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MCQs

THE HINDU

India's rice fields rank among world's top methane sources

Prelims: General Studies Paper 1

Current events of national and international importance

Mains: General Studies 3

Conservation, environmental pollution and degradation, environmental impact assessment.

Why in Focus?

- A new study published in Nature Food has found that greenhouse gas (GHG) emissions from global paddy fields have nearly doubled since the 1960s, highlighting the need for low-emission rice cultivation, region-specific interventions and crop diversification.

Key Highlights

- Global paddy fields emitted around **1.1 billion tonnes of carbon dioxide-equivalent (CO₂-e) annually during 2011–2020**, about 90.4% higher than in 1961–1980.

Carbon dioxide-equivalent (CO₂-e): A common unit used to compare the climate impact of different greenhouse gases by expressing their warming effect as an equivalent amount of CO₂.

- Nearly half of the increase was caused by the loss of soil organic carbon.

- Methane (CH₄)** is a major contributor as continuously flooded fields create anaerobic or low-oxygen conditions, favouring methane-producing microbes.
- India is the world's largest rice producer, and its area under paddy cultivation has increased by around 25%** since the 1970s.
- Paddy accounts for around **55% of India's rainfed harvested area**, while eastern India is among the global methane hotspots from rice cultivation.
- India's irrigated paddy fields release around 3.9 million tonnes of methane annually**, slightly more than Germany
- Continuous irrigation, incorporation of crop residues** such as stalks and stubble, and increased use of nitrogen fertilizers have contributed to rising emissions.
- Paddy-related annual GHG emissions are projected to increase by around 25% during 2031–2050**, driven by global warming, erratic rainfall and intensive use of agricultural inputs.

Implications

- Emission-reduction potential varies across regions** due to differences in soil, irrigation and climate.
- Labour shortages, limited technical knowledge** and erratic rainfall hinder adoption.
- Paddy expansion can increase emissions** and displace indigenous crops.
- India **lacks specific agricultural emission-reduction targets**.



Way Forward

- **Promote region-specific low-emission farming practices.**
- **Improve irrigation, fertilizer and residue management.**
- **Encourage crop diversification** and indigenous grains.
- **Strengthen farmer training,** incentives and procurement support.
- Limit unsustainable expansion of paddy cultivation.
- The **National Innovations in Climate Resilient Agriculture (NICRA) project promotes climate-resilient practices** such as the System of Rice Intensification (SRI).

National Innovations in Climate Resilient Agriculture (NICRA) is an Indian Council of Agricultural Research (ICAR) initiative aimed at enhancing the resilience of Indian agriculture to climate change through research, technology demonstrations and climate-resilient farming practices.

- SRI **involves precise transplantation of young seedlings and avoids continuous flooding,** thereby helping reduce methane emissions

Mains Question

Paddy cultivation presents a growing challenge at the intersection of food security and climate mitigation in India. Discuss the sources of greenhouse gas emissions from rice cultivation and suggest measures for promoting low-emission agriculture. (250 Words)

What is the Saudi-U.S. nuclear deal about?

Prelims: General Paper 1

Current events of national and international importance.

Mains: General studies 1

Bilateral, regional and global groupings and agreements involving India and/or affecting India's interests.

Why in Focus?

- The **U.S.** and **Saudi Arabia** signed a **civil**

nuclear cooperation agreement and a **bilateral safeguards agreement** on **July 22**.

- The deal matters because it connects **energy security, nuclear non-proliferation,** and **West Asian geopolitics.**
- It also reflects the broader **U.S.-Saudi strategic partnership** amid rising regional tensions.

Key Highlights:

- The agreement was signed by the U.S. **Energy Secretary Chris Wright** and **Saudi Energy Minister Prince Abdulaziz bin Salman.**
- It is expected to become the base of a **30-year, multi-billion-dollar nuclear partnership.**
- The deal allows the transfer of **civil nuclear materials, technology, and equipment** from the U.S. to Saudi Arabia.
- **U.S. nuclear companies** are likely to get **preferred treatment** in Saudi Arabia's nuclear infrastructure projects.
- The **bilateral safeguards agreement** covers sensitive areas such as **enrichment, conversion, fuel fabrication, and reprocessing.**
- Unlike the **UAE model** of 2009, the Saudi deal does not publicly include a clear ban on **uranium enrichment** or **spent fuel reprocessing.**
- It also does not require Saudi Arabia to adopt the **IAEA (International Atomic Energy Agency) Additional Protocol**, which allows **short-notice inspections.**

