce paver blocks by replacing stone chips with steel slag, resulting in cost savings and reduced reliance on natural aggregates.

• Metal Recovery and Product Innovation:

- **Tata Steel Plant, Jamshedpur:** The plant recovers metal elements from steel slag for reuse and selling. It has also set up an open steam ageing plant to accelerate the natural ageing process of non-metallic components.

• Technological Advancements:

- **JSW Steel Ltd, Vijaynagar:** This plant has developed technologies to produce

construction aggregates and slag fines suitable for cement making and agricultural applications.

- In 2022, it set up the world's first steel slag-to-sand facility, recycling 0.27 million tonnes of steel slag annually and reducing demand for river sand by 0.2-0.3 million tonnes.

Environmental Challenges of Steel Slag

- BOF slag, in particular, contains free lime, which reacts with moisture to form calcium hydroxide, leading to volume expansion and cracking in construction applications.
- Additionally, its high phosphorous content and specific gravity can prolong the setting time of concrete and reduce its strength.
- These properties make BOF slag less suitable for traditional construction uses compared to blast furnace slag, which has cementitious properties and is widely used in the cement industry.

Recommendations

- The Bureau of Indian Standards and Union Ministry of Steel need to set standards for steel slag usage.
- Ensure that the plants utilise the current generation slags within one year and legacy slags by September 2027.
- Steam ageing should be considered for maturing of steel slag.
- The government should prepare a model of supply chain to ensure that matured steel slag is used for road construction.

MUNICIPAL SOLID WASTE AS A VIABLE OPTION TO SUPPLEMENT COAL AS FUEL IN CEMENT PLANTS

Context

- Municipal solid waste can be converted as a viable option to supplement coal as fuel in cement plants.



Note: mt is million tonnes; Figures in all graphics are estimates for 2030
Source: "Good Practices in Industrial Waste Circularity", Centre for Science and Environment, New Delhi

About

- Municipal solid waste, often seen as a burden on landfills and waste management systems, can be transformed into a valuable resource.
- The **Central Pollution Control Board’s (CPCB’s) annual report for 2020-21** says about 95% of municipal solid waste is collected, of which 50% (29 million tonnes) is treated either in waste-to-energy or compost plants, or used as rdf in cement industries.
- In 2014, the erstwhile Planning Commission estimated that of the 62 million tonnes of municipal solid waste generated in urban India, 12 million tonnes can potentially be converted into rdf, replacing 8 million tonnes of coal.
- By converting MSW into refuse-derived fuel (RDF), cement plants can reduce their reliance on traditional fossil fuels like coal, thereby lowering greenhouse gas emissions and contributing to environmental sustainability.



Benefits of Using MSW as Fuel

- **Environmental Impact:**
 - **Reduction in Greenhouse Gas Emissions:** Using MSW as an alternative fuel can significantly reduce the carbon footprint of cement production. This is because RDF has a lower carbon content compared to coal.
 - **Waste Reduction:** Utilizing MSW in cement kilns helps reduce the volume of waste sent to landfills, alleviating the pressure on waste management systems.

- **Economic Viability:**
 - **Cost Savings:** RDF can be a cost-effective alternative to coal, especially in regions where waste disposal costs are high. Cement plants can save on fuel costs by incorporating MSW into their energy mix.
 - **Resource Optimization:** By using locally available MSW, cement plants can reduce their dependence on imported coal, enhancing energy security and promoting local resource utilization.
- **Energy Efficiency:**
 - **High Calorific Value:** RDF has a high calorific value, making it an efficient fuel for cement kilns. It ensures that the energy content of the fuel is effectively utilized in the production process.
 - **Process Integration:** The cement manufacturing process involves high-temperature operations, which are well-suited for the combustion of RDF.

Challenges and Considerations

- **Quality Control:**
 - **Variability of Waste Composition:** MSW composition can vary significantly, affecting the consistency and quality of RDF. Cement plants need to implement robust quality control measures to ensure the uniformity of RDF.
 - **Pre-treatment Requirements:** MSW requires pre-treatment to remove non-combustible materials and contaminants, adding to the operational complexity.
- **Regulatory and Safety Issues:**
 - **Compliance with Regulations:** Cement plants must adhere to stringent environmental regulations and safety standards when using MSW as fuel. It includes monitoring emissions and ensuring proper waste handling procedures.

- **Health and Safety Concerns:** Handling and processing MSW can pose health and safety risks to workers, necessitating appropriate protective measures and training.

Recommendations

- A new draft notification for **Solid Waste Management Rules, 2024** notifying standards of **refuse-derived fuel (RDF) quality**. The government should implement it.
- Include RDF specifications in urban local bodies' tenders for solid waste management.
- Lack of communication and coordination among players in the RDF supply chain hinder efforts to scale up. Industries, municipal corporations and third-party agencies should come together to sort issues of logistics, costing and other concerns.

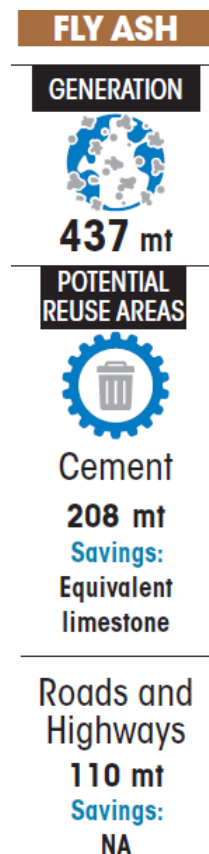
COAL COMBUSTION RESIDUE (FLY ASH) IN CEMENT-MAKING

Context

- Use of the **coal combustion residues (CCR)** in cement-making and road construction can curb fugitive dust emissions

About Fly Ash

- **Coal combustion residues, such as fly ash and bottom ash**, are by-products of coal combustion in power plants. These are composed of fine particles that are driven out of coal-fired boilers along with flue gases.
- Fly ash is categorized into two main types: **Class F and Class C**.
 - **Class F Fly Ash:** Contains low calcium content and is typically produced from burning anthracite or bituminous coal. It is known



for its pozzolanic properties, which means it reacts with calcium hydroxide to form cementitious compounds.

- **Class C Fly Ash:** Contains higher calcium content and is produced from burning sub-bituminous or lignite coal. It can exhibit cementitious properties on its own and is often used in concrete mixes.

Applications of Fly Ash

- **Concrete Production:** Fly ash is widely used as a supplementary cementitious material in concrete. It improves the workability, durability, and strength of concrete while reducing permeability.
- **Road Construction:** Fly ash can be used as a filler material in asphalt and as a base or sub-base material in road construction. It helps reduce dust emissions and enhances the stability of road surfaces.
- **Brick and Tile Manufacturing:** Fly ash can be incorporated into the production of bricks and tiles, reducing the need for virgin materials and promoting sustainable manufacturing.
- **Soil Stabilization:** Fly ash can be used to stabilize soils in construction projects, improving the load-bearing capacity and reducing erosion.
- **Filler in Paints and Plasters:** Fly ash can be used as a filler in paints, adhesives, and plasters, enhancing their properties and reducing the use of natural resources.

Benefits of Using Coal Combustion Residue

- **Reduction of Fugitive Dust Emissions:** By incorporating CCRs in cement-making and road construction, the generation of fugitive dust can be significantly reduced.
 - The stable nature of CCRs minimizes the release of particulate matter into the atmosphere, improving air quality and reducing health risks.

● **Environmental Benefits:**

- **Reduction in Greenhouse Gas Emissions:** By substituting a portion of Portland cement with fly ash in concrete production, the cement industry can significantly reduce its carbon footprint.
- **Waste Reduction:** Utilizing fly ash helps divert this byproduct from landfills, reducing the environmental impact of waste disposal.
- **Resource Conservation:** Fly ash can replace natural aggregates in construction materials, conserving natural resources and promoting sustainable building practices.

- **Economic Benefits:** The use of CCRs can lead to cost savings for the cement and construction industries.
 - By substituting expensive virgin materials with CCRs, companies can reduce production costs and improve their bottom line.

Recommendations

- Implement provisions of the Fly Ash Notification to their full potential. As per a report by the **Central Electricity Authority for 2021-22**, about 4% of fly ash is dumped. Proper monitoring and auditing of plants will promote use.
- Thermal power plants should consider all possible modes of fly ash utilisation and implement measures to increase it.
- Develop fly ash-based industries and ensure availability of the resource. Create and scale up markets for fly ash-based construction materials.

**FLUE GAS DESULPHURISATION GYPSUM
(FGD GYPSUM)**

Context

- Gypsum produced during flue gas desulphurisation is a viable alternative to the rare natural mineral.

Process of Flue Gas Desulphurisation

- Flue gas desulphurisation is a method used to remove sulfur dioxide (SO₂) from exhaust flue gases of fossil-fuel power plants.
- It involves the use of an aqueous slurry of limestone (calcium carbonate) or lime (calcium oxide) that reacts with SO₂ to form calcium sulfite, which is then oxidized to produce gypsum (calcium sulfate dihydrate).
- It can be further processed and utilized in various industries.



Benefits of Using FGD Gypsum

- **Environmental Benefits:** Utilizing FGD gypsum helps reduce the amount of waste sent to landfills and minimizes the environmental impact of sulfur dioxide emissions.
 - By repurposing this by-product, industries can contribute to a circular economy and reduce their carbon footprint.
- **Economic Viability:** FGD gypsum is a cost-effective alternative to natural gypsum, which is often mined in limited quantities and can be expensive.
 - The availability of FGD gypsum provides a steady and affordable supply for industries that require gypsum, such as the construction and agriculture sectors.
- **Resource Conservation:** By using FGD gypsum, industries can reduce their reliance on natural gypsum reserves, which are finite and subject to depletion.
 - It helps conserve natural resources and promotes sustainable practices.

Applications of FGD Gypsum

- **Construction Industry:** FGD gypsum is widely used in the production of plaster, plasterboard, and cement.
 - Its properties make it an excellent substitute for natural gypsum in these applications.
- **Agriculture:** FGD gypsum can be used as a soil amendment to improve soil structure and fertility.
 - It provides essential nutrients such as calcium and sulfur, which are beneficial for crop growth.
- **Waste Management:** The use of FGD gypsum in waste management processes can help stabilize and solidify hazardous waste, reducing the risk of environmental contamination.

