GROUNDWATER

Level of groundwater extraction lowest in 18 years, finds study

Why in News?

Groundwater extraction in India saw an 18-year decline, according to an assessment by the Central Ground Water Board (CGWB).

Key Findings of the Report

- The total annual groundwater recharge for the entire country is 437.60 billion cubic metres (bcm) and annual groundwater extraction for the entire country is 239.16 bcm, according to the 2022 assessment report.
- Out of the total 7,089 assessment units in the country, 1,006 units have been categorised as "over-exploited" in the report.

Comparison of Reports

- An assessment in 2020 found that the annual groundwater recharge was 436 bcm and extraction 245 bcm.
- In 2017, recharge was 432 bcm and extraction 249 bcm.
- The 2022 assessment suggests that groundwater extraction is the lowest since 2004, when it was 231 bcm.
- Improvement in ground water conditions in 909 assessment units in the country when compared with 2017 assessment data.

> The groundwater recharge levels don't reflect the water that can be actually extracted, called the "extractable groundwater resources".

- In 2020, for instance, the "extractable groundwater resources" amounted to 397.62 bcm, which is less than the recharge that year.
- Overall decrease in number of over-exploited units and decrease in stage of groundwater extraction level have also been observed.
- Assessment indicates increase in ground water recharge which may mainly be attributed to increase in recharge from canal seepage, return flow of irrigation water and recharges from water bodies/ tanks & water conservation structures.

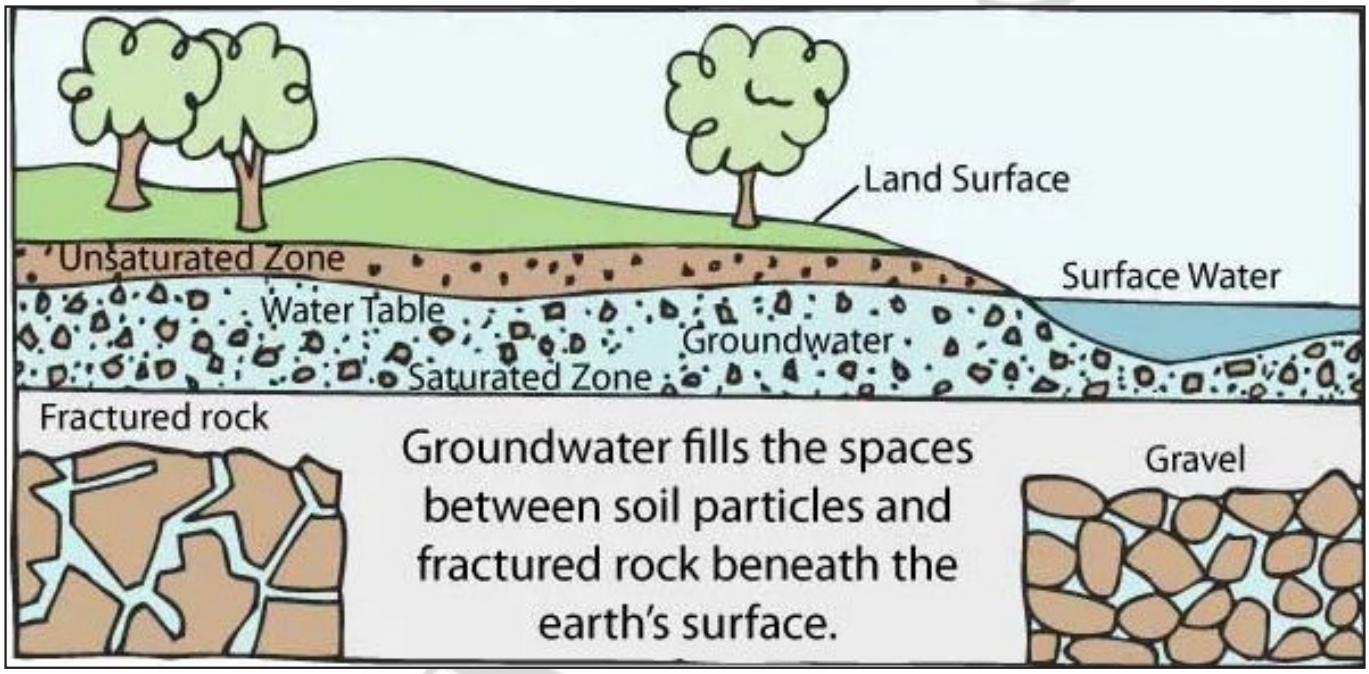
Sources of Water in India

- There are four major sources of surface water.
- These are rivers, lakes, ponds, and tanks. In the country, there are about 10,360 rivers and their tributaries longer than 1.6 km each.
- The mean annual flow in all the river basins in India is estimated to be 1,869 cubic km.
- Due to topographical, hydrological and other constraints, only about 690 cubic km (32 per cent) of the available surface water can be utilised.

