



## India's Water Stress and Hydropower

**For Prelims:** Hydropower Generation, Water Stress, Credit Rating Agencies, [GDP](#), [World Bank](#), [Pradhan Mantri Krishi Sinchayee Yojana](#), Jal Shakti Abhiyan- Catch the Rain Campaign, Atal Bhujal Yojana

**For Mains:** Water Resources, Conservation of Resources, Reasons for the Water Scarcity in India and ways to address it.

[Source: LM](#)

### Why in News?

Recently, [Moody's Ratings](#) has warned that **India's escalating water shortage, climate change-driven natural disasters** can disrupt several sectors including agricultural production and industrial operations which could undermine the country's **sovereign credit strength**.

### What is the Current State of Hydropower Generation in India?

- **Current State of Hydropower Generation:**
  - Hydropower generation in India has **declined by 17.33%** from 162.05 billion units in FY23 to **133.97 billion units in FY24**.
  - India's installed large **hydro capacity currently stands at 46.92 GW**, constituting approximately **10% of the nation's total power generation capability of 442.85 GW**.
  - **Capacity addition** of large hydropower projects witnessed a **decline in FY24**, with only **60 MW added** compared to 120 MW in FY23.
- **Factors Responsible of Low Hydropower Generation:**
  - **Delayed and Irregular monsoons:** The southwest monsoon has been **delayed this year** and the patchy rainfall due to [El-nino Effect](#) and a prolonged dry spell last year have left water reservoirs drying up.
  - **Low Reservoir Levels:** India's 150 key reservoirs had a **live storage of only 37.662 BCM, representing 21%** of their live storage capacity and 80% less than the previous year.
    - The **Indira Sagar reservoir** in Madhya Pradesh, which supports a hydel capacity of 1 GW, is currently **17% full**, down from 24% at this time last year (2023).
    - Meanwhile, the **Koyana dam** in Maharashtra, with a hydro power capacity of 1.9 GW, is at **10% capacity**, lower than the usual level of 15% for this time of year.
  - **Shutdown of Hydropower Plants:** Some hydropower plants were shut down in the last few years **due to the adverse impact of floods and cloudbursts**, and these plants are yet to resume operations.
- **Implications of Low Hydropower for Energy Sector:**
  - **Increased Reliance on Thermal Power:** With declining hydropower generation compared to last year, **coal-fired power plants will have the load** to meet the rising power demand.
  - **Disruptions in Power Supply:** Industries with high water usage, such as coal power

plants and steel makers, will be impacted by the shortage of water supply.

- Further delay in monsoons has led to several **thermal power plants not undergoing the required maintenance**, which may lead to **faults and trippings** in power supply.
- **Reduced Hydropower Potential:** The decline in water availability will further limit the **potential for hydropower generation**, which is a crucial component of India's [renewable energy](#) component.

## What are Threats to India's Sovereign Credit Profile Identified by Moody's Ratings?

- **Moody** has highlighted a **potential threat to India's sovereign credit profile** arising from the **nation's water scarcity**.
- Moody's has currently assigned India a **Baa3 stable rating**, the **lowest investment-grade** and warned that India's low investment-grade credit rating could be downgraded due to **water scarcity** and the **increasing frequency and severity of climate change-driven natural disasters**.
- It has raised concern regarding critical sectors like **manufacturing, coal-fired power plants, steel production and agriculture**, which would be most affected by it leading to inflationary pressures on food prices, **reduced incomes** for affected businesses and communities and **increased volatility** in India's economic growth.

## What is the Current State of Water in India?

- **Water scarcity:** India has a large **population (18% of the world's total)** but limited **freshwater resources (only 4% of the world's total)**. This makes it a water-stressed country.
- **Water pollution:** Around **50%** of India's rivers are contaminated and polluted, making the water unsafe for drinking or irrigation.
- **Overdependence on groundwater:** India is the **world's largest user of groundwater**, which is leading to depletion of these resources.
  - **Groundwater** plays a vital role in ensuring water security in rural and urban areas, fulfilling around **80% of the drinking water requirements** and **two-thirds of agricultural irrigation needs** in the country.
- **Climate Vulnerability:** Around **three-quarters of India's districts** are vulnerable to **extreme weather** events like droughts and floods, which can further disrupt water availability.

### Note:

- According to a study conducted by the [Council on Energy, Environment and Water \(CEEW\)](#), **55%** of tehsils in India have encountered a substantial increase of more than 10% in southwest monsoon rainfall over the past decade compared to the preceding three.

## What are the Causes of Water Stress in India ?

- **Rapid Economic Growth and Urbanisation:** India's population has grown rapidly, from 361 million in 1951 to over 1.3 billion in 2024.
  - This has led to a significant **increase in water demand for both domestic and industrial uses**, putting a strain on already stressed resources. Industries, major water consumers, further exacerbate the problem by polluting water bodies with their effluents.
- **Declining Water Availability:** According to the Ministry of Jal Shakti, India's average annual water availability per capita is likely to drop to **1,367 cubic metres by 2031** from an already-low **1,486 cubic metres in 2021**.
  - A level below 1,700 cubic metres indicates **water stress**, with 1,000 cubic metres being

the threshold for **water scarcity**.