Recommendations

- As per the Central Pollution Control Board's (CPCB's) Guidelines for **Handling and Management of Flue Gas Desulphurization (FGD) Gypsum**, power plants need to utilise a minimum of 25% of FGD gypsum, and eventually all of it.
 - Complete utilisation, ensured by regular assessments of plants by CPCB and state pollution control boards, is recommended.
- National Thermal Power Corporation's initiatives with other agencies to expand application of FGD gypsum should be promoted and emulated by similar efforts.
- CPCB should alleviate the process to transport FGD gypsum by industries for further research and to upscale its usage.

RED MUD: IRON ADDITIVE IN CEMENT PRODUCTION

Context

- Over 40% of red mud is iron oxide which makes it an ideal substitute for iron additive in cement production.

Composition of Red Mud

- **Red mud, also known as bauxite residue**, is generated during the **Bayer process**, which is used to extract alumina from bauxite ore.
- The residue is a fine, reddish-brown material that contains *various oxides, including iron oxide (Fe₂O₃), aluminum oxide (Al₂O₃), and silicon dioxide (SiO₂).*

Benefits of Using Red Mud in Cement Production

- **Resource Utilization:** By repurposing red mud, industries can reduce the environmental impact associated with its disposal.

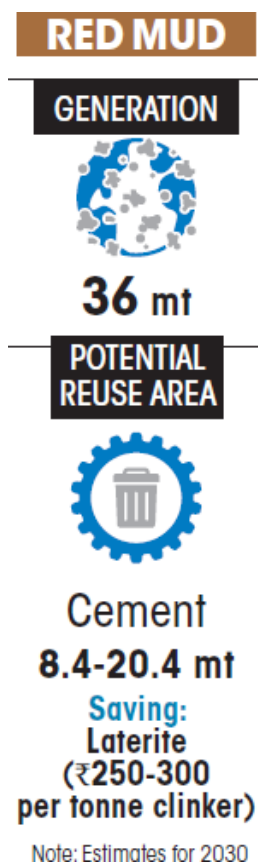
- Utilizing this by-product as an iron additive in cement production promotes the efficient use of resources and supports circular economy principles.

- **Cost-Effectiveness:** Red mud is often available at a lower cost compared to traditional iron additives, making it an economically viable option for cement manufacturers.

- **Environmental Impact:** Incorporating red mud into cement production helps reduce the amount of waste sent to landfills, thereby minimizing the environmental footprint of both the alumina and cement industries.

- Additionally, it reduces the need for mining and processing of natural iron ores, conserving natural resources.

- **Enhanced Cement Properties:** The presence of iron oxide in red mud contributes to the strength and durability of cement.



- Studies have shown that using red mud as an additive can improve the mechanical properties of cement, making it suitable for various construction applications.

Recommendations

- Study feasibility of usage of red mud in areas such as road making, construction activities.
- The Bureau of Indian Standards should define what standard of red mud is required for what type of usage to upscale its utilisation.
- Usage of red mud as an alternative to commercial catalysts should be explored.
- Tests show red mud can be used in manufacture of X-ray shielding tiles and for extraction of rare earth elements. These need to be studied.

BAGASSE, PRESS MUD AND MOLASSES

Context

- The sugar and distillery industry generates bagasse, press mud and molasses, all of which can be completely reused within the sector

About

- The **sugar and distillery industry** is one of the most resource-intensive sectors, **generating significant quantities of by-products** such as **bagasse, press mud, and molasses**.
- **Traditionally seen as waste**, these by-products hold potential for reuse within the sector, contributing to a **circular economy** and promoting sustainable practices.
- By effectively harnessing these resources, the industry can reduce waste, lower environmental impact, and enhance economic viability.

Understanding the By-Products

- **Bagasse:** It is the fibrous residue left after extracting juice from sugarcane. It constitutes about 30% of the sugarcane's weight and is rich in cellulose and lignin.

- Bagasse is primarily used as a biofuel in cogeneration plants to produce electricity and steam.
- Additionally, it serves as a raw material for paper, packaging, and building materials.

- **Press Mud:** Also known as **filter cake**, press mud is the residual sludge obtained from the filtration of sugarcane juice.

- It contains organic matter, nutrients, and micronutrients, making it an excellent soil conditioner and fertilizer.
- Press mud can also be used in biogas production, contributing to renewable energy generation.

- **Molasses:** It is a viscous by-product of the sugar refining process, containing sugars, vitamins, and minerals.
 - It serves as a valuable feedstock for the distillery industry, where it is fermented to produce ethanol.
 - Molasses is also used in animal feed, food products, and pharmaceuticals.



Reusing By-Products Within the Sector

- **Cogeneration with Bagasse:** One of the most efficient ways to utilize bagasse is through cogeneration, where it is burned in boilers to produce steam and electricity.
 - This not only meets the energy requirements of sugar mills but also allows surplus electricity

to be sold to the grid, generating additional revenue.

- Bagasse-based cogeneration significantly reduces the industry's reliance on fossil fuels and lowers greenhouse gas emissions.
- **Press Mud as Organic Fertilizer:** Press mud's high organic content and nutrient profile make it an ideal organic fertilizer for sugarcane fields.
 - When applied to soil, it enhances soil fertility, improves water retention, and promotes healthy crop growth.
 - Using press mud as a fertilizer reduces the need for chemical fertilizers, contributing to sustainable agriculture practices.
- **Ethanol Production from Molasses:** Molasses is a key feedstock for the production of ethanol, an important biofuel.
 - Ethanol production from molasses not only provides an alternative to fossil fuels but also supports the production of by-products such as biogas and bio-compost.
 - The integration of ethanol production with sugar mills creates a closed-loop system, minimizing waste and maximizing resource efficiency.

Recommendations

- Upscale use of press mud as feedstock to manufacture compressed biogas (CBG).
- Develop pipeline infrastructure to tap the potential of CBG.
- Use spent wash along with bagasse as boiler fuel in distillery complex.
- Promote usage of surplus bagasse in industrial co-firing.

BIOMASS: AN ALTERNATE FUEL TO COAL

Context

- Develop a robust supply chain to promote greater adoption of biomass as an alternate fuel to coal

About

- **Biomass**, derived from organic materials such as *agricultural residues, forestry waste, and dedicated energy crops*, offers a viable and eco-friendly alternative to coal.
- It encompasses a variety of organic materials that can be converted into energy through processes such as combustion, gasification, and anaerobic digestion.
- However, the widespread adoption of biomass as a fuel hinges on the development of a robust supply chain that can ensure consistent availability, quality, and economic viability.

Key Components of a Robust Biomass Supply Chain

- **Feedstock Sourcing:** It includes agricultural residues (e.g., straw, husks), forestry by-products (e.g., sawdust, wood chips), and dedicated energy crops (e.g., switchgrass, miscanthus).
 - Collaboration with farmers, foresters, and landowners is essential to ensure a steady supply of biomass feedstock.
- **Collection and Transportation:** Investments in infrastructure, such as collection centers, storage facilities, and transportation networks, can help minimize losses and ensure timely delivery of biomass to processing facilities.
 - Developing regional hubs for biomass aggregation can reduce transportation costs and enhance supply chain efficiency.
- **Processing and Quality Control:** It includes drying, pelletizing, and densifying the biomass to improve its energy content and handling characteristics.



- Implementing stringent quality control measures ensures that the processed biomass meets the specifications needed for efficient combustion or gasification.
- **Market Integration:** It requires establishing supply agreements with power plants, industrial users, and other end-users.
 - Policies and incentives that promote biomass adoption, such as feed-in tariffs, renewable energy credits, and carbon pricing, can further enhance market integration.
- **Sustainability and Certification:** Implementing certification schemes that verify the environmental and social impacts of biomass production can promote responsible sourcing practices.
 - Additionally, life cycle assessments can help quantify the greenhouse gas emissions and energy balance of biomass supply chains.

Case Studies and Success Stories

- **Denmark** has invested heavily in biomass for district heating and power generation, with over 70% of its district heating sourced from biomass.
 - It has established a well-coordinated supply chain, involving farmers, cooperatives, and energy companies, to ensure a steady supply of high-quality biomass.
- In **India**, the ‘**National Policy on Biofuels**’ aims to promote the use of biomass and other renewable sources for energy production.
 - It includes measures to develop biomass supply chains, such as financial incentives for biomass-based power projects and support for research and development.

Key Recommendations

- Develop a national inventory of biomass generation and availability to overcome the dearth and non-uniformity of currently available information.
- Build a robust supply chain for biomass to aid thermal power plants that claim inadequacy of biomass pellet suppliers and enable government policies so that their full potential can be realised.

- Ensure a demand-supply balance for biomass with incentives for pellet manufacturing units and encourage farmers to set up such plants.

HAZARDOUS WASTE IN CEMENT INDUSTRY

Context

- Waste generated from myriad industries can be used as raw material and fuel in cement plants.

Nature of Hazardous Waste

- Hazardous waste encompasses a wide range of materials generated from various industries, including chemicals, pharmaceuticals, petroleum refining, and metal processing.
- These wastes often contain toxic, flammable, corrosive, or reactive substances, requiring careful handling and disposal.
- Traditional disposal methods, such as landfilling and incineration, pose environmental risks and contribute to resource depletion.



Benefits of Using Hazardous Waste in Cement Plants

- **Resource Recovery:** Cement plants can serve as resource recovery facilities by incorporating hazardous waste into their production processes.
 - It reduces the need for virgin raw materials, such as limestone, clay, and shale, conserving natural resources and minimizing environmental impact.
- **Energy Efficiency:** Many types of hazardous waste, such as waste solvents, used oils, and industrial sludge, have high calorific values and can be used as alternative fuels in cement kilns.