The **IAEA (International Atomic Energy Agency)** was established in **1957** and is headquartered in **Vienna, Austria,** to promote the **peaceful use of nuclear energy** and prevent the **spread of nuclear weapons.**

Implications:

- The absence of strict **non-proliferation conditions** (preventing the spread of nuclear weapons and related technology to more countries) raises concern over Saudi Arabia's future **enrichment capability.**
- The deal may help Saudi Arabia expand its **civil nuclear capacity,** but it also increases sensitivity around the **fuel cycle.**
- **Iran** already has a more advanced nuclear programme, so Saudi enrichment plans may intensify **regional rivalry.**



- If Saudi Arabia is allowed to enrich uranium on its soil, Iran may further harden its own nuclear position.

Way Forward:

- The final agreement should include stronger **safeguards** and clear limits on sensitive **fuel-cycle activities**.
- Saudi Arabia should consider adopting the **IAEA Additional Protocol** to improve inspection and verification.

The International Atomic Energy Agency (IAEA) Additional Protocol is a legal document that grants inspectors broader access to a country's nuclear sites, detailed fuel-cycle information, and undeclared locations to ensure peaceful use

- **Civil nuclear cooperation** must remain separate from any **military** or **weapons-related** concern.
- The U.S. should balance strategic partnership with strong **non-proliferation commitments**.
- Regional diplomacy on **Iran, Palestine, and Gulf security** should move alongside nuclear cooperation to reduce future conflict.

Mains Question:

Q. Civil nuclear cooperation can support energy diversification, but it may also raise concerns about nuclear proliferation. Discuss the implications of the proposed U.S.-Saudi nuclear deal in the context of West Asian security and global nuclear governance. (15 marks, 250 words)

What caused the tunnel disaster in Sikkim's Namchi?

Prelims: General Studies Paper 1

Current events of national and international importance

Mains: General Studies 3

Disaster and disaster management

Why in Focus?

- A **suspected methane gas explosion** on July 20 in the under-construction Head Race

Tunnel (HRT) of NHPC's 500 MW Teesta Stage VI Hydropower Project at Samardung in Namchi district, Sikkim, **killed 25 workers, highlighting geological and safety risks associated with infrastructure development in the fragile Himalayas.**

Key Highlights

- **Preliminary reports suggest that methane trapped in rocks was suddenly released during drilling**, resulting in toxic gas formation, an explosion and partial tunnel damage.
- Methane (CH₄) is a **colourless, odourless and highly flammable gas** that can explode when mixed with air in specific proportions and exposed to an ignition source such as drilling sparks.
- Methane **can occur in porous rocks and localised gas pockets, particularly in young geological formations** and areas associated with coal-bearing strata.
- **Sikkim lies in the Rangit Tectonic Window.** Geological Survey of India studies have identified around 1.40 lakh tonnes of coal reserves in southern Sikkim, particularly in the Namchi region.

Rangit Tectonic Window: A geological structure in the Lesser Himalayas of Sikkim and Darjeeling where deep erosion exposes older underlying rocks through the overlying younger metamorphic rocks.

- The **Himalayas are young, tectonically active and geologically fragile due to the continuing collision of the Indian and Eurasian plates**, making the region vulnerable to earthquakes and landslides.
- **Infrastructure activities such as blasting and tunnelling, along with deforestation, unregulated urbanisation** and heavy tourism, can aggravate geological instability.
- Climate change is **increasing risks from cloudbursts, glacier melting and expanding glacial lakes**, further threatening Himalayan infrastructure.
- The **October 2023 Glacial Lake Outburst Flood (GLOF)** killed more than 90 people and destroyed the 1,200 MW Sikkim Urja Limited dam at Chungthang.



A Glacial Lake Outburst Flood (GLOF) occurs when water trapped in a glacial lake suddenly breaches its natural boundary, often triggered by avalanches, landslides, or earthquakes, causing severe downstream flooding.

Implications

- **Underground methane pockets can be difficult to detect** during conventional surveys.
- **Large infrastructure projects increase pressure** on fragile Himalayan geology.
- **Climate change compounds geological** and hydrological hazards.
- The disaster highlights gaps in tunnel safety and gas monitoring.

Way Forward

- Introduce **continuous methane and toxic-gas monitoring**.
- **Strengthen ventilation, evacuation** and worker-safety protocols.
- Improve **geological and geophysical risk assessments**.
- **Integrate climate and disaster risks** into infrastructure planning.

