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## Prelims Exam Topics

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### CARBOSULFAN INSECTICIDE

#### Context

The **Agriculture Ministry** has proposed a **complete ban on carbosulfan**, citing risks to **human health and the environment**, based on expert recommendations under the **Insecticides Act, 1968**.

#### About Carbosulfan

- **Nature:** Broad-spectrum **carbamate insecticide, acaricide and nematicide** with systemic and contact action.
- **Uses:** Used against pests in **paddy, cotton, fruits, vegetables, sugarcane and groundnut**.
- **Formulations:** Available mainly as **emulsifiable concentrates (ECs) and granules**.

#### Working Mechanism

- **AChE Inhibition:** Carbosulfan inhibits **acetylcholinesterase (AChE)**, an enzyme needed to regulate nerve signals.
- **Neurotoxicity:** AChE inhibition causes **acetylcholine accumulation**, resulting in continuous nerve stimulation, paralysis and death of target pests.
- **Systemic Action:** It can be absorbed by **plant roots and leaves** and transported within the plant.

#### Why Is Carbosulfan Being Banned?

- **Carbofuran Formation:** Carbosulfan can break down into **carbofuran**, a highly toxic metabolite, raising concerns over its overall toxicity.
- **Human Health:** Exposure through **inhalation, skin contact or contaminated food** can cause serious neurological effects.
- **Non-Target Species:** It is highly toxic to **birds, bees and other beneficial organisms**, creating risks to agricultural biodiversity.
- **Aquatic Pollution:** Runoff from agricultural fields can contaminate **surface water and groundwater** and harm fish and aquatic invertebrates.

## **MISSION SAMRIDDH GAON**

### **Context**

The **Ministry of Rural Development (MoRD)** has launched **Mission Samriddh Gaon**, with pilot projects in **Budni and Khategaon blocks of Madhya Pradesh**.

### **About Mission Samriddh Gaon**

- **Nature:** An integrated framework for **rural development, livelihood creation and welfare delivery**.
- **Nodal Ministry:** **Ministry of Rural Development**.
- **Objective:** Build **self-reliant and economically vibrant villages** by ensuring basic amenities, sustainable livelihoods and social protection.

### **Key Features**

- **Household Saturation:** Identifies eligible households and prepares plans at the **family, Gram Panchayat and block levels** for wider coverage of government schemes.
- **Scheme Convergence:** Brings together programmes related to **agriculture, health, education, skilling, infrastructure and rural development**.
- **Integrated Farming:** Promotes **horticulture, livestock, fisheries, poultry and beekeeping** along with crop cultivation to diversify farm income.
- **Women's Livelihoods:** Supports women farmers through **advisory services, credit and enterprise opportunities**, building on the Lakhpati Didi approach.
- **Infrastructure & Value Addition:** Promotes **warehouses, cold chains and local processing** to reduce post-harvest losses and increase rural incomes.

## **JOJARI RIVER**

### **Context**

The **Supreme Court** has prohibited construction within **100 metres** of the **Jojari River** in Rajasthan

### **About Jojari River**

- **Nature:** **Seasonal river** and a tributary of the **Luni River**.
- **Origin:** Rises from the hills near **Poondloo village in Nagaur district, Rajasthan**.
- **Course:** Flows for about **83 km** through the Jodhpur region before joining the **Luni River**.

- **Jojari–Bandi–Luni Linkage:** The Jojari and Bandi rivers merge with the Luni near Balotra, forming part of the drainage system of western Rajasthan.

## **NEELAKURINJI**

### **Context**

The **Ministry of Environment, Forest and Climate Change (MoEFCC)** has urged the **National Green Tribunal (NGT)** to direct **Kerala, Tamil Nadu and Karnataka** to prepare annual conservation plans for **Neelakurinji (*Strobilanthes kunthiana*)**.

