



## Groundwater Extraction and Land Subsidence

**For Prelims:** [Groundwater extraction](#), [Land subsidence](#), [Urbanization](#), [National Compilation of Dynamic Ground Water Resources in India](#), [Central Ground Water Board \(CGWB\)](#)

**For Mains:** Status of Ground Water Extraction in India, Land subsidence due to Groundwater Extraction.

### Why in News?

Cracks in **buildings and 'sinking' land in Joshimath, Uttarakhand** a hill town in Uttarakhand, made the headlines earlier in 2023.

- A similar phenomenon has been playing out for years in the plains of **Punjab, Haryana, Delhi and Faridabad**. According to the data gathered for years by the [Central Ground Water Board \(CGWB\)](#), **excessive groundwater extraction** is identified as the underlying cause of these alarming incidents

### What is Land Subsidence?

- **About:**
  - Land subsidence refers to the **gradual sinking or settling of the Earth's surface**, usually due to the compaction of underground layers of **soil, rock, or other materials**.
  - It occurs when the **support structures beneath the land**, such as **aquifers, underground mines, or natural gas extraction**, are depleted or when certain geological processes take place.
- **Impact:**
  - In urban areas, it can **damage infrastructure, including roads, buildings, and underground utilities**.
  - It can also increase the **risk of flooding in coastal regions by reducing the elevation of the land relative to sea level**.
  - In agricultural areas, subsidence can affect irrigation systems, disrupt the flow of water in rivers and canals, and cause **permanent damage to farmland**.

### What has the CGWB Identified About Groundwater Extraction and Land Subsidence?

- **Land Subsidence Due to Groundwater Extraction:**
  - Digging operations conducted for mining activities demonstrated the **occurrence of "soil settlement" or sinking due to voids created from mining**. Similar observations prompted researchers to **investigate the role of groundwater extraction in land subsidence in India**.
- **Evidence of Land Subsidence in Different Regions:**
  - Unlike **land movement from landslides or earthquakes**, **subsidence from groundwater extraction was gradual and barely visible annually**.
    - Studies utilizing satellite-based analysis of ground movement have identified

**building deformities resulting from groundwater withdrawals.**

- Using data from the Sentinel-1 satellite shows that the **National Capital Region (NCR) sank an average of 15 mm per year from 2011-2017.**
  - [Urbanization and unplanned growth](#) exacerbated groundwater withdrawal and contributed to subsidence in the NCR.
- Kolkata and parts of eastern India also **experience overexploited groundwater blocks and land subsidence.**

## What is the Status of Ground Water Extraction in India?

### ▪ About:

- Currently, **85% of rural and 50% of urban population** is dependent on groundwater for sustenance, **making India the largest groundwater user globally.**
- India's stage of groundwater extraction, **which is the percentage of utilization of groundwater against recharge**, has **dropped from 61.6% in 2020 to 60.08% in 2022**, according to the report on the [National Compilation of Dynamic Ground Water Resources in India.](#)

### ▪ Groundwater Depletion in Northwest India:

- Agricultural practices in N-W India heavily depend on **groundwater withdrawal due to limited monsoon rain.**
- Data from the **CGWB** reveals alarming levels of groundwater exploitation:
  - Punjab: **76% of groundwater blocks are 'over exploited.'**
  - Chandigarh: **64% of groundwater blocks are 'over exploited.'**
  - Delhi: **Approximately 50% of groundwater blocks are 'over exploited.'**

### ▪ Issues Associated:

- **Unregulated Pumping:** Several states affected by depletion of groundwater provide **free or heavily subsidized power (including [solar pumps](#))** for pumping groundwater for irrigated agriculture.
  - This enables **overexploitation and depletion of scarce groundwater resources.**
- **Preference to Water-Intensive Crops:** The [minimum support price](#) for wheat and rice creates highly skewed incentive structures in **favor of wheat and paddy**, which are water intensive crops and depend heavily on ground water for their growth.
  - This makes **groundwater a heavenly resource for their farming.**
- **Saline Water Intrusion:** In coastal areas, excessive groundwater pumping can cause [saline water intrusion.](#)
  - As fresh groundwater is depleted, **seawater infiltrates into the aquifers, making the water unsuitable for various uses** and adversely impacting agriculture and ecosystems.
- **Ecological Impacts:** Groundwater depletion affects ecosystems by altering the **flow of water in rivers, lakes, and wetlands.**
  - This **disrupts the natural balance, harming aquatic life and biodiversity.** It also affects the availability of water for plants and animals dependent on groundwater sources.

## What are the Government Initiatives Related to Groundwater Conservation?

- [Pradhan Mantri Krishi Sinchayee Yojana](#)
- [Jal Shakti Abhiyan- Catch the Rain Campaign](#)
- [Atal Bhujal Yojana](#)
- [Atal Mission for Rejuvenation and Urban Transformation \(AMRUT\)](#)

## Way Forward

- **Crop Diversification and Efficient Irrigation:** There is a need to **promote [crop diversification](#)** and shift to more **water-efficient irrigation** techniques like drip **irrigation and sprinkler**

systems.

- **River Catchment Management:** Creation of **green corridors**, [rainwater harvesting zones](#), **mapping of channels for potential recharge zones** to store floodwater and artificial groundwater recharge structures in the urban areas (where groundwater is five-six meters below the surface), **will subsequently contribute to reducing groundwater depletion.**
- **Technology and Monitoring:** Leverage technology for real-time monitoring of groundwater levels, such as **remote sensing**, [IoT devices](#), and **data analytics can help in informed decision-making and enable prompt action to mitigate groundwater depletion.**
- **Wastewater Recycling and Reuse:** There is a need to **encourage the use of treated wastewater for non-potable purposes** like industrial processes to reduce the **reliance on freshwater sources** and alleviate the pressure on **groundwater extraction.**

## 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)**

**Source: TH**

