Sustainability of water consumption in global watersheds - current state and the effects of virtual water trade

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Background and aim

Sustainable water use is an important social issue that is also set as a goal of Sustainable Development Goals (SDGs) by the United Nations. The concept of planetary boundaries is applied for water use to assess the sustainability of human activities, whereas the challenges on the definition of regional carrying capacities at watershed levels and identification of the causes of boundary exceedance need to be overcome. We analyze the current state of the carrying capacity exceedance of freshwater and its sources at watershed levels for the whole world.

Key findings and implications

Here we show that 24% of our current total freshwater consumption exceeds the carrying capacities of watersheds. Our fundamental demand of freshwater for domestic and irrigation use accounts for 60% of the overconsumed part of the total freshwater consumption. We deprive 60% of water requirement for ecosystems in watersheds on average to satisfy our current freshwater demand, which may result in significant effects on ecosystems. Demand for traded crops in the global supply chains indirectly contributes to over-consumption of freshwater in producing watersheds, while around 5% of overconsumption of freshwater is globally saved through virtual water trade for many consuming countries owing to the dependency on producing countries. However, overconsumption of freshwater is imposed in some producing countries in addition to their national demand to satisfy the demand of consuming countries. The balance between the reduction of pressure on planetary boundaries and sustainability at the watershed level is a crucial issue for the sustainability of freshwater use.

Keywords : water consumption, carrying capacity, virtual water, water footprint, planetary boundaries