- Utilizing these wastes as fuel reduces the consumption of fossil fuels, lowering greenhouse gas emissions and promoting energy efficiency.
- **Safe Disposal:** The high temperatures and controlled conditions in cement kilns ensure the complete destruction of hazardous constituents in the waste, converting them into non-toxic compounds.
 - It provides a safe and effective disposal method for hazardous waste, preventing environmental contamination.
- **Economic Viability:** The use of hazardous waste as raw material and fuel can lead to significant cost savings for cement plants.
 - By reducing the need for traditional raw materials and fuels, cement manufacturers can lower production costs and enhance their profitability.

Applications and Success Stories

- The **European Cement Association (CEMBUREAU)** has reported that cement plants in the region co-process around 15% of hazardous waste, contributing to resource recovery and waste management.
- **Cement Manufacturers' Association (CMA) in India** has been actively promoting the use of hazardous waste as a raw material and fuel in cement plants.

Recommendations

- Currently, the cost of pre-processing is approximately R6,000 per tonne while that of disposal is around R4,000 a tonne.
 - Regulating these expenses will encourage industries, particularly small ones that generate lesser quantities of waste, to opt for co-processing.
- Cement plants that do not have pre-processing and waste storage facilities do not accept waste from industries that generate it in small quantities.

- Setting up common hazardous waste management facilities in industrial clusters will help.

STONE SLURRY & ITS APPLICATIONS

Context

- Slurry generated from cutting and polishing of stones can be used to make cement, tiles.

Composition of Stone Slurry

- Stone slurry is a by-product of the cutting and polishing processes used to shape and finish natural stones such as marble, granite, and limestone.
- It primarily consists of fine stone particles suspended in water, along with residues of polishing agents.
- The high content of calcium carbonate, silica, and other minerals present in the slurry makes it a valuable resource for various construction applications.

Benefits of Using Stone Slurry in Cement and Tiles

- **Resource Utilization:** Repurposing stone slurry as a raw material for cement and tiles helps reduce the extraction and consumption of virgin raw materials such as limestone and clay.
 - It promotes resource conservation and minimizes the environmental impact of mining activities.
- **Waste Reduction:** By utilizing stone slurry in the production of cement and tiles, the stone industry can significantly reduce the amount of waste generated.

STONE SLURRY

GENERATION



NA

POTENTIAL REUSE AREAS



Cement
3-7 mt (stone slurry)
1.54 mt (phosphogypsum)
Saving:
Natural gypsum (₹1,050-1,450 per tonne)



Tile
8-10.5 mt (marble slurry)
Saving:
Natural feldspar (₹100-3,900 per tonne)
Note: Estimates for 2030

- It helps alleviate the burden on landfills and mitigates the environmental pollution associated with slurry disposal.
- **Cost-Effectiveness:** Using stone slurry as a raw material can lead to cost savings for manufacturers by reducing the need for conventional raw materials.
 - The availability of slurry as a by-product makes it a cost-effective option for cement and tile production.
- **Enhanced Product Properties:** The mineral composition of stone slurry can enhance the properties of cement and tiles, such as strength, durability, and aesthetic appeal.
 - Research has shown that incorporating stone slurry into cement and tiles can improve their performance and quality.

Key Recommendations

- Upscale stone slurry utilisation in cement and tile-making, and explore alternative applications. Stone slurry can be used in wall putty, pesticides, production of lime and bricks.
- Establish regional waste management facilities for effective collection and transportation of the waste to enable its utilisation by different plants and facilities.
- Recognise its potential value in different industries, and identify plants that can uptake stone slurry.

WASTEPAPER RECYCLING IN INDIA

Context

- India's wastepaper collection rate is close to the global average, but there is still scope for improvement.

About

- Wastepaper recycling is an essential component of sustainable waste management and resource conservation.

- In recent years, India has made significant strides in improving its wastepaper collection rate, bringing it closer to the global average.
- However, there remains substantial scope for improvement to achieve higher efficiency and sustainability in the recycling sector.

Current Status of Wastepaper Collection in India

- India's wastepaper collection rate currently stands at approximately 45%, which is close to the global average of around 50%.
- It is a result of increased awareness, government initiatives, and the efforts of various stakeholders, including non-governmental organizations (NGOs), recyclers, and the paper industry.
- Its emphasis on circular economy principles has also contributed to the progress in wastepaper recycling.

Benefits of Wastepaper Recycling

- **Resource Conservation:** Recycling wastepaper reduces the need for virgin pulp, conserving forests and natural resources.
 - It also decreases the environmental impact associated with deforestation and paper production.
- **Energy and Water Savings:** The recycling process consumes significantly less energy and water compared to producing paper from raw materials.
 - It results in lower greenhouse gas emissions and reduced strain on water resources.



- **Waste Reduction:** Efficient wastepaper collection and recycling help divert waste from landfills, reducing landfill space usage and minimizing the

environmental pollution caused by decomposing paper waste.

- **Economic Opportunities:** The recycling sector provides employment opportunities and supports the livelihoods of waste collectors, recyclers, and small-scale entrepreneurs.
 - It also contributes to the economy by supplying raw materials to the paper industry.

Challenges and Areas for Improvement

- **Informal Sector Integration:** A significant portion of wastepaper collection is managed by the informal sector, which lacks proper infrastructure, training, and support.
 - Integrating the informal sector into the formal waste management system can enhance efficiency and ensure better working conditions for waste collectors.
- **Infrastructure Development:** Insufficient infrastructure for waste collection, segregation, and transportation poses a significant challenge.
 - Investing in robust and efficient waste management systems, including sorting facilities and recycling plants, is crucial for improving the collection rate.
- **Public Awareness and Participation:** Raising awareness about the importance of wastepaper recycling and encouraging public participation are essential for increasing collection rates.
 - Educational campaigns, community initiatives, and incentives can motivate individuals and businesses to actively participate in recycling efforts.
- **Policy and Regulation:** Strengthening policies and regulations to support wastepaper recycling is vital.
 - Implementing **Extended Producer Responsibility (EPR)** frameworks, providing financial incentives for recycling, and enforcing strict waste management laws can drive improvements in the sector.

Recommendations

- An integrated system for wastepaper recycling, including both the formal and informal sectors (which handles 95% of wastepaper).
- Develop extended producer responsibility (EPR) guidelines.
- Introduced quality standards for raw materials to optimise percentage of virgin paper used with recycled paper.
- Restrict the usage of imported finished paper by increasing the customs duty from the current rate of 10% to 30%.
- Use alternative materials for secondary applications of wastepaper: Agro straw for packaging of fruits; bamboo-based utensils; use of steel utensils and pattals for roadside eateries.

ROLE OF INDIGENOUS COMMUNITIES IN TACKLING ARIDITY

Context

- For the first time, the UN has recognised the role of indigenous communities in tackling aridity.
 - A repository of traditional knowledge, India has the wherewithal to lead the way.

About

- **Aridity**, characterized by **prolonged droughts and water scarcity**, poses significant challenges to ecosystems and human livelihoods.
- Indigenous communities, with their deep-rooted knowledge and sustainable practices, play a crucial role in addressing these challenges and promoting resilience.

Traditional Knowledge and Practices

- Indigenous communities have a wealth of traditional knowledge that has been passed down through generations.
- It encompasses sustainable land management practices, water conservation techniques, and the use of native plant species that are well-adapted to arid conditions.

- For example, many indigenous communities practice rainwater harvesting, terracing, and agroforestry, which help to conserve soil moisture and improve water availability.

Dry spread

Global population living in drylands has increased by 8.4% in 1990-2020

Region	Drylands (% of total geographical area)		Population in drylands (% of global population)	
	1961-1990	1991-2020	1961-1990	1991-2020
North America	21	21.3	25.7	26.4
Latin America-Caribbean	14.3	18.6	14.9	16.2
Europe	7.3	12.1	5.7	10.7
Africa	66.2	70.5	47.2	49.6
Asia	33.2	36.1	21.8	30.9
Oceania	86.3	87.9	20.7	45.8
Global (without Antarctica)	37.5	40.6	22.5	30.9

Source: The global threat of drying lands: Regional and global aridity trends and future projections

Community-Based Approaches

- Indigenous communities often employ community-based approaches to manage natural resources. These involve collective decision-making, resource sharing, and the establishment of local institutions to oversee resource management.
- By working together, these communities can implement effective strategies to mitigate the impacts of aridity and ensure the sustainable use of natural resources.

Policy and Recognition

- International frameworks, such as the **Sendai Framework for Disaster Risk Reduction** and the **Kunming-Montreal Global Biodiversity Framework**, emphasize the importance of indigenous knowledge and practices in conservation and disaster risk reduction efforts.
- Governments and organizations must work with indigenous communities to develop policies that support their sustainable practices and ensure their participation in decision-making processes.

SUBJECTIVE QUESTIONS

- How effective do you believe Community-Based Forest Management (CBFM) has been in balancing the needs of local communities with the goals of conservation, and what challenges and opportunities do you see for its future implementation?

- Discuss the significance of a circular economy in addressing plastic pollution. How might the principles of a circular economy be integrated into an international plastic pollution treaty to create a sustainable and effective solution?
- Considering the potential of International Carbon Exchange markets to address global carbon emissions, what do you believe are the key challenges and opportunities for their effective implementation, and how can these markets ensure equitable participation from all countries?

MCQS

- Term '*nilotinib*' sometimes appeared in the news, is related to:
 - Enzyme
 - Biofuel
 - Cancer drug
 - Adhesive
- Which one of the following countries recently launched its '*International Carbon Exchange*'?
 - Egypt
 - Bangladesh
 - Philippines
 - Indonesia
- With reference to the '*Marburg Virus Disease (MVD)*', consider the following statements:
 - It is caused by an Ebola-like virus (Filoviridae family).
 - It is transmitted by direct contact with the bodily fluids of infected individuals.

Which of the statements given above is/are correct?

