EarthTrends: Featured Topic

Title: **Will There Be Enough Water?**
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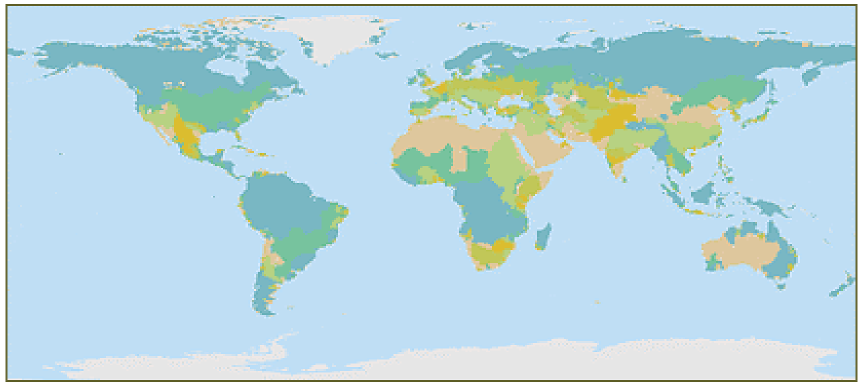
Source: *Pilot Analysis of Global Ecosystems: Freshwater Systems*
Date written: October 2000

Water policies in most nations are failing to protect life's most vital resource. This fact is reflected in growing water scarcity and alarming declines in the health of aquatic ecosystems worldwide. More precious than oil, yet routinely wasted, water is arguably the world's most pressing resource issue.

Water Scarcity: The World's Most Pressing Resource Issue

Figure 1: Annual Renwable Water Supply per Person by River Basin, 1995



Annual Renewable Water (m^3/person/year)

- < 500
- 500 - 1,000
- 1,000 - 1,700
- 1,700 - 4,000
- 4,000 - 10,000
- > 10,000
- No data

Sources: CIESIN et al. 2000; Fekete et al. 2000

Ensuring Water Supply

Human development depends on adequate water—a fact that has driven the location of communities, the extent of agriculture, and the shape of industry and transportation for centuries. Because of its central place in our activities, water is also the focus of much engineering activity and investment in the form of dams, canals, pipelines, and irrigation systems. Today, there are more than 45,000 large dams (dams more than 15 meters high) in the world—most of them built in the last 35 years (WCD 2000:8, 11). This storage capacity represents a 700 percent increase in the standing stock of water in river systems since 1950 (Vörösmarty et al. 1997:210).

The increase in storage capacity has permitted the expansion of agriculture through the use of irrigation, as well as the capability to distribute water more evenly throughout the year in many areas of the world where seasonal water shortages are a problem. But water demand is growing quickly, jeopardizing the availability of the supplies we would like to collect, store and use. Global water consumption rose sixfold between 1900 and 1995—more than double the rate of population growth—and continues to grow rapidly as agricultural, industrial, and domestic demand increases (WMO 1997:9).

Not surprisingly, the environmental impacts of our water consumption are growing rapidly as well. For example, the enormous increase in the number of dams has fragmented and seriously altered the flow of roughly 60 percent of the world's major river basins. These fragmented rivers carry nearly 90 percent of the water flowing through these major basins (Revenga et al. 2000:17). As population increases and freshwater systems are modified to a point where

Nearly Half the World Will Live With Water Scarcity by 2025

Figure 2: Global Renewable Water Supply per Person, 1995 and 2025 (projected)

Water Supply (m3/person/year)	1995 Population (millions)	1995 Percent of Total	2025 Population (millions)	2025 Percent of Total
<500	1,077	19.0	1,783	24.5
500-1,000	587	10.4	624	8.6
1,000-1,700	669	11.8	1,077	14.8
Subtotal	2,333	41.2	3,484	47.9
>1,700	3,091	54.6	3,494	48.0
Unallocated	241	4.2	296	4.0
Total	5,665	100.0	7,274	100.0

Source: WRI. The 2025 estimates are considered conservative because they are based on the United Nations' low-range projections for population growth, which has population peaking at 7.3 billion in 2025 (UNDP 1999:3). In addition, a slight mismatch between the water runoff and population data sets leaves 4 percent of the global population unaccounted in this analysis.

many of their basic functions are affected, it becomes increasingly difficult to ensure that there is enough water for both people and nature. (See related feature: *Freshwater Biodiversity in Crisis*.)

