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Water, investment and food security

Colin J Chartres, Director General
International Water Management Institute (IWMI)

Water resources are already very scarce. With further demand from population growth, dietary changes, biofuel production, urbanisation and climate change, it will be extremely difficult to find enough supply to enable an increase in global food production by 70 per cent. There are, however, potential solutions that involve increasing water productivity, improved water storage, more irrigation and re-using waste water. But current investment levels in overseas development aid and spending at country level are unlikely to be sufficient to ensure food security in the relatively short- term, let alone by 2050, when the global population is forecast to be nine billion. This article describes some of the issues that have to be faced to deliver food security and overcome water scarcity, and how these improvements can be achieved through a combination of science, policy and investment.

The BBC estimated that the cost of bailing out the banks during the global financial crisis was US$10 trillion. The cost of providing food security even for an increasing global population in comparison is relatively trivial. The UN Food and Agriculture Organization (FAO) and the Consultative Group on International Agricultural Research (CGIAR) have suggested that an annual investment of US$16 billion in agricultural research and development would overcome the stagnation that we have observed in crop yield growth. They estimate an annual global investment of about US$200 billion would meet growing world food demands. The solutions are relatively simple and do not involve rocket science, yet once again famine is threatening millions of people in the Horn of Africa.

Drivers of water scarcity

Food security in the developing world is increasingly threatened by the growing population. UN forecasts indicate that by 2050 the global population will have grown by 2 billion, nearly all of whom will be in developing countries. Africa's population will double between 2011 and 2050. As many people become wealthier, they will also demand diets that require more water than that required to produce the staple foods eaten by their grandparents. Biofuels and urbanisation will increasingly compete for land and water resources used previously for agriculture. Globalisation processes (e.g. 'land grabbing') and restrictive trade policies will further impact some countries' abilities to grow sufficient food for domestic consumption, let alone enough to export. Finally, climate change may limit yields of existing crop varieties through temperature increases and more variable rainfall. While there is sufficient land to grow more food in Africa, this is generally not the case in Asia, which will have to increase food supply via intensification of agriculture. A recent study for India (2030 Water Resources Group, 2009) indicated that by 2030 there will be a gap of 50 per cent between water supply and demand. There are major concerns in parts of both continents about physical water scarcity and 'economic' water scarcity, which also exists in parts of sub-Saharan Africa, due to a lack of investment in water storage and distribution networks.

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Compounding the issues of population, climate and water scarcity are the impacts of land and soil degradation and loss of ecosystem services. In Africa, most food is produced by smallholders who do not have enough income for fertiliser. Consequently, their soils become depleted of nutrients, low yielding and more subject to erosion. Increasingly, as urban populations grow in the developing world, sewage is choking rivers and damaging the natural functions that help to provide biodiversity, habitat and fresh drinking water to downstream communities. Elsewhere, similar environmental consequences occur when river waters are so heavily extracted that they no longer run into the

ocean. Groundwater systems in South Asia are also being used beyond their sustainable yield limits, putting millions of livelihoods at risk.

What are the solutions?

So, what can we do to combat this spectre of growing water scarcity that will exacerbate the quest for food security? In terms of physical solutions, we have to invest in increasing water productivity (more crop per drop) and in insuring communities against water shortages through improved storage and access to water. In governance terms, we have to create environments in which policy and institutional responses reflect the seriousness of the situation. We also have to create policies, regulation and incentives that promote increasing efficiency of water use and that share supply equitably between users, while at the same time managing demand.

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Using water storage as an example, World Bank data show that Kenya and Ethiopia have water storage capacities of as little as 4 and 43 cubic metres per capita, respectively. In contrast, Australia has storage capacity of over 4,700 cubic metres per capita. Increasing the amount of water storage provides insurance against drought and climate change, in terms of drinking water and food supply for individual farming families and at the national level. Storage options are not confined to large dams. Depending upon hydrological circumstances and costs, small reservoirs, ponds, rainwater harvesting systems and improved soil moisture storage can all be effective. Similarly, using existing groundwater resources and even artificially recharging groundwater with urban runoff and treated effluent can be important strategies.

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Access to stored water facilitates the development of full and supplementary irrigation systems. According to the World Bank *World Development Report* 2008, in Africa, only 4 per cent of the area under production is irrigated, compared with 39 per cent in South Asia. Developing and implementing effective national water storage solutions is an imperative because not only will it insure against drought and climate change, but it will increase production to feed growing populations.

