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SUNDAY, 5th OCTOBER 2025

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1. James Webb Space Telescope (JWST) and Dark Star

- **Prelims** - James Webb Space Telescope and Dark Star
- **Mains** - GS 3 - Science and Technology

Why in the news?

- Astronomers have unearthed evidence that some of the earliest luminous objects in the universe may be "dark stars" by using James Webb Space Telescope.

James Webb Space Telescope (JWST)

- **Launch**: 2021
- **Launch Vehicle**: Ariane-5 rocket (from French Guiana).
- **Orbit**: Second Lagrange Point (L2), about 1.5 million km from Earth- a stable point for deep-space observation.
- **Space Agencies Involved**: It is a joint collaboration between NASA (USA), ESA (European Space Agency), and CSA (Canadian Space Agency).
- **Objective**
  - ➔ **Study Early Universe**: Observe the first galaxies and stars formed after the Big Bang (~13.5 billion years ago).
  - ➔ **Exoplanet Exploration**: Analyse atmospheres of exoplanets to detect signs of habitability and potential biosignatures.
  - ➔ **Star and Planet Formation**: Investigate birth of stars and formation of planetary systems from interstellar dust.
  - ➔ **Infrared Astronomy**: Detect light from distant, faint, and cool objects invisible to optical telescopes.
- **Major Discoveries**
  - ➔ Detected galaxies formed just 320 million years after the Big Bang- the earliest known.
  - ➔ Found complex organic molecules in interstellar space.
  - ➔ Captured detailed spectra of exoplanets like WASP-39b showing atmospheric chemistry.
  - ➔ Observed stellar nurseries like the Carina Nebula and Pillars of Creation in unprecedented detail.
  - ➔ Provided insights into dark matter distribution and galactic evolution.

Dark Star

- Proposed by Katherine Freese and colleagues (University of Michigan) in 2007.
- These stars are powered by dark matter annihilation energy rather than nuclear fusion.
- Instead of burning hydrogen like normal stars, they convert dark matter particles (e.g., WIMPs – Weakly Interacting Massive Particles) into radiation, which prevents collapse and keeps the star stable.
- They could grow up to millions of times the mass of the Sun, making them supermassive and extremely luminous in infrared wavelengths- consistent with JWST observations.

2. NATO Pipeline System (NPS)

- **Prelims** - NATO Pipeline System
- **Mains** - GS 2 - International Relations

Why in the news?

- Poland announced plans to join NATO Pipeline System (NPS) with a €4.7 billion investment.

NATO Pipeline System (NPS)

- **What is it?**: The NATO Pipeline System (NPS) is an integrated fuel distribution and storage network managed collectively by the North Atlantic Treaty Organization (NATO).
- **Aim**: It ensures strategic fuel supply to allied military forces during both peacetime and wartime operations.
- **Background**
  - ➔ Established during the Cold War (1950s–60s) to secure logistical autonomy for NATO forces against potential Soviet threats.
  - ➔ Built to transport, store, and distribute petroleum, oil, and lubricants (POL) across member territories in Europe.
- **Strategic Importance**
  - ➔ Ensures fuel security and rapid mobility of NATO forces.
  - ➔ Reduces dependency on civilian or external suppliers during crises.
  - ➔ Serves as a dual-use infrastructure, supporting both military and civilian aviation and transport sectors.
  - ➔ Strengthens energy resilience within the alliance.

3. PM Dhan-Dhaanya Krishi Yojana (PMDDY)

- **Prelims** - PM Dhan-Dhaanya Krishi Yojana (PMDDY)
- **Mains** - GS 3 - Economy

Why in the news?

- The Centre announced 100 Aspirational Agriculture Districts to be developed under the Prime Minister Dhan-Dhaanya Krishi Yojana (PMDDKY) across 29 states and UTs.

PM Dhan-Dhaanya Krishi Yojana (PMDDY)

- **Type**: Centrally Sponsored Scheme
- **Implementation Period**: 6 years (FY 2025–26 to 2030–31)
- **Annual Outlay**: ₹24,000 crore
- **Coverage**: 100 agricultural districts
- **Modelled On:** Aspirational Districts Programme (ADP)
- **Objective**
  - ➔ Enhance agricultural productivity
  - ➔ Promote crop diversification and sustainable practices
  - ➔ Improve post-harvest storage at panchayat/block level
  - ➔ Strengthen irrigation infrastructure
  - ➔ Ensure access to short-term and long-term credit
- **Features**
  - ➔ Convergence of 36 schemes from 11 ministries
  - ➔ District Agriculture and Allied Activities Plan (DAAAP) to be prepared by:
    - ★ District Dhan Dhaanya Samiti, headed by the District Collector
    - ★ Will include progressive farmers
  - ➔ Technical support: Central & State Agriculture Universities
  - ➔ Monitoring: Committees at National, State, and District levels
  - ➔ Field Monitoring: Central Nodal Officers (CNOs)
  - ➔ Digital Dashboard: Portal for real-time monitoring and ranking
  - ➔ District Ranking: Based on 117 Key Performance Indicators (KPIs)
- **Implementation Strategy**
  - ➔ Bottom-up planning with agro-climatic zone-based approach

