



Climate Physical Risks in India

For Prelims: [World Bank](#), [Intergovernmental Panel on Climate Change \(IPCC\)](#), [Composite Water Management Index](#), [Green Hydrogen](#), [Drought-resistant Crops](#), [Mangrove](#), [National Manufacturing Mission](#), [Small Modular Reactors \(SMRs\)](#).

For Mains: Climate Physical Risks (CPRs) for India, Challenges in tackling CPRs, Strategies to address CPRs.

[Source: TH](#)

Why in News?

Recent reports, including from the [World Bank](#), confirm **India's climate crisis**, with **Climate Physical Risks (CPRs)** like **rising temperatures**, **erratic monsoons**, and **severe disasters** threatening over 80% of its population and economy.

What are Climate Physical Risks?

- **About: Climate Physical Risks (CPRs)** refer to the **direct and indirect impacts of climate change** on natural **ecosystems**, **human societies**, and **economic systems**.
 - These risks arise from [extreme weather events](#) and **long-term climatic shifts**, leading to financial losses, operational disruptions, and threats to lives and livelihoods.
- **Types:** CPRs are categorized into **two main types**:
 - **Acute Physical Risks:** They are **short-term, high-impact events** caused by **extreme weather**, such as **hurricanes**, [cyclones](#), [floods](#), [heatwaves](#), [droughts](#), and **severe storms**.
 - Impacts include **infrastructure damage**, **supply chain disruptions**, **loss of lives**, and **community displacement**.
 - **Chronic Physical Risks:** They are **long-term, gradual changes** in **climate patterns**, including [rising sea levels](#), increasing temperatures, changing precipitation, and [ocean acidification](#).
 - These lead to **reduced agricultural productivity**, [water scarcity](#), health risks, and **biodiversity loss**.

What are Climate Physical Risks (CPRs) for India?

- **Rising Temperatures & Heatwaves:** India's average temperature increased by approximately **0.7°C between 1901 and 2018**, while the **tropical Indian Ocean's sea-surface temperature** rose by about **1°C from 1951 to 2015**.
 - The [IPCC](#) warns that each **0.5°C rise** will **worsen heat, rainfall, and drought extremes**. Heatwaves in India could **last 25 times longer by 2036-2065** if temperatures rise to **40°C by 2100**.
- **Erratic Monsoons:** Analysis of long-term data shows a **27% increase in dry**

spells during **1981–2011** compared to 1951–1980, alongside **more intense wet spells in the summer monsoon**.

- In **central India**, extreme daily rainfall (>150mm) increased by **75%** from 1950 to 2015.
- **Droughts & Water Scarcity:** According to **NITI Aayog's 2019 [Composite Water Management Index](#)**, approximately **600 million Indians** face **high to extreme water stress**.
 - **12% of India's population** faces '**Day Zero**' conditions (**water supply is nearly depleted**). By **2030**, water demand may double supply, risking **severe scarcity** for millions and a **6% GDP loss**.
- **Rising Sea Levels:** According to the **Global Assessment Report on Disaster Risk Reduction 2022**, by **2100**, around **27 million people** in India could be impacted by **global sea-level rise** (projected to **rise a foot by 2100**).
- **Food Security Crisis:** Climate change could **reduce wheat yields by 19.3% by 2050 and 40% by 2080**, while **kharif maize** yields may **decline by 18% and 23%** in the same periods.
 - Rising CO₂ levels may lower **iron, zinc, and protein** in staple crops like **rice, wheat, maize, and legumes**, risking **nutritional deficiencies** for **over a billion people** globally.
- **Economic & Infrastructure Damage:** Climate-induced events like **floods** and **heatwaves** damage infrastructure. **India lost USD 3 billion** to floods in the last decade—**10% of global losses**.

What are the Challenges in Tackling CPRs for India?

