

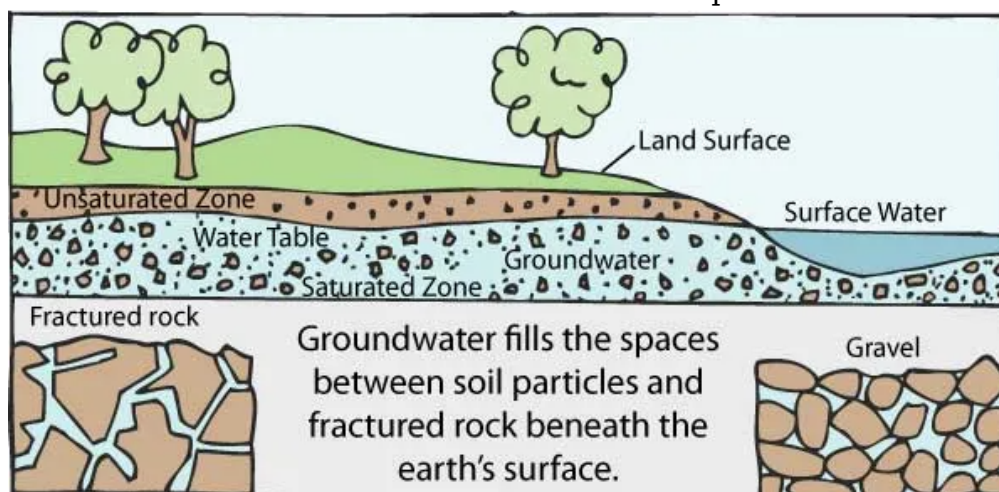
## Groundwater Depletion

### Why in news?

A recent study shows significant groundwater depletion in five Indian states.

### What is groundwater?

- **Groundwater** - It is the water found underground in the cracks and spaces in soil, sand and rock.
- It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.
- **Aquifers** - They are typically made up of gravel, sand, sandstone, or fractured rock, like limestone.
- Water can move through these materials because they have large connected spaces that make them permeable.
- **Saturation zone** - The area where water fills the aquifer is called the saturated zone (or saturation zone).
- **Water table** - The top of the saturation zone is called the water table.
- It may be located only a foot below the ground's surface or it can sit hundreds of feet down.
- It may be deep or shallow that may rise or fall on basis of many factors.
- **Speed of groundwater flows** - It depends on the size of the spaces in the soil or rock and how well the spaces are connected.



- **Groundwater recharge** - They are recharged by rain and snow melt that seeps down into the cracks and crevices beneath the land's surface.
- 'Groundwater' is often referred to as the hidden lifeblood of our planet, essential for sustaining agriculture, industry, and communities.
- **Groundwater depletion** - It occurs when groundwater is extracted faster than it can be replenished.
  - Groundwater, constituting 62% of irrigation and 85% of rural water supply.

## What are the key drivers of groundwater depletion?

- **Agricultural exploitation** - It dominates groundwater consumption, especially with high water-demand crops like paddy & sugarcane.
- Farmers continue to favor these crops for financial returns, even in arid regions, leading to excessive extraction.
  - In regions like Punjab and Haryana, traditional agricultural practices remain highly dependent on groundwater.
- **Energy subsidies** - Power subsidies in agriculture have *incentivized unregulated pumping*, adding to groundwater depletion.
- **Green revolution legacy** - *High-yield crops* introduced during the green revolution remain prevalent, adding pressure to already vulnerable regions.
- **Unregulated industrial use** - Rapid industrialization has led to unmonitored groundwater extraction across all affected states.
- Industries often have high water demands, especially those involved in manufacturing, textile processing, and other water-intensive sectors.
- **Population growth** - As population grows, they require substantial amounts of water for drinking, sanitation, and other domestic uses.
- **Rapid urbanization** - The rapid pace of urbanization has also strained groundwater resources.
  - The level of urbanization between 2001 and 2011 increased by 10 per cent, from 10 to 20%.
- **Encroachments over natural recharge zones** - It seals off areas where rainwater could previously seep into the ground and replenish aquifers.
- **Widespread use of bore wells** - Contributes to rapid extraction, often outpacing natural recharge rates.
- **Groundwater contamination** - Contaminants such as arsenic, nitrate, fluoride, and salinity compromise groundwater quality.
  - Pollution from fertilizers, industrial waste, and poor waste management has impacted nearly 60% of Indian districts.
- **Weak regulation** - With insufficient policies governing groundwater usage, both urban and rural areas face unchecked extraction.
- The lack of stringent regulations on private groundwater ownership has further deepened the crisis.

