For many of us, water simply flows from a faucet,

and we think little about it beyond this point of contact.

We have lost a sense of respect for the wild river,

for the complex workings of a wetland,

for the intricate web of life that water supports.

We have been quick to assume rights to use water

but slow to recognize obligations to preserve

and protect it... in short, we need a water ethic—

a guide to right conduct in the face of

complex decisions about natural systems

we do not and cannot fully understand.

— Sandra Postel,

Last Oasis: Facing Water Scarcity

CHAPTER 2

The Water Crisis

In the beginning of the 21st century, we find ourselves awakening to a water crisis. The signs are everywhere. 25,000 humans a day die from lack of food and water. 6,000 lives are lost each day to water-borne diseases *(UN, 2003)*. Such losses reflect more than disordered supply and demand, and more than inequitable distribution or lack of access to this most essential resource. Rather, they reflect a lack of will and a lack of knowledge to manage water use and abuse in an intelligent way.

That a water crisis is on the radar screen is undeniable. The United Nations Millennium Declaration in 2000 directed members to "stop the unsustainable exploitation of water resources by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies." But saying it is not doing it, and to advocate and collaborate, we need some very basic understanding of the complex relationship between ourselves, our water and our planet.

For humans, water is not a luxury, but a necessity—for drinking, for food, for washing, for producing products, for generating energy, for moving people, for moving goods, for progress. Yet as critical as it is, most of the peoples of the developed and developing world alike know little about water as a resource and in general take water for granted.

It is probable that most of the world's citizens never heard the UN alarm in 2000 *(UNEP, 2000)* that "the world water cycle seems unlikely to be able to adapt to the demands that will be made of it in the coming decades" *(Figure 2.1)*. Fewer still have read the Earth Summit in

FIGURE 2.1

Humans and Water Usage

	• Between 1900 and 2000, the human population increased 300%, while water consumption grew 600%.
	• Between 2000 and 2020, a 40% increase in human water consumption is predicted. During the same period, a 17% increase in agricultural water consumption is expected.
Source: UNEP, 2000.	

Rio de Janeiro's words from 1992: "Water is needed in all aspects of life. The general objective is to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases."

Proclamations and warnings tend to poorly communicate the complexity of the water crisis issue. On one level it is an equity and justice issue. Water is not evenly accessible. For example, the Middle East has 5% of the world's population but only 1% of its water *(Health Politics, 2004)*. Water consumption of a child in the developed world is up to 50 times greater than a child in the developing world. Women are unequally disadvantaged by water scarcity as they do the majority of water transport in developing countries, require it for household and agricultural responsibilities, and suffer unequally from maternal-fetal diseases when it is scarce or soiled.

Health and hygiene issues are inseparably tied to water. The United Nations stated in 2000, "clean water alone leads only to minor health improvements in the absence of personal hygiene and adequate sanitation." 6,000 deaths, mostly of children, each day are due to water-related diseases *(Figure 2.2)*. Water touches, in one way or another, every diarrheal and infectious disease. When it is scarce, famine, malnutrition and dehydration ensure compromised hosts, creating an explosive environment for HIV, malaria and tuberculosis. Poor policy impacts safety, privacy, convenience and dignity. Bad

FIGURE 2.2

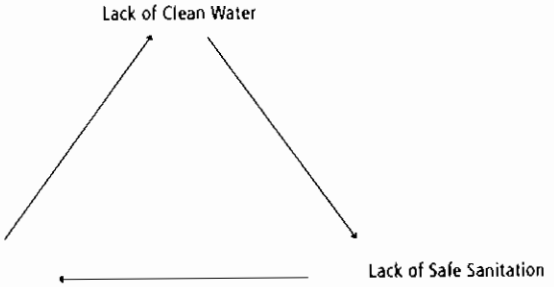
Causes of Death in Children Under Age 5

Neonatal Disorder	37%
Acute Respiratory Infection	19%
Diarrhea	17%
Malaria	8%
Measles	4%
HIV/AIDs	3%
Other	12%

Source. WHO/UNICEF, 2005.

