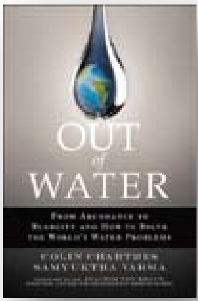
World Water Brief

How to Avert a Water Crisis
A Six-Point Plan

Briefing for journalists attending the 2010 World Water Week in Stockholm

Based on the new publication



Out of Water:

From Abundance to Scarcity

and

How to Solve the World's Water Problems

by

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International Water Management Institute

IWMI Celebrating 25 years 1985-2010

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Action 1: Gather high-quality data

The problem

The adage "if you can't measure it you can't manage it" is true for water as for any other product or service. Making sound decisions on allocating extractions made by agriculture or industry, planning suitable action in the event of floods or droughts, and understanding how natural hydrological ecosystems work, all require high-quality, up-to-date data. Understanding how climate change is affecting water supplies requires long-term datasets. Countries often manage their water resources badly because they simply don't have sufficient data to make informed judgements.

Many developed countries have inadequate data on their water resources due to privatizations during the 1980s. The new corporate water managers scaled back data gathering and monitoring activities to cut costs, and made previously available data unobtainable due to its 'commercial sensitivity'. Developing nations, meanwhile, have never had the funds to invest in comprehensive monitoring networks, so they also suffer from a dearth of data. Where information is available, governments are often unwilling to share it with scientific bodies, citing reasons of national security.

The solution

All water planning and management departments need to prioritize data gathering efforts. Without such data, planners cannot evaluate potential responses of rivers to rainfall, forecast flood risks in different locations, understand seasonal flow variations, monitor fluctuations in groundwater levels or predict the effects of extractions on a river's health. Solving transboundary water issues equitably can only be achieved with knowledge about flow volumes and seasonal fluctuations. Africa, alone, has more than 60 transboundary river basins.

Technological advances are simplifying and reducing the cost of monitoring the characteristics of water resources. Many gauging stations and groundwater bores can now be monitored remotely via satellite or using a mobile phone. Remote sensing also offers opportunities for measuring irrigation water use by farmers, highlighting fluctuations in groundwater levels and evaluating basin water productivity. For example, a satellite water productivity map of Asia's Indo-Gangetic River Basin showed that, while productivity in the basin is relatively low, there is great variation. Parts of the northwest produce much more 'crop per drop' than elsewhere (Cai and Sharma 2010).

Many large-scale datasets are now freely available to water and agricultural planners through external organizations such as the International Water Management Institute (IWMI). IWMI's datasets include: the Global Irrigated Area Mapping (the first such map based on data from satellite sensors); the Global Map of Rainfed Cropland Areas (a by-product of the previous map); and the World Water and Climate Atlas (which provides data on climate and moisture availability for agriculture). In addition to using such resources, water-scarce countries need to put in place their own monitoring systems to underpin water management at national, regional and local scales. Datasets containing information showing past conditions are less relevant today because of climate change. Thus, climate forecasts must be included in water models.

Water information systems provide a way for the authorities to manage and query their data. They incorporate tools such as GIS (Geographic Information Systems), Google Earth and web content management systems. These tools enable planners to assess links between environmental, municipal and health data, and present real-time information about flow rates and groundwater levels. IWMI developed the Sri Lanka Water Resources Audit to demonstrate how data relating to a country's water resources can be gathered in a single information system and queried through an interactive map-based interface. The Institute is also developing a Water Data Portal, as a repository for all data relating to IWMI's water research.

Further reading

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Global Irrigated Area Mapping: www.iwmigiam.org/info/main/index.asp

Global Map of Rainfed Cropland Areas: www.iwmigiam.org/info/gmrca/default.asp

Water Data Portal: http://waterdata.iwmi.org/

World Water and Climate Atlas: www.iwmi.org/WAtlas/Default.asp

Action 2: Treasure the environment

The problem

Water was once considered to be an infinite resource. However, due to population increases and overexploitation of existing water resources, a third of the world's inhabitants now face water scarcity (CA 2007). This includes both physical and economic water scarcity. Physical water scarcity exists where there is not enough water to meet human and environmental demands, while economic water scarcity exists where water may be plentiful in nature but there is insufficient investment or human capacity to satisfy demand for water. One-quarter of the world's population now live in river basins where water is physically scarce and around one-sixth inhabit catchments where water is economically scarce.

As water resources have dwindled, rivers and lakes have become increasingly polluted with industrial discharges and human sewage. This is particularly so in the developing world, where little effort is made to cleanup dirty waterways. Such pollution now includes chemicals from pesticides such as persistent organic pollutants (POPs). These are particularly damaging as they linger in the environment and get carried away by the hydrological cycle far from where they were produced. Because they do not easily degrade, they can accumulate in the food chain and subsequently pose a risk to human health.

