



## Irrigation: Not as wasteful as it seems.

BY DAVID ZETLAND

**IN MANY PARTS OF THE WORLD**, people are worried about the increase in water scarcity. Greater scarcity can be traced to two trends. The first is an increase in demand for water from increasing population, increasing affluence and a desire to restore natural water flows. The second is a decrease in supply that can be traced to falling water quality (or a rising expectation of “normal” quality) and climate change, which is altering the location of water flows and speeding up the hydrological cycle.

Scarcity turns to shortage when higher demand collides with lower supply, but shortages are not inevitable. They are the result of mismanaging our water resources.

One area appears in nearly every discussion: the use—or “waste”—of water in agriculture. My main points are that agriculture “wastes” much less water than we often hear, and that

changes in agricultural water use will not happen without changing the incentives structure farmers face.

### The physical facts

Conventional wisdom holds that agricultural water withdrawals account for approximately 70 per cent of total human water withdrawals worldwide. Municipal and industrial withdrawals account for the rest. (Energy withdrawals are large but ignored because they quickly return to water bodies at higher temperatures.) These average withdrawals hide a lot of variation—they are over 80 per cent in Asia and Africa but only 30 per cent in Europe, according to the United Nations’ Food and Agriculture Organization.

But it’s important to note that

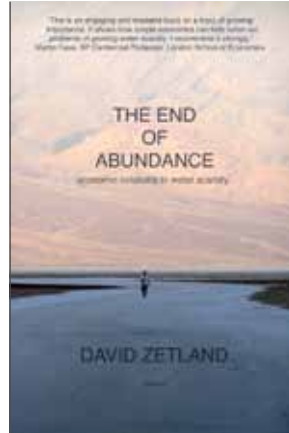
withdrawals are not the same as use or consumption. As any scientist will tell you, water is not used in the sense that it’s destroyed. Water use usually means that the water is contaminated or evaporated so that it’s not usable at a particular place and time. Flushing the toilet thus “uses” water until it’s cleaned. Water that floods into a field is “used” when it evaporates into the air.

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Agricultural crops get water via precipitation or irrigation flows that come from ground or surface waters. Some surface water is “natural” because it comes from a lake or stream. Other

surface waters are brought to fields via aqueducts and/or pumping. In all cases of irrigation flows, water is taken from its natural location. These withdrawals can be precisely measured, but they do not directly translate into use. Applied water can evaporate, flow off the land, sink into the soil, or be absorbed into the plant. Agronomists with precision instruments can measure each of these flows, but it's safe to say that they vary with elevation, air temperature, soil type, plant variety, and irrigation technique.

So, agricultural withdrawals do not equal use. Many people mistakenly believe that reducing diversions from, say, 20 to 15 units of water will leave five units of water for use in cities (or in the environment), but that reduction of five units of diversion can adversely impact a farmer who was using return flows. Say, for example, that Farmer A diverts 20 units of water, of which three evaporate, five are used by his crops, and 12 flow into surface and groundwaters that are used by Farmers B and C. A five-unit reduction in diversions is more likely to reduce those 12 units than the three units lost to evaporation or five units used by crops. So Farmer A's gift or sale of water out of the area indirectly harms Farmers B and C.



# Book Giveaway

**In this book**, economist David Zetland describes the impact of scarcity on our many water uses, how the institutions of abundance fail in scarcity, and how economic ideas and tools can help us direct water to its highest and best use. Written for non-academic readers, *The End of Abundance* provides examples, insights and ideas to anyone interested in the management of our most precious resource. **WC**

What is your biggest concern regarding the economics of water? Send your answer to [kerry@watercanda.net](mailto:kerry@watercanda.net) and be entered to win a digital copy of Zetland's book.

*See page 7 for last issue's winners.*

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# Rethinking Food

## Recognizing healthy ecosystems

as the basis for sustainable water resources and stable food security can help produce more food from each unit of agricultural land, improve resilience to climate change and provide economic benefits for poor communities, according to a new report from the United Nations Environment Programme (UNEP) and the International Water Management Institute (IWMI), in partnership with 19 other organizations.

The report shows how managing and investing in the connections between ecosystems, water and food, through diversifying crops, planting trees on farmland and improving rainwater collection and other practical steps, could help avoid water scarcity and meet the growing food demands of a global population set to reach nine billion by 2050.

An Ecosystems Approach to Water and Food Security, which was launched during World Water Week in Stockholm this August, says that policymakers should consider farmland, fisheries and other agricultural areas as “agroecosystems,” which provide sources of food as well as performing diverse ecosystem services such as water purification and flood regulation.

Declines in these regulatory ecosystem services—leading to problems such as a loss of soil nutrients or increased vulnerability of crops to disease—have begun to adversely affect agricultural productivity. Exacerbated by climate change, these declines could result in crop yields that are up to 25 per cent short of demand by 2050, greatly impacting poor

communities worldwide.

One of the main challenges in boosting current levels of food production is the availability of water, which is needed for livestock and crop irrigation, fisheries, and other agricultural uses.

In many parts of the world, increases in food production through intensive farming methods have come at the expense of other ecosystem services, such as biodiversity, pollination or soil erosion protection, caused by pollution from agricultural run-off or the diversion of water from rivers to farmland.

The UNEP-IWMI report shows how an ecosystems-based approach to agriculture can restore this balance and result in a more efficient use of water, a reduction in the 5-10 million hectares of farmland that are lost each year to degradation, fewer yield losses as a result of pests and increased benefits to poor communities dependent on farmlands, rivers, forests and other ecosystems for their food and livelihoods.

Written by over 50 contributors from 21 organizations, and using case studies from China, Guatemala, Jordan and other communities, the report recommends changes to three specific areas: environmental protection, water resources management, and food production. The report also sets out recommendations for drylands, wetlands, crop systems, fisheries, and livestock systems. WC

*Read the report at [iwmi.org/ecosystems](http://iwmi.org/ecosystems)*

But what about Farmer A using drip irrigation to reduce evaporative losses? Farmer A may decide to install that equipment, but he will only do so if it's profitable, which generally means that he's going to want to use the “saved” water for additional crops or sell the water to someone else. Even worse, he may get so efficient in reducing losses that those 12 units of water to Farmers B and C are also reduced. Someone will be upset.

## The economic facts

These scenarios bring us to the second point: incentives. We know that farmers will use more or less water if that increases their profits. Sometimes they will use more or less if they are told to (regulations and laws), but not if they can help it. The economics of irrigation, water rights and markets are complicated, but it's important to keep a few things straight:

- 1 Irrigation costs often depend on the cost of energy for pumping and the availability of infrastructure to move water.
- 2 Water rights vary by location, and they do not make it easy to change the location of water withdrawals.
- 3 Water markets—farmers selling extra water to other farmers or cities—depend on proper measurement of consumptive water use (to avoid hurting Farmers B and C), strong property rights (so Farmer A's water can be sold), and conveyance (so the water can be delivered). These features exist in Australia's well-developed water market, but they are not complete in most North American irrigation areas.

## The bottom line

It is not easy to save agricultural water for use elsewhere, but it can be done. Farmers need to have strong property rights in their consumptive use, reduce that use by the amount that's sold to others (typically by fallowing land, changing their crop mix or reducing evaporation), and be paid a price that reflects their lost revenues or additional equipment costs. Markets for water will work if the proper incentives are in place, the impacts of trades on others are minimized, and it's easy for buyers and sellers to exchange cash for water. WC

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