## Status of Groundwater Depletion in India

- India, home to 16% of the global population but with just 4% of the world's freshwater.
- According to the Central Groundwater Board, ***17% of India's groundwater blocks are classified as over-exploited***, with extraction far exceeding natural recharge rates- a situation worsened by climate change and pollution.
- A drop in net annual groundwater availability between 2004-05 and 2018-19 by 4%.
- **Hotspot categorization** - The study raises serious concerns for five hotspots with the northern and northwestern hotspots have suffered a staggering loss of approximately 64.6 billion cubic meters of water over the past two decades.

Hotspot	State	Decline in net annual groundwater availability (2004- 2018)
I	Punjab & Haryana	4 %
II	Uttar Pradesh	4 %
III	West Bengal	3 %
IV	Chhattisgarh	4 %
V	Kerala	17 %

### What are its impacts?

Social Impacts	Ecological Impacts
<ul style="list-style-type: none"> <li>• Water Scarcity</li> <li>• Food Insecurity</li> <li>• Public Health Crisis</li> <li>• Livelihood Challenges</li> </ul>	<ul style="list-style-type: none"> <li>• Damages Habitat</li> <li>• Reduced Productivity</li> <li>• Reduced Biodiversity</li> <li>• Ecosystem Damages</li> </ul>

- **Water scarcity** - It reduces water availability thereby impacting sustenance of living organisms.
- **Public health issues** - People may turn to unsafe sources, risking exposure to contaminants like arsenic.
- **Food insecurity** - Overexploitation of groundwater resources has led to large-scale depletion in key food producing countries, cascading impacts for global food security.
- **Impact on livelihood** - Marginalized section of people who cannot afford alternative water sources will have impact on their incomes.
- **Ecosystem damage** - It affects vegetation, wildlife, and wetland habitats that depend on consistent water levels.
- **Biodiversity crisis** - It leads to reduction in biodiversity, impacting flora and fauna and threatening overall ecological balance.

### Groundwater Contaminants and their Impacts

- **Nitrates from fertilizers and sewage** - They contribute to health risks like methemoglobinemia.
- **Pathogens from poor sanitation** - They lead to waterborne diseases.
- **Trace Metals from industrial activities** - They pose carcinogenic risks.
- **Inorganic Compounds** - They degrade water quality, affecting human health and water hardness.
- **Organic Compounds from pesticides and industrial discharges** - They harm ecosystems and health.

### What are the government measures?

- **Statutory measures** - The Water (Prevention and Control of Pollution) Act 1974 aims to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country.
- **Policy measures** - National Water Policy (2012) promotes efficient water use across all sectors.
- **Institutional measures** - Bureau of Water Use Efficiency (BWUE) formed under the National Water Mission develops standards for water-efficient products and practices.
- Central Ground Water Authority (CGWA) regulates large-scale groundwater extraction.
- **Water management initiatives** - Jal Shakti Abhiyan (JSA) focuses on rainwater harvesting and groundwater recharge under [Catch the Rain initiative](#).
- [Amrit Sarovar Mission](#) aims to rejuvenate and develop 75 water bodies in each district of the countries.
- Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) focuses on building water conservation and water harvesting structures.
- Atal Mission for Rejuvenation and Urban Transformation ([AMRUT](#)) 2.0 uses 'Aquifer Management Plan' harvesting the rainwater through storm water drains into water body.
- [Atal Bhujal Yojana](#), a community-led scheme focuses on sustainable groundwater management in 80 water-stressed districts of 7 States, viz., Haryana, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.
  - The scheme incentivizes states to adopt water-efficient agricultural practices.
- National Aquifer Mapping and Management (NAQUIM) to delineate the aquifers, characterize them and prepare management plans.
- Watershed Development Component under Pradhan Mantri Krishi Sinchai Yojana (WDC-PMKSY) for the development of rain fed and degraded lands in the country.

### What lies ahead?

- Strengthen groundwater regulations.
- Promote sustainable agricultural practices.
- Promote less water-intensive crops.
- Implement efficient irrigation techniques, such as drip and sprinkler systems.
- Invest in water infrastructure.
- Decentralize groundwater management.
- Encouraging Blue Credit schemes for encouraging water conservation efforts in both domestic and industrial sectors.

- Encourage community-based water management initiatives to promote sustainable water usage at the local level.
- Restore wetlands and urban recharge zones in urban areas.

## Reference

[Down To Earth| Ground Water Depletion in India](#)

