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Water – the foundation of all life

We have not written a great deal on the topic of water before now perhaps because it is a resource that we often take for granted in the western world. A twist of the tap and out flows water. It is also a topic which enjoys an enormous amount of coverage in the media so you will most likely already know plenty on the subject and will have your own opinions about it. However, this is intended as a taster rather than a complete review and something that may initiate other thoughts and discussions with our readers.

Water stocks have enjoyed a strong performance in recent times after an extended period of poor returns and even though stock performance is still a very mixed bag there does seem to be an increasing awareness that water is facing severe challenges.

One of the most obvious challenges for the planet's resources is population growth with the UN estimating that the world's total population will reach 9.2 billion people by 2050 compared to 6.2 billion today. The birth rate has also risen recently in the developed world and the UN have revised their estimates slightly higher because of this. Their projected range for 2050 is for 8 billion people at the low-end estimate and 10.5 billion people for the high-end estimate. Either way there are likely to be more people for the planet to sustain in the years ahead and this is also the experience of the recent past making further growth likely.

Two thousand years ago the population stood at some 300 million people and a thousand years later this number had grown by as little as ten million and was then held back by plague, wars and illness in the Middle Ages. By 1800 the population had grown to a billion with the majority living in Asia (65%) and less than 1% of the total in America and it took until 1927 to reach the 2 billion mark. It was then that the advent of antibiotics saved so many lives and this brought about the real expansion in population. By 1974 improved agriculture and sanitation saw the world reach the 4 billion mark with the biggest growth coming in the developed world. The six billion mark was reached in 1999 and interestingly the demographics show that, like in 1800, the majority (61%) now live in Asia.

Source: http://www.globalchange.umich.edu/globalchange2/current/lectures/human_pop/human_pop.html#Past

Up until this point humanity has been inventive and food production methods have improved to keep up with the pace of change in population. The words of Malthus on demographics and the tipping point of food production have been largely dismissed because of technological advancement, although it is worth quoting from his 1798 essay entitled "An essay on the principle of population" when he said:

"The power of population is so superior to the power of the earth to produce subsistence for man that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fall in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world."

Thomas Robert Malthus:
Source: wikipedia





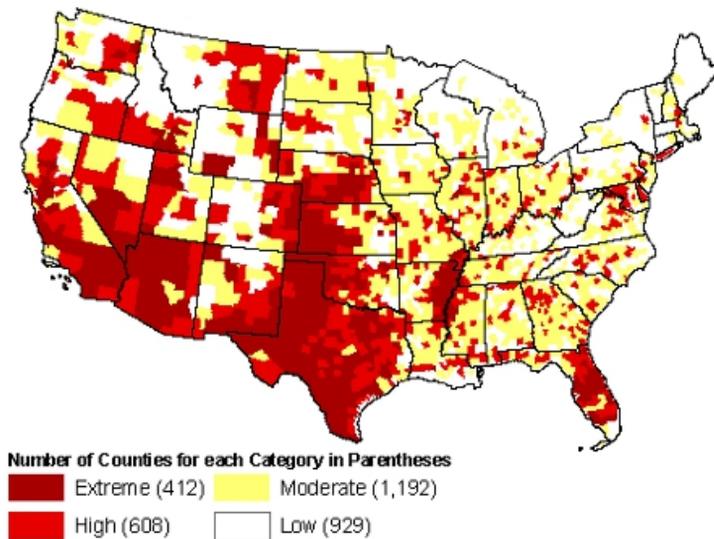
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We hope that science will continue to prove Malthus wrong and this brings us back to the water theme and the world's sources of potable water as this is the key to how humanity copes with the additional demographic pressure to come. The United Nations have written many papers about water supply and the challenges that face us and it is clear that our lakes and rivers are being depleted at an alarming rate. As an example, the middle part of the Mississippi river has been experiencing the worst drought in 50 years with many barges now unable to navigate its low waters. This has led to supply blockages and increased costs for goods with the effect felt well beyond the US especially in terms of food prices. This link covers this particular story in greater depth:

<http://news.nationalgeographic.co.uk/news/2012/12/121207-nation-mississippi-river-drought-environment-economy/>

The US Intelligence Community Assessment wrote a paper on global water security in 2012 which concluded that the demand for water in 2030 would exceed current supplies by 40%. This map of the US is an indicator of projected future stresses:

Water Supply Sustainability Index (2050) With Climate Change Impacts



Source: <http://www.uswateralliance.org/2010/09/01/water-scarcity-facing-13-of-u-s-counties/>

Hillary Clinton when she was the US Secretary of State announced a programme to improve water security as well as issuing the above-mentioned report on global water security.

