From: Lester R. Brown, Earth Policy Institute
Published July 25, 2007

Water Tables Falling and Rivers Running Dry

As the world's demand for water has tripled over the last half-century and as the demand for hydroelectric power has grown even faster, dams and diversions of river water have drained many rivers dry. As water tables fall, the springs that feed rivers go dry, reducing river flows.

Scores of countries are over-pumping aquifers as they struggle to satisfy their growing water needs, including each of the big three grain producers--China, India, and the United States. More than half the world's people live in countries where water tables are falling.

There are two types of aquifers: replenishable and nonreplenishable (or fossil) aquifers. Most of the aquifers in India and the shallow aquifer under the North China Plain are replenishable. When these are depleted, the maximum rate of pumping is automatically reduced to the rate of recharge.

For fossil aquifers, such as the vast U.S. Ogallala aquifer, the deep aquifer under the North China Plain, or the Saudi aquifer, depletion brings pumping to an end. Farmers who lose their irrigation water have the option of returning to lower-yield dry land farming if rainfall permits. In more arid regions, however, such as in the southwestern United States or the Middle East, the loss of irrigation water means the end of agriculture.

The U.S. embassy in Beijing reports that Chinese wheat farmers in some areas are now pumping from a depth of 300 meters, or nearly 1,000 feet. Pumping water from this far

down raises pumping costs so high that farmers are often forced to abandon irrigation and return to less productive dry land farming. A World Bank study indicates that China is over pumping three river basins in the north--the Hai, which flows through Beijing and Tianjin; the Yellow; and the Huai, the next river south of the Yellow. Since it takes 1,000 tons of water to produce one ton of grain, the shortfall in the Hai basin of nearly 40 billion tons of water per year (1 ton equals 1 cubic meter) means that when the aquifer is depleted, the grain harvest will drop by 40 million tons--enough to feed 120 million Chinese.

In India, water shortages are particularly serious simply because the margin between actual food consumption and survival is so precarious. In a survey of India's water situation, Fred Pearce reported in New Scientist that the 21 million wells drilled are lowering water tables in most of the country. In North Gujarat, the water table is falling by 6 meters (20 feet) per year. In Tamil Nadu, a state with more than 62 million people in southern India, wells are going dry almost everywhere and falling water tables have dried up 95 percent of the wells owned by small farmers, reducing the irrigated area in the state by half over the last decade.

As water tables fall, well drillers are using modified oil-drilling technology to reach water, going as deep as 1,000 meters in some locations. In communities where underground water sources have dried up entirely, all agriculture is rain-fed and drinking water is trucked in. Tushaar Shah, who heads the International Water Management Institute's groundwater station in Gujarat, says of India's water situation, "When the balloon bursts, untold anarchy will be the lot of rural India."

In the United States, the U.S. Department of Agriculture reports that in parts of Texas, Oklahoma, and Kansas--three leading grain-producing states--the underground water table has dropped by more than 30 meters (100 feet). As a result, wells have gone dry on thousands of farms in the southern Great Plains. Although this mining of underground water is taking a toll on U.S. grain production, irrigated land accounts for only one fifth of the U.S. grain harvest, compared with close to three fifths of the harvest in India and four fifths in China.

Pakistan, a country with 158 million people that is growing by 3 million per year, is also mining its underground water. In the Pakistani part of the fertile Punjab plain, the drop in water tables appears to be similar to that in India. Observation wells near the twin cities of Islamabad and Rawalpindi show a fall in the water table between 1982 and 2000 that ranges from 1 to nearly 2 meters a year.

In the province of Baluchistan, water tables around the capital, Quetta, are falling by 3.5 meters per year. Richard Garstang, a water expert with the World Wildlife Fund and a participant in a study of Pakistan's water situation, said in 2001 that "within 15 years Quetta will run out of water if the current consumption rate continues."

Iran, a country of 70 million people, is over pumping its aquifers by an average of 5 billion tons of water per year, the water equivalent of one third of its annual grain harvest. Under the small but agriculturally rich Chenaran Plain in northeastern Iran, the water table was falling by 2.8 meters a year in the late 1990s. New wells being drilled both for irrigation and to supply the nearby city of Mashad, are responsible. Villages in eastern Iran are being abandoned as wells go dry, generating a flow of "water refugees."

Saudi Arabia, a country of 25 million people, is as water-poor as it is oil-rich. Relying heavily on subsidies, it developed an extensive irrigated agriculture based largely on its deep fossil aquifer. After several years of using oil money to support wheat prices at five times the world market level, the government was forced to face fiscal reality and cut the subsidies. Its wheat harvest dropped from a high of 4 million tons in 1992 to some 2 million tons in 2005. Some Saudi farmers are now pumping water from wells that are 1,200 meters deep (nearly four fifths of a mile).

In neighboring Yemen, a nation of 21 million, the water table under most of the country is falling by roughly 2 meters a year as water use outstrips the sustainable yield of aquifers. In western Yemen's Sana'a Basin, the estimated annual water extraction of 224 million tons exceeds the annual recharge of 42 million tons by a factor of five, dropping the water table 6 meters per year. World Bank projections indicate the Sana'a Basin--site of the national capital, Sana'a, and home to 2 million people--will be pumped dry by 2010.