The solution

Nations must stop considering the world's water resources as mere receivers of effluents and begin viewing them as valuable ecosystems that can decontaminate wastes and provide sustainable supplies of fresh drinking water. Rivers have remarkable abilities to dissolve and break down sewage but they cannot fulfil this role if overloaded with waste and chemicals. Non-biodegradable and endocrine-disrupting substances should be banned from entering the hydrological cycle. The latter include chemicals such as dichlorodiphenyltrichloroethane (DDT), which has been used as a pesticide since the mid-1930s even though it harms birds, beneficial insects and marine creatures. Although now prohibited in most countries, deposits containing DDT persist in Antarctica and on Himalayan glaciers.

The authorities must also work to create productive agroecosystems that deliver valuable, regulating functions while sustainably producing food. In their natural state, ecosystems provide services; wetlands regulate floods, mangroves provide protection from coastal storms, and forests help regulate erosion. Agriculture essentially concentrates the natural ecosystem service of providing food, but this often comes at the expense of losing other natural functions of ecosystems. Successful sustainable agricultural systems mimic natural ones. For example, paddy fields emulate the water retention of natural wetlands. They provide rice and fish, while absorbing floods, recharging groundwater supplies, controlling soil erosion and purifying water.

Maintaining healthy ecosystems while growing sufficient food to feed the world will require water flows to be allocated to the environment. If all the water in a river is used by agriculture and industry while leaving nothing for the aquatic environment, fish and plants can no longer survive and the river 'dies'. The Syr Darya and Amu Darya rivers in Central Asia are examples of waterways that have been overexploited to the detriment of their ecosystems. The term 'environmental flow' is used to describe the amounts of water required by a river, as seasons pass, to sustain its ecosystem. It is possible to calculate the environmental flow of a river (IWMI 2007) and then use this information to set sustainable limits for water use by industry and agriculture whereby the river is left in a healthy state.

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Action 3: Reform water governance

The problem

Water governance is the set of processes through which decisions related to water management are made. Achieving good water governance requires knowledge about what actions work best in a particular physical and socioeconomic context. In many developing countries, institutional and governance models in operation today were designed in a colonial context. At that time, the authorities favored growing crops in large-scale monocultures and viewed water as an infinite resource. Accordingly, nations installed large, supply-driven surface irrigation schemes. Under today's conditions of a swelling global population, farmers producing a greater variety of crops, and increasing competition for water from cities and industry, these enduring systems of governance are out of sync with modernity. Poor water governance has been cited as being one reason behind today's water scarcity (CA 2007).

As surface irrigation schemes have slowly stagnated, farmers have taken water management into their own hands. Unable to access water with enough flexibility to nurture the variety of fruits, cereals and vegetables they grow now, they have started pumping up groundwater through boreholes. This trend has been wide-ranging, especially in South and East Asia where planned and regulated surface irrigation has now largely given way to 'anarchic' pump-based systems. The inability of governments to regulate water use under such conditions has resulted in some catastrophic environmental problems. For example, in India, there have been cases within North Gujarat, Tamil Nadu, Saurashtra and Southern Rajastan where agriculture has collapsed and drinking water supplies have become contaminated by polluted aquifers (IWMI-TATA Water Policy Program 2002).

The solution

A new form of governance is needed that acknowledges the value of water and ensures it is used efficiently. To date, governments have been reticent to implement reforms because they fear political repercussions. Generating support for reform requires recognition of the value of water. Although access to clean drinking water and sanitation must remain a fundamental right, water used by agriculture, industry and the environment will ultimately need to be priced. To ensure dwindling water resources are shared equitably, governments must introduce allocation policies, based on well-defined water rights, where water allocations can be reduced when supply becomes scarce or demand from different sectors increases. Farmers will need incentives to encourage these sectors to use less water. A way to achieve this is to link agricultural practices to their impacts on society. For example, municipal authorities might pay farmers who use less water, so there is more water available for cities.

Models of successful water governance reforms are emerging. In Gujarat, decades of electricity subsidies left the authorities facing bankrupt electricity utilities and depleted groundwater stores. Scientists suggested that governments should introduce 'intelligent rationing' of power by separating cables carrying electricity to farmers from those supplying domestic users. They recommended providing farmers with a high-quality power supply for a set number of hours each day at a price they could afford. Gujarat implemented the scheme across its 18,000 villages. This action boosted the well-being of individuals by increasing the quality of power supply to rural households, schools and industries; halved the power subsidy to agriculture; reduced the groundwater overdraft; and encouraged the development of non-farm enterprises (Shah et al. 2008). In Australia's Murray-Darling River Basin, a successful system of governance is in operation based around separate land and water rights, water trading and water pricing.