Mains Question

Infrastructure development in the Himalayan region requires balancing developmental needs with geological and ecological vulnerabilities." Discuss with reference to hydropower development in the Indian Himalayan Region. (250 Words)

Why are there protests over the Ken-Betwa project?

Prelims : General Studies Paper I

Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Mains: General Studies 2

Government policies and interventions for development in various sectors and issues arising out of their design and implementation.

Why in Focus?

- **Tribal communities** in **Madhya Pradesh** protested against the **Ken-Betwa River Linking Project**, citing concerns over **displacement, rehabilitation, environmental damage, and irregularities in compensation**.

Key Highlights

- **Ken-Betwa River Linking Project** is India's **first river-linking project** under the **National Perspective Plan (NPP)**.
- It aims to transfer **surplus water** from the **Ken River** to the **Betwa River** through the **Daudhan Dam** and a **221-km canal**.
- The project seeks to provide **drinking water, irrigation**, and generate **hydropower** and **solar power**, especially for the **Bundelkhand** region.
- Protesters demanded **fair compensation, proper rehabilitation, and inclusion of all eligible displaced families** in the rehabilitation package.

Challenges / Issues

- **Displacement** and rehabilitation of affected **tribal communities**.
- Alleged **irregularities** in beneficiary identification and compensation.
- Protesters alleged that the **Gram Sabha consent process in tribal villages was not conducted properly**.
- Environmental concerns include **tree felling**, impact on the **Panna Tiger Reserve**, and threats to species such as **tigers, gharials, mahseer fish, and endangered vultures**.
- Lack of public access to **hydrological data**, raising concerns about transparency.
 - ◆ **Hydrological data** is information about the **availability, movement, and behaviour of water** in a river or river basin.

Way Forward

- Ensure **transparent and fair rehabilitation** of all affected families.
- Implement robust **environmental safeguards** and wildlife conservation measures.



- Make **hydrological and environmental assessments** publicly available to improve transparency.
- Balance **water security, ecological sustainability, and community rights** in implementing river-linking projects.

National Perspective Plan (NPP) was formulated in **1980** by the **Union Ministry of Irrigation** and the **Central Water Commission** to transfer water from **surplus river basins** to **water-deficit basins**. The **NPP** consists of **30 river-linking projects**, aimed at improving **water availability, irrigation, and regional water security**.

The plan has **two components**:

- **Himalayan Rivers Development – 14 river links**
- **Peninsular Rivers Development – 16 river links**

Mains Question

River interlinking projects can address regional water scarcity but also pose significant environmental and social challenges. Discuss with reference to the Ken-Betwa River Linking Project. (250 Words)

KEYWORDS

Chandipura Virus

- Chandipura Virus belongs to the **Rhabdoviridae family, which also includes the virus responsible for rabies**.
- It was **first identified in 1965 in Chandipura village, Maharashtra**, from which it derives its name.
- It is a **vector-borne virus, transmitted mainly through the bite of infected sand flies, while ticks have also been suggested as possible vectors**.
- Chandipura Virus can **cause Acute Encephalitis Syndrome (AES) and predominantly affects children**, with outbreaks occurring mainly in western and central India during the rainy season.
- There is **currently no specific antiviral treatment or vaccine against Chandipura Virus infection**; treatment primarily involves supportive care.

International Diabetes Federation (IDF)

- The International Diabetes Federation (IDF) was **established in 1950 and is headquartered in Brussels, Belgium**.

- It is a **global umbrella organisation representing national diabetes associations** across more than 160 countries and territories.
- The **IDF works to prevent diabetes, improve diabetes care and promote the rights and well-being of people living with diabetes worldwide**.
- The IDF, along with the World Health Organization (WHO), **launched World Diabetes Day, observed annually on 14 November**.
- The IDF **publishes the IDF Diabetes Atlas**, a major global source of data and estimates on diabetes prevalence, mortality, health expenditure and future trends.

Megamonas

- Megamonas is a **genus of bacteria found in the human gut microbiome**.
- It belongs to the phylum Bacillota (formerly Firmicutes).
- It is an **obligate anaerobe, meaning it grows in the absence of oxygen**.
- Megamonas rupellensis has **been linked with obesity and increased fat accumulation**.

- It **can break down myo-inositol**, which may increase **fat absorption** in the intestine and contribute to weight gain.

