



India's Path to Climate Resilience

This editorial is based on “[Why climate adaptation can't wait any longer](#)” which was published in Hindustan Times on 01/11/2024. The article brings into picture the urgent need for climate adaptation alongside mitigation, highlighting India's potential to lead with innovative, dual-purpose initiatives like PM Surya Ghar Yojana as a model for the Global South.

For Prelims: [Climate Adaptation](#), [PM Surya Ghar Yojana](#), [Greenhouse gases](#), [Climate-related losses](#), [World Economic Forum](#), [World Migration Report 2024](#), [National Action Plan on Climate Change](#), [Budget 2024-25](#), [National Innovations in Climate Resilient Agriculture](#), [Pradhan Mantri Krishi Sinchayee Yojana](#), [Jal Jeevan Mission](#), [Atal Bhujal Yojana](#), [Smart Cities Mission](#), [AMRUT 2.0](#), [Renewable energy program](#), [Sovereign Green Bonds](#).

For Mains: Importance of Climate Adaptation, India's Progress Towards Climate Adaptation, Major Challenges for India in Climate Adaptation.

With [global temperatures rising](#) and extreme weather intensifying, [climate adaptation is now as critical as mitigation](#). The UN warns that the **1.5°C limit may be breached within 15 years**, putting countries like India at risk. With inadequate international climate finance, India can lead by developing solutions that blend adaptation with mitigation. As **COP in Baku nears**, India's initiatives like [PM Surya Ghar Yojana](#) could serve as a model for the Global South.

What is Climate Adaptation and Climate Mitigation?

- **Climate Adaptation:** Climate adaptation refers to the process of **adjusting to the actual or expected climate and its effects**. It involves making changes to social, economic, and environmental practices to minimize the damage caused by climate change.
 - Examples of climate adaptation include **building flood defenses, developing drought-resistant crops, improving water management systems**, and implementing early warning systems for natural disasters.
- **Climate Mitigation:** Climate mitigation involves efforts to reduce or prevent the emission of [greenhouse gases](#). Its goal is to address the root causes of climate change by limiting the extent of global warming.
 - Examples of climate mitigation strategies include adopting **solar and wind energy, promoting energy-efficient appliances, reforestation**, and reducing reliance on fossil fuels.

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Climate Change Strategies

Climate Adaptation

Adjust to the effects of climate change (e.g., flood defenses, drought-resistant crops).



Climate Mitigation

Reduce greenhouse gas emissions (e.g., solar energy, reforestation).

Why is Climate Adaptation Just as Crucial as Climate Mitigation?

- **Inevitability of Near-term Impacts:** The Earth has already warmed by **1.1°C**, and even **immediate emission cuts** can not prevent certain climate impacts from unfolding in the coming decades.
 - Vulnerable communities urgently need adaptation strategies to survive these severe changes.
 - In 2023, record high temperatures raised poverty risks for **32 to 132 million people** by 2030, with **climate-related losses** totaling **USD 260 billion in 2022**.
- **Economic Cost of Inaction:** Delaying adaptation leads to **escalating costs in disaster response, infrastructure, and economic stability**, especially for developing nations.
 - Conversely, a global investment of **USD 1.8 trillion** in **climate adaptation** measures such as early warning systems, climate-resilient infrastructure, improved agriculture, coastal mangrove protection, and resilient water resources **could generate USD 7.1 trillion in returns** through avoided costs and various social and environmental benefits.
- **Food and Water Security Crisis:** Climate change is disrupting agricultural patterns, water availability, and food production, **making adaptation in these areas critical for global food security**.
 - A recent study using IPCC's highest warming scenario projects a **17% global decline in yields for major crops**—coarse grains, oil seeds, wheat, and rice, which will cover about **70% of the global harvested area** by 2050 compared to a stable climate scenario.
- **Urban Vulnerability:** With over half the world's population residing in cities, urban areas face unique climate risks such as urban flooding, heatwaves, necessitating **immediate adaptation for infrastructure, housing, and public services**.
 - Majority of urban expansion in developing countries is in hazard-prone areas, with adaptation costs projected at **USD 295 billion annually by 2050**
- **Ecosystem and Biodiversity Preservation:** Mitigation alone cannot protect ecosystems already stressed by climate change; adaptation strategies are essential to preserve biodiversity and maintain ecosystem services.
 - **IPBES Global Assessment** estimated that 1 million animal and plant species are threatened with extinction and the **World Economic Forum** highlights that **\$44 trillion** in economic value depends on nature's services.
- **Health System Resilience:** Climate change introduces new health challenges and worsens existing ones, **requiring adaptation of health systems and infrastructure**.
 - The **WHO** projects **250,000 additional yearly deaths** by the 2030s due to climate change impacts on diseases like malaria and coastal flooding.
 - Also, **Climate impacts disproportionately harm vulnerable populations**, making adaptation essential for social equity.
 - **World Migration Report 2024** states that climate impacts will **force 216 million people** to move within their countries by 2050.

