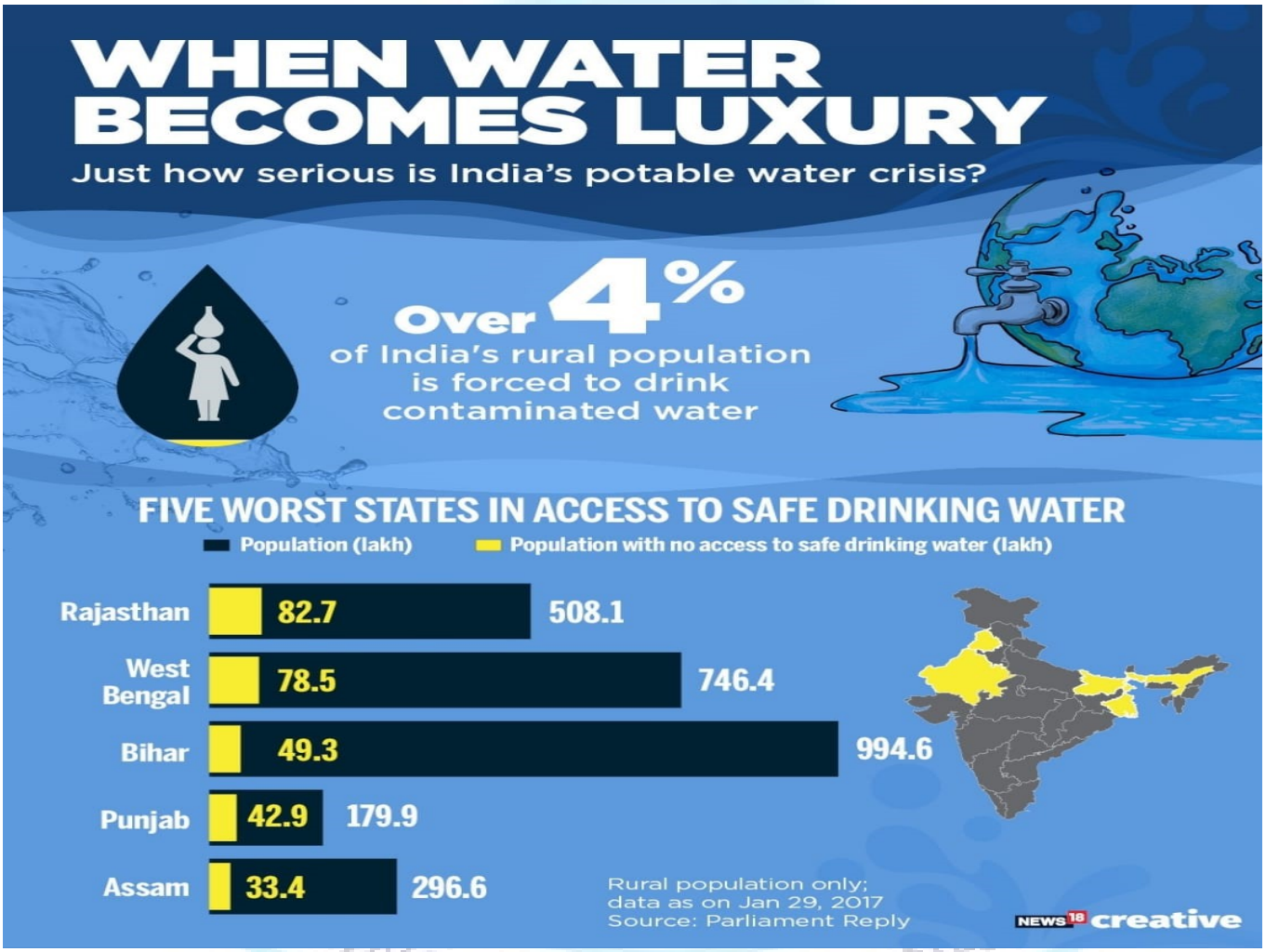
WATER CRISIS AND MANAGEMENT IN INDIA - ENVIRONMENT

India is facing one of the most severe water crises in its history. Rapid population growth, climate pressures, and heavy reliance on agriculture have intensified the challenge, making innovative and effective water governance a pressing necessity.

Water Crisis

A water crisis occurs when the availability, quality, or accessibility of freshwater falls critically short of demand. It leads to severe stress across agriculture, households, industries, and ecosystems, threatening human well-being and economic development.



Water Crisis Situation in India

1. **Limited Resources vs. High Demand**

India has only 4% of global freshwater resources, but it must support 17% of the world's population, creating a structural imbalance.

2. **High Water Stress**

According to NITI Aayog's Composite Water Management Index (CWMI), nearly 600 million Indians face high to extreme water stress, termed the worst water crisis in India's history.

3. **Declining Per Capita Availability**

Per capita water availability was 1,486 cubic meters in 2021, already below the global water stress threshold of 1,700 cubic meters. It is projected to decline to 1,341 cubic meters by 2025 and 1,140 cubic meters by 2050, putting India into the water scarcity zone.

4. **Lack of Safe Drinking Water**

Nearly 200,000 deaths per year are caused by lack of access to safe drinking water. Around 75% of households lack safe drinking water, and by 2030, nearly 40% of Indians may be left without reliable access.

