# A DROP in the BUCKET

## Successful management of water must balance development needs and economic considerations

*Peter H. Gleick*

IN mid-2013, Ethiopia began construction on the Grand Renaissance Dam on the Blue Nile just upstream from Sudan and Egypt. In many ways this massive dam is a symbol of the water challenges faced by billions of people around the world, with multiple meanings, interpretations, and implications.

For Ethiopians, it represents their first major attempt to control and use the waters of the Nile for economic development in the form of hydropower generation and perhaps agricultural production. For Egyptians, it represents potential interference with their own water systems and strategies because of the risks that water flows in the Nile—considered their lifeblood—will be reduced or subject to the political control of governments and institutions outside their borders. To some in the water policy community, the dam represents tangible evidence that efforts to develop joint and comprehensive management of the entire Nile River basin have failed. To others, it is a symbol of the 20th-century approach to water management—that is, to build large-scale centralized infrastructure without understanding or addressing true environmental, social, and political costs and without looking at more comprehensive integrated options for economic development. In reality, the project represents, to some degree, all of these things.

For the last several decades of the 20th century, fresh water played a small but growing role in comprehensive strategies to reduce poverty and promote economic development around the world. Prior development policies focused on trade, agriculture, energy, transportation, and industrial strategies, with only limited attention to water. And in the rare instances when water was integrated into development approaches, it was typically only in the context of building large infrastructure or to satisfy urgent unmet needs for safe water and basic sanitation.

That focus is beginning to change, but only slowly. Among academics, there is growing acknowledgment that water challenges are closely tied to other resource and economic development challenges. But there is still great uncertainty about how best to implement practical development policies that cut across traditional institutional, political, and geographic boundaries.

Water is tied to nearly everything we care about: human and ecological health, industrial and agricultural production, international trade, climate change, and both domestic and international politics. Until we manage water in an integrated fashion, there is a risk that we will continue to miss opportunities for more effective and efficient development strategies. Some of these opportunities involve new technology, different forms of institutional management, or a rethinking of the economic tools we use in the water sector, including pricing, subsidies, markets, and financing mechanisms.

### A water crisis

Today's water challenges take many forms. In some parts of the world, the problem continues to be inadequate access to safe water and sanitation—the prime focus for the water effort of the United Nations Millennium Development Goals (MDGs). In other regions, there is growing competition for limited water resources among agricultural, industrial, domestic, and ecological users. The misalignment of political borders and watershed boundaries has long complicated the effective management of water systems, and, in many parts of the world, these political challenges are getting worse, not better, leading to a growing risk of conflict. Finally, climate changes are increasingly affecting water availability, quality, and demand in ways that most water managers are not prepared for, and new efforts are needed to identify future climate-related risks and opportunities (see map).

As we approach the 2015 target date for achieving the MDGs, it is time to reassess progress and priorities. In the water sector, several shortcomings are already apparent. At the most basic level, there remain unacceptable gaps in our knowledge because of inconsistencies in and uncertainties about measuring and evaluating access to basic water services. It would be wonderful if we knew with any degree of accuracy how much water, and of what quality, was actually available and used by everyone on the planet, but such data are not available.

On the positive side, international agencies report that substantial progress has been made in meeting the MDG for access to safe water, though hundreds of millions of people remain underserved. On the other hand, even optimistic observers have acknowledged the overall lack of progress in meeting the MDG targets for access to adequate sanitation, as well as regional failures to meet safe water needs, especially in parts of Africa and Asia. New and expanded efforts are required to satisfy, once and for all, basic human needs for fundamental water services and to eliminate the scourge of preventable water-related diseases and deaths.

