Urbanisation and Industrialisation Depleting Groundwater

For Prelims: Central Groundwater Board (CGWB), India Meteorological Department (IMD), PMKSY, Jal Shakti Abhiyan, Atal Bhujal Yojana (ABHY)

For Mains: National Aquifer Mapping and Management (NAQUIM) programme, Socio-economic and environmental consequences of groundwater depletion in India, Role of Urbanisation, Government initiatives on groundwater recharge, Issues in Groundwater Management, Strategies for sustainable urban water management.

Source: DTE

Why in News?

A recent study titled ***Detection and Socio-Economic Attribution of Groundwater Depletion in India,*** highlighted the significant impact of urbanisation and industrialisation on groundwater depletion in five Indian states.

What are the Key Findings of the Study?

- **Affected States:** The study raises serious concerns for five hotspots namely Punjab and Haryana, Uttar Pradesh, West Bengal, Chhattisgarh and Kerala:
  - **Punjab and Haryana (Hotspot I):** Most affected, with 64.6 billion cubic metres of groundwater lost in two decades.
  - **Uttar Pradesh (Hotspot II):** Irrigation demand fell by 8%, while domestic and industrial use rose by 38%, causing a 4% groundwater decline.
  - **West Bengal (Hotspot III):** Minimal irrigation growth (0.09%), but a 24% rise in other uses, led to a 3% groundwater drop.
  - **Chhattisgarh (Hotspot I**V): Increased use in all sectors led to declining groundwater levels.
  - **Kerala (Hotspot V):** Groundwater declined by 17% despite high rainfall, due to a 36% irrigation drop and 34% increase in other uses.
- **Primary Cause:**
  - **Rapid Urbanisation: It increased by 10 per cent between 2001 and 2011 and industrialisation,** especially in urban areas like Faridabad and Gurgaon which are not heavily reliant on agriculture, but saw sharp declines in groundwater levels since 2012. It increased by **10% between 2001 and 2011,** accompanied by industrialization, particularly in urban areas like Faridabad and Gurgaon, which are less reliant on agriculture but have experienced sharp declines in groundwater levels since 2012.
  - **Rising Demand**: Increased domestic and industrial water consumption, coupled with only a slight decrease in rainfall during the study period.

Note:

- The **researchers** used data from the Central Groundwater Board (CGWB), India Meteorological

Department (IMD), and **Gravity Recovery and Climate Experiment (GRACE**) satellite between 2003 and 2020.

How is Urbanisation Accelerating Groundwater Depletion?

- **Reduced Natural Recharge:** Impervious surfaces limit rainwater infiltration, hindering natural groundwater recharge.
- **Over-Extraction:** Limited alternative sources in cities lead to excessive, unregulated groundwater extraction.
    - Urban expansion drives high water demand, and it is heavily reliant on groundwater, especially where surface water is scarce.
- **Pollution**: Urban waste and untreated sewage contaminate groundwater, reducing clean water availability and increasing extraction from deeper sources.
- **Higher Extraction Costs:** Deeper water tables from overuse raise pumping costs, with subsidies sometimes exacerbating unregulated extraction.

What are the Major Causes of Groundwater Depletion?

- **Over-Reliance on Groundwater:** Irrigation accounts for approximately 80% of India's total water usage, with a significant portion of this water drawn from groundwater. As the demand for food rises, the extraction of groundwater for irrigation is increasing, leading to its depletion.
- **Poor Water Management**: Inefficient water use, leaking pipes, and inadequate infrastructure for capturing and storing rainwater all contribute to the depletion of groundwater.
- **Decline in Traditional Water Conservation Methods:** Practices like rainwater harvesting, step wells, and check dams have decreased, leading to missed opportunities for groundwater recharge.
- **Climate Change**: Rising temperatures and shifts in precipitation patterns can impact the recharge rates of groundwater aquifers, making them more susceptible to depletion.
    - Factors like deforestation, which leads to soil erosion, can reduce the amount of water able to seep into the ground, diminishing the natural recharge of groundwater aquifers.
    - Climate change events such as droughts, flash floods, and disrupted monsoon seasons are intensifying pressure on India's groundwater resources.

What are the Impacts of Groundwater Depletion?

- **Reduced Crop Yields:** Depleted groundwater limits irrigation, impacting crop productivity and food security.
- **Urban Water Scarcity:** Cities increasingly rely on groundwater, and depletion leads to higher costs, reduced water availability, and strain on municipal services.
- **Public Health Risks**: India is home to **18%** of the world’s population, but only holds 4% of the world’s freshwater resources.
    - Declining water quality from overuse and contamination increases the spread of waterborne diseases and heavy metal exposure.
- **Ecosystem Loss:** Lowered water tables affect wetlands, forests, and aquatic ecosystems, disrupting biodiversity.
- **Increased Drought Risks**: Groundwater depletion reduces resilience to droughts, which are projected to become more frequent with climate change.

What are India’s Initiatives for Sustainable Groundwater Management?

- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
- Jal Shakti Abhiyan - Catch the Rain
- National Water Policy (2012)
- National Aquifer Mapping and Management (NAQUIM) programme
- Atal Bhujal Yojana

What are the Challenges in Groundwater Management in India ?

- **Overexploitation:**The Green Revolution increased the need for groundwater to support food security, leading to widespread borewell installations.
  - The Central Groundwater Board reports **17%** of blocks are overexploited, with significant depletion in north-western, western, and southern India.
- **Climate Induced Challenges:** Erratic rainfall and increased pollution have exacerbated water scarcity.
  - Groundwater serves **85%** of rural domestic water, **45%** of urban water, and over **60%** of agricultural irrigation, impacting multiple sectors.
- **Weak Regulatory Framework:** Regulations currently cover only **14%** of overexploited blocks, allowing unchecked groundwater extraction.
  - Lack of local regulatory enforcement in early stages of depletion exacerbates water scarcity.
- **Community Involvement and Institutional Weaknesses:**
  - Participatory Groundwater Management (PGM) has empowered communities in some regions, but success is limited by weak institutions and supply failures.
  - Informal groundwater committees often become inactive after project completion, lacking sustainability in the long term.
- **Subsidies and Usage:**
  - Subsidized power for water pumping encourages excessive groundwater extraction, leading to rapid depletion.
  - Industrial and domestic usage rose by 34%, while irrigation-related groundwater demand dropped by 36%.

What are the Strategies for Sustainable Groundwater Management?

- **Address Demand and Supply:**
  - Supply Side: Initiatives like watershed management and aquifer recharge are vital but need complementary demand-side measures.
  - Demand Side: Promoting water-efficient irrigation (e.g., drip systems) and encouraging less water-intensive crops can reduce stress on groundwater resources.
- **Community Participation:**
  - Enhanced community involvement in governance improves sustainability, as shown by the PGM approach in regions with defined aquifers.
  - Empowering local institutions and supporting capacity development at the community level is essential for effective management.
- **Regulatory Enhancements:**
  - Comprehensive regulatory measures at local levels before blocks reach the overexploited stage can prevent further depletion.
  - Long-term viability of institutions like **Water User Associations (WUAs)** is crucial for sustained groundwater management.
- **Cross Sectoral Reform:**
  - Cross-sectoral reforms that reduce incentives for groundwater overexploitation, **such as revising power subsidies,** are critical for sustainable usage.
  - Repurposing support for climate-smart agriculture and aligning energy policies with **water conservation objectives** can aid in sustainable resource use.

Drishti Mains Question

Q. Analyze the impact of urbanization and industrialization on India's groundwater resources, noting states with significant depletion. Discuss associated challenges and propose mitigation measures.

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)

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)**