Shompen Tribe

- The **Shompen tribe** is currently in the news due to concerns that their **ancestral lands** and **near-total isolation** are severely threatened by the proposed **mega infrastructure and airport project** on **Great Nicobar Island**.
- They are a **highly isolated, semi-nomadic indigenous community** living in the **dense tropical rainforests** of **Great Nicobar Island**.
- They are classified as a **PVTG (Particularly Vulnerable Tribal Group)** due to their **pre-agricultural hunter-gatherer lifestyle**, **extreme isolation**, and **very small population (229 as per 2011 Census)**.
- Unlike other Andaman & Nicobar PVTGs (**Jarawas, Onges, Great Andamanese, Sentinelese**) with **Negroid traits**, the **Shompens have Mongoloid physical features**, making them **unique in the region**.
- Their staple food is the **Pandanus fruit (a tropical plant)**, and they speak a **distinct unwritten Austroasiatic language** with **multiple dialects**

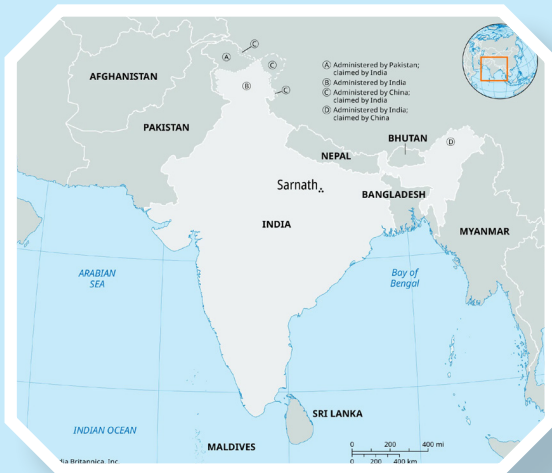


National Water Development Agency (NWDA)

- **National Water Development Agency (NWDA)** was established in **July 1982** as an **autonomous society** under the **Societies Registration Act, 1860**.
- It was set up to **study water resources**, prepare **feasibility reports**, and promote the **optimal use of river water** under the **National Perspective Plan (NPP)**.
- Initially, NWDA was responsible for the **Peninsular Rivers Development** component of the **National Perspective Plan**.
- In **1990**, its responsibilities were expanded to include the **Himalayan Rivers Development** component of the **National Perspective Plan**.
- Since **2006**, NWDA has been entrusted with examining the feasibility of **intra-State river-linking projects** and preparing their **Detailed Project Reports (DPRs)**.

Places in News

Sarnath



- Sarnath, located **near Varanasi in Uttar Pradesh**, is one of the four principal **Buddhist pilgrimage sites** and is where **Gautama Buddha delivered his first sermon** after attaining enlightenment.
- In July 2026, the **Ancient Buddhist Site of Sarnath** was inscribed on the **UNESCO World Heritage List**, becoming **India's 45th World Heritage Site**.
- The **World Heritage property** comprises two archaeological zones: the **Chaukhandi Stupa** and the main archaeological complex containing monuments such as the **Dhamek Stupa**, the historic **Ashokan Pillar site** and **Dharmarajika Stupa**.
- Sarnath **developed into an important centre of Buddhist learning and pilgrimage**, with numerous stupas, temples and viharas constructed over centuries.
- Sarnath **flourished as a major Buddhist centre for centuries before declining around the 12th century CE**, and its archaeological remains reflect its long religious and cultural history.

Pickaxe Mountain

- It is currently dominating international headlines after **U.S. President Donald Trump** threatened military strikes, following intelligence reports that

Iran relocated thousands of **uranium-enrichment centrifuges** to the site.

- Officially known in Iran as **Kuh-e Kolang Gaz La** (also called the **Shahid Alimohammadi facility**), it is located in the **Zagros mountain range**, about **220 km south of Tehran** and close to the **Natanz nuclear complex**.
- It is a **highly fortified underground tunnel complex**, buried under more than **300 feet of solid granite**, making it extremely difficult to destroy, even with advanced **bunker-buster bombs**.
- Construction began in **2020** after sabotage at the **Natanz facility**, with the aim of shifting **sensitive nuclear operations** and **advanced centrifuge manufacturing** deep underground for protection.
- The facility lacks transparency, as **Iran has denied access to the IAEA (International Atomic Energy Agency)**, raising fears of a **covert nuclear weapons programme** (production of weapons-grade uranium).