She said:

"We believe this Water Partnership will help map out our route to a more water secure world: a world where no one dies from water-related diseases; where water does not impede social or economic development; and where no war is ever fought over water."



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Perhaps the best resource for investigating this topic further on a global scale is provided by The World Resources Institute and its Aqueduct interactive maps. Rather than downloading information within this report we would encourage you to visit the site and look at the many variables and stresses on water supply: <http://aqueduct.wri.org/> and mapping tools at this link: <http://aqueduct.wri.org/atlas>

It is interesting to see the US openly making projections like this as the widely held view of the US itself is that it has water in abundance and there is nothing to be concerned about. In other words, water shortages are a concern for other countries not for the United States. In fact, this opinion is quite wrong as the western half of the United States has had ongoing problems with water shortages and are subject to drought conditions as a natural state.

Lake Mead is the largest reservoir in the US covering 640 km² with a capacity of 32.236 km³ when full and is located on the Colorado River close to Las Vegas. It is the 16th largest man-made lake in the world and one of the largest man-made lakes in the Western Hemisphere. This sounds wonderful except that the lake has suffered drought for a number of years and scientists at the University of California-San Diego's Scripps Institution of Oceanography wrote a report in 2008 predicting that the lake has a 50% chance of running completely dry by 2021!

<http://scrippsnews.ucsd.edu/Releases/?releaselD=876>



The white 'bathtub ring' on the rocks around Lake Mead is from mineral deposits left by higher levels of water.

Worryingly they also predicted a 50% chance that reservoir levels will fall low enough to shut down power generation at Hoover Dam by 2017. If the Hoover dam's turbines stop turning then you can wave good bye to Las Vegas which relies on the dam for its source of power. Currently around 20 million people rely on Lake Mead for water so this is a dramatic and immediate concern.

Groundwater is the second largest reserve of freshwater on earth. It also makes up 40% of the freshwater used in the US alone. Groundwater is found within underground aquifers in the "zone of saturation". These zones are located where water fills in all of the spaces that are in the lower layers of soil. The water table is located at the top of the zone of saturation. These aquifers need to be recharged by rainwater and other water sources. The recharge rate is slow which means that groundwater is being removed from the aquifer faster than it can be replenished in most cases. This is a problem across the world as farmers drill boreholes in order to access water to irrigate crops. The fact that they are forced to drill such holes proves that much of the farming relying on this water source is unsustainable in the long-run.

In the Great Plains, the Ogallala Aquifer is a prime example of groundwater depletion. This aquifer provides water for South Dakota, Nebraska, Colorado, Wyoming, Kansas, Oklahoma, Texas, and New Mexico. The water pumped from Ogallala Aquifer is used mostly for irrigation purposes. Due to the need for greater amounts of water for irrigation, the aquifer is being depleted because the recharging process cannot keep up with the withdrawal of water.



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According to a new study just released by the U.S. Geological Survey (USGS), since 1940, the total volume of water in storage in the High Plains aquifer declined by some 266 million acre-feet – a volume equivalent to two-thirds of the water in Lake Erie. (An acre-foot is the volume of water needed to fill an acre of land a foot high. One acre-foot equals 325,850 gallons.)

Of greater concern is the fact that the draining of the High Plains water has picked up speed. The average annual depletion rate between 2000 and 2007 was more than twice that during the previous fifty years. The depletion is most severe in the southern portion of the aquifer, especially in Texas, where the water table beneath sizeable areas has dropped 100-150 feet; in smaller pockets, it has dropped more than 150 feet.

