Study emphasizes trade-offs between arresting groundwater depletion and food security

June 14 2024

Credit: CC0 Public Domain

A study by researchers from the International Food Policy Research Institute (IFPRI), published in *Nature Sustainability*, reaffirms the world's growing dependence on depleting groundwater systems. Although efforts to slow down groundwater depletion need to be urgently accelerated, the study indicates that such efforts—in the absence of other accompanying measures—would likely lead to significant food security impacts.

The study finds that ending groundwater depletion would lead to sharp declines in food production, especially of rice and wheat, in groundwater-dependent food production systems, pushing up international prices of rice by 7.4% and wheat by 6.7%.

Higher food prices, in turn, would make food less affordable for the poor, increasing the number of people at risk of hunger by 24 million, particularly in low- and middle-income countries.

While growing groundwater use has benefited economic development and improved food security, it has also led to severe water depletion and ecosystem degradation, reduced freshwater access, and increased inequity.

A quarter of the world's river basins are already overexploited, including key breadbasket areas in India, Pakistan, China, Iran, the US, and Egypt. Climate change is pushing more farmers to rely on groundwater as rain-fed farming is becoming less viable and surface flows are shrinking.

Given the imperative to both conserve groundwater resources and improve food security, the study used IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) to simulate the impacts from ending groundwater overdraft as well as the likely effects of measures to counteract the negative food security impacts associated with halting groundwater depletion.

Edwin Sutanudjaja, a co-author from Utrecht University, the Netherlands, affirms that most studies either focus on addressing water depletion or on improving food security and not on integrated water-food modeling, which is essential in today's water- and food-constrained world. He points out that "this is the first transdisciplinary study addressing both food security and groundwater depletion issues simultaneously."

Nicostrato Perez, IFPRI's lead modeler on the study, notes that "no single intervention modeled could fully counteract the negative food security impacts from arresting groundwater depletion; however, investments in agricultural research and development would increase yields of water-constrained irrigated crops through better seed technologies and agronomic practices, potentially lowering global wheat prices by more than 3%."

Vartika Singh, a co-author from IFPRI's New Delhi office, emphasizes the importance of increased support for more effectively managing variable rainfall in a climate-constrained world.

She notes that "targeted interventions in support of conservation agriculture, mulching, and terracing in both irrigated and rainfed areas are particularly effective in conserving water and reducing price increases of maize, which is a largely rainfed crop."

Karen Villholth, a co-author from Water Cycle Innovation, stresses the need to support smallholder farmers in Africa South of the Sahara to sustainably develop groundwater resources for irrigated agriculture, saying, "Groundwater in this region still holds great potential for securing food production, nutrition and livelihoods for millions of poor people under climate change, but we need to proactively address the risks of overexploitation of the resource."

Claudia Ringler, Director of IFPRI's Natural Resources and Resilience Unit, summarizes, "These policy measures and investments are needed to sustain food production levels, particularly in groundwater-dependent regions like India and China, since arresting groundwater depletion otherwise would adversely impact food prices and agricultural production."

She adds, "We have to act now—if we continue on the path to total groundwater depletion, permanently higher food prices will be difficult to avoid."

The authors, who also include contributors from Zhejiang University, China, conclude that a transdisciplinary approach combining regulatory, financial, technological, and awareness measures across water and food systems is essential to achieve sustainable groundwater management while preventing increased food insecurity.

More information: Perez, N. et al, The Implications of Ending Groundwater Overdraft for Global Food Security, *Nature Sustainability* (2024). DOI: 10.1038/s41893-024-01376-w

Provided by International Food Policy Research Institute