Water

The global demand for water continues to escalate. It is possible that it could become one of the world's scarcest large resources. If that occurs, there is a further possibility that countries could go to war. Without water, human-kind cannot exist.

The Director General, Colin Chartres, of the International Water Management Institute states, "*Current estimates indicate that we will not have enough water to feed ourselves in 25 years time*."

***e*Research Corporation** is pleased to provide an article by Richard Mills of AheadOfTheHerd.com. This article discusses the implications of what we humans are doing to our most valuable resource. Very scary.

The article, which begins on the next page, is entitled: "**Ecological Overshoot**".

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Bob Weir, CFA,
Managing Director, Research Services

Ecological Overshoot

By Richard (Rick) Mills
Ahead of the Herd

As a general rule, the most successful man in life is the man who has the best information

For most of human history we've been consuming resources at a rate lower than what the planet was able to regenerate. Unfortunately we have crossed a critical threshold. The demand we are now placing on our planets resources appears to have begun to outpace the rate at which nature can replenish them.

The gap between human demand and supply is known as ecological overshoot. To better understand the concept think of your bank account – in it you have $5000.00 paying monthly interest. Month after month you take the interest plus $100. That $100 is your financial, or for our purposes, your ecological overshoot and its withdrawal is obviously unsustainable.

"*One lesson from the five great global extinctions is that species and ecosystems come and go, but the evolutionary process continues. In short, life forms have a future on Earth, but humankind's future depends on its stewardship of ecosystems that favor Homo Sapiens*." John Cairns, Jr., Future of Life on Earth

Water

Freshwater aquifers are one of the most important natural resources in the world today, but in recent decades the rate at which we're pumping them dry has more than doubled. The amount of water pumped has gone from 126 to 283 cubic kilometers per year - if water was pumped as rapidly from the Great Lakes they would be dry in roughly 80 years.

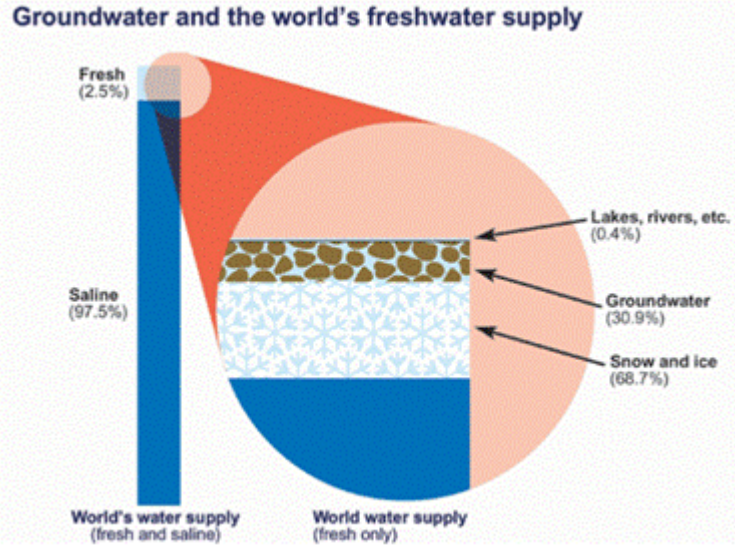
These fast shrinking underground reservoirs are essential to life on this planet. They sustain streams, wetlands, and ecosystems and they resist land subsidence and salt water intrusion into our fresh water supplies.

Many people think of aquifers as underground lakes but that's not the case - the water is held between rock particles. Water infiltrates into the soil through pores and cracks until it reaches what is called the zone of saturation - all of the spaces between the rocks are filled with water, not air. This zone of saturation occurs because water infiltrating the soil reaches an impermeable layer of rocks it can't soak through.

Water held in aquifers is known as groundwater. The water table is located at the top of the zone of saturation. Almost all of the planet's liquid fresh water is stored in aquifers. Some of the largest cities in the developing world - Jakarta, Dhaka, Lima, and Mexico City - depend on aquifers for almost all their water. Most rural areas pump groundwater from wells drilled into an aquifer.

There are two types of aquifers: replenishable (a permeable layer of rock above the water table and an impermeable one beneath it) and non-replenishable (also known as fossil aquifers, no recharge) 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 or refill.

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.



Groundwater represents about 30 percent of the available fresh water on the planet - surface water accounts for less than one percent. The rest is locked up in glaciers or the polar ice caps. The highest rates of groundwater depletion are in some of the world's major agricultural centers:

- Northwest India
- Northeastern China
- Northeast Pakistan
- California's central valley
- Midwestern United States

China's wheat crop is mostly grown in the semi-arid northern part of the country and is particularly vulnerable to water shortages. A World Bank study indicates that China is over pumping three river basins in the north, the Hai, the Yellow and the Huai.

