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Small-scale Irrigation Boosts Incomes and Food Security in sub-Saharan Africa

Posted by [Sandra Postel](#) of National Geographic's Freshwater Initiative in [Water Currents](#) on August 8, 2013

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A solar-powered drip irrigation system waters vegetable crops in northern Benin. Photo by Jennifer A. Burney

For millions of poor farm families in sub-Saharan Africa, access to water makes the difference between hunger and a full belly, between a well-nourished child and one stunted by malnutrition, and between a productive livelihood and one mired in poverty. For many, the long dry season is



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a trying time of one meal a day.

But the emergence and spread of affordable pumps and other technologies that enable farmers to irrigate their small plots has begun to boost harvests and family incomes in some of the world's deepest pockets of hunger, including parts of sub-Saharan Africa.

In [an article](#) published last week in the *Proceedings of the National Academy of Sciences*, my colleagues [Jennifer Burney](#) of the University of California-San Diego and [Roz Naylor](#) of Stanford University and I make the case that scaling up the use of these small-holder irrigation systems should rise to the top of African development priorities.

Decentralized Irrigation

Though sub-Saharan Africa has a rich and varied water endowment, only 4 percent of its cropland is irrigated. Some 40 million hectares of its land are suitable for irrigation, but only 7.3 million hectares are actually irrigated.

Large, centralized irrigation schemes, often built around big water storage dams, were a major component of the Green Revolution that helped boost food production and reduce famine risks for millions of people, especially in Asia. But they have often proven environmentally destructive and, especially in Africa, expensive.

By contrast, decentralized irrigation – small individual systems designed to serve a single or community farm – can often be better tailored to local conditions, purchased and operated by private farmers, and avoid the environmental and social downsides of big dam-and-canal systems.

I first saw the transformative power of one of these small-scale technologies while traveling in Bangladesh in 1998. It was January, the dry season, and many fields were fallow. Plentiful groundwater existed just a few feet below the land surface, but the farmers there – most of whom lived on less than a dollar a day – had no affordable way to access it.

Then, fields of green suddenly appeared. Men, women and children, some under brightly colored umbrellas to protect themselves from the searing sun, were in their rice and vegetable plots operating a pump that was delivering water to their crops. Called [a treadle pump](#), this simple device looks a bit like a Stairmaster exercise machine: the farmer pedals up and down on two poles (called treadles), which activates a cylinder that suctions water up through a tubewell and into the farmer's irrigation ditch.

The families I spoke with said that not only were they no longer hungry, they were taking high-value vegetables to market. And their \$35 investment in the treadle pump returned them about \$100 in the first season. Though it took time and labor to operate, the pump was lifting them out of the trap of poverty and malnutrition.

[Paul Polak](#), the brilliant innovator and social entrepreneur I traveled with to Bangladesh, and whose organization International Development Enterprises (now [iDE](#)) helped manufacture and market the treadle pump, estimates that private farmer investments of \$37.5 million combined with donor investments of \$12 million are generating net returns to Bangladeshi farmers totaling \$150 million per year.

The Untapped Potential

Following on this success, [KickStart](#), [iDE](#) and a number of other organizations have introduced variations of the treadle pump into Kenya, Tanzania, Mali and other African countries. [Kickstart](#) estimates that the sales of its pumps have helped lift 600,000 people out of poverty.

But operating a treadle pump is hard work and takes time away from other important activities.

In recent years the falling price of motorized pumps (typically running on gas or diesel fuel) and solar-powered systems has vastly expanded the potential of small-scale irrigation to raise yields and incomes in sub-Saharan Africa. Some 30 percent of small-scale irrigators in Ghana now own or lease a motorized pump to irrigate their farm plots.

A study by the [International Water Management Institute](#), based in Sri Lanka, estimates that small motorized pumps could expand irrigation by some 30 million hectares in sub-Saharan

About This Blog

The goal of [Water Currents](#) is to bring together diverse voices to discuss pressing issues in freshwater. We are particularly interested in water consumption, locally and globally, and restoration and conservation of freshwater ecosystems.

This blog is hosted by [Sandra Postel](#), Freshwater Fellow with National Geographic and Director of the [Global Water Policy Project](#). Banner photo by NASA. [Freshwater Species of the Week](#) photo by [princedd/Flickr](#).

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Africa (a four-fold increase over the current area), generate annual net revenues of \$22 billion, and improve food security and incomes for some 185 million people.

My co-authors Burney and Naylor have [studied a pilot project](#) in West Africa that highlights the potential of solar-powered systems to sustainably expand irrigation to rural villages. In a project in northern Benin – a region with no electricity and groundwater too deep to access with treadle pumps – solar-powered pumps delivered water to community-scale drip irrigation systems. After one year of operation, the project had raised incomes and improved household food security.

Getting decentralized irrigation to fulfill its potential will take concerted action. For starters, a better understanding of sub-Saharan Africa’s water sources and hydrology is essential to know where and how much irrigation development can sustainably take place. Farmer access to financial services – credit and insurance, for example – as well as to local and regional markets will be critical.

With targeted investments and policies to expand decentralized irrigation, the future for sub-Saharan Africa’s smallholder farmers could be bright. Without them hunger, poverty and humanitarian crises will persist.

Sandra Postel is director of the Global Water Policy Project, Freshwater Fellow of the National Geographic Society, and author of several books and numerous articles on global water issues. She is co-creator of [Change the Course](#), the national freshwater conservation and restoration campaign being piloted in the Colorado River Basin.

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