How Scarce Is Water?

Humans now withdraw about 4,000 km^3 of water a year—about 20 percent of the base flow (the average dry-weather flow) of the world's rivers (Shiklomanov 1997:14, 69). Understanding what this means in terms of the global water cycle requires some context: scientists estimate that the average amount of global runoff (the amount of water that is available for human use after evaporation or absorption into groundwater aquifers) is between 39,500 km^3 and 42,700 km^3 a year (Fekete et al. 1999:31; Shiklomanov 1997:13).

However, not all of this water is available to humans. Much of the runoff occurs in flood events or is inaccessible to people because of its remote location. In addition, part of the runoff needs to remain in waterways so that aquatic ecosystems continue to function. In fact, only around 9,000 km^3 is readily accessible to humans every year as runoff. An additional 3,500 km^3 is stored in reservoirs (WMO 1997:7).

In any case, such global averages fail to portray the details of the world's water situation. Water supplies are unevenly distributed around the globe, with some areas containing abundant water and others a much more limited supply. For example, arid and semiarid regions receive only 2 percent of the world's runoff, even though they occupy roughly 40 percent of the terrestrial area (WMO 1997:7). In river basins with high water demand relative to the available runoff, water scarcity is a growing problem.

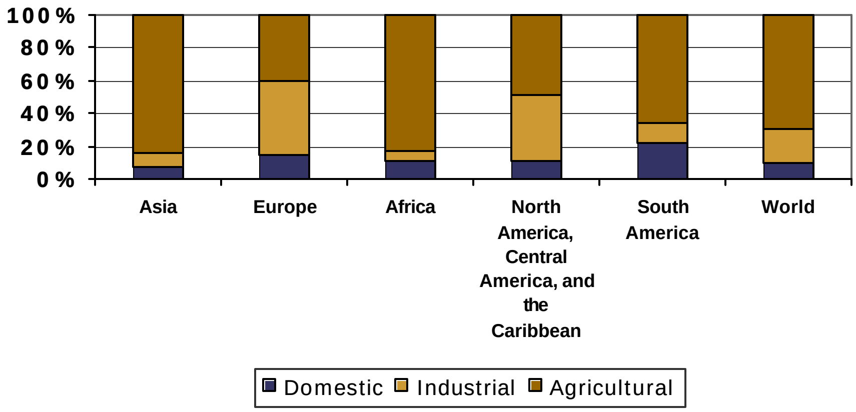
New estimates of water scarcity calculated by the World Resources Institute in collaboration with the University of New Hampshire show that *some 41 percent of the world's population, or 2.3 billion people, live in river basins under "water stress,"* meaning that per capita water supply is less than 1,700 m^3/year (see Figures 1 and 2). An area in "water stress" is subject to frequent water shortages.

In many of these areas, water supply is actually less than 1,000 m^3 per capita. In these "highly stressed" river basins, the consequences of water scarcity can be much more severe, leading to problems with local food production and economic development unless the region is wealthy enough to apply new technologies for water use, conservation, or reuse. *Some 1.7 billion people (out of the 2.3 billion noted above) live in such high water-stress basins*.

Assuming that current water consumption patterns continue unabated, projections show that at least 3.5 billion people—or 48 percent of the world's projected population--

Agriculture Dominates Water Use, But Its Share Will Decline

Figure 3: Water withdrawals by sector, various years (1982-1997)



Source: WRI et al. 2000:276-277 (Table FW.1)

will live in water-stressed river basins in 2025 (see Figure 2). Even regions where per capita water availability appears sufficient when averaged over the year may actually face water shortages in the dry season.

The results of this analysis make it clear that many of the most populous river basins will gradually slip into water stress (with water per capita falling below 1,700 m^3 per year) over the next quarter century as water consumption rises.

Wasting Water: Inefficiency, Overuse, and Pollution

Global food production must increase in the years ahead to accommodate population growth. United Nations projections put global population at nearly 8 billion in 2025—up 1.7 billion from today (UNPD 2001:vi). This means the world's farmers will need more water for irrigation. Growth in food production in the last 50 years has been roughly matched by a proportional increase in water use, with grain yields rising 2.4-fold between 1950 and 1995 and irrigation water use rising 2.2-fold (Postel 1999:165). At present, irrigated agriculture accounts for 40 percent of global food production, even though it represents just 17 percent of global cropland (WMO 1997:9). As a consequence, agriculture is society's major user of water, withdrawing some 70 percent of all water (WMO 1997:8) (see Figure 3).