How India is Progressing Towards Climate Adaptation?

- **Policy Framework and Planning:** India has established comprehensive adaptation strategies through its [National Action Plan on Climate Change \(NAPCC\)](#) demonstrating a structured approach to climate resilience.
 - The framework includes eight national missions and has been reinforced by the **Long-Term Low Carbon Development Strategy (LT-LEDS)** submitted at COP27.
 - **30 adaptation projects** have been approved at a total cost of INR 8,470 million (Third Biennial Update Report to The United Nations Framework Convention on Climate Change)
 - The government allocated **₹3,030 crore** for climate action in [Budget 2024-25](#).
- **Agricultural Adaptation:** India is advancing climate-smart agriculture through the [National Innovations in Climate Resilient Agriculture \(NICRA\)](#) and [Pradhan Mantri Krishi Sinchayee Yojana \(PMKSY\)](#), emphasizing drought-resistant crops and efficient irrigation.
 - More than **200 varieties tolerant to various stresses** have been demonstrated in **446 Climate Resilient Villages (CRVs)** at 151 vulnerable districts/clusters (as of 2021-22).
 - The PM-KISAN scheme supports **11.3 crore farmers** with a focus on climate adaptation practices. (as of April-July 2022-23 cycle)
- **Water Resource Management:** The Jal Shakti Ministry's initiatives, notably the [Jal Jeevan Mission](#) and [Atal Bhujal Yojana](#), are transforming water resource management and adaptation strategies, emphasizing conservation and groundwater recharge.
 - As of **October, 2024**, Jal Jeevan Mission has successfully provided tap water connections to **11.95 crore additional rural households**, bringing the total coverage to more than 15.19 crore households
- **Urban Resilience:** India's urban adaptation is facilitated through missions like [Smart Cities Mission](#) and [AMRUT 2.0](#), integrating climate resilience into urban planning.
 - As of **July 2024**, the 100 Cities have completed 7,188 projects (**90% of total projects**) as a part of Smart Cities Mission.
- **Coastal Adaptation:** The **National Coastal Mission Scheme** and state initiatives enhance coastal resilience through mangrove restoration, sea wall construction, and early warning systems.
 - India has **increased its mangrove cover by 364 sq km** over the past decade (**Economic Survey 2022-2023**), with the **Indian National Centre for Ocean Information Services (INCOIS)** providing early warnings to many coastal villages.
- **Renewable Energy and Adaptation:** India's [renewable energy program](#), especially [PM-KUSUM](#) and [PM Surya Ghar Yojana](#), combines mitigation with adaptation benefits for vulnerable communities.
 - As of **October 2024**, renewable energy-based electricity generation capacity stands at **201.45 GW**, accounting for 46.3 percent of the country's total installed capacity. This marks a major shift in India's energy landscape, reflecting the country's growing reliance on cleaner, non-fossil fuel-based energy sources.
- **Health Sector Adaptation:** The [National Action Plan for Climate Change and Human Health](#) is bolstering health infrastructure to address climate-related impacts.
 - As of 2023, India has established **1.6 lakh Health and Wellness Centers** under Ayushman Bharat. Further, incorporation of principles of **Green & Climate Resilient Hospitals** has been made under Indian Public Health Standards (IPHS), 2022.
- **Financial Mechanisms:** India is innovating financial mechanisms for adaptation via **green bonds, climate budgeting, and international collaborations**.
 - In FY 2022-23, the Government raised `16,000 crore through [Sovereign Green Bonds \(SGrB\)](#).
 - The **National Bank for Agriculture and Rural Development (NABARD)** is the National Implementing Entity (NIE) for **National Adaptation Fund for Climate Change (NAFCC)** and project funds are released to NABARD in installments based on the performance of the projects and NAFCC guidelines

What are the Major Challenges for India in Climate Adaptation?

