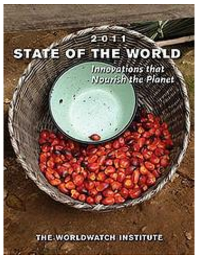


STATE OF THE WORLD 2011

Innovations that Nourish the Planet

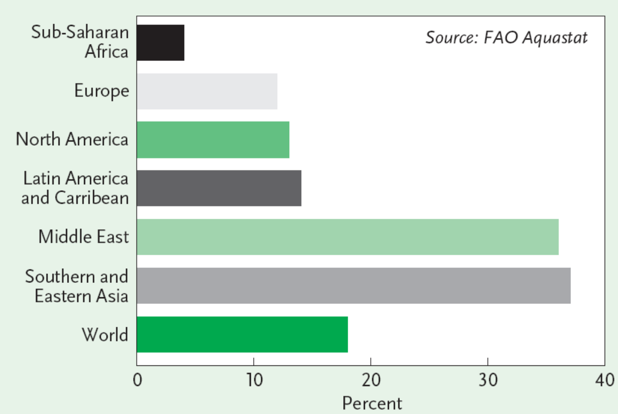
State of the World Brief Series

Chapter 4. Getting More Crop per Drop

Key Messages

- Innovations that can increase the availability of water for crops are helping the world's poorest farmers improve crop productivity and become more food-secure.
- These innovations are affordable and need to be made accessible to smallholder farmers with support from developed countries and international NGOs and improvements in local markets.
- These innovations will help mitigate the effects of climate change and the increasing demand on water resources.

Figure 4–1. Percentage of Cultivated Land That is Irrigated, Selected Regions and World, circa 2005



The Problem

The Green Revolution led to a near-tripling of the global grain harvest since 1960 through a combination of high-yielding seed varieties, fertilizer, and a doubling of world irrigated area. By boosting the productivity of cropland, it spared substantial natural areas from being plowed. But it also demanded vast quantities of water. Today, 70 percent of all freshwater use is for irrigation, and water supplies are drying up in important food-producing areas as extraction exceeds sustainable levels. The expansion of water-intensive cities and industry add to the pressures on water resources.

Moreover, the prescriptions of the Green Revolution were not universally appropriate or accessible, and 1 billion people remain chronically hungry. Some 60 percent of the food-insecure live in South Asia and sub-Saharan Africa, most of them on small farms. Many of these small farmers do not have enough reliable water resources for sufficient yields; in sub-Saharan Africa, only 4 percent of the cultivated land is equipped for irrigation. A majority of African livelihoods are dependent on rainfed agriculture, and climate scientists predict that rainfall on the continent will decline in the coming decades.

Innovations/Solutions

Rainfed areas with low agricultural yields, such as much of Africa, hold the biggest potential for getting more "crop per drop." As long as other ingredients are in sufficient supply, a crop's yield will increase linearly with the amount of water it takes in through its roots. Among the most promising innovations for channeling moisture to the root zones of crops in sub-Saharan Africa are:

Human-powered pumps. The foot-operated treadle pump enables 2.3 million poor farmers in the developing world—some 250,000 in sub-Saharan Africa—to boost their productivity, harvest reliability, and income. The original US$35 version is capable of irrigating 0.2 hectares with ground water; newer variations can irrigate up to 0.8 hectares and cost no more than $140 installed. These devices already generate $37 million a year in new profits and wages, and several important markets for alleviating hunger and poverty have yet to be tapped.

Affordable micro-irrigation. A suite of low-cost drip irrigation technologies has been developed to help farmers use limited water supplies more efficiently, often doubling water productivity. These

Table 4–1. Selected Low-cost Innovations that Improve Water Access and Efficiency in Agriculture

Technology or Practice	Example Locations	Conditions Where Appropriate	General Benefits
Manually operated (foot, hip, hand) pumps that extract water from surface and groundwater sources	Bangladesh, India, Burkina Faso, Ethiopia, Ghana, Mali, Malawi, Niger, Tanzania, Zambia	Shallow groundwater or surface water available; small farm plots; semi-arid zones or areas with distinct dry seasons	May offer entry point to irrigated agriculture by providing access to water (manual pumps) and ability to stretch scarce supplies (drip and micro-irrigation); reduce water-carrying burden and risk of crop failure; lift yields and allow diversification to higher-value crops for marketplace sales; increase income and food security
Micro-irrigation using bucket kits, shiftable drip systems, pitcher irrigation, and micro-sprinklers; solar-powered drip systems being piloted	Northwest, central and southern India; Nepal; Central Asia; China; Near East; semiarid regions in South America and sub-Saharan Africa; solar-powered pilots in Benin and Burkina Faso		
Fog water collection using mesh nets	Peru, Chile, Nepal, South Africa	Upland areas with frequent fog periods	Simple techniques make fresh water available for irrigation year-round, reduce groundwater extraction and the need to purchase water
Capturing surface runoff from “built” surfaces or rooftops in small channels, stabilization ponds, or small reservoirs	Beijing, China; Lima, Peru; Hyderabad, India; Ubuntu, South Africa	Rainfed, urban/peri-urban agriculture; rainfall runoff from greenhouses or other building structures	
On- and off-farm rainwater harvesting through terracing, stone bunds, vegetative barriers, check dams, recharge pits, and other methods	In low-lying areas: “fadama” in Nigeria; “dambos” in Malawi, Zambia, and Zimbabwe; “tassa” in Niger On sloping lands: “fanya-juu” in Kenya; “teras” in Sudan; vetiver contours in Mozambique, Zambia, and Zimbabwe	Where soil moisture is limiting factor to crop production and local, seasonal rains can be captured to fill soil-moisture deficit; where precipitation may result in topsoil erosion and rainfall runoff	Improve food security through effective soil and rainwater management; reclaim barren land, reduce deforestation by increasing per acre crop yields, retain soils and soil fertility and moisture; many methods build on indigenous practices

Examples compiled by Alexandra Tung, Worldwatch Institute

systems deliver water directly to the roots of plants through perforated pipes or tubes, and can come in the form of $5 bucket kits, $25 drum kits, or $100 shiftable drip systems that can irrigate 0.2 hectares. Solar-powered micro-irrigation drip systems are making their debut in West Africa.

More effective use of rainfall. Conservation tillage methods that leave the soil intact; timely weeding and mulching; and planting vegetative barriers all help to maximize green water, or rainwater stored in the soil and plants as moisture. Rainwater harvesting using small earthen dams and other methods also help maximize rainwater utility. Supplementing these practices with irrigation may produce optimal results.

Looking Ahead

In the face of rising population and consumption, persistent poverty, and global climate change, satisfying the water requirements of the future will take a commitment well beyond what has materialized to date. The industrial countries most responsible for the climate changes now under way may have an obligation to assist poor populations in preparing for, adapting to, and becoming more resilient to the effects of these changes. Increased agricultural production rarely trickles down to the very poor, and a degree of food self-sufficiency may be crucial to food security for these groups.

This brief is based on Chapter 4, “Getting More Crop per Drop,” by Sandra L. Postel, published in the Worldwatch Institute report *State of the World 2011: Innovations that Nourish the Planet.* To order a copy of *State of the World 2011* or to read more briefs in this series, visit **www.NourishingthePlanet.org.**