- ➔ Alignment with national goals:
  - ★ Natural and organic farming
  - ★ Soil and water conservation
  - ★ Self-sufficiency in agriculture

- **Selection Criteria for Districts**
  - ➔ Low productivity
  - ➔ Moderate crop intensity
  - ➔ Below-average credit availability

4. Online Gaming in India

- **Prelims -** Online Gaming in India
- **Mains** - GS 3 - Economy

Why in the news?

- The Ministry of Electronics and IT (MeitY) has released draft rules for online gaming.

Online Gaming in India

- **Definition:** Online gaming refers to the playing of video games over the internet, often in multiplayer formats, involving interaction with other players.
- **Potential**
  - ➔ India has one of the world's largest and fastest-growing online gaming markets.
  - ➔ This sector contributes to revenue generation, job creation, and the development of the digital economy.
  - ➔ It fosters innovation in areas like esports, live streaming, and gaming technology.
- **Concerns**
  - ➔ **Addiction and Mental Health**: Excessive gaming can lead to addiction, impacting academic performance, social interactions, and mental well-being. This is a particular concern for children and young adults.
  - ➔ **Financial Risks**: In-app purchases, loot boxes, and predatory practices can lead to financial losses for gamers, especially vulnerable groups.
  - ➔ **Cyberbullying and Harassment**: Online gaming platforms can be breeding grounds for cyberbullying, harassment, and exposure to inappropriate content.
  - ➔ **Data Privacy and Security**: User data collected by online gaming platforms is vulnerable to breaches and misuse.
  - ➔ **Lack of Regulation**: The current regulatory framework for online gaming is fragmented and evolving, leading to uncertainties and challenges.

- **Government Initiatives**

  ➔ **Setting up regulatory frameworks**: Some states have initiated steps to regulate online gaming activities through legislation or regulatory authorities.

  ➔ **Awareness programs**: Government initiatives to raise awareness about responsible gaming practices and the risks associated with online gaming addiction.

  ➔ **Promotion and Regulation of Online Gaming Bill, 2025**: The Parliament has passed the bill in view of protecting citizens from the menace of online money games and regulating online games.

5. Dairying Sector in India

- **Prelims** - Dairying Sector in India
- **Mains** - GS 3 - Economy

Why in the News?

- The Union Cooperation Minister Shri. Amit Shah said that India's dairy sector is the fastest growing in the world.

Dairying Sector in India

- **History of Indian Dairy Sector:**
  - ➔ In India, milk production was unorganised and fragmented during the Colonial period.
  - ➔ The British set up **military dairy farms** for supplying milk to the cantonments.
  - ➔ First **modern dairy plant (Kolar Dairy, Karnataka)** established in **1893** by the British.
  - ➔ By the 1940s, rising urban demand had led to milk shortages in cities.
  - ➔ **Kaira District Cooperative Milk Producers' Union Ltd. (Amul)** was founded in 1946 in Anand, Gujarat, under **Sardar Patel & Tribhuvandas Patel**, guided by **Dr. Verghese Kurien.**
  - ➔ The government launched the Integrated **Dairy Development Programme** in 1955 with UNICEF aid.
  - ➔ The **National Dairy Development Board (NDDB)** was established in 1965 in Anand under Dr. Varghese Kurien.
  - ➔ In 1970, **Operation Flood** was launched by NDDB as the **World's largest dairy development programme**, led by Dr. Kurien - Known as the White Revolution.
  - ➔ It helped India become the **largest milk producer in the world in 1998.**
- **Current Status of Indian Dairy:**
  - ➔ India is ranked 1st in milk production.
  - ➔ India contributes ~**24% of world milk production**.
  - ➔ **Digital initiatives:** e-GOPALA app for breeding services; AI-driven supply chain.

