ENVIRONMENTAL DATA

Water Scarcity: Forecasting The Future With Spotty Data

While global water models warn of parched days ahead, scientists worry that another pressing scarcity is information

Headlines warn that catastrophic thirst will soon choke northern China and mire the Middle East in more war. But a growing number of scientists say there's already a crisis—only it's not just water that's missing. It's information.

Riding dry. According to one recent projection, nearly half the world's population will live in water-stressed river basins (*above*, China's Yellow River) by 2025.

Take Nairobi, Kenya's biggest city. About half the water delivered to Nairobi each year disappears—presumably lost to leaky factory pipes, irrigated corn fields, and other unmeasured drains. The data dearth is similar in Mexico City, Seoul, and Tehran, where no one knows where roughly a third of the water supply goes.

In fact, in countries rich and poor, water data are often based on patchy estimates. Answers to even simple questions remain elusive: How much local water, on average, is there? How much, precisely, is going to farmers versus city dwellers? The knowledge gap shows little sign of improving.

History shows how a data scarcity like this can hamper forecasts. During the 1990s, for instance, the amount of water actually withdrawn for human use worldwide was just half of what modelers had anticipated 30 years earlier. "The track record of water use projection has been abysmal," remarks Robert Hirsch, head of hydrology at the U.S. Geological Survey (USGS).

Along with confusion, water miscalculations have brought nasty surprises, such as conflict over the Colorado River, which in most years actually offers less total water than legally allotted to Western states and Mexico. "If you can't measure water, you can't manage it," remarks Arthur Askew, director of hydrology at the World Meteorological Organization (WMO). In a data crisis, perhaps the only sustainable thing is uncertainty.

Blurry data

Water scenarios usually start with a fundamental fact: Of the roughly 1.4 billion cubic kilometers of water on Earth, less than 1% is fresh water that people can use. And it's not divided evenly. Water is a local treasure, prey to local problems, from pollution and politics to waste. "Overall, yes, there is still plenty of water on Earth," says Jean-Marc Faurès, a water specialist at the U.N. Food and Agriculture Organization in Rome. The poverty occurs at home.

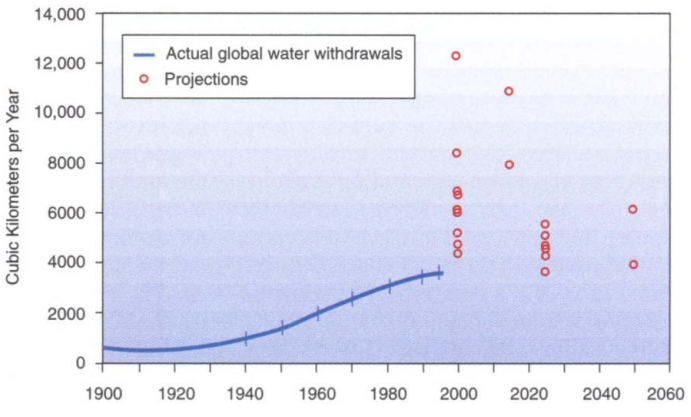
At this local level, accurate water estimates depend on supply and demand. But collecting such data is time-consuming and decidedly unglamorous. "If you open a large dam, your minister of public works will be pleased to cut the ribbon," says Askew. "If, however, you install a stream gauge in the middle of a piece of grass in the back of a post office, nobody will inaugurate it. But after 20 years, that one gauge may have collected vital data essential for building a $100 million water project somewhere."

To assess how much water is available locally, governments typically rely on scattered networks of stream gauges, river runoff monitors, and similar tools. But an ad hoc group of the International Association of Hydrological Sciences reported 2 years ago that this infrastructure has begun to crumble. During the 1990s, for instance, the amount of infrastructure available at water stations fell by roughly 90% in African countries, 30% in the former Soviet Union, and 20% in Canada. Some scientists are optimistic that remote-sensing satellites will soon be able to provide better estimates of the surface water available in watersheds, but Askew contends that on-the-ground monitors are still irreplaceable.

And supply is just half the equation. "Most of the water scarcity arguments are based on availability," says Peter Gleick, head of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California. "We really ought to be looking at water use. A country might be water-rich if you look at the resource, but some people may have very low use and others enormous use." He points to the Sudan, which in theory has plenty of water available from the Nile River—but in reality passes on much of its water to Egypt and struggles to access the rest amid civil war.

Tracking actual water use is even harder than estimating availability. "Water-use data are among the most unreliable in many developing countries because nobody actually measures how much water is taken from every well, river, and aquifer," Faurès says. Instead, he adds, public ministries typically estimate how much land is irrigated, say, and then calculate how much water is used per hectare. Says Faurès: "It's not a measure but an estimate."

Projected and Actual Global Water Withdrawals



All washed up. Many earlier projections of future water use were clear overestimates. Today's estimates may also be unreliable.

