DAILY CURRENT AFFAIRS 27-02-2025

GS-1

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GS-3

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Gulf of Tonkin

Syllabus: GS-1; Geography-Mapping, GS-2; International Relations

Context

- China launched live-fire exercises in the Gulf of Tonkin after Vietnam marked new maritime boundaries, escalating tensions over territorial disputes.

About

- The **Gulf of Tonkin** is a crucial geopolitical and historical region located in the northwestern part of the **South China Sea**, bordering **Vietnam and China**. It has been significant in both modern history and international relations.

Geographical Importance:

- **Location**:
  - Lies between **China (Guangxi province) and Vietnam**.
  - It is part of the **South China Sea**, a region known for strategic and economic significance.
- **Economic Importance**:

- Rich in **marine resources** and **fisheries**.
- Potential **oil and natural gas reserves** make it an area of economic interest.

➢ **Strategic Significance**:

- Lies near key maritime routes.
- Part of the broader **South China Sea disputes**, with China and Vietnam involved in territorial claims.

Historical Importance: The Gulf of Tonkin Incident (1964)

➢ **Background**:

- In August 1964, two alleged attacks on **U.S. naval vessels** (USS Maddox and USS Turner Joy) by **North Vietnamese** forces occurred in the Gulf of Tonkin.

➢ **Gulf of Tonkin Resolution (1964)**:

- Passed by the **U.S. Congress**, allowing the U.S. President **Lyndon B. Johnson** to escalate military involvement in **Vietnam** without a formal declaration of war.
- Marked the beginning of **large-scale U.S. intervention in the Vietnam War**.

➢ **Controversy**:

- Later investigations suggested that the second attack **may not have happened**, and the U.S. government possibly **misrepresented facts** to justify war escalation.

Selenium

Syllabus: GS-3; General Science

Context

➢ Incidents of sudden hair loss in Maharashtra's Buldhana district, which made national headlines, are linked to high selenium content found in wheat from Punjab and Haryana supplied by local ration shops, as per a medical expert's report.

What is Selenium?

➢ Selenium (Se) is a **trace mineral** required in small amounts for various biological functions.
➢ It is a non-metal element (atomic number **34**) found in soil, water, and some foods.
➢ It is an essential component of enzymes and proteins that help prevent cell damage.

Biological Importance

- **Antioxidant Role**: Selenium is a key component of the enzyme **glutathione peroxidase**, which protects cells from oxidative stress.
- **Immune Function**: Strengthens the immune system and helps fight infections.
- **Thyroid Function**: Plays a crucial role in the production of thyroid hormones.
- **Prevents Diseases**: Deficiency can lead to disorders like **Keshan disease** (a heart disorder) and **Kashin-Beck disease** (a bone disorder).

Sources of Selenium

Natural Sources:

- Brazil nuts, seafood (tuna, shrimp), eggs, sunflower seeds, meat, and whole grains.
- Soil selenium content determines its presence in plant-based foods.

Deficiency & Excess:

- **Deficiency**: Can cause muscle weakness, fatigue, mental fog, and reproductive issues.

- **Toxicity**: Excess selenium (selenosis) leads to hair loss, nail brittleness, and neurological problems.

Selenium in Agriculture & Environment Soil Selenium Deficiency:

- Some regions have selenium-deficient soils, affecting plant and animal nutrition.
- Selenium biofortification (enriching crops with selenium) is being explored.

- **Environmental Impact**:

  - Selenium pollution (from mining, fossil fuels) can affect aquatic ecosystems.
  - Selenium bioaccumulation in water bodies can harm fish and wildlife.

Selenium & India

- **India has selenium-deficient regions**, especially in parts of Punjab and Haryana, affecting cattle and human health.
- **Ayurveda & Selenium**: Some traditional medicines incorporate selenium for its health benefits.
- **Recent Research**: Efforts to **fortify crops with selenium** to improve nutrition and public health.