<http://newswatch.nationalgeographic.com/2012/02/07/texas-water-district-acts-to-slow-depletion-of-the-ogallala-aquifer/>

As these waters were built up over thousands of years there is no possibility of replenishing them.

<http://web.mit.edu/12.000/www/m2012/finalwebsite/problem/groundwater.shtml>

This is a problem for the rest of the world as well because this water has been used to grow food for everyone in the “*food basket of the world*”. In essence this water has been sent abroad in the form of food and it seems that we will not be able to rely on the same level of food production in the future. It is logical to expect that countries like America will have to ration food growth and exports in order to preserve their water for domestic use.

Not only is the supply of water falling but a recent report from the Environmental Protection Agency in America has concluded that the rivers that are flowing are in poor health and many are unable to support aquatic life. The report labels 55% of the nation's water ways as being in “*poor*” condition and another 23% as just “*fair*.” Only 21% of rivers are considered “*good*” and “*healthy biological communities*.” Even worse, the number of rivers and streams that qualify as “*good*” went down seven percent between 2004 and 2009.

The reason for the drop in water quality is, of course, pollution; specifically, phosphorus and nitrogen pollution that comes from fertilizer and wastewater run-off. Those chemicals, which come from farms and industrial sites, choke off healthy plant growth, which turn leads to more soil erosion, more flooding, and unhealthy fish and wildlife.

<http://water.epa.gov/type/rsl/monitoring/riverssurvey/index.cfm>

Crop irrigation

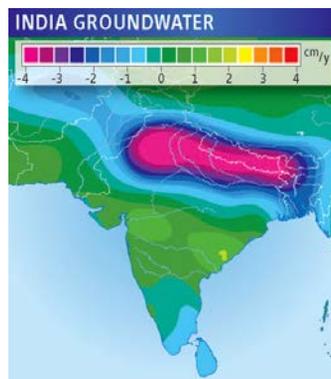




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These developments are all quite shocking and challenge the idea that water will always be freely available. However, the worst of it is that the US is in good shape compared with many other areas of the world and of course places with concentrated populations fare very poorly indeed. Demand for water in China is expected to exceed supply by as soon as 2030 and water quality is already a problem.

In India there is a widespread lack of water treatment facilities so contamination is an enormous problem. A study in 2011 by M.N.Murty and Surender Kumar (Water Pollution in India – An Economic Appraisal <http://www.idfc.com/pdf/report/2011/Chp-19-Water-Pollution-in-India-An-Economic-Appraisal.pdf>) estimates that 70% of its surface water and a high percentage of its groundwater has been contaminated by a range of pollutants that make the water unfit for human consumption. The health and economic impact is far too large a burden to bear and ought to be addressed but this is subject to the laws of supply and demand once again. Farming and irrigation means that groundwater is being lost in India at an alarming rate and satellite imagery taken by the Gravity Recovery and Climate Experiment (GRACE) satellite mission in 2009 shows the extent of the loss of water as shown in the image below:



Several centimetres' worth of water (pink) disappears each year from beneath the northern Indian subcontinent.
<http://news.sciencemag.org/sciencenow/2009/08/10-01.html>

So we know that the problems the world faces are the most challenging we can imagine but what are the solutions? The following top 19 ideas have been put forward as being the best solutions to the global freshwater crisis as captured by a GlobeScan and SustainAbility poll of more than 1200 leading international experts in 80 countries.

<http://www.circleofblue.org/waternews/2010/world/experts-name-the-top-19-solutions-to-the-global-freshwater-crisis/>

Educate to change consumption and lifestyles:

In the end, changing the face of this crisis involves education to motivate new behaviours. Coping with the coming era of water scarcity will require major overhaul of all forms of consumption, from individual use to the supply chains of major corporations, like GE. Some regions led by India, Australia and the Southwest U.S., are already facing the freshwater crisis. The most critical task is making sure the problem is much better understood worldwide.



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Invent new water conservation technologies:

In areas where aquifers are drying up and rainwater is increasingly unpredictable, innovation is needed. But as we attempt to cope with freshwater scarcity and develop conservation technologies, energy consumption is an important consideration.