**Climate change adaptation is absolutely essential in water management and should start now.**

Because of the vital role that water plays in serving both human and environmental needs, there is growing competition among these sectors for increasingly limited water resources. Major rivers such as the Colorado, the Nile, the Yellow, and the Ganges are increasingly overused or suffer from severe pollution. Groundwater resources in India, northern Africa, the central United States, parts of China, and the Middle East are increasingly pumped out faster than nature recharges them. By some estimates, 30 to 40 percent of agricultural production relies on unsustainable water resources. Recent work to define and evaluate peak water constraints for renewable, nonrenewable, and ecological water systems has highlighted the need to improve water management (Gleick and Palaniappan, 2010).

## Integrated strategies

Water is essential to meeting the food needs of the planet's growing population. Seventy percent of the water humans use goes to agriculture. But water is also vital to basic ecological functions that support humans, including fisheries production; natural water quality treatment; and the health of rivers, lakes, and marshes. Twentieth century water policies that favored one sector over another, or ignored the needs of ecosystems, must be replaced by more integrated strategies that maximize the productive use of water while minimizing the adverse consequences of that use. Among other things, this new approach requires setting and enforcing minimum water requirements to support healthy ecosystems, improving the efficiency and productivity of water use, expanding water treatment and reuse systems, and integrating surface and groundwater management rather than continuing to treat these water sources as unconnected and independent. It also means seeking innovative sources of supply, such as rainwater harvesting, desalination, wastewater reuse, and more.

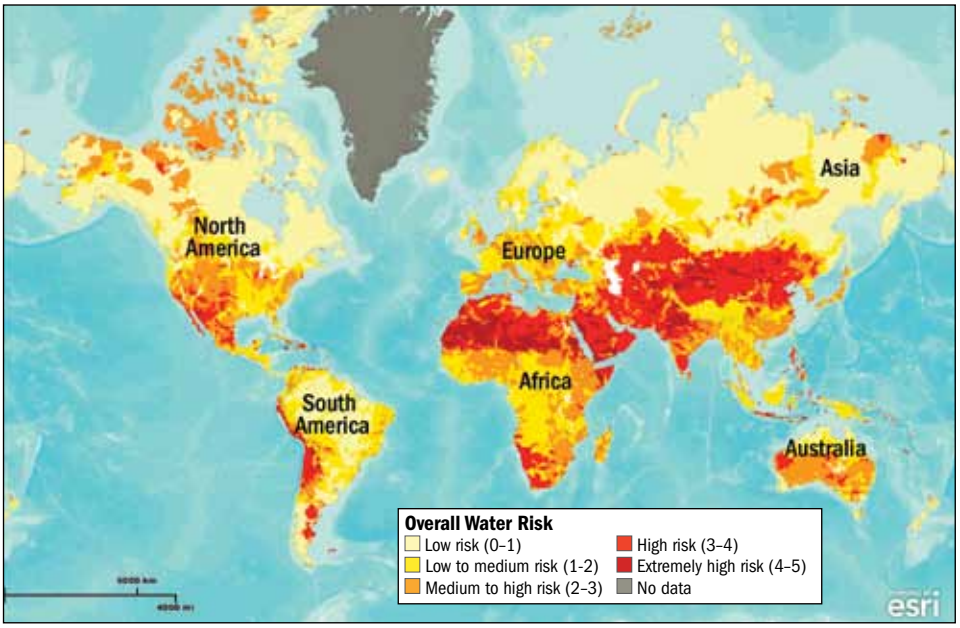
## Cooperation over conflict

There is a long history of conflicts over freshwater resources, going back 4,500 years to ancient Mesopotamia. The Pacific Institute's Water Conflict Chronology is a comprehensive list of water conflicts, including the nature of water disputes, the location and actors involved, and strategies for reducing those conflicts. Most potential water disputes are resolved peacefully, through cooperative negotiations and agreements. The task is to make more international tools available to encourage water cooperation, but also to address the growing connections between inadequate or unsuccessful development strategies and the risks of regional, subnational, and local water disputes. The international community can help reduce the risk of water conflicts such as those on shared international rivers by encouraging negotiations and agreements among the parties sharing a water basin and helping provide data and scientific support for water management. But the current dispute over the Grand Renaissance Dam on the Nile highlights the difficulty of reaching comprehensive agreements over shared river basins when competing interests fail to agree. Even more difficult, however, is the development of useful tools and mechanisms for resolving both growing subnational disputes, many of which have their roots in ethnic, economic, and social competition, and disagreements over how to allocate scarce water resources among different users.