- Water flow in a river depends on size of its catchment area or river basin and rainfall within its catchment area.

About Groundwater

- Groundwater 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 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.



- The speed at which groundwater flows depends on the size of the spaces in the soil or rock and how well the spaces are connected.
- Groundwater supplies are replenished, or recharged, by rain and snow melt that seeps down into the cracks and crevices beneath the land's surface.

Groundwater Resources

- The total replenishable groundwater resources in the country are about 432 cubic km.
- The Ganga and the Brahamaputra basins, have about 46 per cent of the total replenishable groundwater resources.
- The level of groundwater utilisation is relatively high in the river basins lying in north-western region and parts of south India.
- The groundwater utilisation is very high in the states of Punjab, Haryana, Rajasthan, and Tamil Nadu.
- There are States like Chhattisgarh, Odisha, Kerala, etc., which utilise only a small proportion of their groundwater potentials. States like Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra are utilising their ground water resources at a moderate rate.

Water Demand and Utilisation

- India has traditionally been an agrarian economy, and about two-third of its population have been dependent on agriculture.
- Hence, development of irrigation to increase agricultural production has been assigned a very high priority in the Five Year Plans, and multipurpose river valleys projects like the Bhakra-Nangal, Hirakud, Damodar Valley, NagarjunaSagar, Indira Gandhi Canal Project, etc. have been taken up.
- In fact, India's water demand at present is dominated by irrigational needs.
- Agriculture accounts for most of the surface and ground water utilisation, it accounts for 89 per cent of the surface water and 92 per cent of the groundwater utilisation.
- While the share of industrial sector is limited to 2 per cent of the surface water utilisation and 5 per cent of the ground-water, the share of domestic sector is higher (9 per cent) in surface water utilisation as compared to groundwater.
- The share of agricultural sector in total water utilisation is much higher than other sectors.
- But in future, with development, the shares of industrial and domestic sectors in the country are likely to increase.

Causes of Groundwater Depletion

- Groundwater depletion most commonly occurs because of the frequent pumping of water from the ground.
- A large amount of groundwater goes to farming, but the availability of groundwater is steadily declining.
- Changes in our climate and can speed up the process of Depletion.
- Trees hold the rain water and slowly drop it to the ground, absorbing up to 18 inches of precipitation before gradually releasing it to natural channels and recharging ground water.
  - But the way the forests are being destroyed on the Earth, the problem of ground water depletion is becoming even graver.
- When glaciers melt, they initially contribute more water to the rivers they feed.
  - After this there is a decline in water contributed to the seasonal melt cycle, as shrinking glaciers provide a smaller contribution to the overall river flow.
  - It increases the pressure on the water resources as water levels dip in the rivers they feed.

Consequences of Ground Water Depletion

- According to the Report of Central Ground Water Board, more than half of India's groundwater is contaminated.
  - The report says that at least 276 districts have a high level of fluoride, nitrate is above the safe level in 387 districts, and 86 districts have a high level of arsenic.
  - Bad environmental management system leads to the discharge of toxic water with the result that surface and underground water sources used for irrigation and domestic operations have been contaminated.
- Fisheries and turtles are dying in the Yamuna. Pilgrims are unable to find water for bathing. The trees on the river bank are dying. Environment of entire areas is being destroyed.

- Among hill areas, Udham Singh Nagar in Uttarakhand has registered 40% decline in water level.
  - The state has also registered decline in water level in Rudrapur, Haridwar, and Dehradun.
  - The same situation prevails in the plain and lowland regions. All this becomes a major cause of migration.
- Major rivers are gradually drying up with excessive tapping of water. Earlier, Yamuna's water was reach Delhi all through the year, now due to the digging of deep tube-well near the rivers in Haryana and Uttar Pradesh, enough water is not able to reach Delhi.
- World energy requirements are rapidly increasing with modernization and population growth, however energy production is one of the world's greatest consumers of freshwater resources.
- In the United States, thermoelectric power plants accounted for 38% of freshwater withdrawals in 2010.
- Global electricity demand is projected to grow 70% by the year 2035 with India and China accounting for half of the growth.
- Alternative energy sources like wind and solar energy require far less water to produce but only make up a small fraction of today's energy production.
- Lack of freshwater can also affect worker productivity by causing illnesses and higher water costs for individuals can reduce household disposable income.

