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Q14

The groundwater potential of the gangetic valley is on a serious decline. How may it affect the food security of India?

UPSC Civil Services Mains 2024 · GS I · 15 marks · World's Physical Geography

Salient features of world's physical geography.

Core demand of the question

- Explain why groundwater potential in the Gangetic valley is in serious decline
- Show how that decline may affect India's food security

Revision summary

Groundwater in large parts of the north-west **Gangetic plain** is being pumped faster than it is recharged.

Green Revolution paddy-wheat, tubewells, and energy subsidies are the main extraction story.

CGWB over-exploited and critical blocks are the official map of decline.

Lower-Ganga arsenic and other quality failures also cut usable water.

India's wheat-rice PDS buffer still depends on this belt's irrigation.

Food security risk includes falling yields, higher costs, quality in the food chain, and a weaker drought buffer.

Introduction

Groundwater levels in large parts of the **Gangetic plains** are falling because extraction exceeds recharge. The region has monsoon rain, snow-fed rivers, and thick alluvium that can store water. **Central Ground Water Board** maps of **over-exploited** blocks now cover much of **Punjab, Haryana, and western Uttar Pradesh**. That belt supplies a large share of India's **wheat and rice**. Food security therefore depends not only on harvest size. It also depends on whether wells can still lift usable water in a dry summer.

Body

Why the potential is declining

Green Revolution agriculture in the north-west Gangetic and adjacent plains linked **HYV wheat and paddy** to **tubewells** and **free or cheap power**. Paddy in a semi-arid Punjab autumn is a groundwater crop even when it looks like a monsoon crop. Alluvium invited deep boring. Electrification made the pump the main source of irrigation water. Recharge is limited where hardpan, urban sprawl, and vanishing ponds cut infiltration, and where canals leak less than they used to as lining spreads. Climate adds erratic rain and hotter evapotranspiration. In the **lower Ganga** the problem is often quality as well as quantity. **Arsenic** in parts of Bihar and West Bengal poisons the same aquifer people drink and, in places, irrigate from.

CGWB assessment units classed as over-exploited, critical, and semi-critical are the official language of serious decline. The Ganga itself has not dried. The usable, clean, economically lift-able groundwater is shrinking.

- **Extraction:** Millions of wells, energy subsidy, and a rice-wheat lock-in drive pumping.
- **Recharge failure:** Concretised floodplains, lost wetlands, and monsoon extremes reduce refill.
- **Quality:** Arsenic, salinity, and fluoride take water out of the food and drinking budget even when the well is not dry.

Pathways to food security risk

India's calorie security still leans on **MSP-supported wheat and rice** from this belt, stored by the **FCI** and moved through the **PDS**. If wells fail or power-plus-depth costs rise sharply, yields fall or shift to less irrigated crops before institutions are ready. Farmers may deepen bores, idle paddy, or sell land. Nutrition security is hit if farmers abandon pulses and milk fodder for whatever still grows, or if arsenic enters the food chain. Inter-State tension over canal water will rise as groundwater ceases to be a silent buffer. The eastern **Gangetic plain** has unused groundwater in some pockets and a different poverty. A simple plan to move all paddy east faces power, flood, and tenure constraints.

- **Buffer loss:** Groundwater was the drought insurance of the Green Revolution.
- **Price and PDS:** Scarcer irrigation raises cost and political risk of cereal stocks.
- **Regional shift:** Without a just transition, decline in the north-west becomes a national food problem.

What a food-water response looks like

The reply is not only more canals. Cropping has to move away from paddy where the aquifer is mined. Direct-seeded rice, shorter-duration varieties, and diversification into maize, pulses, oilseeds, and millets where diets and MSP allow are needed. Power cannot stay a flat subsidy for midnight pumping. Recharge through ponds, floodplain protection, and aquifer storage must be treated as infrastructure. **Atal Bhujal** and CGWB maps are useless if panchayats never see them. Eastern intensification, if it comes, needs power and flood management. It cannot be a simple copy of Punjab.

- **Demand side:** Policy should seek less water per calorie, not only more water per field.
- **Quality:** Arsenic-safe drinking and irrigation rules are needed in the lower Ganga.
- **Institutions:** Agricultural and water policy must be joined, because the PDS still depends on groundwater.

Food security policy that only counts foodgrain tonnes will miss the water tonnes used under the field.

Flow diagram

Rice wheat tubewell power -> Falling water tables
Urbanisation lost recharge -> Falling water tables
Falling water tables -> Yield and cost shock
Arsenic quality -> Food and drinking risk
Yield and cost shock -> Food and drinking risk
Food and drinking risk -> PDS cereal buffer strain cereal buffer strain

Conclusion

Gangetic groundwater is in serious decline where pumps, paddy, and cheap power have mined the alluvium, and where poison as well as scarcity removes water from use. India's cereal supply still depends on that aquifer. Food security will hold only if cropping, power pricing, recharge, and the PDS adjust together. The Jal Shakti and agricultural ministries must work as one food policy, not as two separate files.

Facts & figures

CGWB assessment

The Central Ground Water Board classifies units as over-exploited, critical, semi-critical or safe; large parts of Punjab, Haryana and western Uttar Pradesh fall in the stressed classes.

Green Revolution irrigation

HYV wheat and rice in the north-west were built on canal plus, increasingly, groundwater tubewells.

Arsenic in the lower Ganga

Parts of Bihar and West Bengal have geogenic arsenic in groundwater, a quality crisis alongside quantity stress elsewhere.

Atal Bhujal Yojana

A Union scheme for community-led groundwater management in notified water-stressed areas, including parts of the north-west.

MSP-PDS cereal axis

Public food security still rests heavily on wheat and rice procurement from the irrigated north-west.

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