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Action 4: Revitalize water use for farming

The problem

Experts predict that the world's population will reach nine billion by 2050. At the same time, people are moving to cities, becoming wealthier and shifting from eating a cereal-based diet to a more diverse mix of meat, fruits and vegetables. These changes mean farmers will have to double the amount of food they produce by the middle of the century to prevent hunger. However, given increasing water scarcity, they will have to achieve this without using any more water than they use today.

Currently, 70% of the world's irrigated land is in Asia. During the 1960s, famines across the continent threatened its people with starvation. A combination of new irrigation infrastructure, fertilizers, pesticides and high-yielding crop varieties helped the region shift from being in food deficit to producing a surplus in less than a decade. Today, this aging irrigation infrastructure is out of sync with diversified agriculture. As a result, millions of farmers have begun pumping-up groundwater. Because their extractions are not regulated, overexploitation is causing environmental problems in some places (Mukherji et al. 2009).

In Africa, 94% of agriculture is rain-fed. Climate change is increasing temperatures and making rainfall more variable, often causing crop failures. Many rain-fed areas also suffer from low fertility and land degradation. Smallholder farmers live a hand-to-mouth existence, with little chance of lifting themselves from poverty. As people have increasingly moved from rural to urban centers, agricultural areas have sprung up around cities. With too many demands placed on freshwater resources, farmers in these areas use wastewater to irrigate their crops. This is often contaminated with pathogens from sewage.

The solution

Experts anticipate that the world's population will stabilize in the middle of the century at nine billion. If this happens, and if countries in the developing world can double their agricultural output, food security can be assured. Productivity in the developing world lags behind that of the developed countries so there is great potential for raising yields; water productivity in Pakistan is three or four times lower than that in the USA. However, with water availability and quality, pumping costs, soil properties, fertilizers, pests and farmer capacity all influencing productivity, achieving gains can be complex. Better knowledge-sharing and management practices, combined with market incentives, can help to significantly raise yields.

Raising productivity in Asia will require investment to overhaul outdated irrigation infrastructure, such as canal linings, piping, and control hardware and software. The way schemes are managed will also need reforming, so that farmers become involved in decision making. Known as Participatory Irrigation Management (PIM), this approach has achieved water savings of 30% in parts of Central Asia. However, PIM requires long-term support from governments and experts to avoid failure, and active participation from communities. Where irrigation is evolving from surface schemes to pumping of groundwater by individuals, the authorities must support this trend. This will require new approaches such as using surface irrigation schemes to recharge groundwater, overhauling governing institutions, and regulating the use of groundwater to ensure sustainability.

Across Africa, and in other rain-fed areas, the authorities have opportunities to invest in new irrigation that suits today's agricultural methods. Building capacity, so that farmers become actively involved in managing these wide-ranging systems will be crucial. As well as investing in large-scale irrigation infrastructure, the authorities should consider providing smallholder farmers with access to small water storage facilities. (McCartney and Smakhtin 2010). Providing access to a variety of water stores could help many farmers overcome dry spells, thereby reducing poverty and helping underpin food security.

Wastewater recycling has an important part to play in achieving productivity gains. However, safe practices must be developed and enforced. IWMI and the World Health Organization (WHO) have jointly developed guidelines for using wastewater more safely. These recommend actions such as linking water supply and sanitation sectors; separating industrial and domestic discharges; and applying simple hygiene rules, e.g., washing vegetables. (Drechsel et al. 2010).

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Action 5: Manage urban and industrial demands for water

The problem

Only 3% of the water on Earth is not salty, and two-thirds of this is locked up in ice caps and glaciers. Of the remaining 1%, one-fifth is in remote, inaccessible areas and much of the rest arrives when it is least wanted, as monsoonal deluges and floods. The result is that humans are able to exploit only 0.08% of all of the world's water. Agriculture presently uses 70% of the available freshwater resources, with industry using 20% and municipalities using 10%. In future, agriculture will have to relinquish some of its share of freshwater use, as megacities expand, industry develops and new competition arises from our need to grow biofuels. As farmers strive to increase productivity to meet growing demands for food, industry and cities must find ways to use water more efficiently.

The solution

Several water-scarce cities are setting good examples of how municipalities can cut water use. In Sydney, Australia, the authorities have replaced leaking infrastructure, and laid down 'Water Wise Rules', promoted via public information campaigns. These restrict times at which gardens can be watered, ban automatic sprinklers, and prohibit car washing except at commercial premises that recycle water. Actions such as fitting dual-flush toilets and low-flow showerheads have also been encouraged. The city is aiming to recycle water to supply 12% of its needs by 2015. This will be used to provide water for industry, irrigate parks, gardens and golf courses, and maintain healthy environmental flows in rivers. New urban design principles are being introduced across Australia that minimize losses to stormwater and promote recycling of urban runoff.