- **Fossil fuel-centric Energy Model:** Despite renewable gains, **77% of India's electricity** (FY23) still comes from **coal**.
- **Lack of Climate Finance:** India needs **USD 10.1 trillion by 2070** for net-zero, but **green financing** falls short.
- **Technological Lags:** India's green tech sector—especially **battery storage and solar panels**—depends heavily on imports, with **over half (USD 3.89 billion of USD 7 billion in FY24)** coming from China.
 - Limited **domestic manufacturing** hampers the **[Production Linked Initiative \(PLI\) Scheme](#)** and slows green self-reliance.
- **Vulnerability to Renewable Projects:** Ironically, **climate impacts** hinder **renewable energy**.
 - **Wind power** in **Tamil Nadu** may drop **5% in 2024–25** due to erratic winds. High temperatures **reduce solar PV efficiency by 0.4–0.5 % per degree Celsius**. **Dust** can **reduce PV output by up to 60 %**, especially in desert regions.
- **Limited R&D Investment in Green Technologies:** India spends just **0.7% of GDP** on R&D, lagging behind global leaders like **Israel (4.6%), South Korea (4.5%)**.
 - This limits innovation in **[green hydrogen](#), [energy storage](#)**, and **[carbon capture](#)**, where India trails despite being the **third-largest CO₂ emitter**.
- **Challenges in Electric Vehicles (EVs):** The transport sector, responsible for **14% of emissions**, struggles with EV adoption due to limited charging infrastructure (**25,000 stations in 2024**) and high costs.
- **Fragmented Data:** India's **CPR assessments** remain **fragmented**, with efforts dispersed among various **agencies** and **institutions** employing different **methodologies**, lacking a **unified system** despite resources like **IIT Gandhinagar's flood maps** and **IMD's vulnerability atlases**.
 - Reliable **CPR projections** are limited by **global climate models** that overlook India's **hyper-local climate**.

What are Government Initiatives to Tackle CPRs?

- **[National Adaptation Plan \(NAP\)](#)**
- **[National Action Plan on Climate Change \(NAPCC\)](#)**
- **[Atal Bhujal Yojana](#)**
- **[Sovereign Green Bonds](#)**
- **[Mangrove Initiative for Shoreline Habitats & Tangible Incomes \(MISHTI\)](#)**

- [Mission LiFE \(Lifestyle for Environment\)](#)

What Strategies can India Implement to Address CPRs?

- **Agricultural Sustainability:** Building resilience in agriculture and water management is vital for climate adaptation.
 - Promoting [drought-resistant crops](#) and **efficient irrigation** helps mitigate **water scarcity** and optimize usage.
- **Robust Urbanisation:** Implement **climate-resilient building codes** and [sponge city planning](#) to manage water and reduce flooding.
 - Develop [urban forests](#), **heat action plans**, and **sustainable transport** to mitigate heat, cut emissions, and improve air quality.
- **Coastal Adaptation:** **Climate-resilient ports**, [mangrove restoration](#), and strengthened **early warning systems** will protect against climate impacts and enhance preparedness.
- **Decentralized Adaptation:** Districts should form **expert climate cells** to assess **vulnerabilities** and craft **tailored solutions** combining **traditional knowledge** and **scientific data**.
- **Domestic Clean Energy:** India's [National Manufacturing Mission](#) targets reducing dependence on foreign **clean energy tech** like **solar panels** and **batteries**, supporting local production of **solar cells**, **wind turbines**, and **storage**.
 - India also promotes indigenous [Small Modular Reactors \(SMRs\)](#) to boost **nuclear energy** and **energy security**.

Conclusion

India faces escalating **Climate Physical Risks (CPRs)** that threaten its **people, economy, and ecosystems**. While **government initiatives** mark progress, addressing CPRs demands **urgent, unified action**. Strengthening **adaptation**, investing in **green technology**, and **decentralizing climate strategies** are essential to build **resilience**, safeguard **development gains**, and secure a **sustainable future**.

Drishti Mains Question:

Examine the vulnerabilities of renewable infrastructure to Climate Physical Risks (CPRs) and suggest mitigation strategies.

UPSC Civil Services Examination, Previous Year Question:

Prelims

Q. In the context of India's preparation for Climate-Smart Agriculture, consider the following statements: (2021)

1. The 'Climate-Smart Village' approach in India is a part of a project led by the Climate Change, Agriculture and Food Security (CCAFS), an international research programme.
2. The project of CCAFS is carried out under Consultative Group on International Agricultural Research (CGIAR) headquartered in France.
3. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India is one of the CGIAR's research centres.

Which of the statements given above are correct?

- (a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (d)

Q. With reference to 'Global Climate Change Alliance', which of the following statements is/are correct? (2017)

1. It is an initiative of the European Union.
2. It provides technical and financial support to targeted developing countries to integrate climate change into their development policies and budgets.
3. It is coordinated by World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD).

Select the correct answer using the code given below:

(a) 1 and 2 only

(b) 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

Ans: (a)

Mains

Q. Describe the major outcomes of the 26th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). What are the commitments made by India in this conference? (2021)

Q. 'Climate Change' is a global problem. How will India be affected by climate change? How Himalayan and coastal states of India be affected by climate change? (2017)