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# Effect of the international food trade on fluvial ecosystems

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Fulfilling the competing water requirements of freshwater ecosystems and societies is a key global environmental challenge for both scientists and governments. Freshwater withdrawal has increased more than six times in the last century, with agriculture accounting for around 70% of all water withdrawals. Globally, about a quarter of the food produced for human consumption is traded internationally and several countries significantly depend on imported food. It follows that an important part of the world population relies on external water resources and impacts external freshwater ecosystems. The concept of water footprint, which is the total volume of freshwater used to produce a good, has played a crucial role to shed light on the links between food consumption geography and water resource exploitation. However, the accounting of water volumes used for food production does not tell the whole story; in fact, due to the heterogeneous spatiotemporal distribution of freshwater resources, a same volume of withdrawn water does not have the same environmental effects in different times or places.
Our work concerns this facet of the water footprint and it analyses the international food trade network focusing on the impact of food production on local fluvial ecosystems. We weigh the amount of surface water used to produce agricultural goods with a country-dependent index that accounts for the impact on fluvial ecosystems of a reference amount of water withdrawn from the river. The proposed (local) index depends on (i) the environmental relevance of the impacted fluvial ecosystem – such relevance is evaluated by descriptors related to the river discharge – and (ii) the downstream portion of the river network impacted by water withdrawal. The index is first assessed at global scale with a 0.5° x 0.5° spatial resolution, considering annual-averaged data of river discharge; then, the detailed index is aggregated at the country scale.
The proposed environmental weighting of fluvial water resources involved in the internationally traded food production depicts a novel picture about the virtual water trade. This picture contributes to give a more refined analysis of the problem of water globalization.