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

4. With reference to the '*Demoiselle Cranes (Grus Virgo, aka 'Kurja' in India)*', consider the following statements:

1. These are one of the smallest crane species, known for their long migratory journeys.
2. Khichan, a village in Rajasthan, India, is a notable wintering site for these cranes, attracting around 20,000 birds annually.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only

- (c) Both 1 and 2
- (d) Neither 1 nor 2

5. '*Hollongapar Gibbon Wildlife Sanctuary*', sometimes appeared in the news, is located in:

- (a) Assam
- (b) Arunachal Pradesh
- (c) Tamil Nadu
- (d) Kerala

Answer Key: _____

1. (c) 2. (d) 3. (c) 4. (c) 5. (a)



SUMMARY OF DOWN TO EARTH

[February, 2025]

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SUBJECTIVE QUESTIONS

MCQs

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NAVIGATING INDIA'S CLEAN ENERGY TRANSITION

Context

- As global temperatures rise and the impacts of climate change intensify, there is increasing pushback against mitigation efforts. It will likely grow even as the wealthy face devastating losses, insurers struggle to cover rising costs, and insurance companies withdraw from high-risk areas.

Urgency of a Clean Energy Transition

- Transitioning to clean energy is not just about reducing emissions—it is about securing livelihoods. Millions of people still suffer from energy poverty, with unreliable, expensive, or unavailable electricity.
 - It is why Indian industries prefer **captive power generation, often relying on coal.**
- Therefore, India's strategy must focus on expanding access to energy, ensuring affordability, and making it cleaner.
- A well-executed transition to low-carbon growth can not only reduce emissions but also drive economic development.

500 GW of Clean Energy Capacity By 2030

- It aims **not to replace coal**, which currently provides **75% of India's electricity**, but to displace it by increasing the capacity of clean energy sources like solar and wind.
- By 2030, clean energy sources are expected to **generate 44% of the country's electricity demand**, requiring a more than doubling of current clean energy capacity.

Assessing the Progress of Renewable Energy Deployment

- Currently, India has around 200 GW of installed clean energy capacity, accounting for 45% of total power generation capacity as of March 2024.
- However, this capacity is not translating into adequate power generation. Non-fossil fuel power sources contribute less than a quarter of the electricity produced, and **solar and wind contribute only 13%.**
- If India is to displace coal effectively, these two sources alone must generate 30% of electricity by 2030—a target far from reality.

Key Concerns

- Mismatch Between Installed & Actual Generation Capacity:**
 - One key issue is the **capacity utilization factor (CUF) of solar and wind plants.**

While CUF data is available for government-owned plants, it is lacking for private projects, creating a transparency gap.

- Unlike thermal power plants, there is **no public database tracking renewable energy projects**, their electricity generation, or their distribution.
- Challenge of Stalled Projects and Power Purchase Agreements (PPAs):**
 - Solar Energy Corporation of India (SECI)** highlights several projects that have not been commissioned even beyond the deadline set in their **Power Purchase Agreements (PPAs).**
 - By June 2024, nearly 34.5 GW of solar, wind, and hybrid projects remained uncommissioned, despite having signed PPAs.
 - Ironically, the cost of electricity from new coal projects is now higher than that of solar energy.

Road Ahead: Fixing the Systemic Shortcomings

- If India is to achieve its 500 GW clean energy target, urgent action is needed to resolve these systemic issues:
 - Improve Data Transparency:** Establish a public database tracking all renewable energy projects, including generation data, commissioning status, and power distribution.
 - Address Project Delays:** Streamline approvals and enforce stricter adherence to PPA deadlines to prevent project stagnation.
 - Resolve PPA Bottlenecks:** Encourage state power agencies to sign PPAs, especially when renewable energy is now cheaper than coal.
 - Invest in Storage Solutions:** Accelerate the deployment of battery storage and hybrid energy systems to ensure reliability.
 - Enhance Private Sector Participation:** Reduce bureaucratic hurdles and provide clear incentives for private investors.

DRAFT NATIONAL POLICY ON AGRICULTURAL MARKETING

Context

- Recently, the Union Ministry of Agriculture and Farmers' Welfare released the Draft National Policy Framework on Agricultural Marketing (NPFAM) for public comments.

About the Policy

- It aims to create a vibrant marketing ecosystem where farmers can find markets of their choice to realize the best prices for their produce.

Summary of Down to Earth [February, 2025]

- It envisions improving the efficiency and competitiveness of agricultural markets through multiple marketing channels, transparency, infrastructure development, and innovative digital technologies.

Rationale Behind the Policy

- The draft NPFAM aims to enhance farmers' income by creating a competitive and transparent marketing ecosystem.
- It seeks to mitigate market and price uncertainties, improve market efficiency, and integrate production and marketing through digital public infrastructure.
- The policy also addresses the unsustainability of Agricultural Produce Market Committees (APMCs) and the need for value chain-centric infrastructure.

Key Features of the Draft Policy

- **Private Wholesale Markets:** The policy encourages the establishment of private wholesale agricultural markets.
 - ♦ Currently, there are 125 private wholesale markets in five states. The policy aims to expand this model to enhance market access for farmers.
- **Direct Purchases:** The draft policy promotes direct purchases by processors, exporters, organized retailers, and bulk buyers from farm gates.
 - ♦ It aims to reduce intermediaries and ensure better prices for farmers.
- **Corporate Post-Harvest Infrastructure:** The policy proposes replacing traditional market yards with corporate warehouses and silos.
 - ♦ It aims to improve storage and reduce post-harvest losses.
- **Unified National Market:** The draft policy seeks to establish a unified market fee and trading license system.
 - ♦ It aims to create a seamless national market for agricultural produce, reducing regional disparities.
- **E-Trade Platforms:** The policy allows the establishment and operation of private e-trading platforms.
 - ♦ It aims to facilitate digital transactions and improve market transparency.
- **Contract Farming:** The draft policy enables agro-processing, exporting, or trading units to enter into contracts with farmers and Farmer Producer Organizations (FPOs).
 - ♦ It aims to provide assured markets and prices for farmers.

- **Federal Committee:** The policy proposes setting up an empowered agricultural marketing reform committee comprising state agriculture ministers.
 - ♦ It aims to build consensus among states to move towards a unified national market.
- **Modernization and Technology:** The policy emphasizes leveraging cutting-edge technologies like blockchain, artificial intelligence, and machine learning to modernize supply chains and improve efficiency.

Key Concerns in Draft National Policy on Agricultural Marketing

- **Privatization and Corporate Control:** The draft policy proposes expanding private wholesale markets and promoting public-private partnerships (PPP) for improving infrastructure at Agricultural Produce Market Committee (APMC) markets.
 - ♦ However, it is argued that this could lead to corporate control over the agricultural supply chain, similar to the concerns raised during the protests against the now-repealed farm laws.
- **Lack of Legal Guarantee for MSP:** Farmers have been demanding a legal guarantee for the Minimum Support Price (MSP) for all crops.
 - ♦ Despite assurances from the government, this guarantee has not been provided, leading to continued dissatisfaction among farmers.
 - ♦ The draft policy does not address this demand, which remains a significant point of contention.
- **Implementation Challenges:** The draft policy lacks a robust grievance redressal mechanism for farmers selling in private markets.
 - ♦ Additionally, the limited window for public comments on the draft policy has been criticized as insufficient for meaningful stakeholder engagement.
- **State Autonomy and Constitutional Validity:** The draft policy proposes a unified national market, which raises questions about state autonomy and constitutional validity.
 - ♦ Agriculture and agricultural marketing are **state subjects under the Constitution**, and the central government's intervention could be seen as an overreach.
- **Impact on Small and Marginal Farmers:** The draft policy aims to address long-standing challenges in agricultural marketing, but critics argue that it does not provide sufficient support for the most vulnerable farmers.

Conclusion

- The Draft National Policy Framework on Agricultural Marketing has reignited debates

about privatization, corporate control, and the need for a legal guarantee for MSP.

- Addressing these concerns will be crucial for ensuring that the policy benefits all stakeholders, particularly small and marginal farmers.

BUDGET 2025-26: INDIA HAS A NON-PAID EMPLOYMENT CRISIS

Context

- The Union Budget 2025-26 has brought to light a significant issue plaguing India's workforce: the non-paid employment crisis.

About

- Every second employed person in India is self-employed, a statistic that is not necessarily a cause for celebration.
- Self-employment includes a wide range of activities, from running a tea stall to working on a farm to practicing as a doctor.
- However, a significant portion of this self-employment is unpaid work undertaken in household enterprises.
- This shift towards self-employment has been driven by the need for flexible work arrangements and the lack of stable, remunerative jobs.

Economic Survey 2024-25 Insights

- It highlighted the rise in self-employment as a factor driving down the unemployment rate.
- However, it also pointed out that the share of workers in regular/salaried jobs has decreased from 22.8% in 2018 to 21.7% in 2024.
- It indicates that while more people are employed, they are not necessarily earning a stable income.

Challenges Faced by the Workforce

- The Economic Survey noted that the number of casual workers has declined from 24.9% in 2017-18 to 19.8% in 2023-24, suggesting a shift towards more structured forms of self-employment.
- However, this shift has not been enough to address the income disparity and job insecurity faced by many workers.

Government Initiatives and Measures

- The Union Budget 2025-26 has proposed several measures to address the non-paid employment crisis. These include revamping the **PM SVANidhi scheme** to provide greater financial assistance to street vendors and introducing UPI-linked credit cards to facilitate better access to formal credit.
- Additionally, the budget aims to include gig workers under the **Ayushman Bharat health**

insurance scheme to provide them with social security.

- Union Finance Minister Nirmala Sitharaman's budget speech emphasized the need for **'hundred percent skilled labor with meaningful employment'** and **'seventy percent women in economic activities'** by 2047.

Conclusion

- While the Union Budget 2025-26 has taken steps to address the non-paid employment crisis, there is still a long way to go in ensuring that all workers have access to stable, remunerative jobs.
- The government's focus on skill development and women's participation in the workforce is a step in the right direction, but more needs to be done to create meaningful employment opportunities for all.

STUBBLE BURNING

Context

- Recently, Thailand ordered a crackdown on stubble burning as pollution levels spiked in Bangkok and other cities.

About

- Stubble burning, the practice of setting fire to the straw stubble left after harvesting crops like rice and wheat, is a significant environmental issue, **particularly in South Asia**.
- It is often used as a **quick and cost-effective method** to clear fields for the next planting season.