- **Financial Constraints:** India faces a significant gap between adaptation needs and available financial resources, with **limited domestic fiscal capacity** and inadequate international support hampering the implementation of crucial adaptation projects.
 - The challenge is compounded by **competing developmental priorities** and the high upfront costs of adaptation infrastructure.

- India will need to spend an estimated **85.6 trillion rupees (\$1.05 trillion)** by **2030** to adapt its various industries to be compliant with climate change norms.
- **Data and Monitoring Challenges:** India struggles with inadequate climate data infrastructure, **limited local-level vulnerability assessments, and weak monitoring systems for adaptation projects**, affecting evidence-based planning and implementation.
 - More than **80% of India's population** lives in districts highly vulnerable to extreme hydro-met disasters. Also, **only 0.86% of districts** in India have a high adaptive capacity. (**Council on Energy, Environment and Water**)
- **Urbanization and Infrastructure Pressure:** Rapid **urbanization** is straining existing infrastructure and creating new vulnerabilities, while adaptation needs in cities grow exponentially.
 - India's urban population is expected to reach 600 million by 2036. According to NIUA, **70% of urban infrastructure needed by 2030 is yet to be built**, requiring climate-resilient planning.
- **Agricultural Vulnerability:** Small and marginal farmers, comprising **86% of Indian farmers**, face severe challenges in adopting climate-resilient practices due to limited resources and knowledge access.
 - Climate variability could reduce agricultural productivity by **10-40% by 2100**.
- **Water Stress Management:** Managing water resources for adaptation is increasingly challenging due to irregular monsoons, groundwater depletion, and competing demands.
 - **NITI Aayog's Composite Water Management Index** reports 600 million Indians face high to extreme water stress.
 - India's northwestern region is predicted to experience **critically low groundwater availability by 2025**, according to a new report by the United Nations.
- **Coastal Vulnerability:** India's 7,500 km coastline faces increasing adaptation challenges from **sea-level rise, cyclones, and coastal erosion**, affecting millions of coastal residents.
 - **One-third of India's coastline** is vulnerable to erosion, impacting coastal communities.
- **Climate-Induced Migration:** Managing climate-induced migration and providing adaptation support to affected communities poses a growing challenge.
 - By 2050, India may experience significant migration, with projections suggesting that up to **45 million people could be displaced due to climate change**.

What Measures can India Adopt to Accelerate Climate Adaptation?

- **Enhanced Financial Mechanisms:** To enhance financial support for climate adaptation, it is essential to revamp the **National Climate Adaptation Fund**, to be financed through a combination of **carbon taxes, cess, and contributions from Environmental, Social, and Governance (ESG) initiatives**.
 - This fund will provide targeted resources for adaptation projects. In addition, **state-level green bonds** specifically designed for adaptation initiatives will allow state governments to raise necessary funds.
 - **Blended finance mechanisms** should also be created, combining public funds with private investment to increase overall financial capacity.
 - Furthermore, **innovative financial products** targeting climate adaptation projects will attract investments, and **special purpose vehicles (SPVs)** at the state level will ensure efficient management and allocation of adaptation funds.
- **Localized Adaptation Planning:** **Localized adaptation planning** is crucial for effectively addressing climate impacts at the community level.
 - Each district should establish **climate adaptation cells** staffed with technical experts to assess local vulnerabilities and develop tailored solutions.
 - By **integrating traditional knowledge with scientific data**, these cells can create effective, location-specific adaptation strategies.
- **Technology-Driven Monitoring:** Implementing a technology-driven approach to climate monitoring can significantly **enhance preparedness and response capabilities**.
 - A national digital platform should be developed to **integrate real-time climate data**, providing accessible information for decision-makers and communities alike.
 - The **deployment of Internet of Things (IoT) sensors and satellite monitoring** systems will enable early warning for climate-related events.
 - Creating mobile applications for community-level monitoring will further empower citizens

to participate in data collection and reporting.