Recycle wastewater:

World Water Day panellists have urged a new mindset for wastewater treatment. Some countries, like Singapore, are trying to recycle to cut water imports and become more self-sufficient. The rich East Asian republic is a leader in developing advanced technology that cleanses wastewater for other uses, including drinking.

Improve irrigation and agricultural practices:

Some 70% of the world's freshwater is used for agriculture. Improving irrigation can help close supply and demand gaps. In certain cases profligate irrigation practices meant for an earlier era has weakened the ability of farmers to provide food and fibre to a growing world. Examples include the Murray-Darling basin in Australia, Central Asia's Aral Sea, and the American Southwest. Although new technology has become an appealing solution, global water experts like Peter Gleick note that in some cases, such as the agricultural systems in California, success stories can happen by improving what's already in place.

Appropriately price water:

Water pricing and rights go hand in hand, with consumers questioning the benefit of higher prices. According to experts from the Organization for Economic Co-operation and Development (OECD), an international economic forum of 31 of the world's richest countries, raising prices will help lower waste and pollution. But Circle of Blue's May investigation into water pricing systems in major U.S. cities, show current utility pricing systems are obsolete, send the wrong signals, and need reform.

Develop energy efficient desalination plants:

To date, desalination has been an energy-intensive solution to water scarcity. Typically the Middle East has capitalized on its large energy reserves to build desalination plants. But Saudi Arabia could be fostering a new kind of desalination with its recent announcement to use solar-powered plants.

Britain has taken a different approach with small-scale facilities for agriculture. But these innovations bring to light another needed resource—the capital for technological experimentation.

Improve water catchment and harvesting:

Water catchment systems are essential for areas with no other reliable water sources. Pakistan and India—two countries that contend with some of the worst effects of climate change—are overhauling rainwater harvesting systems. These efforts provide independent control of water resources.

Look to community-based governance and partnerships:

Community organizations elevate the experiences of those whose voices merit more influence. In April, for instance, indigenous groups met at the alternative climate change conference in Bolivia, a gathering meant to foster international partnerships among underrepresented groups. Ensuring more effective governance at the grassroots-level gives communities stature, and can lead to effective policy changes on a national scale.



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Develop and enact better policies and regulations:

As water scarcity complicates food security and pollution, governments need to redefine their role. The U.S. government is considering expanding the Clean Water Act to ensure more protections. In Russia Vladimir Putin has approved waste discharges in Lake Baikal, one of the world's largest bodies of freshwater. Regardless of what path elected leaders take—the Circle of Blue/GlobeScan WaterViews survey indicates they are considering multiple approaches—the survey also found that most people say it is up to the government to ensure communities have access to clean water.

Holistically manage ecosystems:

Simply put, holistic management applies to a practical, common-sense approach to overseeing natural resources that takes into account economic, cultural, and ecological goals. In essence, the whole is greater than the sum of its parts, and each facet is related to and influences the others. Good examples of holistic management are communities that operate sewage treatment plants while pursuing partnerships with clean energy producers to use wastewater to fertilize algae and other biofuel crops. The crops, in turn, soak up nutrients and purify wastewater, significantly reducing pumping and treatment costs.

Improve distribution infrastructure:

Poor infrastructure is devastating to health and the economy. It wastes resources, adds costs, diminishes the quality of life, and allows preventable water-borne diseases to spread among vulnerable populations, especially children. The problem is not confined to the developing world. Pipes burst on a regular basis in the U.S., prompting boil alerts. Sewage treatment systems regularly overflow and malfunction, causing beach closures.

Shrink corporate water footprints:

Industrial water use accounts for approximately 22% of global consumption. The corporate footprint includes water that is directly and indirectly consumed when goods are produced. As sustainable manufacturing becomes more important, given the increasing severity of water scarcity, Peter Gleick and other experts question the costs of one industry sector in particular: bottled water.