Environmental Impact

- Stubble burning contributes to severe air pollution, releasing large amounts of particulate matter (PM2.5 and PM10), carbon monoxide (CO), nitrogen oxides (NOx), and other harmful pollutants into the atmosphere.
- These pollutants can travel long distances, affecting air quality in urban areas far from the source of the fires.
- For instance, the smoke from stubble burning in Punjab and Haryana often drifts to Delhi, exacerbating the city's already poor air quality.

Health Consequences

- Exposure to the pollutants from these fires can lead to respiratory diseases, cardiovascular issues, and other serious health problems.
- Children, the elderly, and individuals with pre-existing health conditions are particularly vulnerable.

Summary of Down to Earth [February, 2025]

- The World Health Organization (WHO) has highlighted the need for sustainable agricultural practices to mitigate these health risks.
 - ♦ It recommended a safe limit of **15 µg per cubic metre**.

Key Government Initiatives to Address Stubble Burning in India

- **In-Situ Crop Residue Management:** The Ministry of Agriculture and Farmers Welfare has introduced the **Crop Residue Management (CRM) Scheme**, which supports in-situ management of crop residues.
 - ♦ It includes the procurement of CRM machines, setting up **Custom Hiring Centers (CHCs)**, and promoting the use of bio-decomposers.
 - ♦ Financial assistance is provided to farmers and cooperative societies to purchase machinery for residue management.
- **Ex-Situ Crop Residue Management:** The government is also promoting the ex-situ use of crop residues.
 - ♦ It involves utilizing paddy straw for biomass power projects, co-firing in thermal power plants, and as feedstock for 2G ethanol plants and compressed biogas plants.
 - ♦ These initiatives aim to provide alternative uses for crop residues, reducing the need for burning.
- **Prohibition and Monitoring:** The Commission on Air Quality Management (CAQM) has developed a framework for the effective prevention and control of stubble burning.
 - ♦ It includes statutory directions to state governments for implementing action plans, monitoring fire counts, and enforcing prohibitions on stubble burning.
- **Information, Education, and Communication (IEC) Activities:** The government has focused on creating awareness about the ill effects of stubble burning through IEC activities.
 - ♦ These efforts aim to educate farmers about sustainable practices and the benefits of using CRM machinery and bio-decomposers.

HIKE IN THE MINIMUM SUPPORT PRICE (MSP) FOR RAW JUTE

Context

- The Union government announced a 6% increase in the minimum support price for raw jute, to Rs 5,650 per quintal for the 2025-26 marketing season.
- It came to boost jute production, which has dropped by over 29% in the past decade, as

per advanced estimates of the Union Ministry of Agriculture and Farmers Welfare.

Key Details of the MSP Hike

- **New MSP:** The MSP for raw jute has been increased to ₹5,500 per quintal, up from ₹5,300 per quintal in the previous season.
- **Reason for Increase:** The hike is based on the recommendations of the **Commission for Agricultural Costs and Prices (CACP)**, which takes into account factors such as the cost of production, market price trends, and the need to provide a fair return to farmers.
- **Impact on Farmers:** The increase in MSP is expected to benefit jute farmers by providing them with better financial returns, thereby incentivizing the cultivation of jute and ensuring the sustainability of this crop.

Government Initiatives

- **Jute Packaging Materials (Compulsory Use in Packaging) Act, 1987:** This act mandates the use of jute packaging materials for certain commodities, thereby creating a stable demand for jute.
- **Jute Development Programs:** The government has launched several programs to improve jute cultivation techniques, enhance productivity, and provide financial assistance to farmers.
- **Promotion of Jute Products:** Efforts are being made to promote the use of jute products in various sectors, including packaging, textiles, and handicrafts.

For more details, please follow the link: <https://www.nextias.com/ca/current-affairs/23-01-2025/cabinet-announces-6-percent-hike-in-jute-msp>

PASTORALIST RIGHTS OVER GRAZING LANDS

Context

- Recently, the Himachal Pradesh Forest Department issued a notification identifying traditional pastoral routes and halt sites, directing officials to avoid afforestation in these areas.
- It is the first official recognition of pastoralist rights over grazing lands.

Background and Significance

- Pastoral communities in **Himachal Pradesh**, such as the **Gaddi, Gujjar, Kinnaura, Lahaula, and Pangwala**, have practiced seasonal migration for generations.

- These communities move their livestock between different climatic zones in search of year-round fodder.
- However, afforestation efforts have often disrupted these migratory routes, threatening the livelihoods of pastoralists.

Pastoralist Communities in India

- Pastoralists contribute to the economy through livestock rearing and milk production. India accounts for 20% of the world's livestock population.
- The livestock sector of the economy contributes 4% of GDP and 26% of agricultural gross domestic product.
- Population: About 20 million, comprising groups such as Maldharis, Van Gujjars and Rabaris, among others.

Impact on Pastoral Communities

- The notification is expected to provide significant relief to pastoral communities by safeguarding their traditional grazing lands.
- It will mobilize departments and civil society organizations to ensure that division and block-level entities act based on this decision.

- It is seen as a step towards recognizing pastoralists as legitimate users of these lands and protecting their livelihoods.

Challenges and Future Directions

- While the notification is a positive step, experts have raised concerns about its implementation.
- Some argue that the notification does not use any existing legal framework, such as the **Forest Rights Act**, to guarantee the rights of pastoralists.
- A more comprehensive order that makes the consent of gram sabha and graziers mandatory before carrying out plantations would be more effective.

KEY WELFARE SCHEMES: UNION BUDGET 2025-26

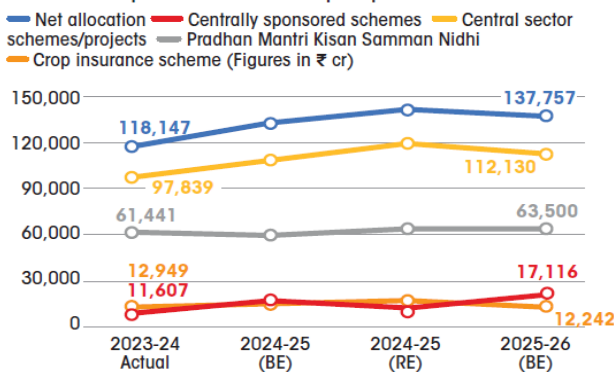
Context

- The **Union Budget 2025-26** cuts corners on key welfare schemes, offering little for climate adaptation and decarbonisation, poised to woo the middle class and tame fiscal deficit.
 - ♦ Rs 5,41,850 cr for Centrally sponsored schemes
 - ♦ Rs 16,21,899 cr for Central schemes/projects

About

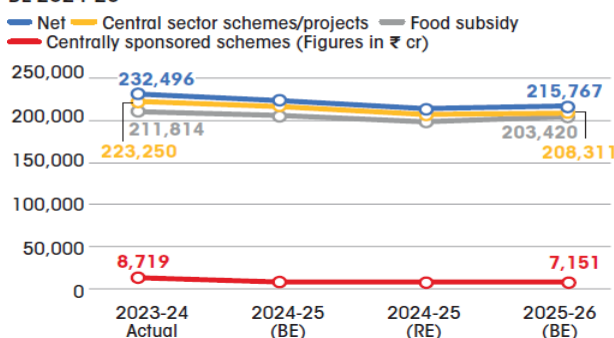
Ministry of Agriculture and Farmers Welfare

The 2025-26 allocation is lower than 2024-25, with cuts in key schemes. Crop insurance sees sharp drop



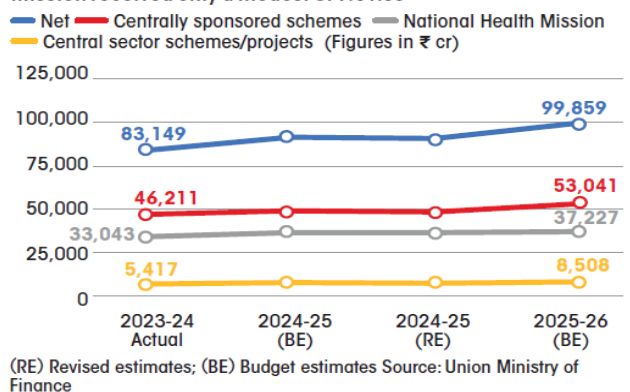
Ministry of Consumer Affairs, Food and Public Distribution

The overall allocation for food subsidy sees a reduction from BE 2024-25



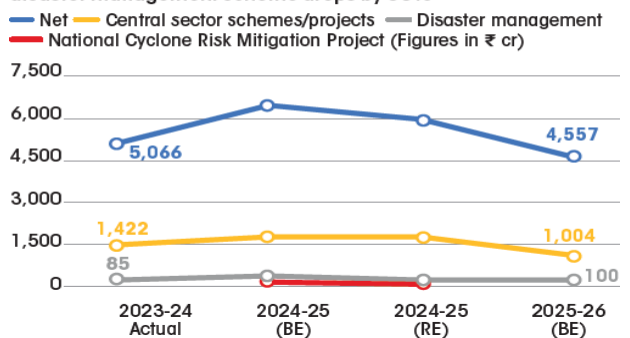
Ministry of Health and Family Welfare

While the overall budget increased by 14%, the National Health Mission received only a modest 3.4% rise



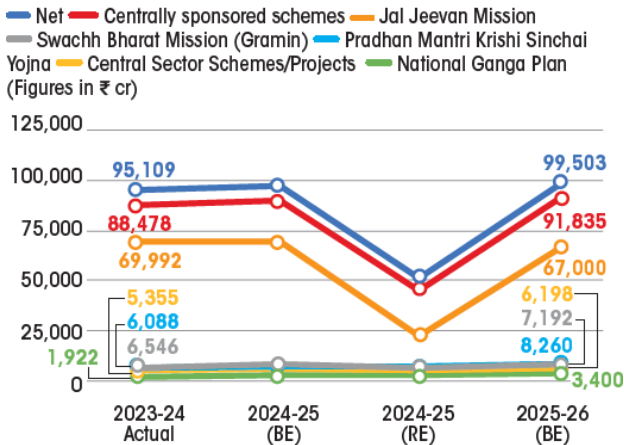
Ministry of Home Affairs

Overall budget sees a 29% cut from last year; allocation for the disaster management scheme drops by 65%