Selenium & Space Science

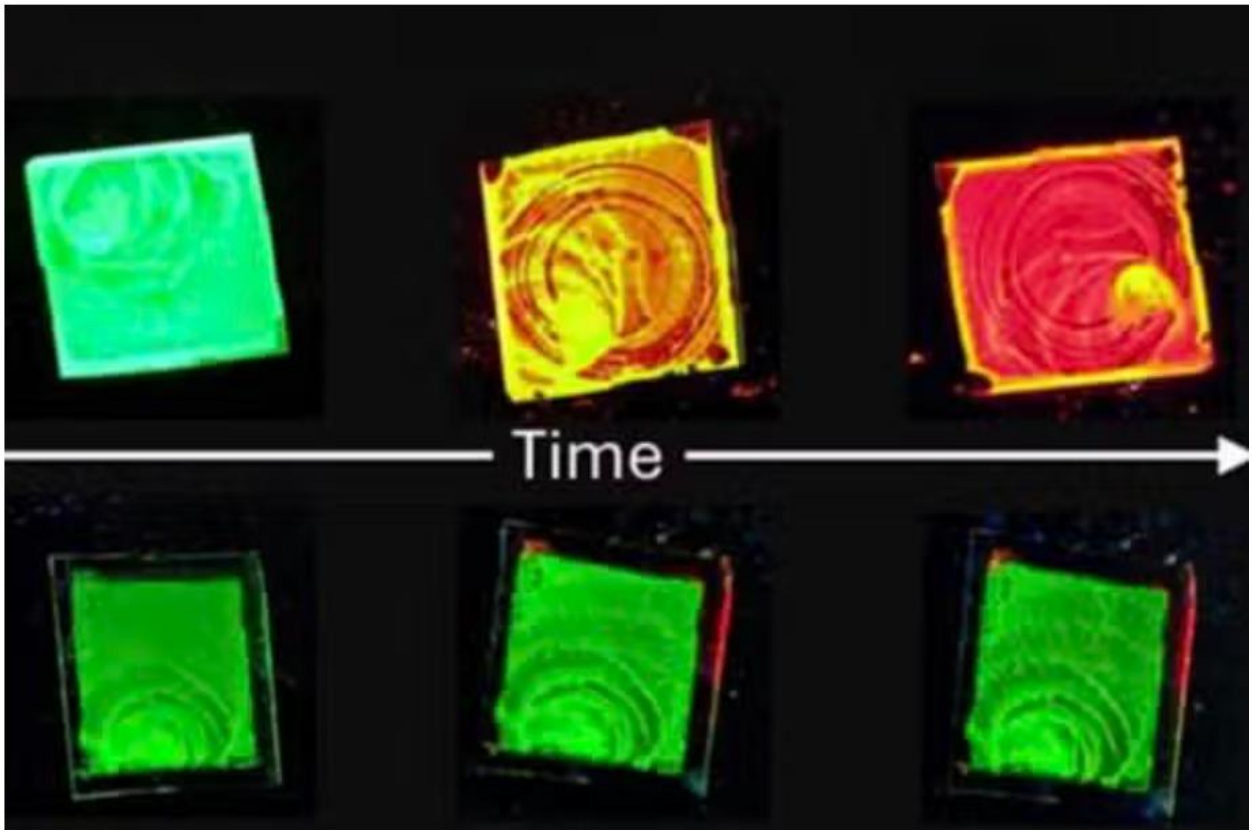
- NASA studies selenium's role in human health during space missions.
- Selenium-based materials are used in **solar cells** and **electronics**.

Perovskite-Based LEDs (PeLEDs)

Syllabus: GS-3; Science and Tech

Context

- Indian scientists have developed an innovative method to minimise anion migration in perovskite nanocrystals, addressing key challenges such as sensitivity to heat and moisture, as well as colour instability.
- Perovskite is a class of compounds which have the same type of crystal structure as CaTiO3 – Calcium Titanate.
- This breakthrough paves the way for efficient and durable optoelectronic devices, bringing perovskite-based LEDs (PeLEDs) closer to commercial viability.



Perovskite-Based LEDs (PeLEDs)

- Perovskite-Based Light-Emitting Diodes (PeLEDs) are an emerging class of light-emitting devices that utilize perovskite materials as the emissive layer.
- They are gaining attention due to their high efficiency, low cost, and potential applications in display and lighting technologies.

What are Perovskites?

- **Definition**: Perovskites are a class of materials with the general formula $\mathbf{ABX_3}$, where:
  - **A** is an organic/inorganic cation (e.g., methylammonium, cesium),
  - **B** is a metal cation (e.g., lead, tin),
  - **X** is a halide anion (e.g., iodine, bromine, chlorine).
- **Significance**: They have exceptional optoelectronic properties, making them suitable for solar cells, LEDs, and photodetectors.

Working Principle of PeLEDs

PeLEDs operate similarly to traditional LEDs:

- **Charge Injection**: Electrons and holes are injected from the electrodes.
- **Charge Transport**: These charges move through different layers of the device.
- **Recombination**: Electrons and holes recombine in the perovskite layer, emitting light.

Advantages of PeLEDs

- **High Efficiency**: Capable of achieving external quantum efficiencies (EQE) above 20%.
- **Color Tunability**: Emission wavelength can be adjusted from UV to near-infrared by changing the halide composition.
- **Low Fabrication Cost**: Solution-processable, reducing manufacturing costs compared to conventional LEDs.
- **Flexibility**: Can be integrated into flexible and wearable devices.
- **High Brightness**: Capable of high luminance, making them suitable for display technologies.