5. **Groundwater Exploitation**

India is the world's largest consumer of groundwater, withdrawing more than 25% of global reserves. Nearly 70% of groundwater is contaminated, and India ranks 120 out of 122 countries in the Water Quality Index (World Bank).

Causes of Water Crisis in India

1. **Demand–Supply Imbalance**

By 2030, water demand is expected to be twice the available supply, putting huge stress on resources. India's population is projected to peak at 1.7 billion in the early 2060s, worsening the crisis.

2. **Over-Extraction & Mismanagement**

Agriculture - Uses about 78–90% of India's freshwater (FAO & CWC estimates). Crops like paddy in Punjab and Haryana have caused critical groundwater depletion.

Urbanisation - Bengaluru's lakes declined from 262 in 1961 to only about 80 today, reducing natural water storage.

3. Pollution of Water Sources

About 70% of surface water is unfit for consumption (World Economic Forum). Lakes like Bellandur in Bengaluru are heavily polluted due to untreated sewage and industrial waste.

4. **Encroachment of Wetlands and Lakes**

Expanding cities like Chennai and Bengaluru have destroyed wetlands, which acted as natural buffers and water storage.

5. **Climate and Environmental Stress**

Erratic monsoons, frequent floods, and droughts triggered by climate change are further straining water security.

6. **Infrastructure and Governance Gaps**

Outdated supply networks, poor treatment plants, and high leakage waste resources. Inter-state disputes over rivers (e.g., Cauvery, Sutlej, Ravi) worsen the situation.

7. **Lack of Public Awareness**

Many citizens still perceive water as a free, unlimited resource, leading to overuse and low conservation efforts.

Impacts of Water Crisis

1. **Agriculture and Food Security**

Shortage of water reduces crop yield, lowering food production and availability, and threatening nutrition security.

2. **Economic Consequences**

According to the World Bank, water shortages could cut India's GDP by 6% by 2050.

3. **Social Consequences**

Unsafe water leads to malnutrition, waterborne diseases, and high healthcare costs, especially impacting the poor.

4. **Ecological Consequences**

Loss of water threatens wetlands, rivers, and biodiversity, leading to extinction of flora and fauna dependent on aquatic ecosystems.

5. **International Relations**

Water scarcity can strain relations with neighbours. Example: China's dams on the Brahmaputra and India–Pakistan tensions over the Indus Water Treaty.

Key Initiatives & Technology in Water Management

a) Digital Mapping, Monitoring, and Data-Driven Planning

Jal Shakti Abhiyan – Catch the Rain (2021) - Uses geo-tagging, remote sensing, and GIS mapping for water conservation.
First Census of Water Bodies (2018–19) - Created a database of 24.24 lakh water bodies, published in 2023.
Jal Dharohar Portal (2023) - GIS-based platform for water body planning and awareness.

b) Groundwater Management

IN-GRES (CGWB) - Web-based application for standard groundwater assessments.
Digital Water Level Recorders (DWLRs) - Over 5,260 devices deployed for real-time monitoring.
Satellite Support - GRACE and NISAR satellites track groundwater depletion.

c) Irrigation & Agriculture

MCAD Scheme (2025-26)- IoT and SCADA for irrigation monitoring, water-use efficiency tracking.
PMKSY-HKKP (2016) - GIS-based mapping of irrigation projects with unique IDs for monitoring.

d) Urban Water Management

AMRUT & AMRUT 2.0 - Incorporates SCADA-based smart urban water management.
UWAIS (Urban Waterbody Information System) - GIS mapping of city water bodies for planning.

e) Rural Drinking Water

Jal Jeevan Mission (2019) - IoT-enabled water supply monitoring in villages.

Global Best Practices

Israel - Drip and micro-irrigation, saving up to 40% of water in agriculture.
Singapore - NEWater project, recycling wastewater into potable water.
Australia - Real-time river management in the Murray-Darling Basin.
China - Use of AI, big data, and satellite imagery for flood and water monitoring.

Challenges in Technology Adoption

1. High costs of advanced systems like IoT, SCADA, and satellites.
2. Digital divide in rural areas due to lack of technical capacity.
3. Fragmented databases, interoperability issues, and cybersecurity risks.
4. Institutional barriers: Water is a state subject, causing coordination problems.
5. Equity concerns: Urban-rich regions benefit more than rural-poor.

Way Forward

1. Scale Up Smart Monitoring – Expand IoT water meters, AI-driven leak detection, contamination alerts.
2. Water Recycling & Reuse – Promote industrial and municipal wastewater recycling.
3. Decentralized Tech Solutions – Greywater reuse, rainwater harvesting, community-led models.
4. Affordable Innovations – Encourage startups and local enterprises for scalable low-cost tech.
5. Community Participation – Vernacular-language dashboards and mobile apps for village-level water audits.
6. Strengthen Governance – Integrate modern tech with traditional wisdom and effective regulation.
7. Climate Resilience – Use predictive analytics for droughts, floods, and disaster preparedness.

Conclusion

India's water crisis is a multi-dimensional challenge, driven by rising demand, over-extraction, pollution, and weak governance. Modern tools like GIS, IoT, AI, and remote sensing can make water management efficient, transparent, and sustainable. However, technology alone is not enough—lasting solutions require a balanced approach, combining advanced tools with traditional practices, community participation, and strong institutional frameworks.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