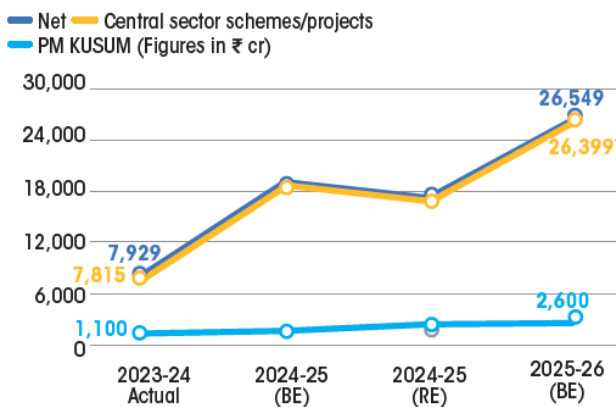
Ministry of Jal Shakti

Jal Jeevan Mission faces a 5% cut from BE 2024-25



Ministry of New and Renewable Energy

Budget for the ministry has been increased by 39%



(RE) Revised estimates; (BE) Budget estimates
Source: Union Ministry of Finance

GENOME INDIA PROJECT

Context

- Recently, the Prime Minister of India hailed the completion of the **Genome India Project**, calling it a 'historic step in the world of research' at **Genome India Data Conclave**, held at Vigyan Bhavan, New Delhi.

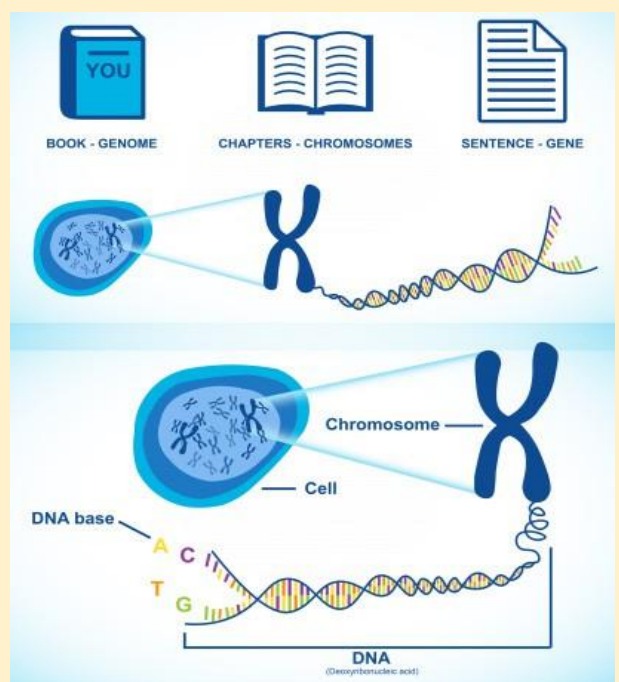
About the Genome India Project

- It was launched in 2020 by the **Department of Biotechnology (DBT)** and coordinated by the Indian Institute of Science (IISc), Bengaluru, aimed at **mapping the genetic diversity** of India's vast population.
- It involved sequencing the genomes of individuals from 99 distinct populations across the country.
- To create a comprehensive reference database of the genetic variations present in the Indian population. It aims to serve as a crucial resource for researchers and scientists, enabling them to:
 - ◆ **Understand Genetic Diversity:** India is

home to over 4,600 population groups, many of which are endogamous. It is reflected in the unique genetic variants found within these groups.

- ◆ **Improve Healthcare:** By identifying genetic predispositions to various diseases, the project aims to enhance diagnostic methods, develop personalized medicine, and improve gene therapy.
- ◆ **Advance Research:** The data generated will aid in understanding the genetic basis of diseases, leading to better-targeted clinical interventions and advancing precision medicine.

Understanding Genomes



- A genome is the complete set of **deoxyribonucleic acid (DNA)** in an organism, **containing all the genetic information** necessary for the **development, functioning, and reproduction** of that organism.
 - ◆ In living organisms, the genome is stored in long molecules of DNA called **chromosomes**.
- In humans, the genome is composed of **approximately 3.05 billion base pairs** of DNA, which are **organized into 23 pairs of chromosomes**.

Key Components of a Genome

- **DNA:** The genome is made up of DNA, a double-stranded molecule consisting of four types of bases: Adenine (A), Cytosine (C), Guanine (G), and Thymine (T).

Do You Know?

- The **discovery that DNA is structured as a 'double helix' by James Watson and Francis Crick in 1953, for which they won a Nobel Prize in 1962.**

- ♦ These bases pair specifically (A with T and C with G) to form the rungs of the DNA ladder.
- **Genes:** Segments of DNA that code for proteins or functional RNA molecules.
 - ♦ **Genes are the functional units** of heredity and play a crucial role in determining an organism's traits.
- **Non-coding Regions:** Parts of the genome that do not code for proteins but have regulatory functions, such as controlling gene expression.

Genome Sequencing

- It is the process of determining the precise order of the base pairs in a DNA molecule.
- It allows scientists to decode the genetic information contained within an organism's genome.

Key Achievements of Genome India Project

- **Completion of Genome Sequencing:** The project has successfully sequenced the **genomes of 10,000 individuals (archived at the Indian Biological Data Centre Portals)**, covering 99 ethnic groups.
 - ♦ It accounts for about 2% of India's population groups.
- **Creation of a Biobank:** A biobank housing 20,000 blood samples has been established at the Centre for Brain Research, IISc.
 - ♦ This biobank aims to support future research endeavors.
- **Phase 1 Analysis:** Detailed quality checks and joint genotyping of 5,750 samples have uncovered rare genetic variations unique to Indian populations.
- **Data Availability:** The genome data is now available at the **Indian Biological Data Center (IBDC) in Faridabad, Haryana.**
 - ♦ Researchers worldwide can access this data for further investigations.

Impact on Biotechnology and Healthcare

- **Empowering Global Research:** The launch of the **IBDC Portals** and the **Framework for**

Exchange of Data Protocols (FeED) ensures seamless access to valuable genetic information.

- ♦ It is set to position India as a leader in genomics, enabling the development of genomic chips tailored to the Indian demographic.
- ♦ Such advancements will enhance the precision of genetic studies and contribute to innovations in areas such as mRNA-based vaccines, protein manufacturing, and genetic disorder treatments.
- **Boost Public Healthcare:** By providing a genetic basis for disease prevention and treatment, the project will significantly improve public healthcare systems.
- **Promote Innovation:** The data will facilitate the development of genomic chips tailored to the Indian demographic, enhancing the precision of genetic studies.
- **Support Policy Making:** The genetic information will assist policymakers in planning and implementing health strategies tailored to the unique needs of India's diverse population.
- **Boosting Bioeconomy:** India's bioeconomy has seen impressive growth, surging from **\$10 billion in 2014** to over \$130 billion in 2024, with **projections to hit \$300 billion by 2030.**
 - ♦ This growth is a testament to the country's increasing capabilities and contributions to the global scientific community.

Key Concerns

- **Medical Ethics:** The project's stated aim is to create a genetic information database, not gene modification.
 - ♦ Gene modification remains a globally sensitive issue due to potential misuse, as seen in the case of the Chinese scientist He Jiankui, who used **CRISPR-Cas9 to create gene-edited babies.**
- **Data & Storage:** Ensuring anonymity of genetic data and addressing its possible misuse is crucial.
 - ♦ Storing data on cloud platforms raises ownership and security concerns.
 - ♦ India lacks a comprehensive **Data Privacy Bill**, creating risks for the Genome India Project.
- **Social Issues:** Genetic studies could reinforce stereotypes and fuel divisive politics, particularly around racial purity and heredity.
 - ♦ In India, debates over 'indigenous' populations could take a genetic turn.
 - ♦ Historical controversies around eugenics and 'selective breeding' highlight the sensitive nature of this subject.

Steps to Overcome Above Challenges

- **Ethical and Secure Data Sharing:** The **Biotech-PRIDE Guidelines**, introduced in 2021, underscore India's commitment to ethical and secure data sharing.
 - ♦ The launch of the **FeED Protocols** under these guidelines ensures that high-quality, nation-specific data will be shared transparently, fairly, and responsibly.
- **Data Privacy and Security:** Given the sensitivity of genetic data, the Department of Biotechnology has implemented stringent measures to ensure privacy and security.
 - ♦ The data is anonymized and encoded before being uploaded to the central database.
 - ♦ Researchers wishing to access the data must collaborate with the department and adhere to strict protocols.

Future Prospects

- Experts emphasize the need to sequence many more genomes to **uncover rare genetic mutations** and gain deeper insights into India's genetic diversity.

- Expanding the database to include a million genomes could dramatically scale the understanding of genetic variations and their implications for health and disease.

CLIMATE'S UNSOLICITED PAYOUT

Context

- Rising weather extremes are destabilising the insurance industry, driving up premium prices and pushing insurers out of high-risk markets.
 - ♦ The crisis is also spurring re-invention of the insurance sector.

About

- Climate change is reshaping the insurance industry in unprecedented ways. As extreme weather events become more frequent and severe, insurers are facing a surge in claims, leading to rising premiums and even withdrawal from high-risk markets.
- This phenomenon, often referred to as 'climate's unsolicited payout' is forcing the insurance sector to rethink its strategies and adapt to a new reality.

Extreme Weather Events in India

- India has been experiencing an increasing number of extreme weather events. In 2023, there were extreme weather events on 318 days out of 365, and in 2022, on 314 days.
- These events have a significant impact on agriculture, leading to crop losses and financial distress for farmers.

