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Dear Students,

In the competitive landscape of the UPSC Mains examination, the significance of integrating data, facts, and examples into your answers cannot be overstated.

These elements serve as the backbone of a compelling and persuasive response, **elevating your answer from a generic narrative to a well-substantiated argument.**

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Leveraging this distilled information will help you **craft comprehensive, informative, and compelling answers** essential for securing higher marks.

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India and Climate Action

- **India's Nationally Determined Contributions (NDCs) Targets for 2030**
  - Reduce Emissions Intensity of its GDP by 45%, from 2005 level.
  - Achieve ~50% cumulative electric power installed capacity from non-fossil fuel-based resources.
  - Additional carbon sink of 2.5-3 billion tonnes of CO2 through additional forest tree cover.
- **Achievements/Progress**
  - **Reduced Emission Intensity of GDP:** by 36% (Between 2005 to 2020)
  - **Share of non-fossil sources:** 46.52% of installed capacity (Oct 2024).
  - **Additional carbon sink of 2.29 billion tonnes of CO2 created** through forest and tree cover (2005 to 2021)

Key Outcomes of UNFCCC COP29

- **New Collective Quantified Goal on Climate Finance (NCQG)**: Mobilize at least $300 billion annually for developing countries by 2035.
- Finalized rules for **Article 6 of Paris Agreement (International carbon markets).**
- Launched **Baku Adaptation Road Map** and **Baku High-Level Dialogue on Adaptation**

Climate Change impacts on Vulnerable Sections

- **Women: 80% of people displaced** by climate change are women. (UN figures)
- **Indigenous Communities:** 40% of land occupied by Indigenous peoples lies in areas of high biodiversity affected by Climate Change.
- **Marginal Farmers:** Over 1/3rd of marginal farmers had to cope with extreme weather events at least twice in five years.

Climate Change impacts on Small Island Developing States (SIDS)

- SIDS lost **US$153 billion** due to weather extremes (from 1970-2020).
- Least responsible for the **climate crisis (1% of Global emissions)**.

Climate Change impacts on Socio-Economic Indicators

- **Education:** Increase of **1°C in outdoor temperature** can result in a substantial decline in test scores. *(World Bank)*
- **Health:** 85% of NCD deaths caused by Climate Change and air pollution.

Sea Level Rise

- From 2014-2023, **global mean sea level rose** at a rate of **4.77 mm per year.**
- **>10% of land** in Mumbai, Yanam, and Thoothukudi would be **submerged** by 2040.

Climate Change impacts on Cryosphere

- **Greenland Ice Sheet**: Losing 30 million tons of ice/hour. ***(State of Cryosphere 2024)***
- **Venezuela** lost all its glaciers (2024)
- If all glaciers and ice sheets melted, **global sea level would rise by more than 60m** (*NASA).*

Climate Change Mitigation

- **Global GHG emissions set a new record in 2023** (with 1.3% increase from 2022 levels) *(Emissions Gap Report 2024)*
- **India:** 3rd in total GHG emissions **(UNEP's Emissions Gap Report, 2024).**
- **Need:** Cuts of 42% in emissions by 2030 and 57% by 2035 (below 2019 levels) to get on track for 1.5°C. (*Emissions Gap Report 2024*)

Climate Finance

- **India's climate finance needs**
  - **~USD 250 billion per year till 2047** needed for energy transition. (NITI Aayog)
  - **USD 10 trillion** needed to achieve net-zero by 2070.
- **Inadequate finance:** Fivefold increase needed by **2030** under 1.5°C scenario *(GLCF 2024).*
- **Development:** Loss and Damage Fund (LDF), agreed upon during COP27, operationalized in COP28.

Carbon Trading and Market

- **Emissions Removal by 2030 by Carbon markets:** Expected to remove over 5 gigatons of CO_2 per year by 2030, at no additional cost.
- **Key Developments:** Article 6 of Paris Agreement finalized in COP29.
  - **Mechanisms:** 2 Market based- Bilateral deals between countries and a new global offset market and 1 Non-Market based approach.
- **Key Indian Mechanisms:** Compliance and Offset mechanisms under Carbon Credit Trading Scheme (CCTS), 2023; Green Credit Programme (GCP).

Industrial Decarbonisation

- **Emissions from Industrial Processes and Product Use**: 8% of the total emissions in India. *(India's 4th Biennial Update Report)*
- **Steel Sector:** 12% of India's CO_2 emissions.

Methane Emissions

- **Methane:** 2nd largest contributor to climate warming after CO_2.
- **Methane's Global Warming Potential (GWP):** 28 times higher than CO_2.

Greenwashing

- **Making a product or policy seem more environmentally friendly** or less damaging than it is in reality.
- **Types:** Greenhushing, Greenrinsing, Greenlabeling, Greenlighting etc.
- **Example:** In 2015, Volkswagen used **software to manipulate emission tests in its Clean Diesel cars.**
- **Initiatives in India:** Standard for eco-labelling of products and services by BIS; Consumer Protection Act, 2019; SEBI's BRSR norms.