On top of these more traditional water problems, a new complex threat faces 21st century water planners and managers: the growing impact of climate changes on water resources and systems. As climate changes accelerate, they will alter evaporation rates, water demands, rainfall patterns, snowfall and snowmelt conditions, glaciers, storm frequency and intensity, and the sea level. While water managers have developed tools to address the natural variability of climate, some of the new threats will either be different in their very nature or fall outside of the range of extremes for which we currently plan, design, and build. Thus, current strategies to address the consequences of floods and droughts, for some regions or water systems, may prove unequal to the task of managing new extremes imposed by climate changes. Climate change adaptation is absolutely essential in water management and should start now. As part of that work, new efforts to understand and then adapt to unavoidable climate changes must be part of any long-term strategy to improve our development policies and approaches.

## Economics of the right to water

There are many approaches to managing water resources, including the construction and operation of large-scale infrastructure in the form of dams, aqueducts, and central-




Source: World Resources Institute/Aqueduct, http://aqueduct.wri.org/atlas

ized water treatment and distribution plants; the imposition of regulations and standards for monitoring water quality or designing water-using appliances; educational strategies to encourage new water policies and behaviors; and the use of the diverse tools of economics and markets.

The role of smart economics in addressing water problems is indisputable, but economics alone can provide only part of the answer. Complex mixes of strategies are in use around the world, all of which have a role to play. Just as there is no single water crisis, there is no single water solution. This presents a problem for funders, development advocates, technology companies, venture capital firms, and potential donors or investors seeking quick, scalable, high-return solutions.

## Setting a price

Perhaps the most useful—and most misunderstood—economic tool for managing water is price. For all natural resources (or indeed any good or service), setting a proper price is key to efficient allocation and use of resources, equity, environmental protection, and innovation. But for water, pricing has proved to be especially complicated and controversial. Part of the problem is the contradictory perception that water is both an economic good and a human right. Indeed, in late 2010 after decades of discussion, analysis, and debate, the United Nations declared access to safe, adequate water and sanitation to be a formal human right (United Nations). Yet that same discussion and debate acknowledged that pricing, markets, and other economic approaches can be used to help satisfy the right to water and to provide sustainable water-related services.

There need not be conflict between these two points of view, at least for the relatively small amount of water required to satisfy basic needs and because there are successful strategies to provide water and sanitation for the poorest populations. In some regions, for example, basic water services can be provided at lifeline rates, or even for free, to meet social objectives.

For larger water users, proper pricing is an integral part of a comprehensive approach to successful water management. For most uses, water is often grossly underpriced. In the basket of utilities that a typical consumer buys, including energy, communications/telephony, Internet, and transportation, water is usually by far the cheapest. And even where sophisticated water utilities provide water supply and wastewater services, the full economic cost of those services, including the ecological externalities—the cost to the environment borne by others—associated with obtaining water or discharging wastewater, is rarely charged to consumers. The failure to properly price water leads to inefficient use, overconsumption, environmental degradation, inadequate investment to maintain and expand services, and inappropriate subsidization of some users at the expense of others.

Some also argue that raising prices for water runs the risk of inappropriately and inequitably hurting the poor, who often use the least water for only basic needs. This is a real risk. The human right to water is especially protective of the modest amounts of water required for minimal basic needs such as drinking, cooking, sanitation, and cleaning; the poor must not be deprived of basic services because of inability to pay. Moreover, study after study has shown that the poorest are often willing to pay for decent water services or already often pay more—both directly and indirectly—than the wealthier segments of society: they are forced to buy water from private vendors, pay extra for energy to boil or treat water, spend hours in backbreaking labor (by children or women) collecting water of often dubious quality from distant sources, or fall ill from exposure to unsafe, contaminated water. These real "costs" are rarely factored into traditional pricing strategies or discussions.

