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GROUNDWATER DEPLETION IN GANGETIC DISTRICTS OF **WEST BENGAL**

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Summary

West Bengal is one of the eleven Indian states that share the Gangetic basin. The state has earned the title of Asia's bread basket due to its location in the highly fertile and enriched Gangetic basin. In recent years, shifting seasons, climate change, and increased demand for water have influenced the volume of surface waters and groundwater aquifers present in the catchment areas of Gangetic basin. In the state, the river enters Murshidabad, enriches the watershed areas of Nadia, Burdwan, Howrah, Kolkata, South 24 Paragnas, North 24 Parganas, Purva Medinipore and finally drains out to the Bay of Bengal at Hooghly. Groundwater level monitoring survey records for the gangetic districts over the period 2017–2021 for the pre-monsoon season, revealed that groundwater depletion is at an alarming rate in Kolkata and the South 24 Parganas compared to other regions, which suggests that the annual rainfall recharge is in deficit or the abstraction is greater than the recharge. Groundwater resources in West Bengal's Gangetic basin must be assessed, and management strategies for conservation of existing deep aquifers must be developed based on detailed research of aquifer characteristics, increasing population, and land use changes. The need of the hour is to frame rules for mandatory installation of rainwater harvesting units and conduct massive awareness campaigns for need-based and sustainable use of water in all sectors.

Introduction

The groundwater supplies of the Gangetic regions of West Bengal, which are in the eastern part of India, have been significantly depleted recently. The Gangetic plain heavily depends on groundwater for irrigation, drinking water, and industrial uses due to its fertile soil and vast agricultural practices. However, the groundwater levels in these districts have been dropping at an alarming rate as a result of many factors including overexploitation, poor recharge, and changing climatic patterns.

Over exploitation- Groundwater depletion factors include groundwater in the Gangetic districts has been overused as a result of the rapid rise in population, urbanisation, and agricultural activity. Groundwater levels have fallen as a result of excessive bore and tube well water extraction for household and agricultural use.

Insufficient recharge- Recharging groundwater is essential to preserving its long-term availability. However, the natural recharging of groundwater in the Gangetic districts has been impeded by encroachments on water bodies, reduced infiltration from urbanisation, and poor land management practises. As a result, less water is recharging the aquifers, which causes depletion.

Climate Change- The Gangetic districts' groundwater depletion has gotten worse as a result of shifting climatic patterns, including erratic rainfall and protracted dry periods. Variations in precipitation patterns have an impact on the rates of recharge and can result in protracted water shortages, placing additional strain on already depleted groundwater resources.

This research report analyses the trends in groundwater depletion in the gangetic districts of West Bengal.

Methodology

- The groundwater data of pre monsoon season over a period of five years starting from the year 2017 to 2021 was analysed. The data was accessed from the Central Ground Water Board to understand the status of groundwater in regions of West Bengal which are a part of the Ganga basin.
- The districts included in the study are Murshidabad, Nadia, Burdwan, Hooghly, Howrah, Kolkata, South 24 Paragnas, North 24 Parganas and Purva Medinpore.

Findings

- The assessment revealed that Murshidabad had consistently low water table levels ranging from 13.39m (2020) to 17.67m (2017) with an average water table level of 15.06m. Nadia had the highest average water table level 5.20m (2020) and had lowest 6.89m (2019) with an average of 5.99m.
- The low water table level in Murshidabad may be due to the fact that parts of Murshidabad district comes in the Chota Nagpur Plateau and is a drought prone area. Also the agricultural activities in the district demand a large volume of water for irrigation.
- The water table level fluctuation from a five years average (2017-2021) showed that there was a water table level decline by 2.53 m (-27.8%) in South 24 Paragnas, 2.12m (-18.6%) in Kolkata and -0.29m (-2.53%) in Purba Midnapore and for the other districts the water level was not decreasing (Fig. 1).