A second challenge is to increase water productivity. Crop yields in many smallholder systems are significantly lower than biological potential and lower than yields obtained under conditions which are non-limiting in terms of inputs in western countries. Obtaining higher water productivity involves access to higher quality crop varieties and fertilisers, and carrying out better soil, pest and weed management. It may also require that farmers are provided with irrigation water when they need it, which is often not the case due to poor system management. Additionally, water supply managers need to deal with issues of poor water quality, degraded canal systems and water losses.

All these solutions require some degree of external investment because, frequently, farmers cannot afford fertiliser or even water supply charges. This often leads to an ongoing decline in rain-fed and irrigation systems. We need to explore ways in which these declines can be overcome. Solutions may often be external in the form of micro-credit facilities, organisation and support of co-operatives, and private sector investment, based on the identification of supply-chain opportunities. In cases where farming activities are degrading or depleting water supplies, the adoption of systems in which downstream water users pay upstream communities to improve management practices (payment for environmental services) may also be effective.

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Another possible solution is that we must become much better at re-using waste water generated from cities and agriculture. The challenge is to do this without risk of contaminants – including biological material (bacteria, viruses and human/animal worms), heavy metals and persistent organic pollutants – entering the food supply chain.

Investing in solutions

Solutions to food security and water scarcity issues undoubtedly exist. The problem is that until the 2007-2008 global food crisis, these issues, given the success of the 'green revolution' 30-40 years earlier, had largely dropped below the political radar. Furthermore, the green revolution never really took hold in Africa. However, given the inexorable, ongoing population growth, unless we act decisively in the next 10 to 20 years, food crises, water shortages and famines will become increasingly common.

The global volume of multilateral and bilateral assistance to agriculture (expressed in 2002 prices)

decreased from US$6.2 billion to US$2.3 billion between 1980 and 2002. Most of this decrease occurred during the 1990s, although there has been some subsequent increase. Furthermore, agriculture's share of overseas development assistance fell from 13 per cent in the mid-1980s to 5 per cent of total ODA in 2007.

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As a consequence of lack of investment, the growth rates of cereal yields have been falling since the green revolution years, dropping from 3.2 per cent per year in 1960 to 1.5 per cent in 2000. The FAO in 2009, and others, have argued that to have food security in 2050 we will need to produce 70 per cent more food. Under a 'business as usual' scenario, the Comprehensive Assessment of Water Management in Agriculture (CA 2007, Earthscan and IWMI) similarly estimated that we would need a similar magnitude increase in water for agriculture (from 7,000 to 13,000 km^3) unless we can increase water productivity. In many physically water-scarce countries such additional supplies of water are just not available.

So we have a paradox in these countries of feeding more people using little more, or – depending on competition from other water users – potentially using even less water than today. Unless investment in agricultural research and development, agricultural development and rural water supply increases, this paradox is unlikely to be solved.

The decision by the African Union to encourage countries to comply with the Maputo Declaration of 2003, to spend 10 per cent of budget on agricultural development, was laudable. Yet, by 2006, only eight countries had reached this target. This is of concern, particularly because many African countries are defined by the Word Bank (2008) as having agricultural-based economies. Evidence suggests that increasing agricultural investment in these countries will not only help them attain relevant Millennium Development Goals, but also has very significant secondary effects with respect to economic development in general.

Colin Chartres *is the Director General of the IWMI. He is co-author with Samyuktha Varma of 'Out of Water: from abundance to scarcity and how to solve the world's water problems' (Financial Times Press, New Jersey, 2010).*

The ***International Water Management Institute*** *(IWMI) is a centre of the Consultative Group on Agriculture Research (CGIAR) and operates in approximately 25 countries. IWMI's vision is 'Water for a Food Secure World.' IWMI is currently spearheading the development of a new CGIAR research programme on Water, Land and Ecosystems, focusing on the critical issues of harmonising increasing agricultural production goals with environmental sustainability.*

International Water Management Institute
PO Box 2075, Colombo
Sri Lanka
Tel: +94-11 2880000
Fax: +94-11 2786854
Email: c.chartres@cgiar.org
Website: www.iwmi.org