Coal Thermal Power Plants

- **Key Pollutants from TPP:** GHGs: Sulphur dioxide; Carbon dioxide (CO_2); Nitrogen oxide, Particulates (Including Fly ash), Heavy metals like Mercury and bottom ash.
- Coal accounts for **55% of the country's energy need**
- **Measures to Reduce Emissions:** Perform, Achieve, Trade (PAT) Scheme; Biomass Co-firing Policy; Ultra Supercritical/Supercritical units over Subcritical Thermal Units.

Urban Air Pollution in India

- **Status: 6 of 10 most polluted cities** of the world in India. **(*2024 World Air Quality Report*).**
- **Impact:** Economic Loss **~$36.8 billion/year (1.36% of GDP, 2019** – *World Bank*) due to premature deaths and illness.
- **Initiatives:** National Clean Air Programme (2019); Graded Response Action Plan; Air Act (1986); SAFAR Portal.

Extreme Water Stress

- **Status:**
  - **India** has **18%** of World population and but only **4%** of its water resources.
  - **~11% of groundwater** units assessed are **'Over-exploited'.** *(Dynamic Ground Water Resource Assessment Report, 2024)*
- **Impacts: 31% of global GDP** to be exposed to high water stress by **2050. (WRI)**
- **Initiatives:** National Water Mission; Jal Jeevan Mission (JJM); Atal Bhujal Yojana (2020); National Aquifer Mapping and Management Program (NAQUIM), etc.

Water (Prevention and Control of Pollution) (Manner of Holding Inquiry and Imposition of Penalty) rules, 2024

- **Key Features: Offenses and violations** of the Act **decriminalized** and replaced with **penalties, Authorized Officers** appointed by Centre, to adjudicate offenses.
- **Water (Prevention and Control of Pollution) Act 1974:** Created **Central Pollution Control Boards (CPCB)** and **State Pollution Control Boards (SPCB)**

Ground Water Pollution

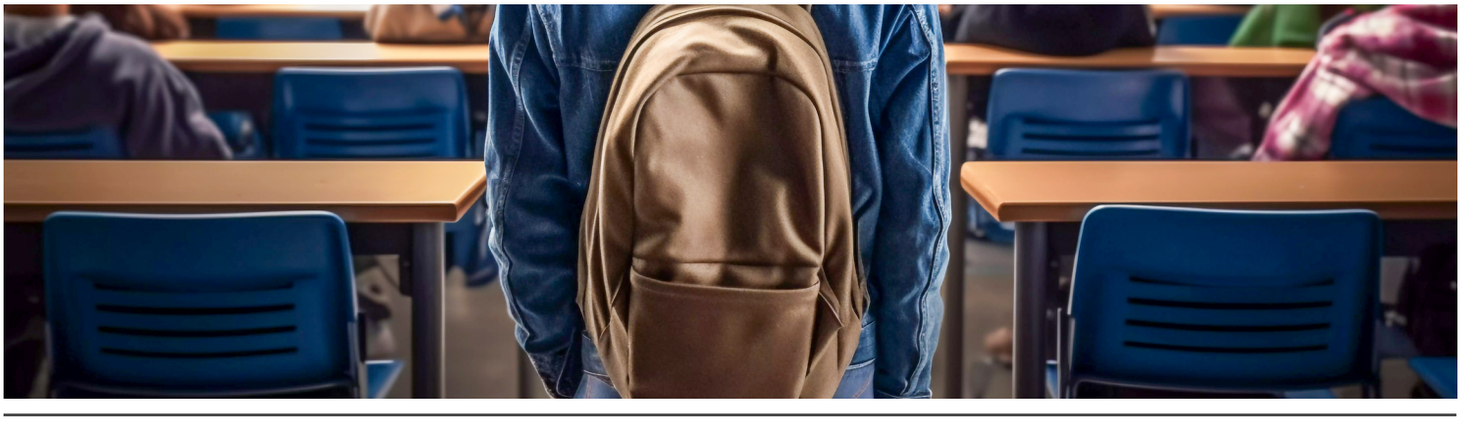
- **Status (India) : ~56%** of districts have nitrates beyond safe limit of **45 mg/L in groundwater (Annual Ground Water Quality Report, 2025).**
- **Major Contaminants: Nitrate** (Rajasthan), **Arsenic** (West Bengal), **Uranium** (Rajasthan)

Community Participation in Water Conservation

- **Examples: Neeru-Chettu** (Andhra Pradesh); **Jal Jeevan Hariyali** (Bihar); **Mission Kakatiya** (Telangana); **Jal Hi Jeevan Hai** (Haryana), etc.
- **Traditional water storage systems in India: Jal Mandir** (Gujarat); **Khatri, Kuhl** (Himachal Pradesh); **Zabo** (Nagaland); **Eri, Ooranis** (Tamil Nadu); **Dongs** (Assam), etc.