Challenges & Limitations

- **Stability Issues**: Prone to degradation due to moisture, oxygen, heat, and light exposure.
- **Lead Toxicity**: Most efficient perovskites contain lead (Pb), raising environmental and health concerns.
- **Scalability**: Large-scale manufacturing techniques need further optimization.
- **Encapsulation Requirements**: Require protective coatings to improve longevity.

Applications of PeLEDs

- **Display Technologies**: Next-generation TVs, smartphones, and VR/AR headsets.
- **Solid-State Lighting**: Energy-efficient indoor and outdoor lighting solutions.
- **Wearable Devices**: Integration into smart textiles and flexible electronics.
- **Optoelectronic Devices**: High-performance photodetectors and sensors.

Recent Developments

- **Indian Research Initiatives**: The **Indian Institute of Science (IISc), Bengaluru**, and **IITs** are working on improving the efficiency and stability of PeLEDs.
- **Global Progress**: Companies like **Samsung and TCL** are exploring perovskite materials for next-gen display panels.
- **Alternative Materials**: Lead-free perovskites (using tin or bismuth) are being developed to address toxicity concerns.

F-35 Lightening II Fighter Jet

Syllabus: GS-3; Science & Technology

Context

The two foremost Fifth Generation Fighter Aircraft (FGFA) of Russia and the U.S., the SU-57 and F-35, got a lot of attention at Aero India, which was held from February 10-14 2025 in Bangalore, with the former undoubtedly being the showstopper with its manoeuvres. Just as that wound up, U.S. President Donald Trump, addressing a press meet with Prime Minister Narendra Modi, said the U.S. is also paving the way to "ultimately" provide India with F-35 stealth fighters.

About

- The **F-35 Lightning II** is a **fifth-generation multirole stealth fighter jet** developed by **Lockheed Martin (USA)**.
- It is considered one of the most advanced fighter aircraft in the world, designed for **air superiority, ground attack, intelligence, surveillance, and reconnaissance (ISR) missions**.

Key Features of F-35 Lightning II:

1. **Stealth Technology:**
    - Uses advanced stealth coatings and design to reduce radar cross-section (RCS).
    - Can penetrate heavily defended enemy airspace undetected.
2. **Variants:**

- **F-35A** – Conventional Takeoff and Landing (CTOL) variant (used by the U.S. Air Force).
- **F-35B** – Short Takeoff and Vertical Landing (STOVL) variant (used by the U.S. Marine Corps).
- **F-35C** – Carrier-based variant with larger wings and arrestor hooks for naval operations (used by the U.S. Navy).

3. **Advanced Avionics & Sensor Fusion:**
   - Equipped with the **AN/APG-81 AESA Radar** for superior tracking and targeting.
   - Electro-Optical Targeting System (EOTS) and Distributed Aperture System (DAS) provide **360-degree situational awareness**.
   - Helmet-Mounted Display System (HMDS) allows pilots to see through the aircraft using external cameras.
4. **Supersonic Speed & Maneuverability:**
   - Powered by the **Pratt & Whitney F135 engine**, the F-35 can reach speeds of **Mach 1.6**.
   - High agility with advanced flight control systems.
5. **Weapons & Payload Capacity:**
   - Can carry a combination of **air-to-air, air-to-ground, and anti-ship missiles**.
   - Internal weapon bays for stealth operations and external hardpoints for additional payloads.
   - Capable of carrying **nuclear weapons** (F-35A variant certified for B61-12 nuclear bomb).
6. **Electronic Warfare & Cyber Capabilities:**
   - Advanced jamming and electronic warfare systems.
   - Capable of engaging in **cyber warfare and network-centric operations**.

Global Operators:

- **United States (Largest Operator)** – Air Force, Navy, and Marine Corps.
- **NATO Countries & Allies** – UK, Australia, Japan, Israel, South Korea, Italy, Netherlands, Canada, and more.
- **India's Stand:**
  - India has not procured the F-35 but operates **Rafale, Su-30MKI, and Tejas** fighters.
  - The U.S. has not officially offered the F-35 to India due to India's procurement of Russian S-400 air defense systems.

Strategic Importance:

- Enhances **deterrence and air dominance**.
- Strengthens **joint operations** between allied nations.
- Considered a key asset in **future warfare**, especially against emerging threats like **hypersonic weapons** and **swarm drone warfare**.

Challenges & Criticism:

- **High Cost:** The F-35 program is one of the most expensive military projects in history.
- **Technical Issues:** Reports of engine problems, software glitches, and maintenance difficulties.
- **Dependency on the U.S.:** Countries operating the F-35 are reliant on the U.S. for maintenance, software updates, and spare parts.