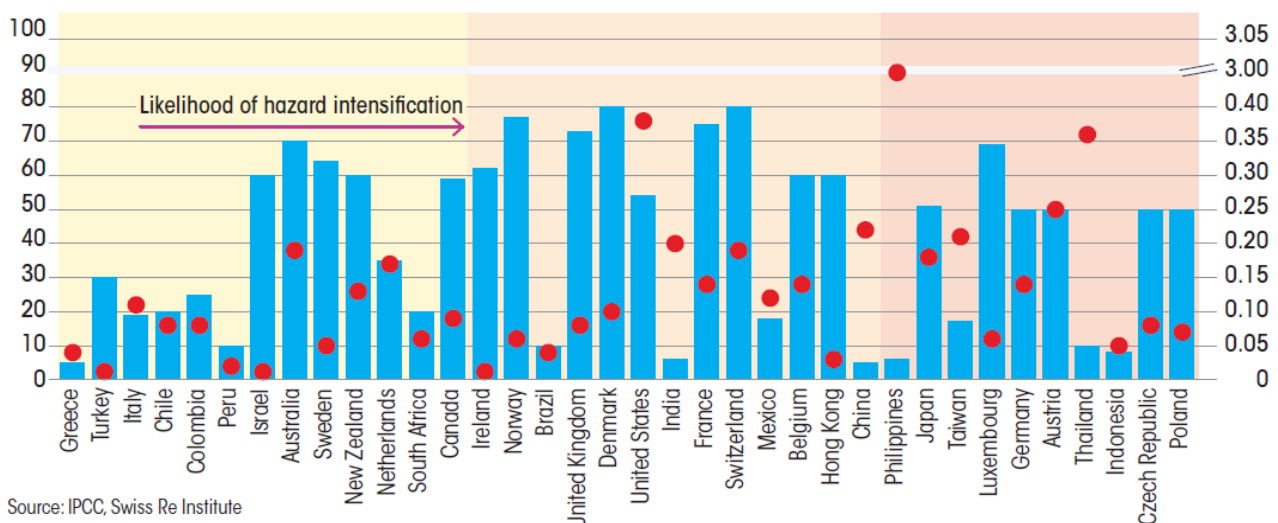
CHANGING RISK LANDSCAPE

Probability of hazard intensification and weather-related insurance resilience index per country

■ Weather insurance resilience % (LHS)

● Expected economic losses as % GDP (RHS)

Overall likelihood of hazard intensification under the scenario of 2–2.4°C warming by 2050 (based on IPCC AR6). Countries are portrayed in terms of probability of hazard intensification, from low (left) to high (right). ■ Low ■ Medium ■ High



Source: IPCC, Swiss Re Institute

Climate Risk in Indian Districts

- Official data reveals that over half (54 percent) of the country's 573 agriculturally relevant rural districts—or 310 districts—face 'very high' or 'high' risk due to climate change.

- Some 19% districts face 'very high' climate risk, and 35% are in the 'high' risk category.
- Only about 10% of districts face 'low' or 'very low' climate risk.
- The remaining 36% districts face 'medium' climate risk.

Performance of Pradhan Mantri Fasal Bima Yojana (PMFBY)

- It aims to provide insurance coverage and financial support to farmers in the event of crop failure due to natural calamities, pests, and diseases.
- It covers individual farmers for localized disasters like hailstorms, landslides, floods, and wildfires, as well as post-harvest losses from cyclones, heavy rain, and hail.

Impact of Extreme Weather

- The increasing frequency of storms, cyclones, floods, and wildfires has made these events almost an annual occurrence in many regions.
- For instance, the wildfires in Los Angeles County

in January 2025, which burned 23,000 hectares of land and caused significant damage, are a stark reminder of the growing insurance crisis.

- The probability of such disasters has shifted from once-in-a-decade to an expected annual event, destabilizing the insurance industry.

Rising Premiums and Market Withdrawal

- As insurers grapple with the rising number of claims, they are forced to increase premiums to cover the costs.
- It makes insurance unaffordable for many individuals and businesses, leading to a decrease in policy subscriptions.
- In some cases, insurers have decided to withdraw from high-risk markets altogether, leaving communities vulnerable and without coverage.

Reinventing the Insurance Sector

- The insurance industry is responding to these challenges by reinventing itself.
- Companies are exploring new models and technologies to better assess and manage climate-related risks.
- For example, leveraging data analytics, artificial intelligence, and blockchain technology can help insurers more accurately predict and price risks, ensuring sustainability in the face of climate change.

Role of Policy and Regulation

- Governments and regulatory bodies play a crucial role in addressing the impact of climate change on the insurance industry.
- Policies that promote climate resilience, such as improved building codes and land-use planning, can help reduce the risk of damage from extreme weather events.

- Additionally, financial incentives for adopting sustainable practices can encourage both insurers and policyholders to invest in climate adaptation measures.

PRELIMS

EMERGENCE OF H5N1 AVIAN INFLUENZA IN THE UK AND US

Context

- Recently, the UK confirmed its **first human case of H5N1 avian influenza** in three years.

About the Avian Influenza H5N1

- It is commonly known as **bird flu**, is a severe and highly **contagious viral disease** that poses significant threats to **both poultry and public health**.
- It is caused by **influenza A viruses** that primarily affect birds, including domestic poultry such as chickens, turkeys, and ducks, as well as wild birds.
- The virus spreads through direct contact with infected birds, their droppings, or contaminated surfaces, equipment, and clothing.
- Infected birds shed the virus in their saliva, mucus, and feces, which can contaminate the environment and facilitate further transmission.

Genomes

- Genomic analysis revealed that the infected birds carried the **D1.2 genotype**, a strain circulating in UK birds in recent months.
- It differs from the ones circulating among mammals and birds in the US, specifically the **B3.13 and D1.1 genotypes**.

About Influenza Virus

- There are four types of influenza viruses: types A, B, C and D.
 - ♦ **Influenza A** viruses infect humans and many different animals.

- ♦ **Influenza B** viruses circulate among humans and cause seasonal epidemics. Recent data showed seals also can be infected.
- ♦ **Influenza C** viruses can infect both humans and pigs but infections are generally mild and are rarely reported.
- ♦ **Influenza D** viruses primarily affect cattle and are not known to infect or cause illness in people.

US AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)

Context

- Recently, the US President announced a freeze on foreign aid funding, which has hindered global health programmes.

About USAID



- It is an independent agency of the US government, established in 1961 by President John F. Kennedy.
- It was created to consolidate various foreign assistance programs under one agency to administer civilian foreign aid and development assistance.
- It receives funding allocated in the U.S. federal budget.
- **Top Recipient:** Ukraine, Ethiopia, Jordan, Somalia etc.

Objectives and Areas of Work

- Economic development, Health and education, Food security and humanitarian assistance, Climate change mitigation and Democracy and governance.

- USAID collaborates with governments, NGOs, businesses, and international organizations, offering grants and assistance for development projects. Some notable initiatives include:
- **President's Emergency Plan for AIDS Relief (PEPFAR)**, addressing HIV/AIDS treatment and prevention.
- Feed the Future, tackling hunger and food security issues.
- Power Africa, expanding electricity access across Africa.
- Water for the World Act, improving water, sanitation, and hygiene services.

USAID's Role in India

- USAID's engagement with India began in 1951 under the India Emergency Food Aid Act signed by President Harry Truman.
- The funding freeze is unlikely to have a major impact on India, given its reduced dependence on USAID assistance.
- However, it may affect select ongoing projects in health and sanitation. In 2024, USAID allocated \$79.3 million for India's healthcare sector.

COAL PRODUCTION IN INDIA

Context

- Recently, Jharkhand Chief Minister has urged the Union Minister for Coal and Mines to clear the state's coal dues amounting to Rs 1.36 trillion.

About the Coal Production in India

- India is the **second largest coal producer** in the world, **after China**. The all India Production of coal during 2023-24 was 997.83 MT with a positive growth of 11.71%.
- Jharkhand is the **country's largest coal producer**, accounting for **26% of the coal reserves**.
 - ♦ In 2023, it produced nearly 157 million tonnes of coal.
- According to the Jharkhand government, the Centre owes it Rs 1.01 lakh crore for land acquisition for mining, Rs 32,000 crore for common cause judgement and Rs 2,900 crore on royalties payable on washed coal.

Key Points

- **Outstanding Dues:** The Jharkhand government highlighted the significant outstanding dues from coal mining operations in the state. These dues

have been a long-standing issue, impacting the state's financial health.

- **Land Management:** He emphasized that lands on which mining operations have been completed **should be returned** to the Jharkhand government.
 - ♦ He pointed out that **many coal projects** in the state have **abandoned lands, leading to illegal mining activities.**
- **Environmental Concerns:** He stressed the need to reduce the environmental damage caused by mining activities.
 - ♦ He suggested that coal companies take initiatives to open permanent training centres, encourage mining tourism, and shift the headquarters of Coal India to Jharkhand from West Bengal.
- **Collaboration:** Union Minister for Coal and Mines directed central government officials to collaborate with the state government to verify the authenticity of the claims and ensure proper management of coal mining, production, transportation, land acquisition, and compensation.

SANTA ANA WINDS

Context

- Climate change increased the likelihood of the wildfires in California that made it more severe with strong Santa Ana winds.

About the Santa Ana Winds

- These are katabatic winds that originate from **high-pressure air masses in the Great Basin and upper Mojave Desert**, sweeping down through mountain passes and canyons to the coastal regions
- These are often referred to as 'devil winds' due to their hot, dry, and strong nature.

Characteristics of Santa Ana Winds

- Hot and extremely dry, with low relative humidity, that can bring the hottest weather of the year to **Southern California.**
- These winds are **known for creating critical fire weather conditions**, as the combination of high wind speeds, warm air, and low humidity can fan destructive wildfires.

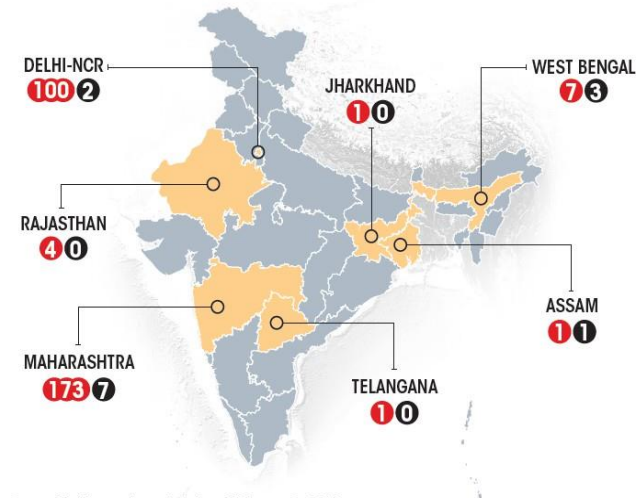
GUILLAIN-BARRÉ SYNDROME

Context

- Recently, an outbreak of Guillain-Barré syndrome was reported across different regions in India.