So proper pricing of water requires the factoring in of a complex set of requirements to ensure that basic human needs can be met, the human right to water is respected, appropriate infrastructure and operation and maintenance costs for water services are covered, and the right signals are sent to markets and consumers. Recent work on innovative utility rate design that encourages efficient use and still supports utility solvency, financing strategies, and equity considerations should be expanded and more widely publicized by water agencies, intergovernmental organizations, and utilities (Donnelly and Christian-Smith, 2013).

## Markets for water

There are vast global markets for all kinds of goods and services, and, as a result, some economists have tried to argue

that developing one for water might also make sense. There is a growing interest in the ability and limitations of such a market to solve water problems, especially local or temporary scarcity. However, markets for water—one exception being "virtual water," discussed below—will always be extremely limited, local, and controversial.

Even though water is in many ways our most important, priceless natural resource, critical for basic survival, it is not very valuable in a market economy. The biggest barrier to comprehensive large-scale water markets is the low cost of water, even when it is properly and fully priced, compared with the high cost of moving it from one place to another. Because water is extremely heavy (one kilogram a liter), it is expensive to move unless that can be done with gravity. It is no accident that the first large-scale transfers of water from one watershed or region to another were all gravity-fed systems, such as the ancient irrigation systems of Mesopotamia and the Indus Valley and the more sophisticated aqueducts of ancient Rome.

Proposals from private entrepreneurs to market and move water from water-rich to water-scarce regions are largely unrealistic simply because of the energy costs involved. Unless the net energy requirements of a water system are zero or low because it relies on gravity, water quickly becomes uneconomic compared with the cost of sophisticated desalination systems that can provide high-quality, reliable water. Although desalination is expensive, it is competitive compared with shipping water long distances. When one adds to the mix local opposition to sending water to distant users, as with transfer proposals in Canada and elsewhere, and legal problems raised by local water rights laws and policies, large-scale markets for water—except for commercial bottled waters, which have their own economic, environmental, and political implications (Gleick, 2010)—are unlikely to ever develop.

The one exception is the vast quantities of water used to produce market commodities, such as food products that are moved all over the world. In recent years, this water has come to be called virtual water (Allan, 1998). If water is properly priced at its point of origin, meaning the full ecological and social costs of obtaining and using water are factored in, then global trade in goods and services can be an appropriate and viable way of *indirectly* trading water. Even today, about 20 countries do not have sufficient natural endowments of freshwater to grow all the food they consume. Thus, food grown in more water-rich parts of the world and moved to these water-scarce regions is a form of water trade. Such innovative economic tools are important components of any sustainable water future.

## Full speed ahead

Traditional approaches to finding, developing, delivering, and using water have served many people well over the past two centuries. But new strategies are needed to address the remaining unmet needs for water and water services and to tackle new complex issues, such as the effects of climate changes and resource-related conflicts.

New traditional infrastructure is still required in much of the world, including large-scale storage, treatment, and distribution systems. As is evident in the Nile River basin, pressure and demand for such infrastructure remain high. But these projects must be built to higher ecological, social, cultural, and community standards that limit population dislocations, protect fisheries and downstream flows, and respect international principles of water sharing. It remains to be seen if these principles and standards will be adequately applied.

Tis Issat waterfall at Blue Nile near Lake Tana, Ethiopia.

We also need to create a "soft-path" approach that uses nontraditional sources of water such as treated wastewater, focuses on satisfying water demands through improved water-use efficiency and productivity, applies innovative economic approaches such as smart pricing and appropriate markets for water and virtual water, and includes improved institutions that pursue integrated regional water planning and management (Gleick, 2003). Above all, listening to an array of voices and concerns and accepting that water, energy, food, and climate challenges are integrated issues could finally make it possible to solve our global water problems. ■

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