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What if all food were sourced locally? Food basins and implications for unsustainable water use and distance to food

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Water resource management problems are strongly influenced by demand. Discourse on virtual water has emphasised that local scale water demand is in turn influenced by global scale demand, particularly for food and other agricultural end-products. In the long term, water supply needs are therefore sensitive to potentially radically different trade patterns.

Globalization in the form of increased efficiency in food production and trade possibilities have drastically changed the patterns of physical and mental distance between food production and consumption. At the same time, distance to food production continues to be a significant part of local food production and self-sufficiency discourses. We therefore propose that it is important to explore a reference scenario where food is obtained as close as possible to the consumption location.

We introduce a novel theoretical approach to investigate distance to food and global food supply, using a simple optimisation framework to reallocate trade routes to minimise distance or travel time utilizing a friction surface model. This provides a means of reflecting on the effects of radically different trade patterns, going beyond expected changes in production and consumption. In particular, we analyse: 1) food basins, which are areas that are able to satisfy their own demand with locally available resources, 2) implications for who is fed through unsustainable water use, 3) implications of distance to food for infrastructure and management.

Our results show that if we account only for the theoretical need for energy from plant based foodstuff, we see formation of multiple food basins capable of being self-supporting in terms of produced energy. However, when we account for differences in actual diets together with losses and waste in food supply chains, the sizes of the food basins grow significantly as trade links increase worldwide. The size and shape of food basins affect both who is fed through unsustainable water use, and how far food needs to travel. While local food systems are frequently preferred over global trade-powered, systems ("the local food trap"), our results highlight the difficulty in bringing together water, food and people, and reinforce the importance of trade in meeting global food demand and minimising alteration of natural water regimes.