Water Recycling and Reuse in India

- **Untreated Wastewater: ~72% of India's wastewater** ends up in nearby rivers, lakes, etc.
- **Water Reuse Technologies:** Membrane Bioreactor; Ultrafiltration; Reverse Osmosis and Disinfection Technologies, etc.
- **Initiatives:** National Framework on Safe Reuse of Treated Water, 2022; National Water Policy-2012; 'Jal hi Amrit' initiative under AMRUT2.0.



Land Degradation

- **Status:**
  - **India**: 29% degraded land; 25% land undergoing desertification
  - **Global**: 75% of soils degraded
- **Targets:**
  - **Global:** Restore **1 billion hectares degraded land by 2030 (***Global- Land Degradation Neutrality (LDN) target setting programme)*
  - **India:** Restore **26 million hectares by 2030.**
- **Initiatives:** Global [Bonn Challenge (restore 150 million by 2020 and 350 million hectares by 2030)] India (Desertification and Land Degradation Atlas of India; Soil Health Card, PM Krishi Sinchayee Yojana, etc.).

Plastic Pollution in India

- **Status:**
  - Generates **4.12 Million Tonnes Per Annum** plastic waste (CPCB)
  - Ranks **3rd** globally in generation of **single-use plastic (SUP).**
- **Initiatives:** Plastic Waste Management Rules; Extended Producer Responsibility on Plastic Packaging, 2022; Global (Global Partnership on Plastic Pollution and Marine Litter (GPML), UNEP Plastics Initiative, etc.).

Solid Waste Management (SWM) in India

- **Current Status (TERI Study): Annual waste generation-** 62+ million tons; **Collection-** 43 million tons; **Treatment-** Only 12 million tons.
- **Initiatives: SWM Rules, 2016** (mandates waste segregation into 3 streams); Swachh Bharat Mission (SBM-U) 2.0; Garbage Free Star Rating Protocol, etc.

E-Waste Management in India

- **Status: 3rd largest generator** following China and USA *(Global E-Waste Monitor 2024 report).*
- **Initiatives: Extended Producer Responsibility (EPR)** under E-waste (Management and Handling) Rules, 2011; **Producer responsibility Organization (PRO)** under E-Waste (Management) Rules, 2016; **Global** (Basel Convention; E-Waste Coalition, 2018).

Oil Spills

- **Meaning: Accidental** operational spills of oil from **ships.**
- **Recent Occurrences:** Philippine oil tanker near Manila (2024); MSC Elsa 3 sinking near Kochi, Kerala (2025); Near Kerch Strait (2024).
- **Initiatives:** National Oil Spill Disaster Contingency Plan (1996); Merchant Shipping Act, 1958; International Convention for the Prevention of Pollution from Ships or MARPOL (India is a signatory); Bioremediation (E.g., Oilzapper & Oilivorous-S).

Revised Classification of Industries

- **New Classification:** CPCB classified into **Red**, **Orange**, **Green**, **White** and **Blue category (Newly Introduced).**
  - **Blue Category:** Includes **Essential Environmental Services (ESSs)** that control, abate and mitigate pollution from **Domestic and Industrial activities.**
  - CPCB has followed a **revised methodology** based on **Pollution Index (PI).**
- **Existing Categories: Red** (PI> 80); **Orange** (55 ≤ PI < 80); **Green** (25 ≤ PI < 55); **White** (PI < 25).

Waste to Wealth

- **Techniques:** Biological Processing; Biomethanation; Thermal/Waste to Energy Processing.
- **Initiatives:** Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2022; National Bioenergy Energy Programme, etc.

Circular Economy (CE)

- **Current situation** Only **7.2 % of the global economy** is circular with a declining trend (Circularity Gap report 2023)
- **Economic Benefits:** Save **11% of GDP** by **2030 & 30%** by **2050.** (Economic Survey 2024-25)
- **Initiatives:** National Resource Efficiency Policy (NREP), 2019; Extended Producer Responsibility (EPR), Swachh Bharat Mission, Ideas for LiFE (Lifestyle for Environment), etc.

Natural Farming

- **Key Components:** Beejamrit, Jivamrit, Mulching, Whapasa, Plant Protection.
- **National Mission on Natural Farming (NMNF):** standalone centrally sponsored scheme.
  - **15,000 willing clusters** in Gram Panchayats.
  - 10,000 Input Resource Centres (BRCs)
  - **Reach 1 crore** farmers and initiate Natural Farming (NF) in **7.5 lakh Ha** area.
- **Other Initiatives:** National Centre for Management of Agriculture Extension (MANAGE); Andhra Pradesh Community Managed Natural Farming (APCNF).

Indian Himalayan Region (IHR)

- **Issues:**
  - Loss of **1,072 sq km of forest cover (2019 -2021)**
  - **Gangotri glacier** (Uttarakhand Himalaya) retreated by **1,700 metres between 1935 and 2022.**
- **Supreme Court (SC) cases:** MK Ranjitsinh vs. Union of India case (2024); Ashok Kumar Raghav vs Union of India case (2023); State of Telangana vs Mohd. Abdul Qasim case.
- **Initiatives:** National Mission for Sustaining the Himalayan Ecosystem (NMSHE); Global Snow Leopard Ecosystem Protection Program (GSLEP); International Big Cats Alliance (IBCA), etc.