Unfortunately, most irrigation systems are relatively inefficient and result in massive water waste. Global estimates of irrigation efficiency show that around 60 percent of irrigation water never reaches the crop and is lost to evaporation and runoff (Postel 1993:56; Rosegrant 1997:4; Seckler et al. 1998:25).

Adding to the problem of inefficient irrigation techniques is the fact that farmers usually pay low prices for irrigation water, giving them little incentive to conserve. Government water subsidies that artificially lower water prices are the primary culprit. In the western United States, for example, water subsidies total some $2-2.5 billion per year. Throughout the world, government support typically allows water utilities to sell irrigation water for far less than the cost of supplying it. In arid Tunisia, farmers pay no more than one-seventh the cost of their water (de Moor and Calamai 1997:14-15). Such low prices and subsidies encourage inefficient use and discourage the adoption of water-saving technology like drip irrigation (Johnson et al. 2001:1072; Postel 1999:228-231)

Water pollution adds enormously to existing problems of local and regional water scarcity by removing large volumes of water from the available supply. In many parts of the world, rivers and lakes have become so polluted that their water is unfit even for industrial uses (WMO 1997:11; UNEP/GEMS 1995:6). (See related feature: *Dirty Water: Pollution Problems Persist.*)

Groundwater Is Scarce, Too

Global concerns about water scarcity include not only surface water sources but groundwater sources. More than 1 billion people in Asian cities and 150 million in Latin American cities rely on groundwater from wells or springs (Foster et al. 1998:xi). In addition, although there are no complete figures on groundwater use by the rural population, many countries are increasingly dependent on this resource for both domestic and agricultural uses (Foster et al. 2000:1).

Currently humans withdraw approximately 600–700 km^3 of groundwater per year—about 20 percent of global water withdrawals (Shiklomanov 1997:53–54). Some of this water is fossil water (ancient water that isn't routinely replenished) that comes from deep sources isolated from the normal runoff cycle, but much groundwater comes from shallower aquifers that draw from the same global runoff that feeds freshwater ecosystems. Indeed, overdrafting of groundwater sources can rob streams and rivers of a significant fraction of their flow. In the same way, pollution of aquifers by nitrates, pesticides, and industrial chemicals often affects water quality in adjacent freshwater ecosystems. Although overdrafting and contamination of groundwater aquifers are known to be widespread and growing problems (UNEP 1996:4–5), comprehensive data on groundwater resources and pollution trends are not available at the global level.

Wiser Management Means More Water

Better management of water resources is the key to mitigating water scarcities in the future and avoiding further damage to aquatic ecosystems. In the short term, more efficient use of water could dramatically expand available resources. This is particularly true in the agricultural sector, where experience shows that drip irrigation systems routinely cut water use 30-70 percent, while simultaneously increasing crop yields 20-90 percent. Although the use of drip irrigation has grown more than 50-fold over the last 20 years, it is still used in only 1 percent of the world's irrigated areas (Postel 1999:174).

More efficient water technology alone will not be sufficient to fully address the looming water crisis. It will also require difficult policy choices that reallocate water to the most economically and socially beneficial use. This may mean diverting water from agriculture to commercial or household uses. In China, for example, planners estimate that a given amount of water used in industry generates more than 70 times more economic value than the same water used in agriculture (Postel 1999:114).

To a certain extent, the transfer of water from low-value uses to higher-value uses is already well under way, especially where individuals hold legal water rights that they can sell to others. Farmers outside the city of Tirupur in southern India, for example, have begun to abandon farming so that they can sell their groundwater at a premium to water-hungry industries and urban users (Postel 1999:114). Such "water markets"are becoming more common in arid regions of the western United States and Australia.

An important key to using and allocating water more efficiently is phasing out subsidies and allowing water prices to reflect the true cost of supply. Price reforms in Chile reduced irrigation water use 22-26 percent and saved $400 million in costs for developing new water supplies. In Bogor, Indonesia, price increases cut domestic consumption by 30 percent (Johnson et al. 2001:1072). However, effective water pricing, particularly of irrigation water, remains a highly sensitive issue in low-income countries, where agriculture still dominates the economy and most farmers have limited incomes.

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