Water Conservation and Management

There is need to encourage watershed development, rainwater harvesting, water recycling and reuse, and conjunctive use of water for sustaining water supply in long run.

Prevention of Water Pollution

- The legislative provisions such as the Water (Prevention and Control of Pollution) Act 1974, and Environment Protection Act 1986 have not been implemented effectively.
- The result is that in 1997, 251 polluting industries were locatedalong the rivers and lakes.
- The Water Cess Act, 1977, meant to reduce pollution has also made marginal impacts.
- There is a strong need to generate public awareness about importance of water and impacts of water pollution.
- The public awareness and action can be very effective in reducing the pollutants from agricultural activities, domestic and industrial discharges.

Recycle and Reuse of Water

- Use of water of lesser quality such as reclaimed waste-water would be an attractive option for industries for cooling and firefighting to reduce their water cost.
- Similarly, in urban areas water after bathing and washing utensils can be used for gardening.
- Water used for washing vehicle can also be used for gardening.
- This would conserve better quality of water for drinking purposes. Currently, recycling of water is practised on a limited scale.

Watershed Management

- Efficient management and conservation of surface and groundwater resources.
- It involves prevention of runoff and storage and recharge of groundwater through various methods like percolation tanks, recharge wells, etc
- There is a need to generate awareness regarding benefits of watershed development and management among people in the country, and through this integrated water resource management approach water availability can be ensured on sustainable basis.

Rainwater Harvesting

- Rain water harvesting is a method to capture and store rainwater for various uses.
- It is also used to recharge groundwater aquifers. It is a low cost and eco-friendly technique for preserving every drop of water by guiding the rain water to bore well, pits and wells.
- Rainwater harvesting increases water availability, checks the declining ground water table, improves the quality of groundwater through dilution of contaminants like fluoride and nitrates, prevents soil erosion, and flooding and arrests salt water intrusion in coastal areas if used to recharge aquifers.

Case Study Related to Water Management

1. Developing a treatment and reuse network for India using Lessons From Israel

2. Ground Water Management in Andhra Pradesh

- Andhra Pradesh has established a comprehensive information portal for water resources in the state.
- The dashboard allows real-time monitoring of rainfall, groundwater, soil moisture, tanks, check dams, and other water indicators.
- Real-time monitoring, and the associated reforms, such as farmer advisory for cropping patterns, have helped the state boost its groundwater management, with Andhra Pradesh scoring the highest on the 'Source augmentation (Groundwater)' theme of the Index. As an input into the data portal, the state has also mapped and constructed recharge infrastructure for all critical and over-exploited groundwater units

Key actions

- The state has partnered with a private firm, Vassar Labs, to undertake the creation of a water and cropping data system targeted towards water conservation and advisory services to farmers. The system is using satellite data and soil sensor data to create local water profiles and recommend optimal agricultural decisions to farmers.
- This system has involved geo-tagging and enabling real-time monitoring of several water assets, such as large dams, tanks, groundwater wells, etc., with a high spatial resolution.
- For groundwater, this means that all units have been mapped and recharge infrastructure created where required, and levels are being monitored in real-time, with interventions such as a ban on extraction being implemented as per need.

Impact

- This data and monitoring system has helped Andhra Pradesh achieve an 80% score on the 'Source augmentation (Groundwater)' theme of the Index the highest in the country.
- The state has mapped 100% of its critical and over-exploited units and constructed recharge infrastructure across 96% of these, in addition to having created a regulatory framework for managing groundwater.

Lessons for other states

- Enable data-backed decision making: States need to create robust water data systems with real-time monitoring capabilities to ensure that the data can be used to target policy interventions and enable innovation in the broader water ecosystem.
- Leverage private sector expertise: Private sector expertise, especially in the realms of technology and data, needs to be leveraged by governments to ensure the quick creation and efficient management of data and monitoring systems.

Steps taken by the Central Government to control water depletion

- Government of India launched Jal Shakti Abhiyan (JSA) in 2019, a time bound campaign with a mission mode approach intended to improve water availability including ground water conditions in the water stressed blocks of 256 districts in India.

