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*sustainable diet*

# How can we avoid eating ourselves out of water?

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**Agriculture is the main contributor to global water scarcity but not all diets contribute equally. Modifying what, and how much, we eat could reduce the impact of our diets on global water resources.**

Almost everything that we eat has used water in its production, and most of this water is 'consumed' – that is, it is not returned to the local terrestrial hydrological system in the short term, and therefore cannot be reused by others in the basin or to support the aquatic environment. Livestock products have a high water consumption, in the order of 1,000 – 20,000 l $kg^{-1}$, due to the large amount of water consumed in growing feed[1]. Cereals, pulses, fruits and vegetables have a much lower water consumption[2], but this can still be 100 – 500 l $kg^{-1}$. The volume of water required to support global food production is staggering - in the order of thousands of litres $person^{-1}$ $day^{-1}$. When considering the water consumption of food production, it is important to differentiate between two types of water. 'Green' water is the rainwater used by plants for transpiration, and we can argue that consuming green water has a low opportunity cost. Of more significance is the 'blue' water that is withdrawn from water resources and used mainly for crop irrigation and supporting animal production. Blue water has an opportunity cost, as, if it were not being used for food production, it could be directed to other valuable uses.

In this issue of Nature Food, Heller and colleagues[3], have used the concept of water scarcity footprint (WSF) to compare the potential impact of different diets in the U.S. on local and global water scarcity. By studying the diets of 16,800 individuals they estimated that the blue water consumption of the average U.S. diet was 504 l $person^{-1}$ $day^{-1}$. This is considerably higher than the 170 – 300 l $person^{-1}$ $day^{-1}$ estimated for diets in Europe[4,5] but may be due to differences in the typical diet, especially the amount of red meat consumed as well as the proportion of food and animal feed that is irrigated.

In their study, animal products were found to make the largest contribution (39%) to the total WSF, but vegetables, fruits and nuts (together) accounted for a similar proportion. Whilst this may seem counterintuitive, given the high water consumption of animal products, it is because a large proportion of the animal feed used in the U.S. is rainfed (using only green water), or is produced in less water-scarce regions, whereas the vegetables, fruits and nuts tend to be irrigated and grown in more water-scarce regions.

Individual dietary choices result in very different potential impacts on water scarcity. When ranked, the highest quintile had an average WSF almost five times that of the lowest quintile and the high WSF diets were typified by a higher intake of meat, but also fruits, nuts and seeds – all water intensive products in the U.S. diet. But there was considerable variability within a food group - allowing for substitutions to reduce WSF without a wholesale change in diet. Chicken, for example, had a much lower WSF than beef, and peanuts much lower WSF than almonds.

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Consuming blue water in food production has the potential to deprive others (including the environment) of water. Globally, agriculture accounts for more than two-thirds of all water withdrawals and is the cause of over-exploitation of water resources and environmental damage in many places. This not only threatens the water-dependent ecosystems, but also the resilience of food supply chains. It is well recognised that we cannot continue to produce and consume food, and therefore water, in the way that we have in the past[6].

It is clear that dietary choices can make a huge difference to an individual's impact on global water resources, but there are no simple rules to guide low water-impact diets. Non-dairy milk-alternatives may not have a lower water scarcity footprint than dairy milk - it all depends on how, and where the food was produced. Milk from cows grazed on rainfed pasture will have a lower water scarcity footprint than irrigated almonds grown in a water-scarce basin. Similarly, beef from cattle raised in one country may have a very different WSF from beef from cattle in another, due to the nature of the feed rations. Vegetarian diets do not necessarily have a lower water scarcity footprint than omnivorous diets, and healthy diets, high in fresh fruit and vegetables, may have a greater WSF than a less healthy diet. The challenge for consumers is how to make informed, sustainable dietary choices. Perhaps a good place to start is to reduce over-consumption and waste as all food that is not consumed (or consumed in excess of dietary needs) is a waste of water.

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## Competing interests

The author declares no competing interests.

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