Comparison with Other Fighter Jets:

Feature	F-35 Lightning II	Su-57 (Russia)	J-20 (China)	Rafale (France)
Generation	5th Gen	5th Gen	5th Gen	4.5 Gen
Stealth	Yes	Yes	Yes	Partial
Speed	Mach 1.6	Mach 2.0	Mach 2.0	Mach 1.8
Role	Multirole	Air Superiority & Strike	Stealth Fighter	Multirole
Cost	$80-120 million	$40-60 million	$100 million+	$90 million

Kuno National Park

Syllabus: GS-3; Biodiversity

Context

- 5 Cheetahs Released Into Wild In Madhya Pradesh's Kuno National Park

About

- Kuno National Park, located in the **Sheopur district of Madhya Pradesh**, was originally established as a wildlife sanctuary in **1981** and later upgraded to a national park in **2018**. It covers an area of **748 sq. km** and is part of the larger **Kuno Wildlife Division (1,235 sq. km)**.

Location

- Situated in **Sheopur district, Madhya Pradesh**
- Lies within the **Vindhyan Hills** and forms part of the **Kuno Wildlife Division**

Geography & Climate

- Spread over **748.76 sq. km** (core area) and surrounded by a buffer zone
- Dry deciduous forest, dominated by **Anogeissus pendula (Kardhai trees)**
- Semi-arid climate, with extreme summer and winter temperatures

Historical Background

- Initially designated as **Kuno Wildlife Sanctuary (1981)**
- Upgraded to **Kuno National Park in 2018** to prepare for the **Asiatic Lion Relocation Project**
- Later chosen as the site for **Cheetah Reintroduction Project**

Cheetah Reintroduction Project

- Part of **Project Cheetah**, the world's first intercontinental wild-to-wild cheetah translocation
- **First batch (2022):** 8 cheetahs from Namibia
- **Second batch (2023):** 12 cheetahs from South Africa
- **Objective:** To reintroduce cheetahs in India after their extinction in 1952

Flora & Fauna

- **Flora:** Kardhai, Salai, Palash, Tendu, Mahua, etc.
- **Fauna:**
    - **Predators:** Indian leopard, striped hyena, jackal
    - **Herbivores:** Chital, sambar, nilgai, blackbuck
    - **Others:** Sloth bear, Indian wolf, and various bird species

Challenges & Conservation Issues

- **Cheetah Adaptation Issues** – Several cheetahs have died due to infections, habitat stress, and climatic conditions.
- **Human-Wildlife Conflict** – Villages around Kuno pose challenges for conservation.
- **Prey Base Maintenance** – Requires continuous monitoring and habitat enrichment.

- **Infrastructure for Monitoring** – Radio collaring, tracking systems, and veterinary facilities are needed.

Government Initiatives & Future Prospects

- **National Tiger Conservation Authority (NTCA)** oversees Project Cheetah.
- **Proposal to introduce cheetahs in Gandhi Sagar Wildlife Sanctuary (Madhya Pradesh)** to reduce dependency on Kuno.
- Strengthening prey base and habitat for **long-term survival of cheetahs**.

Reintroduction of Cheetahs in India – Project Cheetah

Background

- **Cheetahs were declared extinct in India in 1952** due to excessive hunting and habitat loss.
- In 2020, the Supreme Court allowed the introduction of African cheetahs on an experimental basis.
- Kuno was chosen due to its **suitable habitat** and **low human disturbance**.

Key Events of Project Cheetah

- **September 17, 2022**: **Eight cheetahs (5 females, 3 males)** from Namibia were released in Kuno by PM Narendra Modi.
- **February 18, 2023**: Another batch of **12 cheetahs from South Africa** arrived.
- **The total introduced cheetahs: 20 (including cubs born in Kuno).**

Challenges & Conservation Efforts

- **Mortality Issues**: Some cheetahs have died due to **adaptation stress, infections, and territorial fights**.
- **Lack of Prey & Space**: Conservationists suggest expanding protected areas.
- **Radio-Collaring & Monitoring**: Experts track cheetahs using **satellite collars**.

Future Plans

- The government plans to introduce **50 cheetahs in India over the next decade**.
- Efforts are being made to explore **alternative reserves** like Gandhi Sagar Wildlife Sanctuary (MP) and Mukundra Hills (Rajasthan).

Significance of Cheetah Reintroduction

- **Ecological Restoration** – Restoring the predator-prey balance in grasslands.
- **Biodiversity Conservation** – Enhancing India's wildlife diversity.
- **Tourism & Economy** – Boosting eco-tourism and local livelihoods.
- **International Collaboration** – Strengthening ties with Namibia & South Africa.