- In this regard, teams of officers from Central Government along-with technical officers from Ministry of Jal Shakti were deputed to visit water stressed districts and to work in close collaboration with district level officials to undertake suitable interventions.

- In addition, 'Jal Shakti Abhiyan – Catch the Rain' campaign has been launched by Hon'ble Prime Minister of India on 22 March 2021.
- National Water Policy (2012) has been formulated by Department of Water Resources, RD & GR, inter-alia advocates rainwater harvesting and conservation of water and highlights the need for augmenting the availability of water through direct use of rainfall.
  - It also inter-alia, advocates conservation of river, river bodies and infrastructure should be undertaken in a scientifically planned manner through community participation.
  - Further, encroachment and diversion of water bodies and drainage channels must not be allowed and wherever, it has taken place, it should be restored to the extent feasible and maintained properly.
- Ministry has circulated a Model Bill to all the States/UTs to enable them to enact suitable ground water legislation for regulation of its development, which also includes provision of rain water harvesting. So far, 19 States/UTs have adopted and implemented the ground water legislation
- Central Ground Water Authority (CGWA) has been constituted under Section 3 (3) of the "Environment (Protection) Act, 1986" for the purpose of regulation and control of ground water development and management in the Country.
- CGWA has advised States/UTs to take measures to promote/adopt artificial recharge to ground water / rain water harvesting. CGWA grants No Objection Certificates (NOCs) for ground water abstraction to Industries, Infrastructure units and Mining projects in feasible areas in certain States/UTs where regulation is not being done by the respective State/UTs.

- Central Government supports construction of water harvesting and conservation works primarily through Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and Pradhan Mantri Krishi Sinchayee Yojana – Watershed Development Component (PMKSY-WDC).
- Model Building Bye Laws (MBBL) 2016 circulated by Ministry of Housing & Urban Affairs include provisions for Rainwater Harvesting and it has been shared with all the States / UTs. So far 32 States / UTs have adopted the provisions of rainwater harvesting of MBBL-2016.
- Atal Bhujal Yojana (ABHY), a Rs.6000 crore scheme with World Bank funding, for sustainable management of ground water with community participation is being taken up in the identified over-exploited and water stressed areas fall in the States of Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.
  - This scheme is expected to contribute significantly towards water and food security of the participating States.

Jal Jeevan Mission

- Jal Jeevan Mission, is envisioned to provide safe and adequate drinking water through individual household tap connections by 2024 to all households in rural India.
- Jal Jeevan Mission, led by the Department of Drinking Water and Sanitation its stated aim is to ensure at least 55 litres per person per day of potable water to every rural household

The broad objectives of the Mission are:

- To provide FHTC (Functional Tap Connection) to every rural household.
- To prioritize provision of FHTCs in quality affected areas, villages in drought prone and desert areas, Sabsad Adarsh Gram Yojana (SAGY) villages, etc.
- To provide functional tap connection to Schools, Anganwadi centres, GP buildings, Health centres, wellness centres and community buildings
- To monitor functionality of tap connections.
- To promote and ensure voluntary ownership among local community by way of contribution in cash, kind and/ or labour and voluntary labour (shramdaan)
- To assist in ensuring sustainability of water supply system, i.e. water source, water supply infrastructure, and funds for regular O&M
- To empower and develop human resource in the sector such that the demands of construction, plumbing, electrical, water quality management, water treatment, catchment protection, O&M, etc. are taken care of in short and long term
- To bring awareness on various aspects and significance of safe drinking water and involvement of stakeholders in manner that make water everyone's business

Recent Audit of Jal Jeevan mission by Private Agency

- 10.2 crore rural households, or about 53% of eligible population, now have tap water access.
- Government claims, is a 37percentage point rise from 2019
- A recent audit, by a private agency, found that around 62% of rural households in india had fuly funcgtional tap water connections within their presmises.
- A report of a Parliamentary Standing Committee on Water Resources in March, based on numbers provided by the nodal Jal Shakti Ministry, Stated that 46% households had such fully functional tap water connections.
- Only 3% of rural households were surveyed by the agency for the updated numbers and so the margin of error may be substantial and subject to the way the survey was designed.
- The survey, however, revealed wide dispartiies in achiement.
- About 75% of households received water all days of the week, and only 8% just once a week.
- On average, households got water for three hours every day.
- Moreover, the report mentions a problem of chlorine contamination.
- Though 93% of the water samples were reportedly free of bacteriological contamination, most of the ang anwadi centres and schools had higher than the permissible range of residual chlorine.

