Water Security

Solutions for addressing threats to water security require new approaches to land use management

by Benjamin Hennig

Global croplands play a central role in feeding the world's population. As the population keeps growing, though with declining growth rates that suggest an end of growth towards the end of the century, the importance of croplands for water and food security has become a central focus of research.

The US Geological Survey estimates that there are 1.87 billion hectares of global croplands, which means that on average one hectare sustains the food production for about four people in the world. The three most populous countries, China, India and the USA, also have the highest net cropland area (albeit the largest country by population, China, only comes third in terms of cropland area). However, the overall distribution is much more uneven and less related to where most people live on the planet.

The distribution of croplands is used as a basemap in the cartograms below where each area in the maps is proportional to its amount of cropland. Beyond the aforementioned largest countries, the cartograms show how Europe, with its favourable climate conditions and fertile soils, has a significant share of the global cropland distribution.

Croplands are competing with other forms of land use such as expanding cities or cultivation of land for bio fuels. They are also increasingly put under pressure from environmental factors that are threatening the extent of croplands through erosion, salinisation, and a wider range of negative effects caused by climate change.

Water is a fundamental element for maintaining the productivity of these valuable lands. The irrigation of croplands accounts for almost 80 per cent of human water use. Croplands are therefore critical for water security, but water security is equally crucial for croplands and consequently also for global food security.

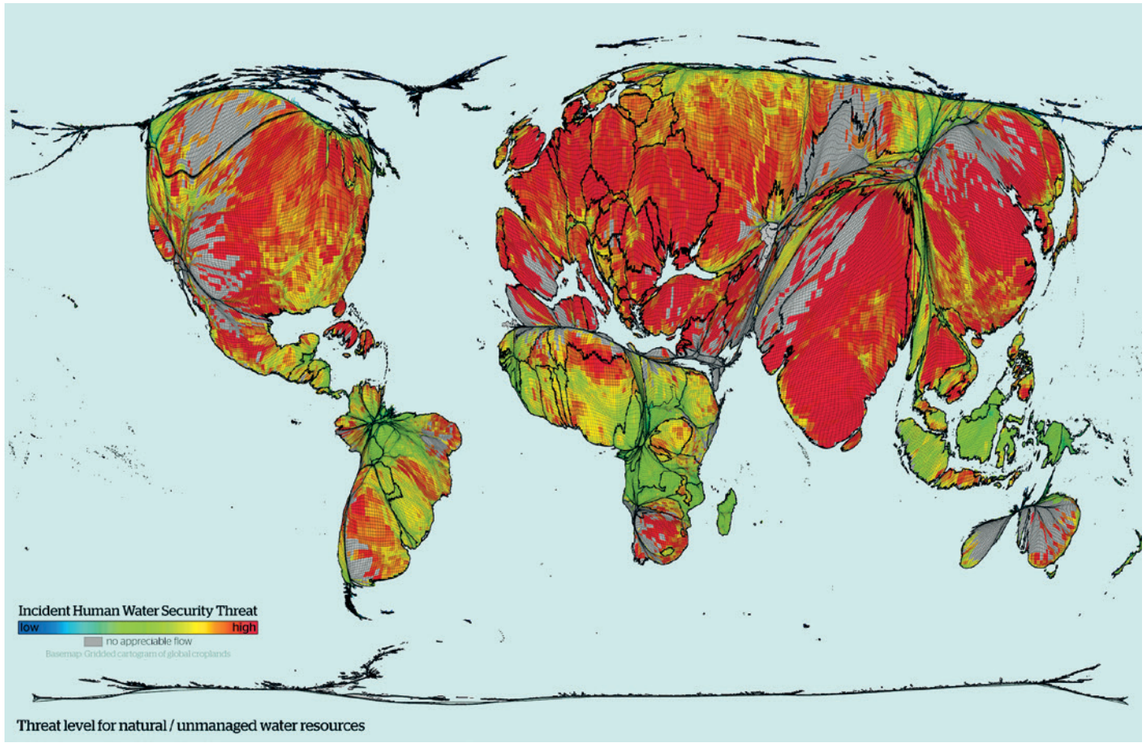
Human-induced stress factors and the use of water technology are central to understanding the emerging threats. This understanding is needed for developing more sustainable ways of food production for a growing world population.

The cartograms show the vulnerability of global croplands in relation to water security. They are based on data from the first global-scale initiative to quantify the impact of human-induced stressors on human water security. This was undertaken in order to better understand the threat levels of the limited freshwater resources on our planet. By combining a range of 30 environmental stressors, such as agricultural runoff, pollution and invasive species, the data shows their impact on fresh water degradation.

