Virtual water saves prized liquid asset

Concept raises awareness about dwindling resource in arid region

Aral Sea in 2000 in 2009
© NASA Earth Observatory: Evaporation of the Aral Sea

Not many people in the Aral Sea Basin in Central Asia realize that it takes about 2,865 litres of virtual water (see box) to produce one simple T-shirt, or that it takes about 2,074 litres to produce one kg of bread, which is part of daily diets of the households in this region.

Countries of the Aral Sea Basin depend a lot on agricultural production to sustain livelihoods, support processing industries and their economies. However, due to the arid continental climate, which is characterized by low precipitation and high evaporation, agriculture is possible with irrigation only.

Irrigation water absorbs around 95 per cent of all available water resources in the region – and is thus much above the worldwide mean. Water in the Aral Sea region has become scarce. This was caused by the diminishing natural availability of water resources and by the growing demand for water resources for irrigating the expanded fields and feeding the growing population.

At the same time, the poor condition of the irrigation and drainage networks causes high water losses. This not only threatens agricultural production and thus the entire set up of the local production systems, but it has already resulted in unprecedented ecological consequences, such as the drying of the Aral Sea.

The increasing scarcity of water may lead in future to increased political and social tensions and even trans-boundary conflicts over water. It is therefore really important to create water shortage awareness among the population in the Aral Sea region.

This can start through using less water. In this regard, the concept of virtual water is becoming an important component of sustainable water use and water management in water-scarce regions worldwide, and is expected to lead to more efficient water use.

Researchers from the German Ministry for Education-funded ZEF (Zentrum für Entwicklungsforschung/Centre for Development Research, University of Bonn/ UNESCO) project, titled "Economic and Ecological Restructuring of Land and Water Use in the Region Khorezm (Uzbekistan): A Pilot Project in Development Research" have worked extensively on developing comprehensive, science-based concepts to improve economic efficiency and ecological sustainability of agricultural land and water use in the Khorezm region of northwestern Uzbekistan, as an example for the whole of the Aral Sea Basin.

Among the many findings are the estimates of the virtual water content for the main agricultural crops in the region (cotton and wheat) and the respective processed products.

Virtual water estimates for a T-shirt, or a loaf of bread reflect total water use at all production steps, starting from cropping raw cotton in the field by farmers, plus the water used during industrial processing (e.g. raw cotton – fibre – yarn – fabrics – T-shirts), or in the case of bread from the wheat kernel to the bread (wheat – flour – bread). Thus, the total virtual water (TVW) of each product is the sum of agricultural water use (AWU) and water use at each industrial stage (IWU):

TVW=AWU + IWU. For a T-shirt this would be: 2,865 litres = 2,074 + 791; Whereas, for one kg of bread this would be: 2,074 litres = 2,072 + 2 .

Obviously, irrigated agriculture demands the greatest share in water use, since it uses the most water, not only for the irrigation of agricultural fields, but also for washing out salts from the soil, a process called leaching.

Thus, irrigated agricultural water use includes water for leaching, irrigating fields during the vegetation season and the amount of water lost in the main and on-field irrigation canals.

But also the grey water (see box), or water virtually needed to dilute the pollutants caused by pesticide and fertilizer seepage need to be included.

Under irrigated agricultural conditions this can be estimated as: **AWU=Leaching + Vegetation + Losses + Grey**. Similarly, the virtual water content was calculated for all cotton and wheat products in the conditions of the Aral Sea Basin.

Such estimates will make people aware of how much water is used and will be needed, unless present production and processing procedures are altered.

In a follow-up step, farmers and authorities in the Aral Sea Basin need to become more aware to consider their options to improve water use efficiency in a region which became famous for the drying up of the Aral Sea.

The goal of the ZEF/UNESCO project is to assist people to be prepared for the future by laying a good knowledge foundation, which will help to improve water availability in the future.

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For more information access: **http://www.zef.de/zur_khorezm.0.html**

The concept of 'virtual water' refers to the total volume of water used to produce any commodity.

The virtual water content of any product, (a commodity, good or service) is defined as the volume of freshwater used to produce the product. The virtual water of a product refers thus to the sum of the water used in all steps of the production chain. The adjective 'virtual' refers to the fact that most of the water used to produce a product is not contained in the product itself. The real-water content of products is generally negligible if compared to the virtual-water content. Virtual water consists of the three components: the blue, green and grey water.

The blue water is the volume of freshwater (surface water and ground water) used for the production of a product.

The green water is the volume of rainwater used in the production cycle.

The grey water is the volume of polluted water or water needed to dilute the polluted water in the production process of any commodity.

The concept of virtual water is used to increase awareness on the high water use and water shortage in the world, and to release the pressure on the scarcely available domestic water resources of countries through producing and trading goods with low virtual water content, while importing commodities with high virtual water content.