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THE WORLD'S WATER
2008-2009

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2008-2009

The Biennial Report
on Freshwater Resources

Peter H. Gleick

with Heather Cooley, Michael J. Cohen, Mari Morikawa,
Jason Morrison, and Meena Palaniappan

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Foreword

When it comes to freshwater—the bloodstream of both the biosphere and the social sphere—the world is on the threshold to a new era. Humanity’s profound dependence on freshwater makes basic water security a necessary condition for improving living conditions, securing food production to eradicate hunger, and providing employment and income to eliminate poverty.

Looking at countries from the perspective of water security reveals some important differences. Industrial countries have already tackled their hydroclimatic vulnerability, and have come far in expanding economic development and improving the quality of life for their populations. Emerging economies, on the other hand, remain hampered by water-related challenges such as flooding, drought, and severe water pollution. And the poorest economies in semi-arid climates still remain hostage to water problems and suffer large-scale poverty, disease, and uncurbed population growth.

To make matters worse, we now see evidence signalling the end of the era of easy access to freshwater. In many places, the perception of water security is starting to dissolve: overpumped aquifers under breadbasket regions of the world constitute economic “bubbles” ready to burst; excessive water consumption by irrigation is depleting rivers and deltas; neglect of pollutants in return flows from water use is contaminating potential raw water sources; and some city water-supply systems have started to crumble because of neglect of critical maintenance. We even hear about drought-driven farmer suicides in places where farmers find themselves unable to repay loans they had to take to deepen failing irrigation wells.

A fundamental tool in mastering the variability that characterizes the hydroclimatic water delivery system has been water storage. Statistics shows that North Americans have access to over 6,000 cubic meters per person per year stored in reservoirs, while the poorest African countries have less than 700. Ethiopia, for example, has less than 50 cubic meters per person per year of water storage. This adds a trace of myopia to Northerners’ anti-dam campaigns in the South. Instead of asking how to simply stop dams, a fairer question would be “how much per-capita water storage does a poor semiarid country need to eradicate poverty and hunger in line with the Millennium Development Goals, and how can it be built to protect both people and the environment?”

Furthermore, we are slowly starting to realize that water is the key vector of climate change. The models developed and summarized by the scientific community and the Nobel Prize-winning Intergovernmental Panel on Climate Change show how we can expect altered atmospheric circulation patterns, expanding aridity, changes in the patterns of rainfall and river flow seasonality, vanishing winter snow, and much more. We can no longer make the comfortable assumption that history will be repeating itself and that planning of new water infrastructure can be based on hydrologic averages from the past. In response to this new non-stationary situation, universities, water managers, and others will have to develop new methods and planning tools to allow safe water infra-

structure in the future, and the water community will have to rewrite their textbooks.

A shift in thinking will be essential. First, we have to realize that the true water resource is not just what happens to go in the river today – it may not be there tomorrow – but includes the precipitation and the way it recharges both the soil moisture feeding plants and trees and the water flowing through rivers and aquifers. To this aim, the distinction between *green water* in the soil and *blue water* in rivers and aquifers is now spreading across the water community. We now know that most crop production is in fact supported by green water—rainfall—not by the blue water we apply through irrigation. Sustainable water management will thus require a broader approach than used over the past century.

A rethinking is also necessary to answer the question “*what happens to water after use?*” We must distinguish between water withdrawals based on taking water from rivers and aquifers and then returning it after use, often loaded with pollutants, and water consumption, where a single use prevents any later uses in a watershed because the water is consumed, evaporated, or lost. Indeed, the treatment and reuse of water can be repeated over and over again. But the unlimited consumption of water can lead to disasters like the Aral Sea, and we must not let new such disasters happen.

Freshwater is fundamental for the biosphere as well as the social spheres. When water gets increasingly scarce, more attention will have to be paid to the compatibility between upstream and downstream uses of water in a catchment in an integrated way. A key tool for this is catchment-based Integrated Land Water Resources Management. We must balance the “green water” component in the soil, influenced by land use patterns and other factors, and the “blue water” component in rivers and aquifers, influenced by societal factors, consumptive uses, and return flow. After all, humanity is living at the mercy of the water cycle shared with the equally water-dependent terrestrial and aquatic ecosystems.