Desalination and sewage treatment plants are providing cities with 'new' supplies of water. As well as increasing the efficiency of freshwater use, Sydney has invested in a seawater desalination plant that will supply water to meet 15% of the demand by 2015. In both California and Namibia, the authorities have begun successfully recycling sewage to provide drinking water. In Orange County, treated water is injected back into the aquifer to minimize saltwater intrusion and provide water for public use. In Windhoek, treated sewage is recycled back into the water purification plant, where it is filtered using activated carbon, ozone and a pressure membrane. The water goes back into the urban pipe network. There have been no incidents of illness in the plant's three-decade history.

Industries are also taking more responsibility for the water they use by calculating their 'water footprints' and identifying where they can make water savings. This process involves calculating how much water is used at each stage of production from crop to shop. For example, Nestle is working with IWMI to calculate the water footprint of its milk operations in the Punjab, India. The company buys 1.25 million liters of milk a day from 100,000 farmers in this region. However, the local water table is dropping by one meter a year, and the company is concerned that this could affect milk supply in the district. 'Water footprinting' enables companies to identify where water-saving methods can best be employed during the production process (Amarasinghe et al. 2010).

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Action 6: Empower the poor and women in water management

The problem

Providing water effectively for a range of agricultural needs has been proven to reduce poverty. At the individual farm scale, access to a reliable water store can be the difference between a crop failing or thriving during dry spells, which in turn will determine whether or not a poor farmer has enough food to feed his or her family. At a global scale, achieving food security through effective water management can prevent the deaths of millions from starvation and malnourishment. While past efforts to develop irrigation infrastructure have had success in reducing poverty, the benefits have not been equitably shared and there are many regions where pockets of poverty still remain. With the increasing variability that climate change brings there is now an even greater need to find the most appropriate solutions to address poverty and vulnerability, specifically in regions that have not yet been reached.

Women's varying roles in agriculture have also been overlooked when decisions about water use have been made. There is a perception that rural women are solely responsible for fetching and carrying water, and that men undertake the farming, but this is not necessarily the case. Often, women have different roles to men; female villagers might manage fruit trees, while men manage crops in the fields. If a government or development organization comes to install an irrigation system and is guided by village men to cut down trees, they may inadvertently dispossess women of their livelihoods. Increasingly, poor families are seeking to escape poverty by sending men to cities to find alternative work. This trend has been observed in many places where women are increasingly taking on full responsibility of running farms. Despite assuming chief decision-making roles in many farming systems, they often remain underrepresented in water users' groups because of community attitudes and neglect on the part of policymakers to improve the rights and access of women.

The solution

Many of today's smallholder farmers grow a range of crops, often on unproductive marginal lands such as uplands. They would benefit from access to a combination of small-scale water storage facilities, along with soil improvement technologies. These would help them to overcome issues of rainfall variability, which is likely to be exacerbated in the future due to climate change. They may also provide them with opportunities to diversify, for example, by farming fish as well as crops. Providing a large number of smallholder farmers with access to artificial ponds or tanks, small reservoirs, wetlands, and groundwater or soil moisture, has the potential to lift individual families from poverty and underpin global food security. In southern Sri Lanka, the construction and linking of a large storage reservoir to five small existing reservoirs resulted in a 400% increase in productivity (McCartney and Smakhtin 2010).

Decision-makers need to take into account the roles of women much more if they are to effectively address poverty as well as food security. A project to include women in decision-making on irrigation in Jambar, South Gujarat, India, resulted in a higher social status for the women along with greater productivity from their crops (van Koppen et al. 2001). The project involved researchers educating the community's men as to why the women should be involved in making decisions. IWMI and the International Food Policy Research Institute (IFPRI) are presently developing a gender map of smallholder farming in Africa. This will be used to develop recommendations on how to target the main decision-makers of the farms with water management technologies.

Further reading

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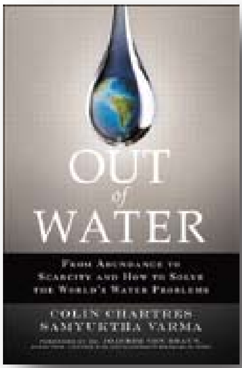
Gender mapping project: www.iwmi.org/Topics/Gender/



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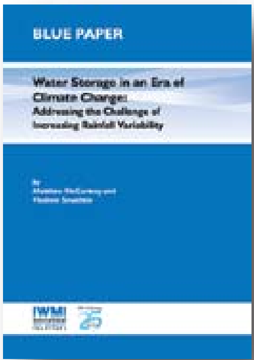
www.iwmi.org/OutOfWater/



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www.iwmi.org/Topics/Water_Storage/

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Mission: To improve the management of land and water resources for food, livelihoods and the environment

Vision: Water for a food-secure world

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