

**SIN AQUA NON**  
**Apr 8th 2009**

From <http://www.economist.com>

Water shortages are a growing problem, but not for the reasons most people think

THE overthrow of Madagascar's president in mid-March was partly caused by water problems--in South Korea. Worried by the difficulties of increasing food supplies in its water-stressed homeland, Daewoo, a South Korean conglomerate, signed a deal to lease no less than half Madagascar's arable land to grow grain for South Koreans. Widespread anger at the terms of the deal (the island's people would have received practically nothing) contributed to the president's unpopularity. One of the new leader's first acts was to scrap the agreement.

Three weeks before that, on the other side of the world, Governor Arnold Schwarzenegger of California declared a state of emergency. Not for the first time, he threatened water rationing in the state. "It is clear," says a recent report by the United Nations World Water Assessment Programme, "that urgent action is needed if we are to avoid a global water crisis."

Local water shortages are multiplying. Australia has suffered a decade-long drought. Brazil and South Africa, which depend on hydroelectric power, have suffered repeated brownouts because there is not enough water to drive the turbines properly. So much has been pumped out of the rivers that feed the Aral Sea in Central Asia that it collapsed in the 1980s and has barely begun to recover.

Yet local shortages, caused by individual acts of mismanagement or regional problems, are one thing. A global water crisis, which impinges on supplies of food and other goods, or affects rivers and lakes everywhere, is quite another. Does the world really face a global problem?

**WATER, WATER EVERYWHERE...**

Not on the face of it. There is plenty of water to go around and human beings are not using all that much. Every year, thousands of cubic kilometres (km<sup>3</sup>) of fresh water fall as rain or snow or come from melting ice. According to a study in 2007, most nations outside the Gulf were using a fifth or less of the water they receive--at least in 2000, the only year for which figures are available. The global average withdrawal of fresh water was 9% of the amount that flowed through the world's hydrologic cycle. Both Latin America and Africa used less than 6% (see table). On this evidence, it would seem that all water problems are local.

The trouble with this conclusion is that no one knows how much water people can safely use. It is certainly not 100% (the amount taken in Gulf states) because the rest of creation also has to live off the water. In many places the maximum may well be less than one fifth, the average for Asia as a whole. It depends on how water is returned to the system, how much is taken from underground aquifers, and so on.

But there is some admittedly patchy evidence that, given current patterns of use and abuse, the amount now being withdrawn is moving dangerously close to the limit of safety--and in some places beyond it.

An alarming number of the world's great rivers no longer reach the sea.

They include the Indus, Rio Grande, Colorado, Murray-Darling and Yellow rivers. These are the arteries of the world's main grain-growing areas.

Freshwater fish populations are in precipitous decline. According to the World Wide Fund for Nature, fish stocks in lakes and rivers have fallen roughly 30% since 1970. This is a bigger

population fall than that suffered by animals in jungles, temperate forests, savannahs and any other large ecosystem. Half the world's wetlands, on one estimate, were drained, damaged or destroyed in the 20th century, mainly because, as the volume of fresh water in rivers falls, salt water invades the delta, changing the balance between fresh and salt water. On this evidence, there may be systemic water problems, as well as local disruptions.

Two global trends have added to the pressure on water. Both are likely to accelerate over coming decades.

The first is demography. Over the past 50 years, as the world's population rose from 3 billion to 6.5 billion, water use roughly trebled. On current estimates, the population is likely to rise by a further 2 billion by 2025 and by 3 billion by 2050. Demand for water will rise accordingly.

Or rather, by more. Possibly a lot more. It is not the absolute number of people that makes the biggest difference to water use but changing habits and diet. Diet matters more than any single factor because agriculture is the modern Agasthya, the mythical Indian giant who drank the seas dry. Farmers use about three-quarters of the world's water; industry uses less than a fifth and domestic or municipal use accounts for a mere tenth.

Different foods require radically different amounts of water. To grow a kilogram of wheat requires around 1,000 litres. But it takes as much as 15,000 litres of water to produce a kilo of beef. The meaty diet of Americans and Europeans requires around 5,000 litres of water a day to produce. The vegetarian diets of Africa and Asia use about 2,000 litres a day (for comparison, Westerners use just 100-250 litres a day in drinking and washing).

So the shift from vegetarian diets to meaty ones--which contributed to the food-price rise of 2007-08--has big implications for water, too. In 1985 Chinese people ate, on average, 20kg of meat; this year, they will eat around 50kg. This difference translates into 390km<sup>3</sup> (1km<sup>3</sup> is 1 trillion litres) of water--almost as much as total water use in Europe.

The shift of diet will be impossible to reverse since it is a product of rising wealth and urbanisation. In general, "water intensity" in food increases fastest as people begin to climb out of poverty, because that is when they start eating more meat. So if living standards in the poorest countries start to rise again, water use is likely to soar. Moreover, almost all the 2 billion people who will be added to the world's population between now and 2030 are going to be third-world city dwellers--and city people use more water than rural folk. The Food and Agriculture Organisation reckons that, without changes in efficiency, the world will need as much as 60% more water for agriculture to feed those 2 billion extra mouths. That is roughly 1,500km<sup>3</sup> of the stuff--as much as is currently used for all purposes in the world outside Asia.

The other long-term trend affecting water is climate change. There is growing evidence that global warming is speeding up the hydrologic cycle--that is, the rate at which water evaporates and falls again as rain or snow. This higher rate seems to make wet regions more sodden, and arid ones drier. It brings longer droughts between more intense periods of rain.

