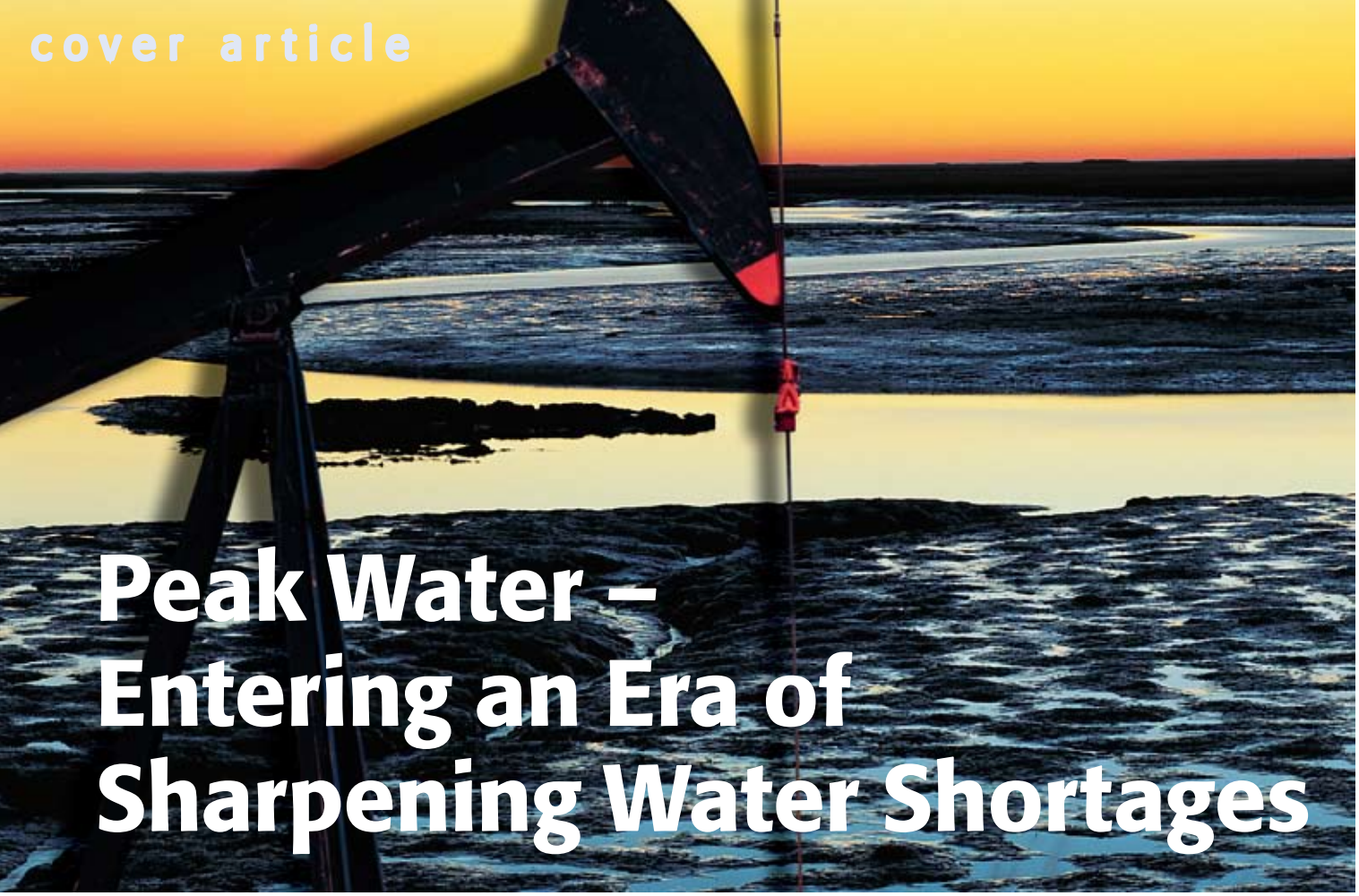

Peak Water – Entering an Era of Sharpening Water Shortages

Photo: Getty Images

A new concept, "peak water" has emerged. It indicates that the era of easy access to blue water is coming to an end in many regions of the world. Expanding water pollution, depleted river streamflow, overdrawn groundwater, water usability threatened by salinisation, and water for ecosystems sinking below the acceptable minimum all point to a peaking of blue water resources, a theme highlighted in "The World's Water 2008-2009" from the Pacific Institute. Green water scarcity through soil and land degradation has been discussed as drought and desertification. Human ingenuity, coping strategies and fundamental rethinking on water management are urgently needed to mitigate the drivers of peak water and adapt to their effects on freshwater and natural resources.

Borrowing momentum from the peak oil debate, the peak water concept has appeared in environmental texts predicting that as future demand for water grows its availability in many places will shrink. The term itself is a new and apt name for the present and looming threat of amplified water scarcity of both blue and green water sources occurring around the world.

Blue Water Scarcity Mounts

At the 2008 World Economic Forum in Davos, Switzerland, water scarcity attracted considerable concern. A CEO Water Mandate was formulated with the aim to assess the level of water insecurity and its influence on future economic wealth and political security. The International Water Management Institute (IWMI) has shown that a man-made blue water scarcity, manifested in terms of river basin closure, is a problem developing mainly in irrigated regions but covers over 15 percent of all continental land.