- **Success of Indian Dairy Sector:**
  - ➔ **Global Price Competitiveness:** India's farm-gate milk prices are quite competitive, comparable to the U.S. and lower than the EU and New Zealand.
  - ➔ **Cost-Efficient Production:** Despite low yields, overall production costs remain low thanks to the abundant and inexpensive labour, use of cheap fodder etc.
  - ➔ **Highly Efficient Cooperatives:** Success of AMUL and Anand Model Cooperatives in Indian states helped in strengthening the Diary sector.
- **Challenges:**
  - ➔ **Production Challenges:** Low productivity of animals, Lack of balanced diets to the cattle, Lack of Mechanisation due to Small-holder scenario.
  - ➔ **Supply Challenges:** Fragmented supply chains, Infrastructure gaps(e.g.: Cold storages), and Perishability of Milk.
  - ➔ **Price Constraints:** Price volatility, Unorganised markets and small-holder scenarios causes poor returns for farmers.
  - ➔ **Climate and Environmental Concerns:** Methane emissions from the dairy sector(~25% of India's methane emissions) as well as Heat stress related reduction in production.
  - ➔ **Quality and Value Addition:** Adulteration concerns and Inadequate value addition facilities.
- **Way Forward:**
  - ➔ **Genetic improvement:** Artificial Insemination, sex-sorted semen, indigenous breed conservation.
  - ➔ **Fodder development:** Protein-rich crops, hydroponics, silage adoption.
  - ➔ **Infrastructure:** Chilling plants, cold chains, rural logistics.
  - ➔ **Mechanisation:** Low-cost milking machines, solar chilling.
  - ➔ **Climate mitigation:** Methane-reducing feed additives, resilient breeds.
  - ➔ **Market reforms:** Digital milk procurement, contract farming, wider cooperative coverage.
  - ➔ Promotion of **value-added dairy exports**.

6. Mud Volcano

- **Prelims -** Mud Volcano
- **Mains -** GS 1 - Geography

Why in the news?

- India's only mud volcano erupted on the Baratang island in the Andaman and Nicobar archipelago on October 2 after a gap of two decades

Mud Volcano

- **Definition**: A geological formation where mud, water, and gases (like methane) erupt to the surface, forming cones or craters.
- **Formation**
  - ➔ **Subsurface Gas Accumulation**: Gases build pressure in underground sediment layers.
  - ➔ **Hydrothermal Activity**: The interaction of water and heat pushes mud and gases to the surface.
  - ➔ **Eruption**: Mud and gases escape through cracks or vents.
- **Features**
  - ➔ **Composition**: Mud, water, methane, carbon dioxide, and hydrogen sulfide.
  - ➔ **Temperature**: Cool or warm (not hot like magma).
  - ➔ **Eruption Patterns:** Slow bubbling to explosive outbursts, depending on gas pressure.
- **Global Distribution in Asia**
  - ➔ **India**: Baratang Island, Andaman and Nicobar Islands.
  - ➔ **Azerbaijan**: Caspian Sea region.
  - ➔ **Pakistan**: Hingol National Park, Baluchistan.

7. Snow Leopard

- **Prelims -** Snow Leopard
- **Mains -** GS 3 - Environment

Snow Leopard

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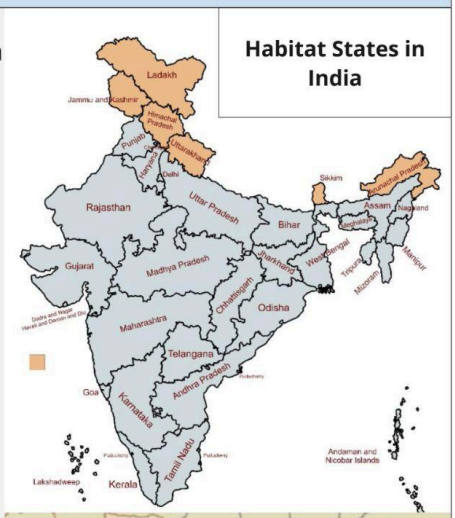
Why in news?

- Snow leopard population in Himachal Pradesh has seen an increase from 51 to 83.

Snow Leopard

- **Other Name**: Also called ghost of the mountains' in India's easternmost tiger reserve.
- **Altitude Range**: 3,000 – 5,500 metres
- **Ecosystem**: Alpine and subalpine zones
- **Conservation Reserves**
  - Hemis National Park (Ladakh)
  - Nanda Devi Biosphere Reserve
  - Gangotri NP
  - Great Himalayan NP
- **Significance**: Snow leopards act as an indicator of the health of the mountain ecosystem due to their position as the top predator in the food web.
- **Protection Status**
  - **IUCN** - Vulnerable
  - **CITES** - Appendix I
  - **Wildlife (Protection) Act 1972** - Schedule I
- **Threats**
  - Poaching (for fur, bones)
  - Habitat loss due to infrastructure, climate change
  - Human-wildlife conflict with herders
  - Decline in prey species
- **National Initiatives**
  - **Project Snow Leopard (2009)**: Conservation model integrating community participation
  - **SECURE Himalaya Project (2017)**: Partnership between MoEFCC and UNDP. Aim to sustainable development & biodiversity conservation in high-altitude landscapes.
- **Global Level**
  - **GSLEP (Global Snow Leopard and Ecosystem Protection Program)**: Intergovernmental alliance of 12 range countries.India is a signatory



Snow Leopard Range Countries