Renewable Energy (RE) in India

- **India's RE targets**
  - Achieve **50%** cumulative **electric power installed** by 2030 from renewables. (INDC)
  - **500 GW of renewable energy** installed capacity by 2030. **(Panchamrita targets)**
- **Progress: Installed Capacity of Renewable energy** (Incl. Hydro): **226 GW** (43.7% in total) *(Power Ministry, June 2025)*

Just Energy Transition

- **Status in India:** Coal-based Thermal Power Plants produce more than **70% of electricity**.
- **WEF Energy Transition Index (ETI):** India's rank 71/118 countries (63rd in 2024).
- **Initiatives:** Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY); National Programme on High Efficiency Solar PV Modules; ILO Guidelines for a Just Transition.

Nuclear Energy Mission

- **Aim:** Development of **small modular reactors (SMRs),** setting up of at least 5 SMRs by **2033**.
- **Target: 100 GW** of nuclear power capacity by **2047.**
- **Current Installed nuclear energy capacity:** 8.18 GW (January 2025)

Solar Energy in India

- **Status in India:**
  - **Solar energy capacity: 110 GW** (*Power Ministry, June 2025*)
  - India ranks **5th** in Solar Power Installed Capacity globally.
  - **Potential:** 748 Giga Watt peak (*National Institute of Solar Energy*).
- **Initiatives:** PM Surya Ghar Muft Bijli Yojana; Grid Connected Solar Rooftop Programme; Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM).

International Solar Alliance (ISA)

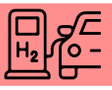
- **Origin:** 2015 at Paris **(COP-21 of the UNFCCC)** by India and France.
- **Guided by 'Towards 1000' strategy:**
  - Mobilise **USD 1,000 billion investments** in solar energy solutions by **2030**
  - Installation of **1,000 GW** of **solar energy capacity.**
- **Other ISA Initiatives:** One Sun One World One Grid (OSOWOG); MIGA-ISA Solar Facility; Global Solar Facility.

Offshore Wind Energy in India

- **Long-term target:** Addition of **30 GW** by **2030.**
- **Current Installed Capacity: ~51 GW** (10.7% of total installed capacity) (June 2023).
- **Initiatives:** National Offshore Wind Energy Policy, 2015 and Wind-Solar Hybrid Policy, Viability Gap Funding (VGF) scheme for Offshore Wind Energy Projects.

Hydrogen Energy in India

- **Status:** 6.5 million metric tonnes per annum (MMTPA).
- **Initiatives:** Hydrogen-based Fuel-Cell Electric Vehicle (FCEV) buses in Leh; Green Hydrogen Certification Scheme of India (GHCI); Hydrogen fuel-run train engine.



National Green Hydrogen Mission

- **Duration:** Phase I (2022-23 to 2025-26) and Phase II (2026-27 to 2029-30).
- **Expected Outcomes:** Green Hydrogen Production capacity of **5 MMT per Annum by 2030.**
- **Key components:** Strategic Interventions for Green Hydrogen Transition (SIGHT) programme, Development of Green Hydrogen Hubs.

Biofuels

- **Potential: 28 GW** through Surplus biomass availability in India.
- **Current Installed capacity of Biomass cogeneration**: 10 GW (*Power Ministry, June 2025)*
- **Initiatives**: National Policy on Biofuels, 2018; Pradhan Mantri JI-VAN Yojana (2019); Global Biofuels Alliance (2023); National Biofuels Coordination Committee.

Ethanol Blending

- **Key Targets: 20%** in **petrol** by **2025** (Updated) and **5% biodiesel blending** in diesel by **2030.** (National Policy on Biofuels, 2018)
- **Initiatives:** National Policy on Biofuels, 2018; Ethanol blending Program (EBP) targeting 20% ethanol blending in petrol by 2025; PM JI-VAN YOJANA; Flexi Fuel Engines, etc.

Geothermal Energy in India

- **Potential:** 10,600 MW of geothermal **power** *(Geothermal Atlas of India, 2022).*
- **Initiatives:** Renewable Energy Research & Technology Development Programme (RE-RTD); Renewable Energy Technology Action Platform.

Underground Coal Gasification (UCG)

- Energy manufacturing process where coal is gasified/chemically converted into synthesis gas (syngas) in its original coal seam.
- **Initiatives:** Scheme for promotion of Coal/Lignite Gasification; Policy framework (2015) for development of UCG in coal and lignite bearing areas; Underground Coal Gasification pilot project in Jharkhand by Ministry of Coal.