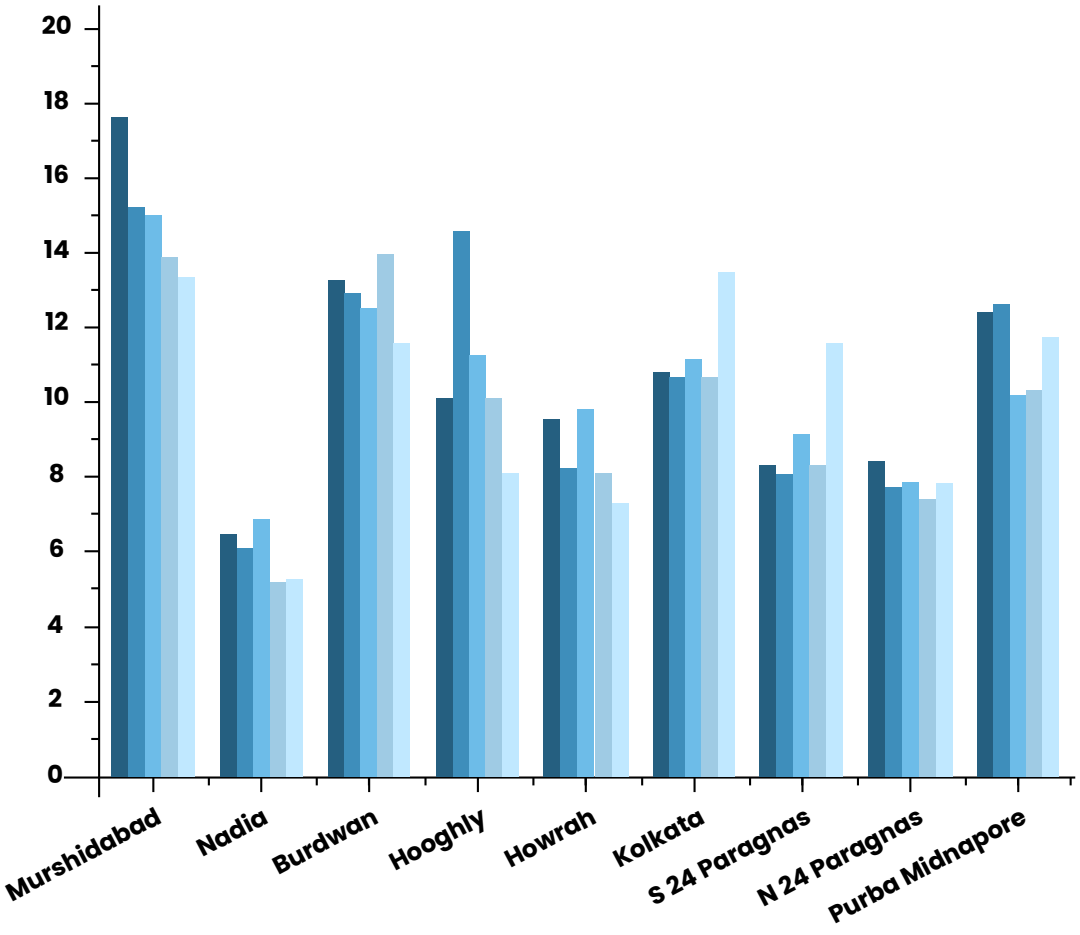

Figure. 1. Trend in depth to water level in the districts of Gangetic Basin from 2017- 2021

- This shows there is sustained abstraction of groundwater in these three districts, and annual rainfall recharge is not sufficient to maintain the groundwater level.
- A basic forecast done, with the depth to water level data for the pre monsoon season for five years (2017-2021) was done and the findings showed that in Kolkata there could be a reduction of 44% water table level in 2025.

Districts	Ground to water level 2021*	Average ground to water level*	Decline	% decreased from 5 years average
Kolkata	**13.52**	**11.40**	2.12	(19%)
S 24 Paragnas	11.67	9.13	2.54	(28%)
Purva Midnapore	11.79	11.49	0.29	(2.5%)

Similar Research Findings

- In West Bengal, water stress occurs in the western and southeastern districts as a result of low water supply, especially during post monsoon cropping; There is great demand for water for intensive farming and greater concentration of people in the southeast part of the state (Mandal et al. 2022, Bandyopadhyay et al.2014)
- Research has to be done to understand how the intensive groundwater pumping has impacted and will continue to affect, both the sources and timing of groundwater recharge is required to understand and manage the regional hydrologic system (Jameel et al. 2023).
- In the Gangetic basin, the groundwater levels are falling with net annual depletion of 8.0 ± 3.0 km^3(Mac Donald et al 2016).
- Study conducted over a period of 2000-2012 (Fig.1) shows parts of lower gangetic Bengal where annual water table falling rates are more than 0.75m/yr (Mac Donald et al 2016).

