

Can the water footprint contribute to climate change adaptation strategies?*

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Water resources are increasingly subject to human pressure, with demand already outstripping renewable water supplies in many parts of the world. Although water is a necessary prerequisite for all economic activity, agriculture remains the predominant water-using sector, accounting for 70% of global water withdrawals. The trade-off between alleviating water scarcity and maintaining food security poses a major challenge not least because by 2050, agricultural output will need to increase by 60-70% compared to current levels in order to provide sufficient nourishment for a growing global population. Ongoing and future changes in inter-annual precipitation trends and altered water balances owing to the impact of climate change are expected to increase the risks and unpredictability for crop production. This is especially the case for arid and semi-arid regions, where water scarcity is commonly the major constraint to agricultural potential. The complex interplay between production systems and consumption patterns and their associated impacts on water resources are important aspects that need to be better understood and incorporated into management policies towards adaptation, improved water use efficiency and appropriate allocation.

The water footprint was introduced as a multidimensional indicator of consumptive water use around a decade ago, aspiring to an improved understanding of the production-consumption relationship and the quantification of its associated pressure on water resources. It builds on two key concepts that distinguish it from traditional water use indicators. Firstly, it takes into account “virtual water”, a term that has been used to highlight the redistribution of global water resources due to the intrinsic linkage between water availability, food production and the associated flows of embedded water in traded products. Secondly, it differentiates between the two types of water engaged in biomass production, namely the green (soil moisture in the unsaturated zone originating from precipitation) and blue water (irrigation water originating from surface and groundwater resources). This blue-green distinction enhances the water footprint analysis since each type of water is associated with a different opportunity cost and environmental impacts.

Despite the appeal of the water footprint concept, it has been characterized as a partial tool to be used alongside other indicators and also lacks a temporal analysis in most national and regional assessments. In order to enhance the policy relevance of the water footprint, this study employs a supply utilization approach related to crop products along with two complementary indicators, namely the economic productivity of crop water use, and a temporal-explicit blue water scarcity index. This set of indicators is applied to the semi-arid island of Cyprus over the period 1995-2009. The total water footprint of crop supply (food, feed and other end-uses) was found in the range of 1,390-2,135 Mm³/year; on average, 13% was blue water and 87% green water. The supply utilization analysis reveals a high green water import dependency, mainly embedded in crops that are destined for feed ingredients. The gross value generated from irrigated cropland justifies the tendency to exporting crops with higher blue water content. However, the scarcity index reveals an unsustainable blue water footprint, as it exceeds the natural sustainable supply. The study highlights the importance of employing a year-to-year analysis of national water footprints, since inter-annual climate variability was found to be the major determinant of crop supply, land and water use changes. The interplay in the set of indicators examined facilitates an improved understanding of the trade-offs between different policy objectives. Overall, such additional information can potentially assist policies towards adapting production systems based on the availability of land and water resources in the light of climate change, and to make an informed contribution towards more sustainable consumption patterns.

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