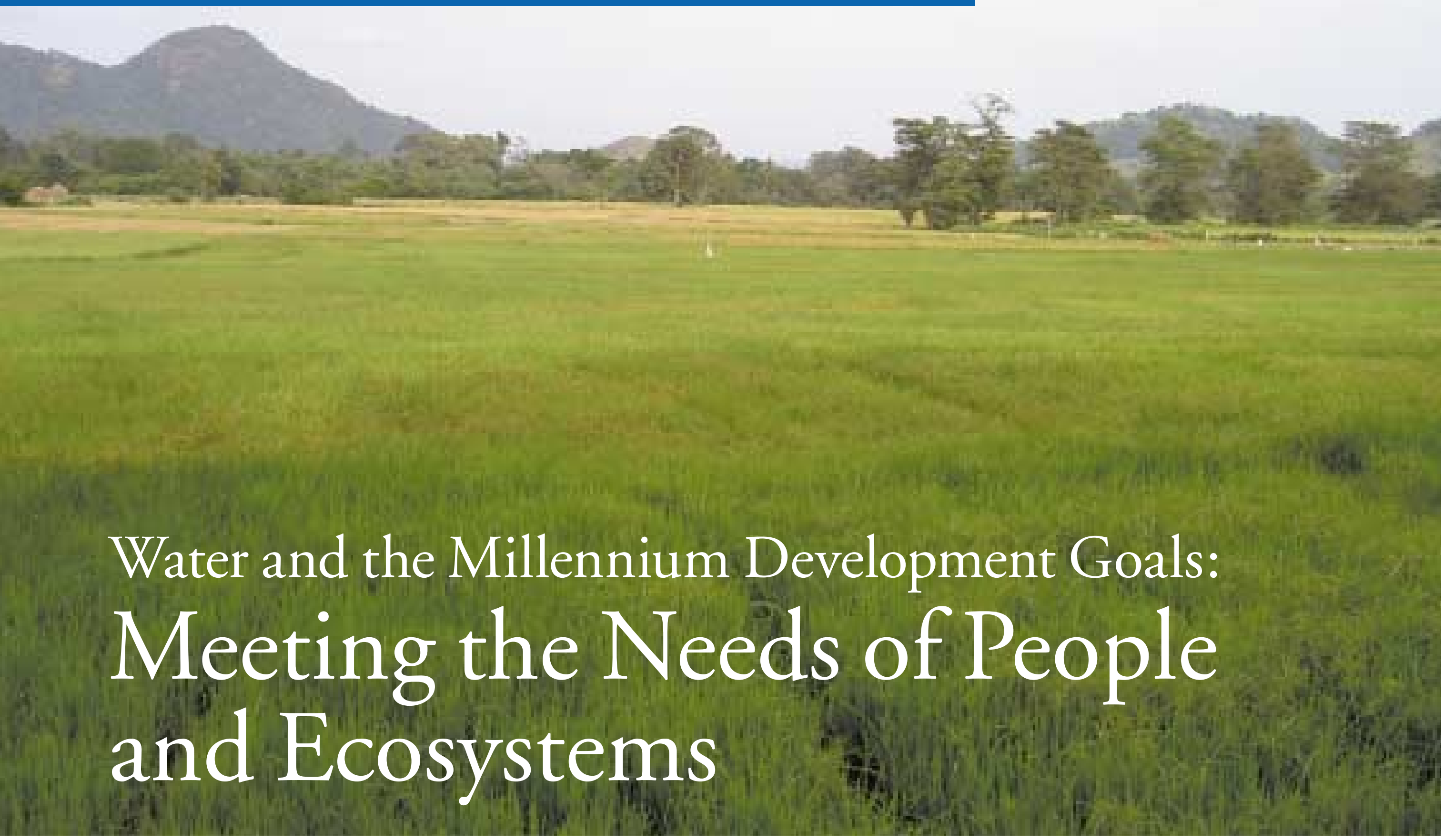

Water and the Millennium Development Goals: Meeting the Needs of People and Ecosystems

When viewed in terms of water, the Millennium Development Goals (MDGs) targeting poverty and hunger seem to be in direct conflict with the goal on environmental sustainability. It is becoming increasingly clear that ensuring people access to water for growing food and earning a living will be necessary to end extreme poverty and hunger in rural areas.

As Kalpanatai Salunkhe succinctly put it, "Water is the dividing line". On the other hand, we have seen, like the character in Arundhati Roy's novel, that agricultural water use has a high price in terms of desiccated rivers, pollution and disappearing wetlands. Can we manage water to meet both goals?

Huge amounts of water consumed to eliminate hunger

Ultimately it is the need for food that is the major driver of human water use. It is not the farming community, but each of us, as consumers of food that contribute to the water crisis. Plant growth by its nature consumes a tremendous amount of water. In the process of producing a kilogram of grain, between 500 to 4000 liters of water are converted into water vapour—depending on the productivity of water. To produce a kilogram of grain-fed beef, it is something more on the order of 10,000 liters. Based on these numbers, each of us "eats" between 2,000 to 5,000 liters of water a day—depending on our diet. Compared to the 2 to 5 liters we drink per day, or the 40 to 400 liters we use for hygiene and sanitation, agriculture dominates humanity's water needs.