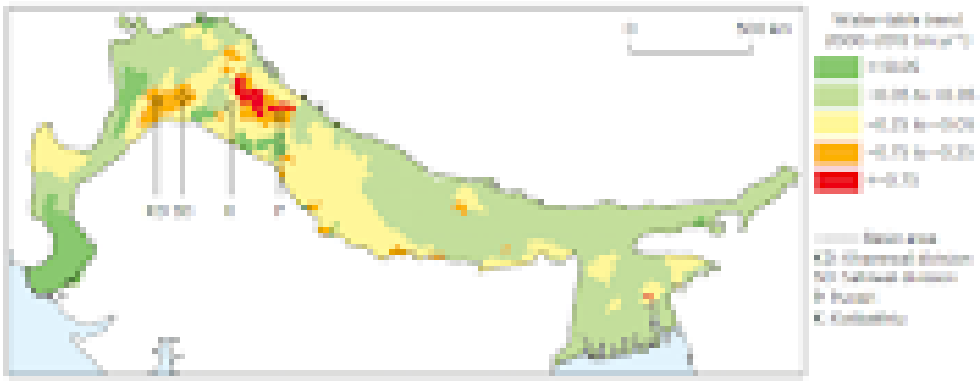

Fig.2. Map of mean annual change across the basin during the period 2000-2012 (Water table trend m/yr) (source:Mac Donald et al 2016)

- In the Gangetic basin in 30% area, the groundwater levels are falling with net annual depletion of 8.0 ± 3.0 km³ (Mac Donald et al 2016).
- Study by NASA on ground water revealed that regions in areas in northern and eastern India are now hotspots where overexploitation of water has caused serious decline of freshwater. Over exploitation of groundwater to irrigate crops such as wheat and rice have caused this rapid decline in available water, though the rainfall has been normal throughout the period.

Consequences of groundwater depletion

Depletion of groundwater has several socioeconomic impacts. Decreased aquifer water level affects surface water flow and also results in land subsidence, saltwater intrusion etc.

- Water Level Decline: The primary effect of groundwater depletion is a decrease in water levels. The expense and labour involved in extracting water for diverse uses rise as a result of the requirement to drill deeper wells as the water table declines.
- Land Subsidence: When too much groundwater is drawn out, the underlying soil may become compacted, which can result in land subsidence. Buildings, infrastructure, and agricultural fields may sustain structural damage as a result.
- Intrusion of saltwater: Excessive groundwater extraction in coastal Gangetic districts can result in saltwater intrusion into the aquifers, rendering the water unfit for cultivation and consumption. The quantity of freshwater resources is further diminished by this process.
- Impact on socio-economic sector: The principal industry in the Gangetic areas is agriculture, which faces significant difficulties as a result of groundwater depletion. Reduced water supply has a negative impact on rural economies, farmer livelihoods, and crop output, creating socioeconomic misery.

Recommendations

- Baseline study of all active groundwater sources, suggesting relevant policy recommendations
- Conservation of traditional wetland to be protected for effective ground water recharge.
- Desiltation/dredging of surface water bodies like streams, rivers and canals for better percolation and recharge of aquifers during monsoons
- Rejuvenation of dried up/deteriorated traditional water storage units like ponds, tanks etc.
- Artificial recharge structures to be constructed based on a research of aquifer characteristics and land use surveys.
- Massive awareness programmes to be done for promoting sustainable use of water, avoiding water wastages in agricultural and domestic sectors, also during supply and distribution etc.
- Integrated approach for water conservation
- Assessing the existing policies, Acts and schemes related to water conservation for their effectiveness.

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