CASE STUDY OF BIHAR HAR GHAR JAL

Bihar's Har Ghar Gangajal scheme for Rajgir, Gaya regions

- Har Ghar Gangajal is part of the Bihar government's Jal,Jeevan,Hariyali scheme.
- In the Rs4,000-crore first phase of the project,giant pumps will lift Ganga water from Hathidah near Mokama and supply it to about7.5lakh homes in the state's main tourism destinations of Rajgir,Bodhgaya,andGaya

The need of the scheme

- The area around Rajgir (in Nalanda district), which was the nucleus of the ancient kingdom of Magadh and is associated with the founders of both Buddhism and Jainism, is rocky and water-deficient.
- Over the years, unplanned use of groundwater has depleted subterranean reservoirs, lowered the water table, and affected the quality of the water.
- The bulk of the urban water supply continues to be through tube wells.
- A study by the Bihar Public Health Engineering Department (PHED) showed the average groundwater level in Gaya district had plunged from 30feet in July 2021 to 41.50 feet in July 2022.
- Data from the Central Ground Water Board's Year Book for Bihar show the water table in Gaya and Rajgir fell by between 2 and 4 metres between 2014-15 and 2020-21.
- Hand Pumps have been going dry at many places in the region.
- The district administrations of Nalanda and Gaya have been arranging for water tankers to supply drinking water in the town areas as the scarcity becomes acute in the summer.

Benefits

- The government expects the Har Ghar Gangajal scheme to also help alleviate distress from the annual flooding of the Ganga.
- Over the years, heavy silting in the riverbed affecting especially Mokama, Hathidah, Barh,and Lakhisarai and release of water from dams in Nepal have resulted in the Ganga spilling over even when the monsoon rainfall over Bihar has not been exceptionally heavy.
- The Government Has assured that the water for the scheme would be lifted only during the four months of the monsoon when the Ganga has excess water.

Working of the system

- The project has been described as a "lift store-tame-treat-supply" system. Hyderabad-based Megha Engineering & Infrastructure Limited (MEIL) has been working on the project since 2019, employing about 2,200 people and high-end technology.
- A 447-metre approach channel has been constructed in Hathidah on the right bank of the Ganga near the Rajendra Bridge, through which water is taken to an intake-well-cum pumphouse, which is powered by a dedicated electricity substation with 7500 KVA transformer,and two smaller 250 KVA transformers.
- State-of-the-art online filters have been installed near the intake well to ensure silt free water enters the pump and pipeline,and there is no erosion in the riverbed.

Way Forward

- Measures such as surface water harvesting through farm ponds and check-dams, the installation of water-efficient irrigation systems (e.g. more efficient drips and sprinklers) and growing less water intensive crops, need to be integrated on the demand side for improved management and reduced depletion.
- The Participatory Groundwater Management approach (PGM) approach empowers communities in a defined aquifer area by providing governance rights, community awareness, capacity development, and knowledge and motivation for social regulation and the implementation of coordinated actions.
- Several states affected by depletion of groundwater provide free or heavily subsidized power (including solar pumps) for pumping groundwater for irrigated agriculture.
  - This creates perverse incentives that enable overexploitation and depletion of scarce groundwater resources.
- In the long-run, sustainable groundwater management will depend on cross-sectoral reforms to address the water-energy-agriculture nexus and providing the right incentives to resource users.
  - This requires better coordination of policy, market and regulatory measures as well as repurposing current distortive public support to more climate-smart solutions.
  - Groundwater extraction has allowed rural families to reduce short-term vulnerability but may incur trade-offs and increase the risk of depletion and ultimately increase vulnerability in the long term.

Water scarcity limits access to safe water for drinking and for practising basic hygiene at home, in schools and in health-care facilities. When water is scarce, sewage systems can fail and the threat of contracting diseases like cholera surges. Scarce water also becomes more expensive.

Water scarcity takes a greater toll on women and children because they are often the ones responsible for collecting it. When water is further away, it requires more time to collect, which often means less time at school. Particularly for girls, a shortage of water in schools impacts student enrolment, attendance and performance. Carrying water long distances is also an enormous physical burden and can expose children to safety risks and exploitation.

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