CoP-16 of UNCBD

- **Held at: Cali**, **Colombia** with the theme **"Peace with Nature".**
- **Major Outcomes:**
  - Operationalization of **Cali Fund**
  - **Recognition of rights of indigenous communities** through establishment of **permanent subsidiary body** under **Article 8(j) of the UNCBD**
  - Launch of **Kunming Biodiversity Fund (KBF)** under **Global Environment Facility** (GEF)

Kunming- Montreal Global Biodiversity Framework (KMGBF)

- **Non-binding,** adopted at **CoP of CBD (Montreal, Canada, 2022).**
- To **half** and **reverse biodiversity loss** by **2030.**
- **Sets 4 goals** and **23 targets** to be met by **2030.**
  - **Key Goals:** Share benefits fairly; closing the biodiversity **finance gap of 700 USD per year.**
  - **Key targets:** 30 by 30 targets; mobilize **USD 200 billion** including **USD 30 through international finance.**

National Biodiversity Strategy and Action Plan (NBSAP)

- Key Highlights of India's updated NBSAP 2024-30
  - **Approach**: **'Whole of Government'** and **'Whole of Society**.'
  - **National Biodiversity Targets (NBTs)**: **23 NBTs** focused on **3 themes** – reducing threats to biodiversity; ensuring sustainable use of resources; and enhancing tools for implementation.
  - **Resource mobilization**: Through **Biodiversity Finance Initiative (BIOFIN)** at national level.

High Seas Treaty

- Formally called **Agreement on Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction**.
- Under the **United Nations Convention on the Law of the Sea (UNCLOS).**
- **Scope of application:** To **Areas Beyond National Jurisdiction (ABNJ),** including high seas (excludes warship, military aircraft, or naval auxiliary).
  - Part-II deals with Marine Genetic Resources, applies to **government vessel.**

Antarctic Treaty

- **Genesis:** Signed in Washington, in **1959** by **12 countries** & enforced in **1961**.
- **Applicability:** Area south of 60° South latitude.
- **India's initiatives for Antarctica: Dakshin Gangotri** (1983, 1st research station); Currently operational are **Maitri** (1989) and **Bharati** (2012); **Antarctic Act** (2022).

Wetland Conservation in India

- **Current Status: 7 lakh wetlands** covering ~**16 Mha i.e., 4.86%** of the total geographic area of the country.
  - India **lost 2 out of 5 wetlands** in last 3 decades (Wetlands International).
- **Significance:** Covers **6% of Earth's surface** but support **~40% of global biodiversity**
- **Schemes/Policies/Initiatives:** Wetland (Conservation and Management) Rules 2017; Centre for Wetland Conservation and Management (CWCM); National Plan for Conservation of Aquatic Eco-systems (NPCA); Blue Flag Certification.

Mangrove Conservation

- **Total Mangrove Cover in India** is **0.15%** of country's geographical area (ISFR, 2023).
- **Threats:** ½ of world's mangrove provinces are threatened (**IUCN Red List of Mangrove Ecosystems).**
- **Initiatives:** MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes); Sustainable Aquaculture in Mangrove Ecosystem (SAIME); Mangrove Alliance for Climate,.

Peatland Conservation

- **Global Peatlands distribution:** Covers **3.8% of the world's land area.**
- **Status:** ~12% of global peatlands and >60% of peatlands in India degraded. (*Global Peatland Hotspot Atlas, 2024)*
- **Initiatives:** Guidelines for **Global Action on Peatlands (2002), UNEP Global Peatlands Initiative** (COP UNFCCC in Marrakech, Morocco in 2016).

Marine Protected Areas (MPAs)

- **MPAs in India: Gulf of Mannar Marine Park** (Tamil Nadu), **Lothian Island** (West Bengal), **Gahirmatha** (Odisha).
- **Global Initiatives to Protect Marine Biodiversity:** Kunming-Montreal Global Biodiversity Framework; United Nations Human Rights Council (UNHRC) Resolution.

Forest Conservation

- **Tree and forest cover in India:** 25.17% of geographical area (increase from 24.62% in 2021) (*India State of Forest Report 2023).*
- **Threats:** India **Lost 3.3% tree cover** to deforestation (2001-2022) (*Global Forest Watch).*
- **Initiatives:** Forest Conservation (Amendment) Act, 2023; Green India Mission to increase Forest/Tree Cover by 5 mha; REDD+ Mechanism; Bonn Challenge; EU's Nature Restoration Plan (recover 20% of EU's land and sea by 2030).

Ecologically Sensitive Areas (ESA)

- **Governed Under:** Environment (Protection) Act, 1986.
- **Examples:** Doon Valley, Bhagirathi, Western Ghats, Matheran, Mount Abu, etc.
- **Activities allowed (ESZ Guidelines): Prohibited** (Commercial Mining, setting of polluting industries); **Regulated** (Felling of Trees); **Permitted** (Ongoing agriculture and horticulture).

