

Water and food security in a changing world

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“Water scarcity is projected to increase in much of the world, and together with climate change and other factors will likely slow growth in agricultural productivity and slow progress in the reduction of hunger.” So concludes Mark W. Rosegrant in “[Challenges and policies for global water and food security](#),” published in a 2016 special issue of the Federal Reserve Bank of Kansas City *Economic Review*. But this bleak picture is not without hope: using a model developed by the World Bank and proposing some ideas based on that model, Rosegrant suggests that, with the right water policies, humankind can meet the challenges posed by increasing water scarcity and not only improve water and food security, but also make a large dent in the number of people who are at risk of hunger.

The “standard” model currently used to forecast the global availability of water and food is called the “business as usual” (BAU) model. According to that model, 4.7 billion people, 49 percent of the world’s grain production, and \$63 trillion of global gross domestic product will be at risk from water stress in 2050. The model projects that increasing water scarcity and other factors will slow agricultural growth and raise food prices. Specifically, slow growth in investment in agricultural research, in new irrigation technology, and in infrastructure in developing countries, as well as the effects of climate change, will likely suppress productivity growth. Together with population growth, especially in Africa and South Asia, and rising incomes, these factors are projected to increase food prices as much as 50 percent by 2050. The higher food prices, the model tells us, will also slow reductions in hunger, effectively thwarting the United Nations Sustainable Development goal of ending hunger by 2030. Instead, 530 million people are projected to be at risk of hunger by 2050, including 155 million in sub-Saharan Africa and 140 million in South Asia.

Opposed to the BAU model is the World Bank’s model, a computable general equilibrium model that captures how changes in the water sector affect the general economy. Using the results obtained from this model, says Rosegrant, along with adopting sensible policies for water security and crop productivity, “can significantly improve water and food security outcomes.” He proposes a number of water policies and investments that will enhance efficiency and productivity in the use of the world’s water resources.

First is a measure to be taken outside of the water sector: Rosegrant proposes that, because increases in crop yields contribute so prominently to increases in water productivity, researchers should seek to improve plant breeding, using the most cutting-edge technological tools available, including “marker-assisted selection, cell and tissue culture, and gene editing.” Even transgenic breeding is on the table, although some countries may elect to forgo that controversial technology.

Second, the countries of the world need to adopt new irrigation technologies and farming systems as much as possible. Among those technologies are drip and sprinkler irrigation, enhanced water harvesting, conservation tillage, and precision farming. Such technologies can save water that would otherwise evaporate, divert water that would otherwise be used downstream by others, and induce increased water use by increasing the profitability of

irrigation. Along with the new technologies and farming systems must come a water allocation system that promotes their use and that recognizes the hydrologic realities of the region.

The third policy change that Rosegrant proposes is the establishment of secure and well-defined tradable water rights, because “a properly managed system of tradable water rights provides incentives for water users to internalize the external costs imposed by their water use,” and the result is less pressure to degrade resources. Finally, he recommends increased capital investment in irrigation and water, especially in Africa, where there remains substantial potential to expand irrigation. Included in this idea are large additional investments in water treatment plants and sewage disposal plants.

In sum, to counter the growing threat of water scarcity, Rosegrant suggests a scenario that can significantly improve water and food security outcomes. This scenario, constituting a “precise mix of water policy and management reform and investments . . . must be tailored to specific countries and basins and will vary across underlying conditions and regions.” Never easy, finding the right solutions “will take time, political commitment, and money.”