Build international frameworks and institutional cooperation:

Binding international accords for natural resource issues are hard to achieve. The 2009 United Nations Climate Change Conference in Copenhagen is evidence of that point. That is not just because the freshwater crisis, arguably the most visible and dire of the climate change risks, was ignored. Regional agreements regarding trans-boundary or shared water bodies such as the Great Lakes Compact in the U.S., and Nile River basin agreement in Africa are just as difficult to ratify. But policymakers and advocates need to keep trying. Humanitarian-oriented treaties, such as the U.N.'s drinking water Millennium Development Goals, indicate that comprehensive global strategies are possible.

Address pollution:

Measuring and monitoring water quality is essential to human health and biodiversity. This monumental issue rears its head in many forms and can be addressed in just as many ways, whether it's David de Rothschild's eco-adventure in a plastic ship or Joe Berlinger's documentary on oil contaminating the Ecuadorian Amazon. While securing the quality of drinking water and at the local level, it's essential to build international bridges to solutions.

Public common resources / equitable access:

One of the key United Nations' Millennium Development Goals (MDGs) is ensuring access to drinking water. While the steps to achieve this goal are debated, the thesis that water is a basic right comes into play. As countries such as Chile attempt to reform water rights, U.S. politicians are considering how access rights translate into federal protection of Lake Michigan, one of the world's largest reserves of freshwater.



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R&D / Innovation:

Access to water in a water-scarce world will become a much higher priority in business decisions. Communities are likely to pursue public-private partnerships that draw on the innovative capacities of companies. One example— cities that operate sewage treatment plants are likely to pursue partnerships with clean energy producers to fertilize algae and other biofuel crops with wastewater.

Water projects in developing countries / transfer of technology:

Climate change and water scarcity are producing the most dramatic consequences in developing regions, such as northwest India and Sub-Saharan Africa. One proposed solution is to transfer water conservation technologies to these dry areas. Doing so is tricky because economies are weak and there are gaps in skills that often compel government and business authorities to impose these changes on local citizens.

Climate change mitigation:

Climate change and water scarcity go hand-in-hand to cause some of the biggest contemporary challenges to the human race. These issues have a reciprocal relationship, identified by the Intergovernmental Panel on Climate Change (IPCC), in which, *“water management policies and measures can have an influence on greenhouse gas (GHG) emissions.”* As renewable energy options are pursued, the water consumption of these mitigation tactics must be considered in producing alternatives ranging from bio-energy crops to hydropower and solar power plants.

Population growth control:

Because of the accelerating growth in global population, parts of the world could see a supply-demand gap of up to 65% in water resources by 2030. Currently, more than one billion people do not have access to clean water. And with 70% of the world's freshwater used for agriculture, water's critical role in food production must be considered as climate and resource conditions change.

You may not agree with all the 19 points made but these are shaping the current debate on water usage. Of course, the ethics of investing in water are also open to debate as water is not something that should be owned by individuals and sold for profit but rather it is a public good. This is a conclusion of surveys undertaken as mentioned above. Therefore, discussing water supplies and access can understandably hit raw nerves. However, the need to replace and build improved infrastructure, to repair damaged and leaking pipes, install water meters to encourage efficiency, to develop filtration techniques, irrigation systems and so on – these are all valid needs where companies are working on finding solutions and this is where the profit ethic becomes less problematic.

The principal concern we should all have is water rights and ownership as owners can exert price pressure over those who need the water. The famous Texan billionaire oil investor T. Boone Pickens is the largest individual water owner in America, with rights over the Ogallala Aquifer as discussed above in the report. If an oilman smells a profit in water then alarm bells should be ringing as they are generally finely tuned to the profit motive! It highlights that the problem of future supply is one that we all need to concern ourselves with and that a variety of solutions need to be adopted and taken up.



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Solving those problems by building and renovating water-system infrastructure, developing technologies to purify water and transporting water to people who need it present powerful financial and investment opportunities. To meet the coming demand, some analysts project the world may need to spend as much as US\$1 trillion per year through 2030 applying technologies to conserve water, maintain and replace water-related infrastructure and to construct sanitation systems.

Whatever your feelings on the subject, the water problem is going to be discussed more and more and we continue to filter the good ideas for investment.

We wish you a peaceful Easter break and look forward to being in touch with you again soon,

Colin Moor and the SUNARES team

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