Climate Change and Water Governance

Mains: *GS III –Environmnet and Biodiversity*

Why in News?

Rapid urbanisation, encroachment of water bodies, extreme heat, and recurring water shortages have pushed several Indian cities towards 'Day Zero'–like situations.

What is the current issue and developments?

- **UN recognition of Water** – Water, a United Nations-recognised human right, is under unprecedented stress globally due to rising demand, deteriorating quality, and depletion of renewable sources.
- **Acknowledgement of Water scarcity** – The urgency of reforming water governance has been highlighted by the United Nations University Institute for Water, Environment and Health (UNU-INWEH).
- The UNU – INWEH termed the present global condition as 'Water Bankruptcy'—a stage where water withdrawals exceed renewable replenishment, making terms like "water stress" inadequate.
- **Response from India** – India has responded with technological interventions such as Artificial Intelligence (AI) in water management and renewed attention to traditional systems like baravs (stepwells). However, structural and governance reforms remain imperative.

What are the extent and implications of global water crisis?

- **Limited Freshwater Availability** – Only 0.5% of total global water is readily available as usable freshwater.
- Of this:
  - 70% is used in agriculture
  - The rest is shared between industry and domestic consumption.
- Nearly half of the global population faces at least one month of water scarcity annually, with many experiencing "extremely high" water stress.
- **Ecosystem Degradation and Economic Loss** – Over the last 50 years:
  - Approximately 410 million hectares of natural wetlands have been lost.
  - Ecosystem service losses exceed $5.1 trillion.
- Declining surface and groundwater resources in major food-producing regions have resulted in:
  - Soil salinity and desertification
  - Reduced soil moisture retention

    - Degradation of agricultural lands
- Groundwater over-extraction has caused land subsidence, affecting nearly 5% of global land area, with implications for food security and infrastructure stability.

What are the impacts of climate change on water system?

- **Cryospheric Loss and Sea-Level Rise –** Around *2 billion people* depend on mountain glaciers and seasonal snowmelt for water.
- The World Meteorological Organization reported the largest glacier mass loss in 50 years, amounting to 600 gigatons of water.
- According to the Intergovernmental Panel on Climate Change (IPCC), global sea levels are now approximately 20 cm higher than in 1900, driven in part by glacier melt.
- **Extreme Weather Events** – Since 2000:
    - Asia has recorded the highest flood-related deaths and economic losses.
    - Africa has seen the highest drought-related deaths.
- Water-related vulnerabilities directly affect livelihoods, public health, gender equity, and socio-economic development.

To accelerate conservation efforts, the UN declared 2018–2028 as the **International Decade for Action: "Water for Sustainable Development."**

What is India's surface water status?

- **Hydrological Dependence –** India's surface water availability depends on precipitation, evaporation, seepage, storage capacity, temperature, soil permeability, and runoff patterns.
- More than two-thirds of India's water originates from three Himalayan transboundary river systems:
    - Indus
    - Ganga
    - Brahmaputra
- The Central Water Commission estimates average annual water availability at 2116 BCM (1985–2023), with major contributions from:
    - Brahmaputra basin – 592.32 BCM
    - Ganga basin – 581.75 BCM
    - Godavari basin – 129.17 BCM
- **Water Bodies Census –** India's first census of water bodies (2023) reported:
    - 24,24,540 water bodies, of which 97.1% are in rural areas
    - Only 3.1% have a water spread area greater than 5 hectares
    - Only 12.7% have storage capacity exceeding 10,000 cubic metres
- **State-wise distribution:**
    - West Bengal leads in ponds and reservoirs
    - Andhra Pradesh in tanks
    - Tamil Nadu in lakes
    - Maharashtra in water conservation schemes
- **Per Capita Water Stress –** According to the **Falkenmark Index**:

    - **<1700 m³ per capita/year** = Water stress
    - **<1000 m³ per capita/year** = Water scarcity
- As per NITI Aayog, India's per capita water availability is projected to decline to 1140 m^3 by 2050.
- Around 820 million people already face availability close to or below 1000 m^3, intensifying pressure on urban centres.
- **Urban Water Crisis & Day Zero' Scenarios –** Rapid and unplanned urbanisation has led to encroachment of lakes and wetlands, increased impermeable surfaces, and rising demand.
- Cities that faced 'Day Zero'–like conditions:
    - Shimla (2018)
    - Chennai (2019)
    - Bengaluru (2024)
- **Case Study: Chennai (2019) –** Chennai experienced nearly *200 days without rain.*
- Its four major reservoirs:
    - Red Hills
    - Cholavaram
    - Poondi
- Chembarambakkam, all together met 60% of the city's demand—fell below 1% capacity.
- Out of 6,000 lakes and reservoirs that once existed in Chennai, Kancheepuram, and Tiruvallur (the "Yeri districts"), 2,104 have disappeared.
- **Case Study: Delhi –** Delhi faces a demand-supply gap of 344 million gallons per day (mgd).
- Nearly half its water is non-revenue water (NRW) due to:
    - Leakages
    - Illegal connections
    - Ageing infrastructure
    - Poor maintenance
- Moreover, about 70% of India's surface water is contaminated, although treated wastewater reuse remains an underutilised opportunity.
- **Emerging Hydro-Political Challenges –** Global water governance has largely focused on WASH (Water, Sanitation and Hygiene) and SDG-6.
- However, broader concerns such as groundwater depletion, ecological degradation, agricultural overuse, and transboundary conflicts require urgent attention.
- Recent South Asian hydro-political developments include:
    - China's proposed mega dam on the Yarlung Tsangpo (Brahmaputra)
    - Expiration of the Ganga Water Treaty
- The upcoming UN Water Conference (2026), co-hosted by UAE and Senegal, has prioritised:
    - "Water in Multilateral Processes"
    - "Water for Cooperation"

What measures can be taken?

- **Integrated Basin Management**
    - Strengthening inter-state river basin authorities.

    - Promoting data transparency and ecological monitoring
- **Urban Water Budgeting**
    - City-level water accounting
    - Reducing non-revenue water
    - Mandating wastewater recycling
- **Sponge-City Infrastructure**
    - Increasing green spaces
    - Promoting permeable pavements
    - Enhancing rainwater harvesting
    - Recharging urban aquifers
- **Reviving Traditional Systems**
    - Restoration of tanks, stepwells, wetlands
    - Community-based water governance
- **Expanding Global Water Governance**
    - Moving beyond WASH to include groundwater, ecosystem restoration, desertification, and climate adaptation

What lies ahead?

- The world is entering an era of 'Water Bankruptcy', where demand exceeds renewable supply.
- In India, shrinking per capita availability, urban mismanagement, ecological degradation, and climate variability are converging into a systemic crisis.
- A shift from crisis-response to climate-resilient, integrated water governance—combining technology, traditional knowledge, basin-level planning, and international cooperation—is essential to secure water for future generations.

Reference

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