FIGURE 2.3

Water Disease Triangle



Source. WHO/UNICEF, 2005.

decisions regarding sanitation lead to bad water. Bad water leads to poor health, low productivity and the loss of hope *(Figure 2.3) (WHO/UNICEF, 2005)*.

An examination of poverty reveals poor water access as a major determinant. Access to water is critical to basic needs, nutrition, general health and securing a livelihood. Of the seven key challenges facing the global community according to the 2003 UN Development Report, safe water is well-represented. In addition, the other obstacles — life expectancy, health services, underweight children

under age five and literacy — all rely on adequate clean water supplies to be addressed.

The Organization for Economic Cooperation and Development (OECD) in its Poverty Guidelines in 2001 states, "poverty, gender and environment are mutually reinforcing, complementary and cross-cutting facets of sustainable development." And from the UN, "One of the main characteristics of poverty is now seen as vulnerability...This includes both shocks (sudden changes such as natural disasters, war or collapsing market prices) and trends (for example, gradual environmental degradation, oppressive political systems or deteriorating terms of trade). Many such vulnerabilities are related to water resources (for example, health threats, droughts or floods, cyclones and pollution). The need to integrate vulnerability reduction into water policies (and in particular the links between water policies, disaster mitigation and climate changes) is being increasingly considered" *(UN, 2003)*.

The message, then, is that water must be addressed in an integrated way. So, for example, the UN's Vision 2015 standards place side by side decreasing by one half the proportion of people without access to hygienic sanitation facilities, and reducing by one half the proportion of people without sustainable access to adequate quantities of affordable and safe water. They also target 2025 as the date when nations should "provide water, sanitation and hygiene for all." An integrated view is also reflected in balancing the need for food, raw materials and products for sustained development in concert with water preservation. Clearly, poor planning can pull everyone and everything down. Whether it be wastage precipitated by deforestation, erosion and flooding, or damage to surface or ground water by pollution, little margin for error exists to accommodate human ignorance. To advance together as a human population we must address poverty, hunger, education, gender inequality, child mortality, maternal mortality and infectious diseases.

When handled wisely, water sources are renewable. They are also variable, by geography and by seasons. For example, total renewable water per capita per year varies from a high of 10,767,857 m^3/cap/yr in Greenland to a low of 276 m^3/cap/yr in Israel *(FAO, Aquastat, 2002)*. Planning must account for this variability. Resources for most of the world's water needs — for drinking, agriculture, industry, waste removal and preservation of ecosystems — literally "drops out of the sky" in the form of precipitation. The water moves vertically and horizontally in a water cycle. This water manages, mainly by diverting as runoff or accessing ground sources, to support our consumption. It is estimated that 26% of precipitation and 54% of accessible runoff is now accessed by humans. And usage rates, fueled by population growth, life style changes and expansion of agriculture, industry and urbanization, are projected to increase substantially. By 2050, one in four worldwide will experience chronic or recurring shortage of fresh water. 2 billion are already impacted one way or another by water shortage in 40 countries. 1.1 billion don't have enough clean water to drink and 2.4 billion have no sanitary facilities, making clean water even less likely. In addition, progress will require cooperation, as rivers cross national boundaries. Worldwide, 263 river basins cross at least one border, and these rivers service over 40% of the world's population *(UN, 2003)*.

What water we have is frequently polluted. Human waste, some two million tons a day, discarded directly into surface water basins, is the most common culprit. Agricultural pesticides and fertilizers as well as industrial chemicals contribute as well. Together, man-made deposits of one sort or another ensure that 50% of the citizens in developing nations receive water that is unacceptable for ingestion. In it, you will find fecal bacteria, organic chemicals, heavy metals, nitrates and phosphates from farms and sediment resulting from poor land management *(WHO/UNICEF, 2000)*.