### **About Neelakurinji**

- **Nature:** An **endemic shrub** of the Western Ghats.
- **Distribution:** Found mainly in the **high-altitude grasslands and shola landscapes** of **Kerala, Karnataka and Tamil Nadu**.
- **Flowering Cycle:** Typically blooms **once every 12 years**, after which it flowers, produces seeds and completes its life cycle.
- **Plietesimal Plant:** A **plietesimal species**, meaning it reproduces at long, fixed intervals rather than annually.
- **Mass Flowering:** Synchronized blooming can cover hillsides with **bluish-purple flowers**.
- **IUCN Red List:** **Vulnerable**
- **Nilgiri Hills:** The **Nilgiri Hills**, meaning “**Blue Mountains**,” are named after the bluish appearance created by mass flowering of Neelakurinji.
- **Paliyan Tribe:** The **Paliyan tribe of Tamil Nadu** traditionally uses the plant’s flowering cycle as a reference for calculating age.

## **TRISHULI RIVER**

### **Context**

A flash flood originating from a **dammed lake in Tibet** sent excess water through the **Bhote Koshi–Trishuli–Narayani river system** into Nepal.

### **About Trishuli River**

- **Nature:** A **transboundary, snow-fed Himalayan river** and an important tributary of the **Gandaki/Narayani River** in central Nepal.

- **Origin:** Rises in the **Langtang Himal of southern Tibet, China**, with the upper system linked to the **Kyirong Tsangpo and Lende Khola**.
- **Course:** Enters Nepal through **Rasuwa**, flows through **Nuwakot and Dhading**, and joins the **Kali Gandaki at Devghat** to form the **Narayani River**.
- **Ganga Linkage:** The Narayani flows into India as the **Gandak River** and ultimately joins the **Ganga**.
- **Tributaries:** **Langtang Khola, Trisuli Khola, Tadi Khola, Likhu Khola, Bhote Koshi/Kyirong Tsangpo and Lende Khola**.

## **GLOBAL DROUGHT RESILIENCE ARCHITECTURE: DRI AND DRIF**

### **Context**

The **UNCCD COP17** launched a global drought resilience framework featuring the **Drought Resilience Index (DRI)** and **Drought Resilience Investment Facility (DRIF)**.

### **Drought Resilience Index (DRI)**

- **Nature:** A global assessment tool to measure a country's **capacity to anticipate, prepare for and withstand droughts**.
- **Objective:** Identifies **structural vulnerabilities** and supports data-driven policies and investments for drought preparedness.
- **AI-Based Analysis:** Uses **AI-enabled analytics** to convert climate and geographical data into useful insights.
- **Vulnerability Mapping:** Identifies **high-risk regions** to enable targeted intervention before drought becomes a major crisis.
- **Policy Support:** Helps governments prioritise **resilience measures and investment** based on identified vulnerabilities.

### **Drought Resilience Investment Facility (DRIF)**

- **Nature:** A global financing platform focused on **drought resilience projects**.
- **Objective:** Uses public finance to **reduce investment risks and attract private and institutional capital**.
- **Priority Areas:** Supports **water security, drought-resilient agriculture, land restoration and nature-based solutions**.

- **Catalytic Finance:** Public funds act as a **risk buffer**, making resilience projects more viable for larger-scale financing.
- **Partnership Model:** Brings together **governments, financial institutions, development partners and the private sector**.

## **UN COMMITTEE ON THE ELIMINATION OF RACIAL DISCRIMINATION**

### **(UNCERD)**

#### **Context**

India has rejected observations by the **UN Committee on the Elimination of Racial Discrimination (UNCERD)** following its **11th periodic review** in Geneva, describing them as **politically motivated and malicious**.

#### **About UNCERD**

- **Nature:** Independent **UN human rights treaty body** that monitors implementation of the **International Convention on the Elimination of All Forms of Racial Discrimination (ICERD)**.
- **Composition:** Comprises **18 independent experts**.
- **Parent Treaty:** **ICERD**, adopted in **1965** and entered into force in **1969**.
- **Secretariat Support:** Supported by the **Office of the UN High Commissioner for Human Rights (OHCHR)**.

#### **Key Functions**

- **Periodic Review:** Examines reports submitted by States on measures taken to eliminate **racial discrimination**.
- **Concluding Observations:** Issues findings and recommendations on **progress, concerns and follow-up measures after** reviewing a State's record.
- **Early Warning:** Identifies situations involving serious **racial or ethnic tensions** and can recommend preventive action.
- **Complaints:** Can consider **Inter-State disputes** and individual communications where a State has accepted its competence under **Article 14 of ICERD**.