Blue water scarcity has conventionally been conceptualised by addressing use-to-availability ratio – also called criticality ratio. The usual recommendation is for water demand management to bring down over appropriation. The relative amount that should remain unallocated to maintain aquatic ecosystem health has been specified as "environmental flow". The water quality dimension of the unallocated flow is frequently neglected but poses a serious problem for both human and ecosystem health.

As population increases, a second dimension of blue water scarcity has to be taken into account. The population pressure on the available water, or the level of water crowding, is a phenomenon referred to as "chronic water shortage". When combined with high water stress this results in "severe water shortage". By combining these two dimensions it has been shown that 1.4 billion people are already living in over-appropriated areas. 1.1 billion of these people live in areas that are also suffering under severe water shortage. In such areas, demand management will not be enough. These areas will require import to achieve food security.

For each aspect of water scarcity, the populations affected are expanding. Following predictable climate change, it can

What is Blue and Green Water?

Blue water is the visible water contained in rivers and aquifers. Green water refers to the invisible water in the soil, which comprises a huge but often forgotten portion of water resources. Both sources originate from the rainfall captured within the water divide of the catchment. Climate defines the constraints to human activities in terms of evaporative demand, droughts, dry spells, rainfall seasonality and variability. The roots catch the infiltrated rain, which supports plant production and vegetation covers in forests, grasslands and croplands, and which transpires back to the atmosphere. Runoff, resulting from the climate, topography and the ability of the soils to absorb the rain impact the consumptive water use of the vegetation.

be foreseen that by 2050, depending on the rate of fertility decline, the population in countries with chronic water shortage (above 1,000 people per million cubic meters per year) will be 3 to 5.5 billion. Looking at the other dimension of blue water scarcity, expressed as use to availability ratio, the population in countries with high water stress (more than 40 percent use to availability) may rise to between 4.5 and 7 billion people.

Green Water Scarcity and Food Security

Green water may also be scarce in different ways. This leads to problems for food production, especially in semiarid regions. Green water in the soil is exposing quantitative deficiency in vulnerable regions. Manmade green water scarcity, which results in land degradation conventionally called desertification, a phenomenon that has remained high on the political agenda since the 1970's. Natural green water scarcity in semiarid regions is caused by a lack of rain, which may, but may also not, increase with climate change.

Problems of green water deficiencies caused by meteorological factors, (i.e. lack of rain) can be met by irrigation in areas that do not also suffer blue water shortages. In situations where the deficiency is manmade and land degradation has left the root zone too dry to meet the water needs of crops, the deficiency can be mitigated through soil and water conservation. The way forward may be "triple green" agriculture: green water based, green for increased production – like was seen in the "green revolution" in agriculture – and green in the sense of being environmentally sound.

Globally, producing food for the growing world population will be challenging. By mid-century, half of the world population may live in countries where national food self-sufficiency – generally preferred by politicians to avoid the risk of food riots – is impossible. Food trade will therefore be essential to eradicate hunger. If fertility decline would follow the slow route, world food trade would have to double by 2050. In low-income countries, where purchasing power is low, cropland expansion will have to be accepted to make a decent level of food security possible.

Food production ambitions might be lowered, for instance by avoiding unnecessary food losses from field to fork (see article pages 12-13). If 2200 kcal/p day would be considered enough, at least half of this huge future water deficiency would be covered. Many countries would still, however, remain import dependent.

Governance Implications

Today's water crisis is seen as a crisis of management, not a crisis of water shortage. Many international organisations mainly focus on blue water and are more concerned with water stress caused by high use-to-availability ratios than with chronic blue water shortages.

Tomorrow's water resources management will have to address green and blue water together with the strong link between land and water. This is especially critical in the semiarid tropics where poverty, under nutrition and population growth dominate. In Australia, a long sequence of drought years linked to climate change is causing both green and blue water shortages and revealing the needed shift towards a blue/green and land/water integrated approach.

Humans are exerting multiple pressures on the freshwater resources. Population growth, economic development, increasing water demands, increasing water pollution, increasing food expectations and climate change are squeezing from all fronts. Future water resources governance must sharpen its tools to avoid approaching tipping points that would unbalance a peaceful world.

Water and the Planet's Life Support System

The global change debate is now raising concerns. At the recent Tällberg Forum in Sweden, the possibility of formulating planetary constraints for human activities was analysed. As the water cycle is central in the operation of the global life-supporting system, determining a maximum blue water withdrawal to safeguard a minimum river streamflow was one of the ten items under discussion.

Water shortages are mounting while demand and consumption rapidly accelerate. The urgency of this situation can not be overstated. Yet, the need to anticipate, prevent, mitigate and adapt to this reality and potential "peak water" remain either poorly understood or greatly underestimated. Measures to control the massive driving forces behind global warming, population growth and economic development that rapidly accelerate unquenchable demand for water must be crafted. Water resources management will have to address the original resource – precipitation –to steer land and water-related human activities that are compatible at the basin level and strive towards hydrosolidarity.

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Photo: Mats Lannerstad

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