CREDITS: (TOP TO BOTTOM) GREG BAKER/AP; SOURCE: P. GLEICK, *THE WORLD'S WATER*, ISLAND PRESS (2002)

Then the guesswork continues. Strapped by limited budgets and staff, international keepers of water data, such as WMO and the United Nations, usually have no way to verify these country-by-country statistics.

It's not surprising that water data are often a low priority for developing nations, where millions struggle simply to find shelter and food. But rich countries also lack complete data. Much of the United Kingdom, for instance, does not use water meters—a classic source of consumption data elsewhere.

Even in the United States, water information is relatively spotty. Since 1950, USGS has published national water-use data every 5 years. But the agency essentially reports each state's own estimates of groundwater and surface water withdrawals for irrigation, livestock, homes, and the like. The quality of state data varies considerably, depending on local politics and priorities, concedes Hirsch. Arkansas, for instance, has a much stronger water-data program than Washington.

On the national level, the USGS National Water-Use Information Program, as it's known, does minimal analysis of overall trends, Hirsch says, because the survey can't afford it. The program has recently applied to Congress for additional funding.

Water pressure

Without good water data today, it's hard to know what will happen tomorrow. To make matters worse, conventional water models oversimplify the dynamics of water demand—often resulting in doomsday scenarios similar to those of the last century. By 2025, according to the World Resources Institute's 2000 Pilot Analysis of Global Ecosystems, at least 3.5 billion people, or 48% of the world population, will live in water-stressed river basins. But that projection, like many others, assumes for simplicity that current water consumption patterns will continue.

Is that a fair assumption? At least in the United States, Hirsch says, annual water consumption has fallen by more than 10% since 1980. He attributes the savings to increased water efficiency, from home appliances and savvy landscaping to water pricing regulations. Europe has seen similar gains.

In fact, Gleick says, a little water efficiency can go a long way for any population, wealthy or poor. "When Mexico City replaced 350,000 leaky toilets with more efficient ones, they saved enough water to meet the needs of 250,000 new residents," he notes.

On a broader scale, such savings could add up. Factoring efficiency gains and conservation into a global water forecast, Gleick projects that total water demand in 2025 need not greatly exceed today's. "We are moving away from the assumption that increased well-being requires exponential increases in water," Gleick says. "This is the most important point in the whole question of forecasting today."

Information is key. In Sri Lanka, local water managers and scientists from the International Water Management Institute are using satellite imagery to track the amount of water used on crops and their growth, among other variables. The goal is to figure out where water is most needed—and how much is currently wasted. "Using this information, we can see our water use situation clearly," reports Sri Lankan irrigation manager H. M. Jayatillake. But Sri Lanka is just one tiny corner of a world in which water remains largely a mystery.

–KATHRYN BROWN

HIV/AIDS

Malawi: A Suitable Case for Treatment

One country's efforts to secure help in tackling its AIDS epidemic indicates the gulf between needs and the resources available to meet them

BARCELONA—One statistic haunted the international AIDS conference here last month: 40 million, the number of people estimated to be infected by HIV around the world. The unfolding catastrophe reflected in that figure had pricked the world's conscience at the previous international AIDS meeting in Durban, South Africa, 2 years ago. This year's gathering provided the first real opportunity to evaluate how well the world has responded. The resounding answer, in session after session and from protesters and panelists alike: not well enough.

There has been some progress. In January, a new multinational organization, the Global Fund to Fight AIDS, Tuberculosis, and Malaria, opened its doors. Largely through its work, the World Health Organization (WHO) predicts that anti-HIV drugs could reach at least 3 million people in developing countries by 2005—10 times the number now being treated. But that still leaves a yawning gulf. And for countries bearing the brunt of the epidemic, getting desperately needed help is turning out to be a difficult and frustrating exercise. Just ask officials from Malawi.

A small landlocked country in southern Africa with a per capita income of just $200 a year, Malawi is facing an unimaginable public health crisis. HIV has infected an estimated 1 million Malawians, 16% of the country's adult population. In an interview in October 2000, Malawi's vice president, Justin Malewezi, said that unless his country confronts HIV and AIDS more aggressively, "there will not be any Malawi in the future." In many respects, Malawi's experience in putting together a plan to deal with its mounting AIDS disaster symbolizes the difficulties that poor countries and international organizations face in confronting the epidemic with inadequate funds and limited health services. In the end, after repeated interactions with donor organizations and the Global Fund, Malawi was forced to whittle down an ambitious plan to one that will barely make a dent in its problems.

Crisis. AIDS patient in Malawi, where 16% of adults are infected.

CREDIT: DENIS FARRELL/AP

As Malewezi recounted in a talk here, soon after the Durban meeting, Malawi began assessing its needs and how to secure the resources to meet them. For 2 days in October 2000 an international group of experts met in Malawi's capital, Lilongwe, to begin hashing out a plan. "The first day was simply trying to break through the feeling that treatment was an impossibility and shouldn't even be considered," recalls Peter Salk, scientific director of the foundation