The conversion has been rapid and recent. In Asia, over three decades, suspended solids have increased by a factor of four and

human waste by a factor of three. With pollution comes disease, accessed through unhealthy behaviors. For example, in Varanasi, India, a sacred site on the Ganges River, 60,000 people bathe in the polluted waters each day *(CSE, 1999)*. Asia as well is at the epicenter of water-related disasters, accounting for 40% of all such events. Worldwide, there were approximately 2,500 water-related disasters with 665,000 deaths between 1991 and 2000 *(UN, 2003)*. The year 2000 had 153 flood events, and the tsunami in 2004 alone resulted in 220,000 deaths *(Health Politics, 2005)*.

On the supply side then, we have inherited a renewable resource, if wisely managed in an integrated fashion. But the supply of water is only as good as its quality and reliability. As global populations rise, all other things being equal, supplies of water per capita fall. In fact, available water per person declined by one-third between 1970 and 1990. Currently, population growth is slowing down with the total number of people worldwide expected to increase from 6.1 billion in 2001 to about 9.3 billion by 2050 and there remain stable. So even though our rate of growth is declining, we still must assimilate a population that will be 52% larger by 2050 than it is now. Translating these numbers to projected water realities leads experts to predict that 7 billion people in 60 countries will be dealing with water scarcity by 2050. This is 75% of our future global population. Were we to embrace the most optimistic projections, 2 billion in 48 nations, or 22%, will be water-scarce *(UNFPA, 2002)*.

As these growing numbers must drink, so must they eat. And while our daily water requirement to survive is less than 3 liters, it takes about 3,000 liters of water to grow our daily food requirement *(UN, 2005b)*. This means more demand for agricultural yield, drier season planting and more exploitation of both surface and ground waters. The population will also require increased energy. Hydropower is a significant resource for developed and developing nations, generating 70% and 30% respectively of the total hydroelectric output worldwide over the past few decades. Most water

consumption related to hydroelectric plants comes from evaporation from the surface of the large reservoirs. In the future, use of hydroelectric power will grow, especially in the developing world, which has only tapped 15% of its total potential. Though substantial amounts of water are used for cooling and the chemical process, most is returned to the watershed without consequences, unless significant water temperature variations are not properly managed. Overall, the generation of hydroelectric energy is considered by most to be environmentally benign *(UN, 2003)*.

As hydroelectric production grows, so will urbanization. By 2025, 58% of the world's population will be urban. The greatest increases will occur in Asia. For example, south-central Asia is projected to grow in urban population from some 400 million to 1 billion by 2030. By that time, about 3 billion citizens will be rural and 4 billion will be urban. This influx of people to the cities will further stress water supply and sanitation infrastructure. This will lead to predictable over-exploitation of aquifers and falling water levels. Pollution, unchecked, will further compromise the usefulness of what water there is, sending many to private vendors, taxing a vulnerable population with high water prices *(UNFPA, 2002)*.

As we urbanize, we will continue to industrialize. Polluting industries are also fast growth industries. For example, paper and steel industries in Latin America are growing at twice the rate of the local economy. Wastewater from factories contains high levels of suspended solids that line and suffocate waterway life. Organic material competes for oxygen, and heavy metals interfere with reproduction of species. Occasional industrial accidents can be devastating to water supply. A single fire in a Swiss pesticide plant in 1986 shut down water supply for 1,000 kilometers downstream for days. New technology may offer some protection, providing remote sensing and active and effective monitoring. We can expect in the near future better drilling and extraction of ground water, better transport and improved decentralization. Technology will

also improve efficiency of drinking, bathing and sanitation systems *(UN, 2003)*.