Since growing food literally consumes water that would otherwise go to natural ecosystems, meeting the poverty, hunger and environmental sustainability MDGs seems an almost impossible challenge. It will also be made considerably more difficult by the 2.5 billion additional mouths to feed expected by 2025. So what do we do?

Potential shift from non-productive to productive water use

Fortunately, there are opportunities to manage water more effectively in trying to meet these MDGs. A first focus is on water productivity – getting more food for every drop of water. The high range in values of water productivity, plus our general knowledge of field practices, indicates ample scope for water productivity gains. For example, in irrigated agriculture, an International Water Management Institute (IWMI) study of 40 irrigation systems world-wide revealed a 10-fold difference in the gross value of output per unit of water consumed by crops. Much more food can in other words be grown with less blue water – the water diverted from rivers and pumped from aquifers.

But we shouldn't focus just on irrigated areas – rainfed agriculture consumes approximately 4,500 km^3 of water annually, compared to the 2,500 km^3 diverted for irrigation. Water productivity is extremely low in marginal rainfed areas where the majority of the world's rural poor live—an estimated 1.8 billion people. In these areas practices, such as conservation tillage, which help store more green water in the soil profile and reduce evaporation from the surface, can greatly increase productivity. Other practices, such as supplemental irrigation combined with water harvesting, contribute to water productivity by protecting crops from yield reductions due to dryspells. These practices, which help get "more crop per evaporated drop", have the potential to more than double yields of staple crops in many areas in sub-Saharan Africa, according to studies by IHE-UNESCO. By making investments in developing and spreading land and

> ***"More rice, for the price of a river."***
>
> *Arundhati Roy, The God of Small Things*

water practices and technologies suitable for resource-poor farmers, we can increase the productivity of water and help people escape extreme poverty and hunger.

Opportunity for sequential reuse

Getting water to the people who need it while preserving ecosystems requires an understanding of flow paths of water within a basin setting. In both rainfed and irrigated agriculture, addressing poverty and hunger generally means more water – more drops to people and crops. This means changes in aquatic and terrestrial ecosystems. Whether there will be ecosystem effects depends on where the gained drop of water was heading: whether it was on its way to evaporate anyway or to generate runoff. Converting land into farmland redirects green water flows to agriculture, and impacts terrestrial ecosystems. Harvesting, storing, diverting and pumping additional blue water – river and groundwater – affect aquatic ecosystems. The irrigated agricultural production process converts blue water flows to green water vapour flow, leading to reduced river flows downstream or depleted groundwater reserves.

Typically water management has been focused on delivery of water services to people and industrial uses, with much less emphasis on what happens to water after delivery. The difference between delivery and evaporation are the return flows back to the hydrologic system. For example, roughly 50% of the water applied in paddy rice is actually consumed by plants. Water which remains filters through the soil to recharge aquifers, waters the next farmer's field, or flows back into the river system. In water stressed environments, these return flows mean opportunities to many people. Farmers pump water from drains or aquifers recharged by irrigation. To millions of peri-urban farmers throughout the developing world untreated wastewater is a valuable source of irrigation and nutrients. The problem is water management agencies often don't acknowledge these reuse strategies. The result is that water quality and human health are often compromised and the full potential of these practices to improve water productivity is not reached. People and ecosystems at the tail of river systems often have no choice but to live with what is left-over – they have to deal with radically changed flow patterns and polluted waters. Without formal recognition, these "reusers" are highly vulnerable to shifting water use patterns and pollution upstream.

> ***"Water is the dividing line between poverty and prosperity."***
>
> *Kalpanatai Salunkhe, Rural Development Officer, Mahrashtra, India*

There are examples where reuse has been deliberately considered in design and management—to the benefit of both people and ecosystems. For centuries, cultivators in Sri Lanka have used the tank cascade system to capture, deliver, use water, and drain water to the next downstream tank for further use. These systems support farmers and highly diverse ecosystems. The Chinese effectively employ "melons-on-the-vine" consisting of reservoirs of all sizes interconnected to canal and drainage systems. In Egypt, the irrigation agency works with farmers to reuse drainage water – blending this water with fresh supplies for agriculture.

Better understanding of landscape functions

We have to find out how to link water security, ecosystem security and food security, all of them closely related through the water flow down the catchment. In a river basin there are hydrological and topographical differences in terms of where the water goes after use: whether the return flows are recoverable and can be reused downstream, or whether they are non-recoverable and cannot be reused because of location, implying that the return flows go to sinks or involve poor water quality beyond usability. There are three zones where the outflow can be reused downstream:

- the water source zone in the upstream basin
- the natural recapture zone where the water drains back to the water system through gravitational flows
- the regulated recapture zone where the water has to be pumped back

But there are also zones from where no reuse is possible: the final zone where there are no further users downstream; stagnation zones in dead ends or depressions from where there is no drainage; and environmentally sensitive zones with particular water requirements.

Putting the pieces together to meet the MDGs

Managing water to reduce poverty and feed more people, without harmful ecosystem degradation is indeed a challenge. But improving crop per drop to free up water for the ecosystems and other uses, targeting poor farmers in marginal rainfed lands for productivity increases, and taking the big picture of basin water use into account in planning and management are all potential pathways to meeting that challenge.

This article was written by Dr. David Molden of IWMI and Professor Malin Falkenmark of SIWI.