About the Guillain-Barré Syndrome (GBS)

● Cases confirmed ● Deaths (suspected or confirmed)



Source: Media reports (updated as of February 9, 2025)

- It is a rare autoimmune disorder in which the body's immune system mistakenly attacks the peripheral nerves.
- It can lead to muscle weakness, numbness, and even paralysis.
- The exact cause of GBS is unknown, but it is often preceded by an infection, such as respiratory or gastrointestinal infections, including COVID-19.

Symptoms and Diagnosis

- GBS typically begins with tingling and weakness in the feet and legs, which can spread to the upper body.
- Other symptoms may include difficulty walking, facial weakness, difficulty swallowing, and in severe cases, respiratory failure.
- Diagnosis is based on clinical observations and tests such as nerve conduction studies and lumbar punctures.

Treatment and Recovery

- While there is no cure for GBS, treatments such as **intravenous immunoglobulin (IVIG) and plasma exchange (plasmapheresis)** can help reduce symptoms and speed up recovery.
- Supportive care, including physical therapy and pain management, is also crucial.
- Most people recover fully, but recovery can take months or even years.

Prevention and Awareness

- Preventing infections that can trigger GBS, such as through vaccination and good hygiene practices, is key to reducing the risk.
- Raising awareness about the symptoms and early signs of GBS can also help ensure timely medical intervention and better outcomes.

DISASTER RISK TRANSFER PARAMETRIC INSURANCE SOLUTION

Context

- Nagaland became India's first state to insure its entire area under **Disaster Risk Transfer Parametric Insurance Solution (DRTPS)** to protect the state's infrastructure and reduce economic losses due to disaster in 2024.

About DRTPS

- It is an innovative financial mechanism designed to provide quick and efficient payouts to governments and organizations in the event of natural disasters.
- It is triggered by specific, pre-defined events, such as the intensity of a storm or the occurrence of an earthquake, rather than by the actual losses incurred.
- It allows for faster financial support, helping to mitigate the economic impact of disasters and accelerate recovery efforts.

Working of Parametric Insurance

- Unlike traditional insurance, which requires detailed damage assessments and can take weeks or months to process claims, parametric insurance provides **pre-determined payouts** based on the occurrence of specific events.
- It means that once the event meets the pre-defined criteria, the insured receives financial support quickly, often within days or weeks.

Significance

- The DRTPS initiative is expected to improve disaster resilience and ensure better protection for the state's people and resources.

- Providing quick payouts after disasters helps to ensure rapid recovery and reduces economic losses, making it a valuable tool for disaster risk management.

ENGAGING COMMUNITIES TO SAFEGUARD OCEAN LIFE

Context

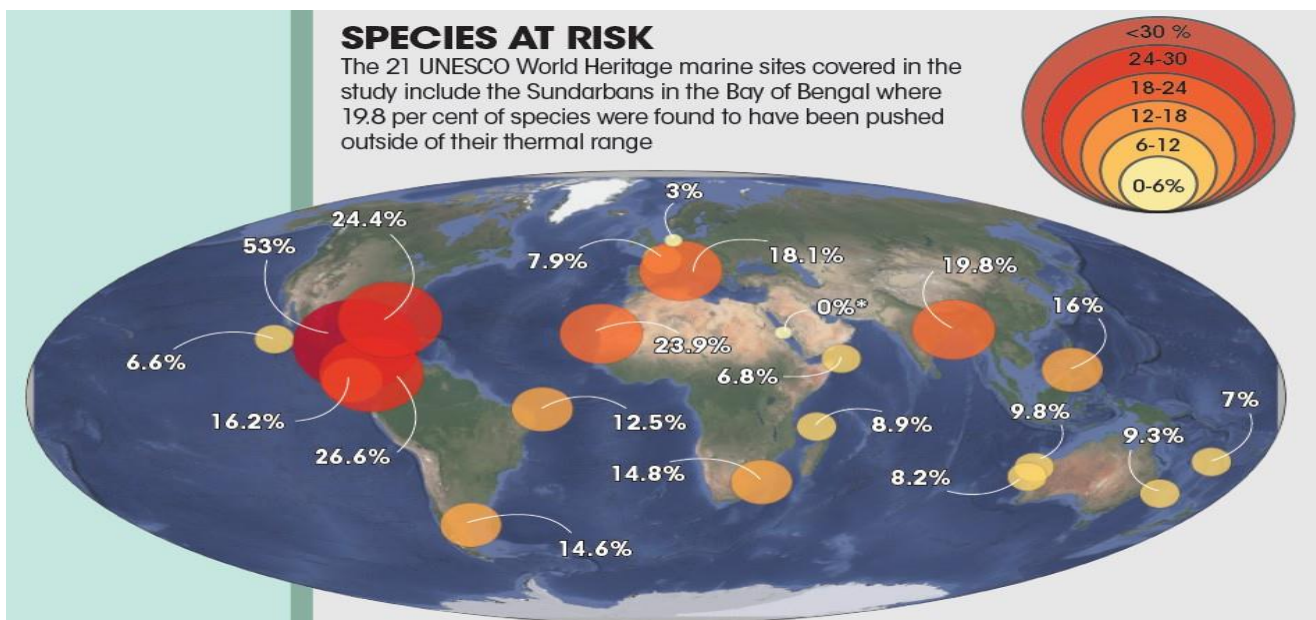
- A recent analysis by UNESCO has revealed that nearly 20% of species residing in UNESCO's World Heritage Marine Sites live in unsuitably warm waters.

Key Findings of Engaging Communities to Safeguard Ocean Life

- About 881 out of 4,406 species mapped in 21 of UNESCO's 51 World Heritage marine sites have reached or exceeded their thermal limits.
- These species include 342 fish species, 135 species of algae, and 76 species of molluscs.
- Notably, five species of mammals and seven species of sharks are also affected.

Affected Species

- Among the mammals, species such as the Atlantic bottlenose dolphin, West Indian manatee, southern elephant seal, True's beaked whale, and Crabeater seal are living in areas with unsuitable temperatures.
- The shark species affected include the lesser sandshark, Whitespotted eagle ray, Caribbean reef shark, Southern stingray, Krefft's ray, Lemon shark, and yellow stingray.



Thermal Limit Hotspots

- The **Belize Barrier Reef Reserve System** has the highest percentage of species living at their thermal limits, with 53% of its species affected.
- **Coiba National Park in Panama** follows with 26.6%, and Everglades National Park in the USA with 24.4%.
- Other notable sites include Banc d'Arguin National Park in Mauritania (23.9%) and the Sundarbans in the Bay of Bengal (19.8%).

Impact of Warming Waters

- Warming oceans impose significant stress on marine life, affecting food availability, reproduction, and overall well-being.
- Species under heat stress exhibit reduced reproductive rates and increased vulnerability to disease.
- While some species may adapt or migrate to cooler waters, many are unlikely to survive in conditions beyond their tolerance.

Ocean Heat Trends

- Global sea surface temperatures have increased by approximately 1°C since 1884, and projections suggest a potential rise of 4.4°C by the end of the century if emissions continue unchecked.
- This increase in ocean temperatures disrupts oxygen and nutrient circulation, vital for marine life, and poses a threat to marine ecosystems.

SUBJECTIVE QUESTIONS

1. Considering the multiple facets of India's clean energy transition, including the adoption of renewable energy sources, grid modernization, and energy efficiency measures, what strategies and policies should the government prioritize to ensure a sustainable and inclusive energy future for the country?
2. Given the objectives and proposed changes in the Draft National Policy on Agricultural Marketing, what are the potential benefits and challenges of implementing this policy?
3. What strategies and policy interventions do you believe are necessary to effectively reduce stubble burning while ensuring the economic well-being of farmers?
4. In light of the recent recognition of traditional pastoral routes and the restrictions on afforestation in key grazing areas by the Himachal Pradesh Forest Department, what are the potential benefits and challenges of safeguarding pastoralist rights over grazing lands?

MCQS

1. With reference to the *India's 500 GW of Clean Energy Capacity By 2030*, consider the following statements:
 1. It aims to replace coal with clean energy sources like solar and wind.
 2. Clean energy sources are expected to generate 44% of the country's electricity demand by 2030.

Which of the statements given above is/are correct?

- (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2
 - (d) Neither 1 nor 2
2. Pastoral communities like *Gaddi, Kinnaura, Lahaula, and Pangwala* primarily located in which of the following Indian states or Union Territories?
 - (a) Uttarakhand
 - (b) Jammu & Kashmir
 - (c) Himachal Pradesh
 - (d) Ladakh
 3. Genotypes like *D1.2, B3.13 and D1.1*, sometimes appeared in the news, primarily is in the context of:
 - (a) Avian Influenza (H5N1)
 - (b) Malaria
 - (c) Tuberculosis (TB)
 - (d) Swine Flu (H1N1)
 4. With reference to the *Guillain-Barré Syndrome (GBS)*, consider the following statements:
 1. It is a rare autoimmune disorder in which the body's immune system mistakenly attacks the peripheral nerves.
 2. Plasma exchange (plasmapheresis) can help reduce symptoms and speed up recovery.

Which of the statements given above is/are correct?

- (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2
 - (d) Neither 1 nor 2
5. Which one of the following Indian states is first to insure its entire area under *Disaster Risk Transfer Parametric Insurance Solution (DRTPS)* to protect the state's infrastructure and reduce economic losses due to disaster in 2024?
 - (a) Sikkim
 - (b) Assam
 - (c) Arunachal Pradesh
 - (d) Nagaland

Answer key: 1. (b) 2. (c) 3. (a) 4. (c) 5. (d)