- **Agriculture and Water Resilience:** Building resilience in agriculture and water management is essential for adapting to climate change.
 - Scaling up **climate-smart agriculture through incentive mechanisms** will encourage the adoption of sustainable practices that enhance productivity while minimizing environmental impacts.
 - The promotion of **drought-resistant crop varieties will help farmers mitigate the effects of water scarcity**, while the development of efficient irrigation systems will optimize water use for agricultural purposes.
- **Urban Climate Resilience:** To ensure urban areas are prepared for climate impacts, it is vital to implement **climate-resilient building codes** that mandate standards for new constructions.
 - Urban planning should incorporate **sponge city concepts that enhance water management capabilities**, reducing the risk of flooding.
 - Initiatives to create **urban forests and heat action plans will help mitigate urban heat effects**, while sustainable transport systems will reduce emissions and improve air quality.
- **Coastal Adaptation:** Coastal areas require integrated management strategies to effectively respond to climate change challenges.
 - Implementing **integrated coastal zone management** will ensure a balanced approach to development and conservation.
 - Developing **climate-resilient port infrastructure** will safeguard these critical economic assets against climate impacts.
 - Furthermore, **restoring and protecting mangrove ecosystems will provide natural barriers against erosion and flooding**, while strengthening coastal early warning systems will enhance community preparedness for extreme weather events.
- **Skill Development:** Investing in skill development is essential for enhancing climate adaptation capacities across various sectors.
 - Dedicated **climate adaptation skill programs** will be created to train individuals in effective adaptation practices.
 - Establishing **climate education centers** will further enhance public awareness and understanding of climate issues, promoting a culture of adaptation.
- **Private Sector Engagement:** Engaging the private sector is crucial for scaling up investments in climate adaptation initiatives.
 - Developing **tax incentives for adaptation investments** will encourage businesses to contribute to resilience-building projects.
 - **Mandating climate risk disclosure** will promote transparency and encourage corporations to consider climate impacts in their operations.
 - Supporting climate-resilient business models will further incentivize private sector involvement in adaptation efforts.
- **Research and Innovation:** Fostering research and innovation is vital for developing effective climate adaptation solutions.
 - Establishing **climate adaptation innovation hubs** will serve as centers for research and development of new strategies and technologies.
 - Creating research consortiums will facilitate **collaboration among academic institutions, government, and industry** to advance adaptation research.
- **Inter-State Coordination** Effective climate adaptation requires coordinated efforts across states.
 - Creating **Regional Climate Adaptation Councils** will facilitate collaboration and communication between states on shared challenges and solutions.
 - Developing **cross-state adaptation projects** will allow for the pooling of resources and expertise to address regional climate impacts.
 - Coordinating **shared resource management will ensure sustainable use of environmental assets**, while harmonizing adaptation policies across states will enhance the overall effectiveness of resilience efforts.
- **Mainstreaming Adaptation:** Mainstreaming **climate adaptation into development planning** is essential for long-term resilience.
 - Integrating adaptation considerations into all levels of development planning will ensure that **climate impacts are addressed proactively**.
 - Existing infrastructure should be assessed and upgraded to climate-proof it against future

- risks.
- Finally, **developing adaptation indicators** will allow for ongoing monitoring and evaluation of adaptation initiatives, ensuring accountability and continuous improvement.

Conclusion:

India's proactive climate adaptation efforts are commendable, but significant challenges remain. To accelerate progress, India must enhance **financial mechanisms, strengthen localized adaptation planning, leverage technology, and prioritize agriculture, water, urban, and coastal resilience**. By effectively addressing these challenges and implementing comprehensive adaptation strategies, **India can build a resilient future and lead by example for the Global South**.

Drishti Mains Question:

Why is climate adaptation essential for India in the face of climate change? Discuss the challenges in implementing adaptation measures and suggest ways to overcome them.

UPSC Civil Services Examination, Previous Year Question:

Prelims

Q.1 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.2 Which of the following best describes/describe the aim of 'Green India Mission' of the Government of India? (2016)

1. Incorporating environmental benefits and costs into the Union and State Budgets thereby implementing the 'green accounting'.
2. Launching the second green revolution to enhance agricultural output so as to ensure food security to one and all in the future.
3. Restoring and enhancing forest cover and responding to climate change by a combination of adaptation and mitigation measures.

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

Ans: (c)

Q.3 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.1 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.2 'Climate Change' is a global problem. How will India be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? **(2017)**

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