Wildlife Conservation in India

- **Legislative Framework:** Wildlife (Protection) Act, 1972 categorizes wildlife in 4 schedules.
- **Protected Areas:** 5.32% of India's geographical area with >100 National Parks (Nov, 2023).
- Achievements:
  - **Tiger Population** increased to **3, 682 from 2967 in 2018.** *(All India Tiger Estimation 2022)*
  - Achieved targets set under TX2 initiative in 2018 (4 years in advance).
  - **Elephant Population** Increased from 26,786 (2018 census) to **29,964 in 2022.**
- **Species specific Conservation Efforts:** Species Recovery Programme; Project Tiger (completed 50 years in 2023); Project Cheetah (2002); International Big Cat Alliance (IBCA); Integrated Development of Wildlife Habitats (IDWH), centrally sponsored Scheme.

Human Animal Conflict

- **1,510 deaths** due to animal attacks (*Accidental Deaths & Suicides in India 2022)*
- **Recent Example:** Wolf attacks in Bahraich, Uttar Pradesh (2024).
- **Initiatives:** Wildlife Protection Act of 1972**;** National Wildlife Action Plan 2017-2035 (NWAP); National Human-Wildlife Conflict Mitigation Strategy and Action Plan (2021-26).

Coral bleaching

- **Distribution:** >1/3rd world's coral reefs in Australia, Indonesia and Philippines.
- **Coral Bleaching: Fourth Global Bleaching Event (GCBE)** in 2024 impacted 77% of world's coral reefs.
- **Initiatives: Coral** listed in **Schedule I** of the **Wildlife (Protection) Act, 1972; Mangroves and Coral Reefs (1986); International Coral Reef Initiative (ICRI)**; etc.

Genetic Resources (GR) and Traditional Knowledge (TK)

- **GR:** Resources in medicinal plants, agricultural crops, and animal breeds.
- **TK:** Knowledge system held by **indigenous communities.**
- **Example: karez' or 'surang bavi' system** in Bidar region; **Polyculture technique called Milpa** by Mayan People; **Khasi and Garo tribes** sacred groves conservation in Meghalaya.
- **Initiatives:** Traditional Knowledge Digital Library (TKDL); Protection of Plant Varieties and Farmer's Rights Act, 2001; Geographical Indications Act 1999, UNESCO recognition (Yoga).

Biological Diversity (Access and Benefit Sharing [ABS]) Regulation 2025

- Notified by **NBA in accordance with the Biodiversity Act (BDA) 2002 replacing 2014 rules**.
- Most well-known ABS cases from India involves the **Kani tribal community of Kerala** and the **Arogyapacha plant (Trichopus zeylanicus),** for revitalizing properties (**Jeevani drug).**
- **Key Provisions**
  - **Inclusion of Digital Sequence Information (DSI**)
  - Prior intimation to **National Biodiversity Authority** for approval.
  - **Benefit Sharing of profits based on Annual turnover**
  - **Benefit Sharing for High-Value Biological Resources.** E.g. red sanders, agarwood, etc.

Disaster Management (Amendment) Act, 2025

- **Key amendments**
  - **National Disaster Management Authority (NDMA)** and **State Disaster Management Authority (SDMA)** given responsibility to prepare DM plans (earlier with National Executive Committee and State Executive Committee)
  - State governments empowered to constitute separate **Urban Disaster Management Authority (UDMA) for state capitals and State Disaster Response Force (SDRF).**
  - **Statutory status** to **National Crisis Management Committee (NCMC)** and **High-Level Committee (HLC).**

Earthquake Management in India

- **Vulnerability:** 59% of the Indian landmass classified as earthquake-prone
- **Recent Earthquakes: Myanmar earthquake,** ("Strike-slip faulting" between the Indian and Eurasian plates); **Taiwan** (Reverse Faulting), etc.
- **Initiatives:** Earthquake Risk Assessment and Mapping by GSI; Indian Standard Code for seismic design and construction of structures (IS 1893) by BIS; National Disaster Management Authority's (NDMA) guidelines, etc.

Landslide Management in India

- **India's Susceptibility: 13.17%** of India's geographical area. **8% of global fatalities.**
- **Northwest Himalayas:** 66.5%**, Northeast Himalayas:** 18.8%, **Western Ghats** - 14.7%.
- **Recent Occurrences:** Sikkim, Uttarkashi, Wayanad.
- **Initiatives:** National Landslide Susceptibility Mapping (NLSM); Landslide Atlas of India; National Landslide Forecasting Centre (NLFC), etc.

Heatwave Management in India

- **IMD criteria for Heat waves:** Maximum temperature of **40**° C **(Plains)** and **30**° C **(hills).**
- **Vulnerability: 4**% of the districts and 7% of the population are highly vulnerable**.**
- **Initiatives:** Color code impact-based heat wave warning, Heat Action Plans, Climate Hazard & Vulnerability Atlas of India, Heat Index launched by IMD.

Droughts Management in India

- **Definition:** When rainfall deficiency in an area is **≥26%** of its **long term normal** (26-50%: Moderate drought); (>50%: Severe Drought).
- **Vulnerability:** 91 districts in 'Very High' drought risk category.
- **Recent examples:** Rayalaseema (Andhra Pradesh (2024)), South American Drought **(**2024),
- **Initiatives:** National Policy on Disaster Management; National Agricultural Drought Assessment and Monitoring System; Rashtriya Krishi Vikas Yojana (RKVY); etc.