Irrigated land accounts for four-fifths of the grain harvest in China.

In India the water situation is even more serious - the 21 million wells drilled are lowering water tables in most of the country - in North Gujarat, the water table is falling by six meters per year. In the state of Tamil Nadu falling water tables have dried up 95 percent of the wells owned by small farmers.

Irrigated land accounts close to three-fifths of the grain harvest in India. Indian water well drillers are now using modified oil drilling technology and going as deep as 1,000 meters.

In North America the major concern is over water levels in the Ogallala aquifer under the U.S. Great Plains - the world's bread basket. The Ogallala is the world's largest known aquifer having an approximate area of 450,600 square kilometers and stretches from southern South Dakota through parts of Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and northern Texas.

The Ogallala Aquifer was formed roughly 10 million years ago when water flowed onto the plains from retreating glaciers and streams of the Rocky Mountains. The Ogallala is no longer being recharged by the Rockies and precipitation in the region is only 30-60 cm per year.

In three leading grain producing states - Texas, Oklahoma, and Kansas - the underground water table has dropped by more than 30 meters.

In the Pakistani part of the fertile Punjab plain, the drop in water tables appears to be similar to that in India.

Iran is over pumping its aquifers by an average of 5 billion tons of water per year.

Saudi Arabia, relying heavily on subsidies, developed an extensive irrigated agriculture based on its deep fossil aquifer - and they sucked it dry. Some Saudi farmers are now pumping water from wells that are 4,000 feet deep.

In Yemen the water table under most of the country is falling by roughly 2 meters a year. In western Yemen's Sana'a Basin, the estimated annual water extraction of 224 million tons exceeds the annual recharge of 42 million tons; this drops the water table 6 meters per year.

In Mexico the demand for water is outstripping supply. In the agricultural state of Guanajuato the water table is falling by 2 meters or more a year.

When groundwater is depleted, the effects (besides lessening of supply or no more water) can be drastic. Land subsidence happens when porous formations that once held water collapse resulting in the surface layer settling. Water won't compress, but when the water is sucked out of an aquifer air fills the void between the rocks where the water used to be. Air compresses and the ground sinks or compacts - the aquifer will never hold the same amount of water again.

One study shows that from 1986 to 1992 some parts of the Mexico City Aquifer's water levels dropped 6 to 10 meters. Areas of Mexico City, as a consequence, have fallen as much as 8.5 meters. The subsidence (ground compaction) is also damaging the sewer system, potentially leading to untreated sewage mixing with fresh water in the aquifer.

In March of 2009, Enoch City in Iron County, Cedar Valley Utah, contacted the Utah Geological Survey (UGS) about what they believed to be a fault running through one of their new subdivisions. It was determined by the UGS that it was a fissure caused by the groundwater level dropping as much as 114 feet since 1939 due to pumping more groundwater than is recharged (refilled).

Another effect of over pumping is saltwater intrusion. If too much groundwater is pumped out from coastal aquifers saltwater may flow into them causing contamination of the aquifer. Many coastal aquifers - the Biscayne Aquifer near Miami and the New Jersey Coastal Plain aquifer for example - have problems with saltwater intrusion.

Conclusion

Streams, rivers and lakes are almost always closely connected with an aquifer. The depletion of aquifers doesn't allow these surface waters to be recharged; lowering water levels in aquifers is being reflected in reduced amounts of water flowing at the surface. This is happening along the Atlantic Coastal Plain. Groundwater depletion is also responsible for the Yellow River in China not reaching the ocean for months at a time, the failure of the Colorado River in the U.S. and the Indus River in Pakistan failing to reach the ocean every day.

"*If you let the population grow by extending the irrigated areas using groundwater that is not being recharged, then you will run into a wall at a certain point in time, and you will have hunger and social unrest to go with it. That is something that you can see coming for miles*." Marc Bierkens of Utrecht University in Utrecht, the Netherlands

Water is a commodity whose scarcity will have a profound effect on the world within the next decade. The danger to us from the worsening ecological overshoot concerning the world's fresh water supply makes the reevaluation of our values mandatory. We will have to drastically change the way in which we view our freshwater as a resource.

"Current estimates indicate that we will not have enough water to feed ourselves in 25 years time." International Water Management Institute (IWMI) Director General Colin Chartres

The central issue for us over the next few decades is not climate change or the global financial crisis - it is whether humanity can achieve and sustain the enormous harvest we need from this planet to feed ourselves.

Is this soon-to-be front-and-center issue - our fresh-water resources - on your radar screen?

If not maybe it should be.

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