#### **UNCERD and India**

- **Ratification:** India signed ICERD in **1967** and ratified it in **1968**.

- **Domestic Framework:** Articles 14, 15, 16 and 17 of the Constitution, along with the **Protection of Civil Rights Act, 1955** and **SC/ST (Prevention of Atrocities) Act, 1989**, address equality and discrimination.
- **Caste Issue:** India maintains that **caste-based discrimination is distinct from racial discrimination** and is addressed through India's constitutional and legal framework.
- **India's Objection:** India rejected the **Committee's observations**, particularly its treatment of **caste-related discrimination within the racial-discrimination framework**, and termed the remarks **politically motivated and malicious**.

## LITHIUM CARBONATE

### Context

Prices of **battery-grade lithium carbonate** recently fell, reducing the cost of **Lithium Iron Phosphate (LFP)** energy-storage cells.

### About Lithium Carbonate

- **Nature:**  $Li_2CO_3$  is a **white crystalline inorganic salt** and an important refined lithium product.
- **Role in Batteries:** Used as a key precursor for **cathode materials**, especially **LFP and Lithium Cobalt Oxide (LCO)** batteries.
- **Other Uses:** Also used in **specialised glass, ceramics and pharmaceuticals**.

### Sources of Lithium

- **Brine Deposits:** Extracted from lithium-rich underground brines, especially in the **Lithium Triangle of Chile, Argentina and Bolivia**.
- **Hard-Rock Deposits:** Obtained from minerals such as **spodumene, lepidolite and petalite**.
- **Clay Deposits:** Lithium also occurs in **sedimentary and clay formations**.

### Role in Battery Production

- **Processing:** Lithium-bearing brine or ore is processed to obtain a concentrated lithium solution.
- **Precipitation:** **Sodium carbonate ( $Na_2CO_3$ )** is added to the solution, causing lithium carbonate to precipitate.
- **Cathode Production:** Refined lithium carbonate is combined with other materials to produce **battery cathode compounds**.

- **Battery Operation:** During charging and discharging,  $\text{Li}^+$  ions move between cathode and anode through the electrolyte.

#### Key Features

- **High Purity:** Battery-grade lithium carbonate generally requires **very high chemical purity** to avoid battery degradation.
- **Solubility:** Its **solubility in water decreases with rising temperature**, aiding crystallisation during processing.
- **LFP Compatibility:** An important and relatively economical lithium source for **LFP batteries** used in energy storage and electric vehicles.
- **Applications:** Used in **EV batteries, grid-scale energy storage, specialised glass and ceramics, pharmaceuticals and aluminium production.**



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## Mains Exam Topics

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### INDIA'S R&D FUNDING ECOSYSTEM

#### Context:

A 2026 NITI Aayog report on Ease of Doing R&D in India found that nearly 80% of funding under the Anusandhan National Research Foundation (ANRF) is concentrated in the IITs, while multiple agencies may be funding similar research areas.

#### What explains the concentration of public R&D funding among a limited number of institutions in India?

- **Unequal Research Capacity:** Institutions with better laboratories, research teams and research-support systems are better placed to compete for competitive grants.
  - e.g., NITI Aayog notes that **more than 80% of ANRF R&D funding goes to the IIT system**, while the participation of State institutions remains far below the intended level.
- **Funding Feedback Loop:** Institutions that receive more funding can further improve their infrastructure and research capabilities, increasing their ability to secure future grants.
- **Limited Diversity in Review:** Concentrated representation in funding committees can favour familiar institutions and research networks, reinforcing the existing concentration of R&D funding.
  - e.g., NITI Aayog noted **limited representation of institutions outside the IIT system in ANRF expert committees**, which may contribute to a narrower distribution of research funding.
- **Unequal Research Capacity:** State universities often have weaker **labs, research facilities and research-support systems**, making it harder for them to compete with well-established institutions for national R&D grants.
- **Focus on Research Excellence:** Leading institutions may receive a larger share of funding because advanced research requires **specialised infrastructure, skilled researchers and a strong research ecosystem**.
  - e.g., NITI Aayog states that **uniformity in R&D funding is neither expected nor desirable**, recognising that institutions with stronger research capabilities may require greater funding for high-end research.