Cyclone Management

- **India's vulnerability:** Exposed **to nearly 10% of the World's tropical cyclones.**
- **Recent Occurrences:** Cyclone Dana (2024), Odisha; Cycone Fengal (2024), Tamil Nadu, etc.
- **Institutions:** National Cyclone Risk Mitigation Project (NCRMP) by MHA; IMD's Dynamic impact-based Color-coding warnings, Indian National Centre for Ocean Information Services (INCOIS).

Glacial Lake Outburst Flood (GLOF) in India

- **Vulnerability: >**9 million people in High Mountain Asia (HMA) are vulnerable to GLOF.
- **Recent Occurrences:** 2023 (GLOF at South Lhonak, Sikkim), Chamoli (2021).
- **Initiatives:** National Disaster Management Authority (NDMA) guidelines; Guidelines for Hydro projects by Central Electricity Authority (CEA).

Fire Safety in India

- **Status:** 7,435 people killed in over 7,500 fire accidents in India in 2022 (NCRB).
- **Recent Accidents:** Gaming zone in Rajkot (Gujarat), private hospital in Delhi.
- **Initiatives:** Fire service a **state subject** (included in 12th Schedule); National Building Code (NBC) by BIS; Model Bill to Provide for the Maintenance of Fire and Emergency Service for the State, 2019; Fire and Life Safety guidelines by Ministry of Health.

Dam Safety in India

- **Status:** 3rd largest dam owing nation (5,700 dams) after USA and China.
  - **80% of dams** in India are over **25 years old**.
- **Major Dam Failures:** Derna Dam (Libya, 2023); Chungthang Dam (Sikkim, 2023)
- **Initiatives:** National Register of Large Dams (NRLD); Dam Rehabilitation and Improvement Project (DRIP); Dam Health and Rehabilitation Monitoring Application (DHARMA); Dam Safety Act, 2021.

El Niño Southern Oscillation (ENSO)

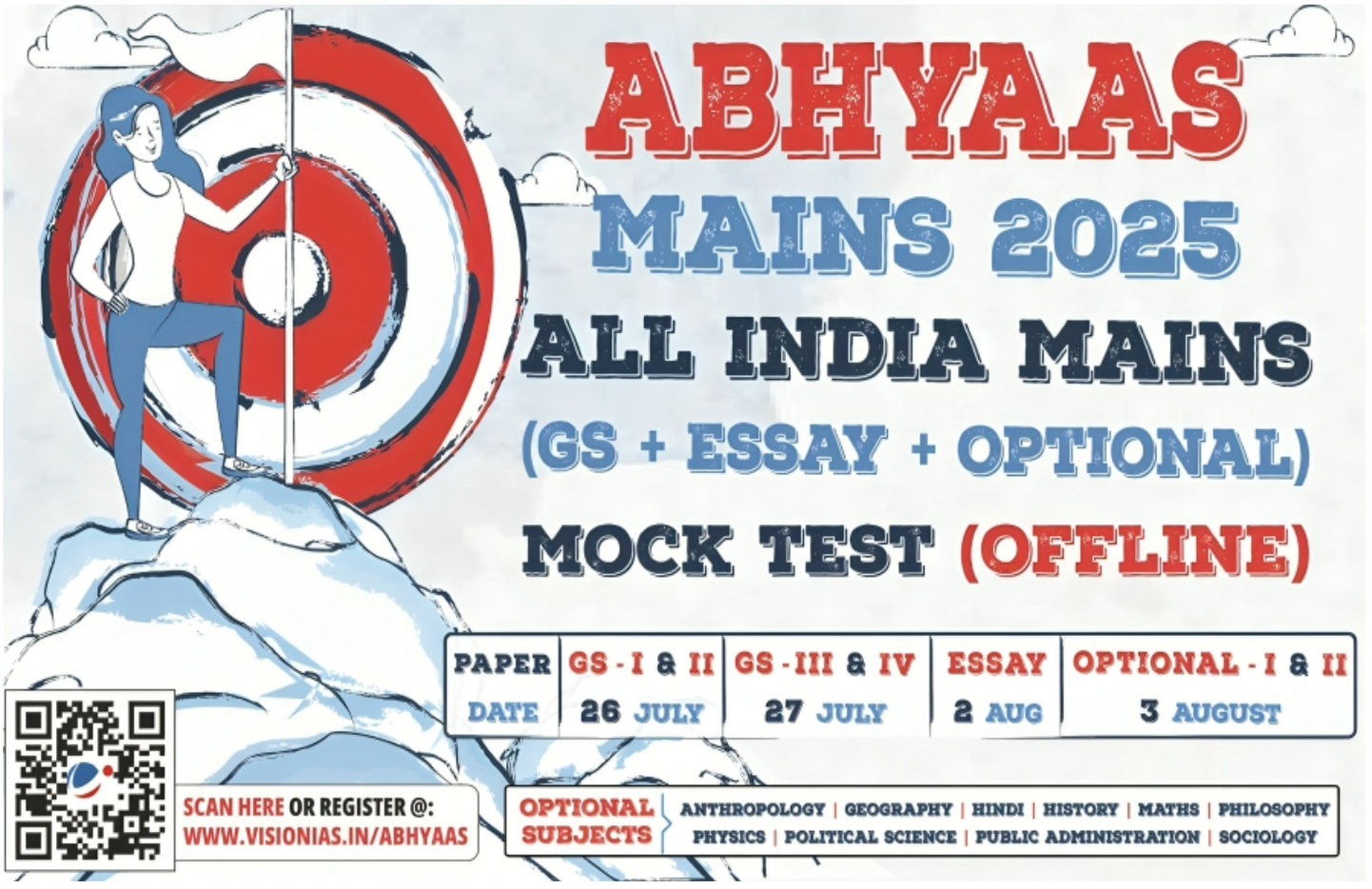
- Associated with **strong anomalous warming** in the central tropical Pacific and **cooling** in the **eastern and western tropical Pacific.**
- Inverse relationship between ENSO and Indian monsoon rainfall.
  - **El Niño** tends to **suppress monsoon rainfall.**
  - **La Niña** generally enhances **monsoon rainfall.**