All of the volumes of *The World's Water*—the biennial series initiated by my long-time friend and colleague Peter Gleick in 1998—highlight these problems and coming transitions. This volume is the sixth in the series and, among other things, addresses the new concept of “peak water” in the context of growing scarcity. It addresses water as a vector of climate change, as it has done regularly since the first volume. It addresses water pollution in response to blind and inappropriate water policies in advancing industrialized nations, such as China. And it addresses the particular problems of water security in growing cities and how improving efficiency is a critical element for moving along the “soft path” for water that Gleick has developed. Like the earlier volumes, *The World's Water* continues to provide a highly interesting and up-to-date place to go to explore the new water transitions that are coming. Once again, Peter Gleick and his colleagues are to be congratulated.

Finally, *The World's Water* continues to carry a fundamental message: humanity finds itself on the threshold to a new era related to its dependence on, and interaction with, the global water cycle, the bloodstream of the biosphere. This new era demands that we further develop our thinking and approaches so that we adequately prepare for a better future and lay the basis for successfully coping with the increasingly complex challenges that will face our children and grandchildren.

Malin Falkenmark

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Acknowledgments

Thanks up front to my dear friend and colleague, Malin Falkenmark, for her kind foreword to this volume. Malin is a Swedish water expert who has worked on water forever, and who continues to challenge the water community and policymakers to do the right thing, faster. I still fondly remember visiting her when my wife and I were living in Sweden in 1987 and being fed real Moose Mousse while we talked water.

Special thanks to my co-authors, but especially to Heather Cooley. Heather has continued to write and co-author several of the chapters, and she also did much of the hard work of preparing many of the data tables. She better watch out or I may end up turning over to her the whole show. Continued thanks to Todd Baldwin, my editor at Island Press, whose enthusiastic support of this project from the beginning has helped spur me on.

Finally, thanks to all my readers and colleagues who write, call, or email me with comments, suggestions, and ideas for *The World's Water*. You've all helped make it a bearable load and better product.

Peter Gleick

Introduction

Water has become a hot topic and I'd like to think that the five previous volumes of our biennial book, *The World's Water*, have helped improve global understanding of the water challenges and solutions that face us, at least a little. But it is also true that a series of growing crises in water have finally raised enough awareness that more policy makers, scientists, and members of the public are paying attention. The water crisis is a bad thing; but more attention and effort focused on solving it is good.

The need for *The World's Water* is more evident to me than ever. Good information and analysis on critical issues, new thinking about solutions, and better data on water are more valuable than they've ever been. While I believe that we know enough to take far more aggressive and extensive actions now to solve water problems, I also believe in the value of debate, discussion, and data.

This is the sixth volume of *The World's Water*. As with the first five, my colleagues and I have chosen a subset of water issues to explore based on timeliness, urgency, and our own experience. There is no shortage of important water topics to address, and as always, it is a challenge to try to choose among them for inclusion in the books.

Among the topics acquiring a growing urgency, as the deadline for meeting them closes in, is the Millennium Development Goals for water. The MDGs define the ongoing effort of nations, international organizations, and communities to seriously address unmet needs for water and sanitation by 2015, specifically the inexcusable failure to provide safe water and adequate sanitation for billions of the world's poorest. In this volume, Meena Palaniappan offers us both good news and bad news. Some remarkable progress is being reported in meeting needs for safe water. We are failing miserably, however, in meeting sanitation needs. And regional progress has been spotty, with Africa, once again, being neglected and falling further and further behind the rest of the world.

This volume also offers a comprehensive assessment of the water catastrophe rapidly unfolding in China. Previous volumes looked briefly at some of the major water projects underway there, such as the Three Gorges Dam project and the massive South-North water diversions. But here I devote a full chapter to the implications of China's extraordinary economic expansion for that nation's water resources, and to the country's gross failure to tackle pollution, overuse, and mismanagement. As a result, economic productivity, human health, and ecosystem survival are all directly threatened. It remains unclear whether China will be able to avoid a water nightmare.