### Why does fragmented R&D funding reduce coordination among research funding agencies in India?

- **Siloed Funding Data:** Separate databases prevent agencies from getting a complete picture of projects already funded by other agencies.
- **Incompatible Data Systems:** Different agencies use different formats and names for researchers, institutions and projects, making it difficult to match records across databases.
- **Poor Information Sharing:** When funding information is not routinely shared, agencies find it harder to coordinate their research priorities and funding calls.
- **Weak Project Monitoring:** Without linked records, agencies cannot easily track whether a researcher or institution is already undertaking related projects or what results earlier funding has produced.
- **Higher Administrative Burden:** Researchers often provide similar information separately to different agencies, while agencies independently verify and process the same data.
- **Weak Learning Across Projects:** When grants are not linked with researchers, institutions and research outputs, agencies cannot easily learn from earlier projects while designing new funding programmes.

### What are the implications of fragmented R&D funding data for the effective use of public research funds in India?

- **Duplicate Funding:** Fragmented data makes it difficult for agencies to know whether similar research is already being funded, leading to possible overlap in public spending.
  - e.g., NITI Aayog identified overlapping support by **DST and CSIR in Hydrogen Energy and Carbon Capture, Utilisation and Storage**, showing how separate funding systems can support similar research.
- **Poor Funding Allocation:** Fragmented data prevents policymakers from seeing the **overall distribution of public R&D funding**, making it difficult to identify institutions or research areas that are over-funded, under-funded or receiving little attention.
- **Weak Research Planning:** Fragmented funding information makes it difficult to align government spending with national research priorities and identify gaps in important research areas.
- **Poor Measurement of Research Outcomes:** When grant records cannot be reliably linked with researchers, projects and their outputs, it becomes difficult to assess whether public funding is producing meaningful results.

- **Higher Research Transaction Costs:** Multiple and incompatible funding systems increase the administrative work required from researchers and funding agencies, reducing the efficiency of the research process.

### Way Forward

- **Build a Single National Platform:** Bring Central and State R&D funding agencies onto one common platform to provide a complete picture of research funding.
  - e.g., The proposed **Unified Project Management System (UPMS)** can serve as a single entry point for planning, funding, monitoring and evaluation of public R&D projects.
- **Adopt Common Digital Identifiers:** Give every funder, institution, researcher and grant a unique identifier so that records across different agencies can be linked accurately.
  - e.g., **Funder IDs, ROR for institutions, ORCID for researchers and Grant DOIs** can connect funding records across agencies and reduce duplication caused by inconsistent names.
- **Standardise Research Data:** Require agencies to record funding information in a common and machine-readable format covering the **funder, researcher, institution, amount, duration and research field**.
  - e.g., Standard metadata can ensure that records such as “**IISc, Bangalore**” and “**Indian Institute of Science, Bengaluru**” are recognised as the same institution.
- **Ensure Interoperability with Global Systems:** India should connect its national system with existing global research infrastructure rather than creating an isolated database.
  - e.g., A UPMS-based system compatible with **Crossref, ROR and ORCID** would allow Indian research funding to be compared and tracked within global research databases.
- **Use a Hybrid National Model:** India can retain national ownership of the funding platform while adopting internationally compatible technical standards.
  - e.g., The **UK Gateway to Research** and EU systems such as **CORDIS and OpenAIRE** demonstrate how government-owned portals can work with globally compatible research identifiers.
- **Link Grants to Research Outcomes:** Every grant should be connected with the publications, patents, datasets and other outputs produced from it.
  - e.g., A **Grant DOI** can connect a funded project with its subsequent **papers, patents and data**, making it easier to assess the impact of public R&D spending.

- **Use Data for Funding Decisions:** A unified database should not merely store information; it should help identify **duplication, funding concentration and neglected research areas**.
  - **e.g.,** Comparing grants across agencies can reveal whether multiple agencies are funding **near-identical research proposals or the same research theme**, allowing better allocation of public funds.