It will have to, in order to countercheck demand, driven in part by the belief that water is a right, to be used without limit or common sense; by expanded needs for agriculture and manufacturing; and by globalization, urbanization and tourism. In 1970, less than 8% of citizens from developed nations had visited a developing nation. The number now sits at 29% and is rising. This of course carries economic benefits, but also consumes a disproportionate share of water and public infrastructure resources for tourism. In the Caribbean islands, 80% to 90% of hotel sewage in 1994 was deposited directly, untreated, into coastal waters. And a single 18-hole golf course consumes more than 2.3 million liters of water a day *(UN, 2003)*.

Finally, we must increasingly consider climate change. It is now universally recognized that increased carbon dioxide and other greenhouse gases are driving significant global climate changes. These are projected to yield significant increases in precipitation from 30° North and 30° South due to expanded evaporation. Tropical and subtropical regions in contrast will see rainfall become less common and more erratic. Most agree now that there will be climate change, but where, when and how much are up for dispute. That said, many believe that arid areas—currently most water-stressed—are likely to experience declines, not rises, in water levels due to climate variation. There is also general concern that these changes will result in an increase in the number and severity of water-related disasters, including floods, droughts, mudslides, typhoons and cyclones *(Abramovitz, 2001)*. A study in 2000 projected that 20% of our future water scarcity would be the result of climate variations, and 80% would result from population growth and its secondary effects *(Vorosmarty, 2000)*.

What is indisputable is that absent careful, planned and consistent action, our water crisis will worsen. The Conference on Water in Dublin in 1992 layed out these principles:

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels.
3. Women play a central part in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognized as an economic good.

The 1994 UN Commission on Sustainable Development said it this way:

"While in the past there was a tendency to regard water problems as being regional in nature, there is growing recognition that their increasingly widespread occurrence is quickly adding up to a crisis of global importance."

And in 1998:

"It is important that consideration of equitable and responsible use of water becomes an integral part in the formulation of strategic approaches to integrated water management at all levels, in particular in addressing the problems of people living in poverty."

And two years later, in 2000, seven challenges were defined with four more added later:

1. Meet basic needs: Provide access to safe and sufficient water and sanitation for basic human needs; and empower women in this process.
2. Secure the food supply: Efficiently use water for food production, and equally allocate water for food production.
3. Protect ecosystems: Ensure the integrity of ecosystems.
4. Manage risk: Provide security from flood, drought, pollution and water hazards.
5. Share water resources: Encourage peaceful cooperation and synergies whenever possible.

6. Value water: Manage water in a manner that reflects its economic, social, environmental and cultural values in all uses with a move towards pricing to reflect true cost, but ensuring basic provision for the poor and vulnerable.
7. Govern water wisely: Ensure good governance involving the public and stakeholders in integrated water management.
8. Water and cities: Manage distinct challenges to water and sanitation that come with urbanization.
9. Water and industry: Manage needs and water quality, considering economic needs, energy needs and competing interests.
10. Water and energy: Recognize that water is vital for all forms of energy production.
11. Ensure the knowledge base: Provide decision makers with the knowledge necessary to ensure good water policy and management.

And finally in 2002, the call for sustained development in Africa with specific policies, strategies and real commitments in six specific areas:

1. Access to clean water and sanitation.
2. Focus on secure food supply and income generation.
3. Advance Integrated Water Resource Management (IWRM) locally and globally.
4. Ensure water-related disaster prevention, mitigation and management.
5. Empower capacity building with a special focus on equity and gender sensitivity.
6. Encourage pro-poor water governance and water policies.

There is, then, an undeniable momentum gathering within the international community. Since water touches literally everyone and everything, it is the logical beginning point and transcendent metaphor for sustainable development. Water is more broadly viewed today as a potentially renewable, but threatened resource. Water's complex interfaces are increasingly evident, and its value

increasingly understood. Supplying safe, clean water has a price, as does wasting or fouling this critical resource. Its supply must rise to meet its forecast population demand. Water scarcity is a crisis today, with solutions that cannot wait until tomorrow.