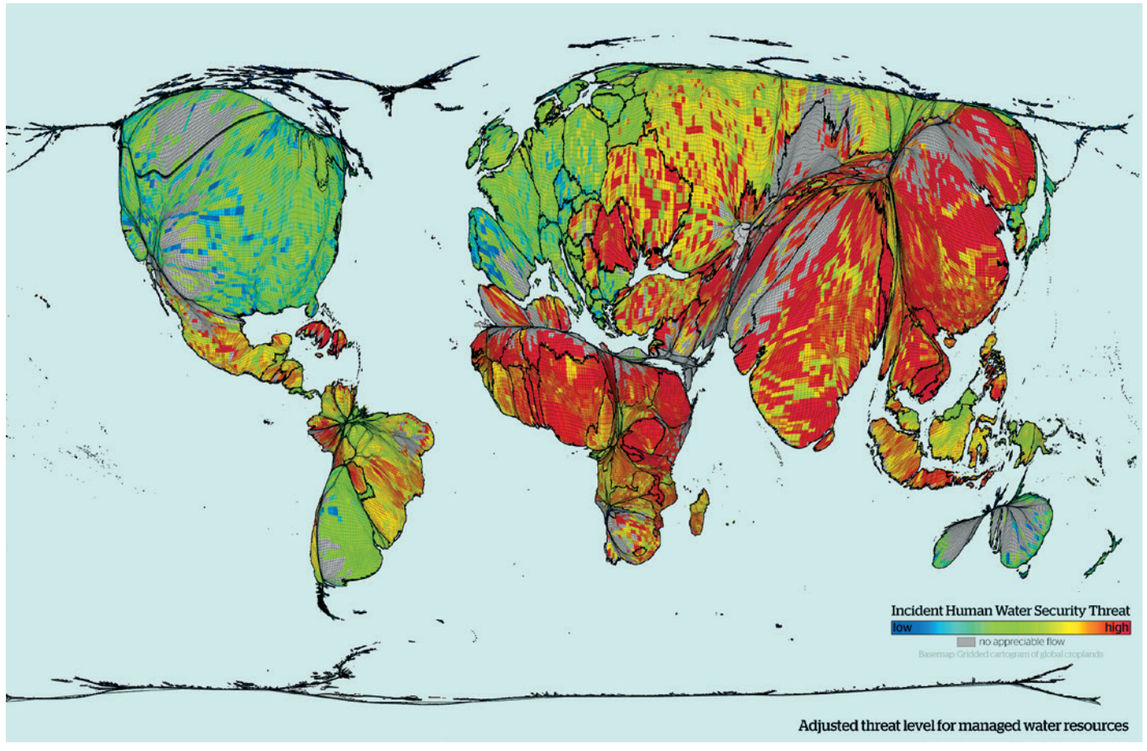
The cartograms show these threats to freshwater resources from the perspective of croplands as one of the main areas where human water security matters most. The left-hand map is a representation of the threat level for natural or unmanaged water resources. It shows the acute levels of imposed threat to freshwater resources in croplands of almost all regions. Only areas in the tropics have relatively lower treat levels in some parts. However, this picture almost reverses when taking the use of (usually costly) water technology into account. Mostly wealthier countries are able to utilise these as a remedy to overcome water problems, while they are too costly as solutions for agriculture in the poorer parts of the world. Therefore, the right-hand map, which shows the adjusted threat level for managed water resources, provides a picture of how engineering solutions help to provide a sense of water security there, whereas the poorer regions show perilous water insecurity conditions.

Repeated famines in recent years show how important the aspect of water is for sustaining agricultural production. At the same time the use of water technology provides a false sense of security because such measures do not prevent the degradation of freshwater resources from happening. Technological efforts, such as reservoirs, do not address the underlying causes of increasing pressure on the world's water resources but only tackle the immediate symptoms of water shortages. Recent events such as droughts in the UK have shown the vulnerability of technological solutions. These are the first signs for forthcoming threats to human water security that cannot be tackled through such technological measures alone.

Solutions for addressing such threats to water security require new approaches to land use management, more effective farming methods including better irrigation techniques and a more integrated ecological approach that aims at protecting ecosystems and preserving biodiversity. Environmental sustainability and ecological integrity play an important role in increasing water security in croplands. This is needed in order to preserve the productivity of global croplands and ensure food security for the forthcoming generations so that each hectare of land can provide food for five or six people. A more sustainable way of producing food that puts less pressure on the environment as well as a more equal distribution of food will be key to helping these croplands feeding a planet of 7.5, ten or even 11 billion people. ●



Threat level for natural / unmanaged water resources



Adjusted threat level for managed water resources