- **Climate Change and Weakening Monsoon Patterns:** The Indian Ocean has been warming at a rate of **1.2 degrees Celsius per century during 1950-2020**, and this is expected to intensify to **1.7-3.8 degrees Celsius during 2020-2100**.
  - This warming is leading to a **narrowing gap between land and sea temperatures, weakening the monsoon circulation** and resulting in **more severe and frequent droughts**.
  - **Changing weather patterns and melting glaciers** in the Himalayas are altering the availability and distribution of water resources.
- **Agricultural Practices and Inefficient Usage:** Agriculture accounts for over **80%** of India's total water usage.
  - Inefficient irrigation techniques, such as **flood irrigation**, cultivation of **water-intensive crops** like rice and sugarcane in water-scarce regions further strains water resources.
- **Groundwater Depletion:** According to the **Central Ground Water Board**, **54%** of India's groundwater resources are **overexploited** due to **excessive and unregulated groundwater extraction** for irrigation and other purposes.
- **Poor Water Infrastructure and Management:** India's water management system suffers from **deficiencies in infrastructure and governance. Inadequate storage, distribution, and treatment facilities** lead to significant water losses and inefficiencies.
  - Additionally, **weak water management policies, monitoring, and enforcement** worsen these issues.
- **Water Pollution:** Industrial effluents, **agricultural runoff, and domestic sewage** have polluted many of India's surface and groundwater resources. This has reduced the availability of clean, usable water for various purposes.

## What are the Implications of Water Scarcity in India?

- **Health Impacts:** Lack of access to safe drinking water can lead to various health issues like dehydration, infections, and waterborne diseases. The [NITI Aayog](#) reports that **around 200,000 people die in India annually due to inadequate water supply** and related issues.
- **Ecological Damage:** Water scarcity poses a **threat to wildlife and natural habitats, as animals are forced to venture into human settlements**, leading to conflicts and endangerment.
  - It has also disrupted the biodiversity and ecological balance of ecosystems.
- **Reduced Agricultural Productivity:** Agricultural sector, **which consumes 85% of India's water resources**, has been negatively affected with water scarcity leading to reduced crop yields, **affecting food security, and increasing poverty among farmers**.
- **Economic Losses:** Water scarcity can hamper India's economic growth and development by **affecting industrial production, reducing energy generation**, and increasing the cost of water supply and treatment.
  - The [World Bank's 'Climate Change, Water and Economy' report](#) (2016) warns that countries with water shortages may face a significant setback in economic growth by 2050.
- **Effect on India's Climate Goal:** India targets generating **50% of its electricity from non-fossil fuel sources by 2030** and lower hydropower output would lead to **relying heavily on solar and wind power** to fulfil its climate pledge.

## Initiatives Related to Water Management

- [National Water Policy, 2012](#)
- [Pradhan Mantri Krishi Sinchayee Yojana](#)
- [Jal Shakti Abhiyan- Catch the Rain Campaign](#)
- [Atal Bhujal Yojana](#)

## Way Forward

- **Sustainable Groundwater Management:** There is a need to devise a proper mechanism and rural-urban integrated projects for [artificial recharge to groundwater](#) and [rainwater harvesting](#) at household level, conjunctive use of surface water and groundwater, and regulation of water reservoirs.
- **Smart Agriculture:** [Drip irrigation](#) is a powerful technology that can reduce water consumption by **20-40%** while **increasing crop yield by 20-50%** compared to furrow (**flood**) irrigation.
  - Also, cultivation of **less [water-intensive crops](#)** like pulses, millets and oilseeds **should be encouraged** in water-stressed regions.
- **Blue-Green Infrastructure:** Combining [green and blue](#) elements together in modern infrastructure planning can be an effective way of providing a sustainable natural solution for [watershed management](#) and eco friendly infrastructure.
  - **Green indicates:** Gardens, permeable pavements, green roofs.
  - **Blue indicates:** Water bodies like rivers, canals, ponds and [wetlands](#).
- **Using Modern Water Management Techniques:** [Information Technology](#) can be integrated with water-related data systems to enhance management and efficiency.
  - Recent advances in technology have enabled the purification of water previously deemed unfit for consumption, making it clean and safe.
  - Some of the most commonly used techniques include [Electrodialysis Reversal \(EDR\)](#), [Desalination](#), **Nanofiltration**, and **Solar and UV Filtration**.

**Drishti Mains Question:**

What is Water Stress? Discuss the current challenges related to water management in India?

**UPSC Civil Services Examination, Previous Year Question (PYQ)**

**Prelims**

**Q.1 Which one of the following ancient towns is well known for its elaborate system of water harvesting and management by building a series of dams and channelizing water into connected reservoirs? (2021)**

- (a) Dholavira
- (b) Kalibangan
- (c) Rakhigarhi
- (d) Ropar

**Ans: (a)**

**Q.2 With reference to 'Water Credit', consider the following statements: (2021)**

1. It puts microfinance tools to work in the water and sanitation sector.
2. It is a global initiative launched under the aegis of the World Health Organization and the World Bank.
3. It aims to enable the poor people to meet their water needs without depending on subsidies.

**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: (c)**

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**Mains**

**Q.1** What are the salient features of the Jal Shakti Abhiyan launched by the Government of India for water conservation and water security? **(2020)**

**Q.2** Suggest measures to improve water storage and irrigation system to make its judicious use under the depleting scenario. **(2020)**

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