VIEWPOINT

Water, Food, and the Environment

by Mark W. Rosegrant and Joachim von Braun

Recent research at the International Food Policy Research Institute (IFPRI) indicates that further inattention to water-related investments and policies could lead to a severe water crisis that precipitates a food crisis.

Fortunately, there are alternatives. Policies and investments that promote sustainable water use can contribute to greater water and food security. Water may be a scarce resource, but humans have already developed many ways of using it more efficiently in irrigation and in household and industrial uses.

Business as usual means growing irrigation water scarcity

Assuming that current trends in water and food policy, management, and investment continue, IFPRI projects a 22 percent increase in total global water withdrawals between 1995 and 2025. Non-irrigation uses—domestic, industrial, and livestock—will increase dramatically, rising by 62 percent. Rapid population growth, mainly in the cities of the developing world, will drive a 71 percent rise in domestic water consumption, with more than 90 percent of this coming from developing countries. As a result, irrigation water use will rise by only 4 percent, although irrigation water demand will grow 12 percent in all developing countries and 27 percent in Sub-Saharan Africa.

The relative scarcity of irrigation water will mean slower growth of food production. Cereal yield growth rates will fall from 1.5 percent per year over 1982–95 to 1 percent annually between 1995 and 2025. For developing countries, the rates will decline from 1.9 percent to 1.2 percent. The direct contribution of water scarcity to the yield slowdown translates into 130 million metric tons less cereal production each year, equivalent to a year of rice output in China or two years of wheat production in the United States.

However, rising incomes and brisk urbanization in developing countries will account for most of the 47 percent growth in cereal demand over 1995–2025. The resulting growth in meat and dairy consumption will mean strong growth in demand for maize for animal feed.

Given the gap between domestic grain production and demand, developing countries will more than double their imports between 1995 and 2025. These "virtual water imports," which substitute food imports for irrigated agricultural production, offer developing countries one means of conserving water. However, it is unlikely that Sub-Saharan Africa will be able to finance a projected threefold jump in cereal imports on commercial terms, so it will require financial or food aid.

Water crisis scenario

Even a moderate worsening of current trends could spur a genuine water crisis. In such a scenario, governments further

cut their spending on irrigation systems and rapidly turn over irrigation systems to farmers and farmer groups without the necessary reforms in water rights. Governments and donors reduce investments in crop breeding for rainfed agriculture in developing countries. This would result in an additional 13 percent increase in water consumption in 2025, almost entirely for irrigation, and much of this water will be wasted. Farmers will extract increasing amounts of groundwater and environmental flows, causing failure of key aquifers and compromising aquatic ecosystems.

Given the inefficiency of water use in this scenario, cereal production will decline by a further 10 percent over the business-as-usual shortfall, equivalent to the entire Indian cereal crop. Grain prices will rise dramatically, causing a 23 percent fall in developing-country imports from the business-as-usual scenario. Per capita cereal consumption in developing countries in 2025 will drop below 1995 levels, meaning an increase in food insecurity.

Sustainable water use

In a sustainable water use scenario, governments and donors increase investments in crop research, technological change, and reform of water management to boost water productivity and the growth of rainfed yields. Improved policies and increased investment in rural infrastructure will help link remote farmers to markets and reduce the risks of rainfed farming. If reduced investments in irrigation and water supply were combined with growth in rainfed cereal production and increased harvesting of rainwater, this would mean 153 million metric tons less irrigated output, but 187 million tons more rainfed production. This requires crop breeding targeted to rainfed environments, agricultural extension services, and access to markets, credit, and input supplies in rainfed areas.

Halting unsustainable groundwater pumping in China, India, and the Middle East will reduce developing-country cereal production and necessitate imports. Efforts to restore sustainable groundwater supplies must be accompanied by policies to increase the efficiency of water use, to encourage diversification of production beyond irrigated cereal cultivation into crops that give more value per unit of water, and to boost the nonfarm rural economy in overdrafting regions.

To stimulate water conservation, the effective price of irrigation water will need to gradually increase. Governments in many regions will have to shift water rights and management responsibilities to users and offer them training and support. This will stimulate increased farmer investments in water-saving technologies. Higher prices for (and stricter regulation of) domestic and industrial water use can likewise lead to greater efficiency. Industrial water recycling can be a major source of water savings, and domestic use can be made more efficient through improved maintenance of municipal systems. Higher water prices must be accompanied by targeted subsidies to ensure that poor urban consumers have access, and by compensation to farmers for reduced water consumption. Even with such policies, raising water prices is politically difficult, given the range of actors with vested interests in maintaining the status quo. Some of the reduced water consumption that results from these measures can be allocated to environmental uses. In order to maintain adequate food production, more efficient water use can be achieved through technologies such as drip irrigation (which also has the health benefit of reducing malaria mosquito habitat) and precision agriculture and through management changes such as adoption of demand-based irrigation scheduling systems.

The sustainable water scenario results in 20 percent less water consumption than under business as usual, but developing countries reap greater benefits. Water savings left instream for environmental purposes will be triple the annual levels of the Mississippi River. Faster growth in rainfed yields will compensate for declining growth of harvests in irrigated areas, boosting global cereal production in 2025 by 1 percent over harvests in the business-as-usual scenario.

The strategies outlined in the sustainable water scenario can avert the impending water crisis that much of the world faces, but they will require time, political commitment, and money. To succeed, implementation of these strategies must begin now.

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