Climate change has three big implications for water use. First, it changes the way plants grow. Trees, for example, react to downpours with a spurt of growth. During the longer droughts that follow, the extra biomass then dries up so that if lightning strikes, forests burn more spectacularly. Similarly crops grow too fast, then wilt.

Second, climate change increases problems of water management. Larger floods overwhelm existing controls. Reservoirs do not store enough to get people or plants through longer droughts. In addition, global warming melts glaciers and causes snow to fall as rain. Since snow and ice are natural regulators, storing water in winter and releasing it in summer, countries are swinging more violently between flood and drought. That is one big reason why dams, once a dirty word in development, have been making a comeback, especially in African countries with plenty of water but no storage capacity. The number of large dams (more than 15 metres high) has been increasing and the order books of dam builders are bulging.

Third, climate change has persuaded western governments to subsidise biofuels, which could prove as big a disaster for water as they already have been for food. At the moment, about 2% of irrigated water is used to grow crops for energy, or 44km<sup>3</sup>. But if all the national plans and policies to increase biofuels were to be implemented, reckons the UN, they would require an extra 180km<sup>3</sup> of water. Though small compared with the increase required to feed the additional 2 billion people, the biofuels' premium is still substantial.

In short, more water will be needed to feed and heat a world that is already showing signs of using too much. How to square that circle? The answer is by improving the efficiency with which water is used. The good news is that this is possible: vast inefficiencies exist which can be wrung out. The bad news is it will be difficult both because it will require people to change their habits and because governments, which might cajole them to make the changes, are peculiarly bad at water policy.

#### ...NOR ANY DROP TO DRINK

Improving efficiency is doable and industrial users have done it, cutting the amount of water needed to make each tonne of steel and each extra unit of GDP in most rich countries (see first chart). This can make a difference. The Pacific Institute reckons that, merely by using current water-saving practices (ie, no technological breakthroughs) California, a water-poor state, could meet all its needs for decades to come without using a drop more.

Still, industry consumes less than a fifth of the world's water and the big question is how to get farmers, who use 70-80%, to follow suit.

It takes at least three times as much water to grow maize in India, for example, as it does in America or China (see second chart). In some countries, you need 1,500 litres of water to produce a kilo of wheat; in others, only 750 litres. It does not necessarily follow that water is being used unsustainably in the one place and not the other; perhaps the high-usage places have plenty of water to spare. But it does suggest that better management could reduce the amount of water used in farming, and that the world could be better off if farmers did so.

Changing irrigation practices can improve water efficiency by 30%, says Chandra Madramootoo, of the International Commission on Irrigation and Drainage. One can, for example, ensure water evaporates from the leaves of the plant, rather than from the soil. Or one can genetically modify crops so they stop growing when water runs dry, but do not die--they simply resume growth later when the rains return.

The world might also be better off, at least in terms of water, if trade patterns more closely reflected the amount of water embedded in traded goods (a concept called "virtual water" invented by Tony Allan of King's College London). Some benign effects happen already: Mexico imports cereals from America which use 7 billion cubic metres (m<sup>3</sup>) of water. If it grew these cereals itself, it would use 16 billion m<sup>3</sup>, so trade "saves" 9 billion m<sup>3</sup> of water. But such beneficial exchanges occur more by chance than design. Because most water use is not measured, let alone priced, trade rarely reflects water scarcities.

To make water use more efficient, says Koichiro Matsuura, the head of UNESCO, the main UN agency dealing with water, will require fundamental changes of behaviour. That means changing incentives, improving information flows, and improving the way water use is governed. All that will be hard.

Water is rarely priced in ways that reflect supply and demand. Usually, water pricing simply means that city dwellers pay for the cost of the pipes that transport it and the sewerage plants that clean it.

Basic information about who uses how much water is lacking. Rainwater and river flows can be measured with some accuracy. But the amount pumped out of lakes is a matter of guesswork and information on how much is taken from underground aquifers is almost completely lacking.

The governance of water is also a mess. Until recently, few poor countries treated it as a scarce resource, nor did they think about how it would affect their development projects. They took it for granted.

Alongside this insouciance goes a Balkanised decision-making process, with numerous overlapping authorities responsible for different watersheds, sanitation plants and irrigation. To take a small example, the modest town of Charlottesville in Virginia has 13 water authorities.

Not surprisingly, investment in water has been patchy and neglected. Aid to developing countries for water was flat in real terms between 1990 and 2005. Within that period, there was a big shift from irrigation to drinking water and sanitation--understandable no doubt, but this meant less aid was going to the main users of water, farmers in poor countries. Aid for irrigation projects in 2002-05 was less than half what it had been in 1978-81. Angel Gurría, the head of the Organisation for Economic Co-operation and Development, talks of "a crisis in water financing".

As is often the way, business is ahead of governments in getting to grips with waste. Big drinks companies such as Coca Cola have set themselves targets to reduce the amount of water they use in making their products (in Coke's case, by 20% by 2012). The Nature Conservancy, an ecologically-minded NGO, is working on a certification plan which aims to give companies and businesses seals of approval (a bit like the Fairtrade symbol) according to how efficiently they use water. The plan is supposed to get going in 2010. That sort of thing is a good start, but just one step in a long process that has barely begun.

See this article with graphics and related items at

Go to <http://www.economist.com> for more global news, views and analysis from the Economist Group.