In the search for water, the Yemeni government has drilled test wells in the basin that are 2 kilometers (1.2 miles) deep--depths normally associated with the oil industry--but they have failed to find water. Yemen must soon decide whether to bring water to Sana'a, possibly by pipeline from coastal desalting plants, if it can afford it, or to relocate the capital. Either alternative will be costly and potentially traumatic.

Israel, even though it is a pioneer in raising irrigation water productivity, is depleting both of its principal aquifers--the coastal aquifer and the mountain aquifer that it shares with Palestinians. Israel's population, whose growth is fueled by both natural increase and immigration, is outgrowing its water supply. Conflicts between Israelis and Palestinians over the allocation of water in the latter area are ongoing. Because of severe water shortages, Israel has banned the irrigation of wheat.

In Mexico--home to a population of 107 million that is projected to reach 140 million by 2050--the demand for water is outstripping supply. Mexico City's water problems are well known. Rural areas are also suffering. For example, in the agricultural state of Guanajuato, the water table is falling by 2 meters or more a year. At the national level, 51 percent of all the water extracted from underground is from aquifers that are being over pumped.

Since the over pumping of aquifers is occurring in many countries more or less simultaneously, the depletion of aquifers and the resulting harvest cutbacks could come at

roughly the same time. And the accelerating depletion of aquifers means this day may come soon, creating potentially unmanageable food scarcity.

While falling water tables are largely hidden, rivers that are drained dry before they reach the sea are highly visible. Two rivers where this phenomenon can be seen are the Colorado, the major river in the southwestern United States, and the Yellow, the largest river in northern China. Other large rivers that either run dry or are reduced to a mere trickle during the dry season are the Nile, the lifeline of Egypt; the Indus, which supplies most of Pakistan's irrigation water; and the Ganges in India's densely populated Gangetic basin. Many smaller rivers have disappeared entirely.

Since 1950, the number of large dams, those over 15 meters high, has increased from 5,000 to 45,000. Each dam deprives a river of some of its flow. Engineers like to say that dams built to generate electricity do not take water from the river, only its energy, but this is not entirely true since reservoirs increase evaporation. The annual loss of water from a reservoir in arid or semiarid regions, where evaporation rates are high, is typically equal to 10 percent of its storage capacity.

The Colorado River now rarely makes it to the sea. With the states of Colorado, Utah, Arizona, Nevada, and, most important, California depending heavily on the Colorado's water, the river is simply drained dry before it reaches the Gulf of California. This excessive demand for water is destroying the river's ecosystem, including its fisheries.

A similar situation exists in Central Asia. The Amu Darya--which, along with the Syr Darya, feeds the Aral Sea--is diverted to irrigate the cotton fields of Central Asia. In the late 1980s, water levels dropped so low that the sea split in two. While recent efforts to revitalize the North Aral Sea have raised the water level somewhat, the South Aral Sea will likely never recover.

China's Yellow River, which flows some 4,000 kilometers through five provinces before it reaches the Yellow Sea, has been under mounting pressure for several decades. It first ran dry in 1972. Since 1985 it has often failed to reach the sea, although better management and greater reservoir capacity have facilitated year-round flow in recent years.

The Nile, site of another ancient civilization, now barely makes it to the sea. Water analyst Sandra Postel, in Pillar of Sand, notes that before the Aswan Dam was built, some 32 billion cubic meters of water reached the Mediterranean each year. After the dam was completed, however, increasing irrigation, evaporation, and other demands reduced its discharge to less than 2 billion cubic meters.

Pakistan, like Egypt, is essentially a river-based civilization, heavily dependent on the Indus. This river, originating in the Himalayas and flowing westward to the Indian Ocean, not only provides surface water, it also recharges aquifers that supply the irrigation wells dotting the Pakistani countryside. In the face of growing water demand, it

too is starting to run dry in its lower reaches. Pakistan, with a population projected to reach 305 million by 2050, is in trouble.

In Southeast Asia, the flow of the Mekong is being reduced by the dams being built on its upper reaches by the Chinese. The downstream countries, including Cambodia, Laos, Thailand, and Viet Nam--countries with 168 million people--complain about the reduced flow of the Mekong, but this has done little to curb China's efforts to exploit the power and the water in the river.

The same problem exists with the Tigris and Euphrates Rivers, which originate in Turkey and flow through Syria and Iraq en route to the Persian Gulf. This river system, the site of Sumer and other early civilizations, is being overused. Large dams erected in Turkey and Iraq have reduced water flow to the once "fertile crescent," helping to destroy more than 90 percent of the formerly vast wetlands that enriched the delta region.

In the river systems just mentioned, virtually all the water in the basin is being used. Inevitably, if people upstream use more water, those downstream will get less. As demands continue to grow, balancing water demand and supply is imperative. Failure to do so means the water tables will continue to fall, more rivers will run dry, and more lakes and wetlands will disappear.

Adapted from Chapter 3, "Emerging Water Shortages" in Lester R. Brown, *Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble* (New York: W.W. Norton & Company, 2006), available free of charge on-line at www.earthpolicy.org/Books/PB2/index.htm

Additional data and information sources at www.earthpolicy.org

Source: Earth Policy Institute

Related articles:

- World's Water Resources Face Mounting Pressure
- Water Scarcity Crossing National Borders
- Food Scarcity Predicted with Rising Temperatures, Falling Water Tables
- World Grain Stocks Fall To 57 Days Of Consumption : Grain Prices Starting to Rise