Part of China's problem, like that in the U.S., stems from a belief that we can engineer our way out of water scarcity with "hard" solutions like dams. But we now know that there are limits to our water resources, and that we will have to learn to make

do with less. This requires “soft path” solutions. As part of our ongoing effort to explore the soft path for water— the subject of several past chapters—this volume looks at the concept of “peak water” as a parallel to the ongoing debate about “peak oil.” Meena Palaniappan and I find there are both strong similarities and strong differences between oil and water. Some regions of the world are truly approaching limits to sustainable extraction and use of water. Understanding these limits and the consequences for food production, economic well-being, and the environment may help us develop ways of managing and using water that will help us avoid those consequences.

Moving to a soft path for water is especially important in urban areas. Heather Cooley and I tackle the issue of wasteful and inefficient use of water in urban centers of the United States, with a chapter that offers lessons on both inefficient use and on ways to improve that efficiency and reduce demand for water. We focus on recent experience in a number of major western U.S. cities where water is increasingly scarce and valuable, and where efforts to understand and improve water-use efficiency are advancing. This chapter looks at a variety of technologies, pricing strategies, and conservation policies to highlight successful efforts and ways that urban centers everywhere can meet growing demands with the same, or even less, water than now being used.

In recent years, I and my colleagues Jason Morrison and Mari Morikawa, together with others, have begun to extensively explore the risks that water problems pose for corporations and industrial production, and the parallel risks that these organizations pose to water resources. The role of the private sector in using, managing, and even commercializing water is intensely controversial, and we’ve analyzed and written about these issues for many years. As part of that work (available at the Institute’s website, www.pacinst.org), we recently completed an analysis of the kinds of information, water thinking, and reporting done by over 120 different leading companies, described and summarized in a chapter here. More and more companies are issuing sustainability or environmental reports of some kind – indeed, corporations that do not are now in the minority – and their use or management of water is one of the factors often discussed in them. But there is no consistency in how water use is reported or described, and this chapter offers suggestions for improving corporate reporting on water.

The complex and growing implications of climate change for water resources continues to be a critical issue. We take another look at the problem here, with a chapter by Heather Cooley updating the state-of-knowledge related to water and climate. We continue to believe that among the most severe consequences of unavoidable climate change will be changes in water availability, quality, and demand. National and local water managers and planners continue to be grossly underprepared. Read this chapter to learn the latest.

As in the previous volumes, the major chapters are supplemented with shorter “In Brief” reports on items of interest. Heather Cooley offers an update to the status of the Tampa Bay desalination plant, which is finally up and running after years of delay and many millions of dollars in overruns. The experience at Tampa Bay offers lessons to anyone interested in the future of desalination. Michael Cohen, who has previous written about the remarkable saga of the Salton Sea brings new information about ambitious, but not-yet implemented plans to try to salvage a healthy ecosystem and environment while stabilizing the human and economic benefits of the Sea as well. I also update the reader on the status of the Three Gorges Dam project in China – the

largest dam and reservoir in the world. This topic was originally covered in the very first volume of *The World's Water* in 1998 and in the subsequent decade, the Chinese moved aggressively to complete the project. As noted in 1998, Three Gorges Dam offered both benefits and risks, and these benefits and risks are now both increasingly obvious.

And we bring to the readers, once again, our tremendously popular *Water Conflict Chronology*, with hundreds of updated historical examples of conflicts related to water going back millennia. This *Chronology* is also on line at www.worldwater.org.

Finally, *The World's Water* has always offered readers a variety of data tables in the final section. In this volume we again present the popular data on water availability and water use by country, and offer new data on access to safe water and sanitation. We have also compiled new data on dams in the United States, including a growing number of dams removed for safety, economic, or environmental reasons, a summary of dams in Africa, data on the mortality rate in children under five years of age from water-related diseases, a remarkable dataset on the prices for water in a range of OECD (Organization for Economic Cooperation and Development) and non-OECD countries and cities, and much more. Over the next few years, we will continue to explore new issues, new data, and new ways of reaching out to all of you interested in the world of water.

Peter H. Gleick
Oakland, California, 2008