India Meteorological Department (IMD)

- **Key Achievements**
  - Accurate cyclone warnings reduced deaths **from 10,000 (1999) to near zero (2020-2024).**
  - IMD serves as **UN Early Warning for All advisor to five developing nations**.

River linking project

- **National Perspective Plan (NPP):** National Water Development Agency (NWDA) identified 30 links (16 under Peninsular Component & 14 under Himalayan Component) for preparation of Feasibility Reports
- **Examples:** Ken-Betwa Linking Project (KBLP), Wainganga-Nalganga river linking project



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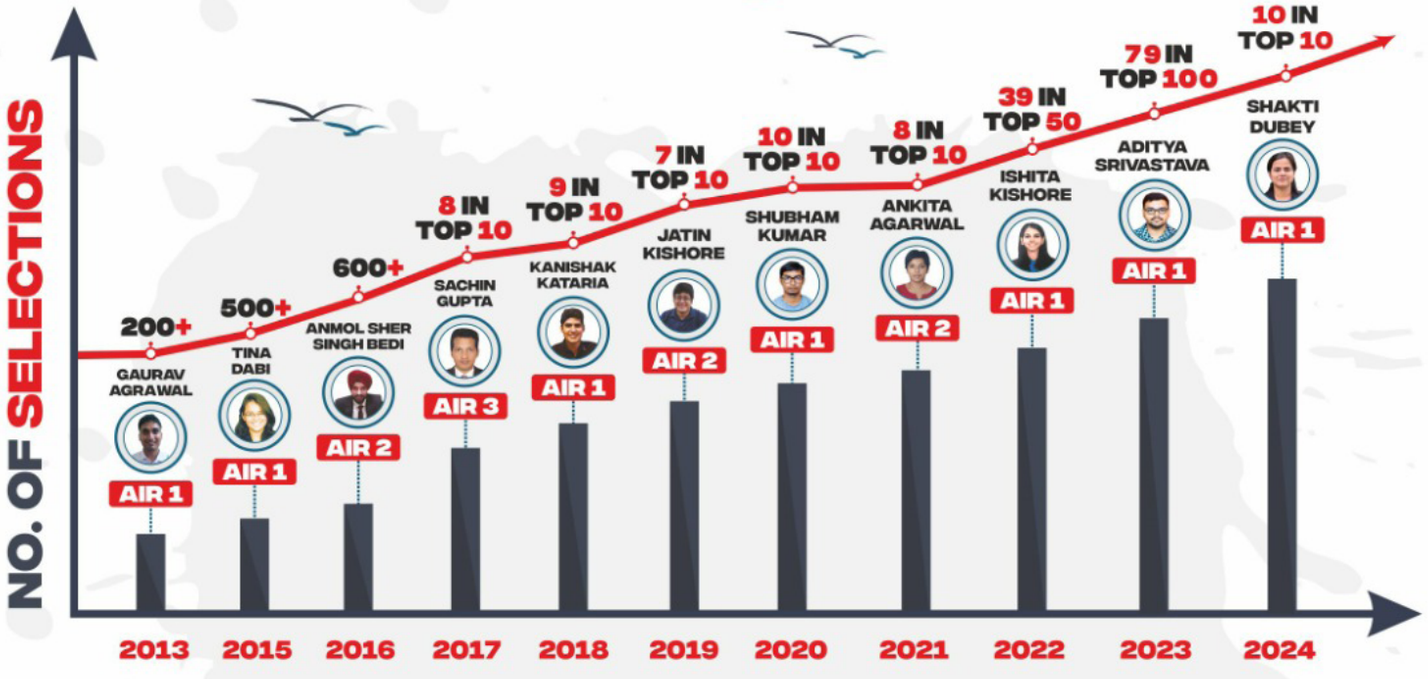

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