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Virtual water and trade: lightening water footprints

Climate change is a threat to irrigated crops in Australia's semi-arid Murray Darling Basin. © Claire Miller.

KEY POLICY MESSAGES

- **Virtual water** helps to articulate trade-offs among social, economic and environmental objectives.
- **Water footprints** can be a powerful but sometimes misleading communication tool.
- Both show that more sustainable water use demands an integrated approach.

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EATING THE PLANET DRY

'Virtual water', embedded in commodities and raw materials, especially food, is traded within and between nations. The concept paints a compelling picture for environmentally conscious consumers. For policymakers, complex trade-offs must be considered.

Global food demand is expected to double by 2050. Some 70% of the world's fresh water is used to produce food. The challenge is where best to produce food, how best to use water, and how best to inform consumer choices.

Sustainable surface and groundwater use is the ultimate objective, but accounting for environmental costs in the food supply chain is largely missing. Water footprints link what we consume to sustainable water use. Water footprints tell part of the story, although additional social and economic analysis is warranted.

HOW MUCH CROP PER DROP?

Ray et al. describe a 'water footprint' as a measure for how much fresh water is used to grow food or make goods, deliver to consumers, and to handle waste flows.

Footprints typically classify water use as blue, for surface and groundwater used in irrigation; green, for rainwater used before it becomes runoff; and, grey, for describing water with assimilated pollutants. 'Virtual water' is the amount of water of all these colors embedded in food and products.

Farm, growing crops with green (rain) water in Maisse, France. © James E. Nickum.

Blue water: surface & ground waters (by irrigation).

Green water: rain water, including soil and intercepted moisture.

Gray water: fresh water that has assimilated pollutants & meets quality criteria.

Water footprint categories based on consumption.

Water footprints can be useful in showing where extraction is greater than recharge. Álvarez highlights that globally, green water accounts for 86.5 per cent of crop water use. The green footprint is smaller in arid and semi-arid regions with more reliance on blue water for irrigation.

Irrigation to grow fresh fruit and vegetables for distant markets is increasing worldwide. The practice boosts yields and returns to growers, diversifies food choices in developed countries, and meets quality standards demanded by retailers. Yet expanding irrigation also increases blue water consumption and the global water footprint.

NO ONE SIZE FITS ALL FOOD

The concepts of water footprints and virtual water have potential to reveal the true cost of water use to consumers. In agriculture, they can reinforce practices and crop choices that are attuned to local water limits.

Yet, beneath their superficial simplicity, calculations of these concepts are fraught with complexity. The 'global' average water footprint of a kilogram of beef conceals whether cattle graze free-range on rainfed pastures or are fed in yards with irrigated grain (Ray et al.). Different production systems have very different water efficiency and sustainability profiles.

Water footprints and virtual water have potential to reveal the true cost of water.

WASTE NOT, AND SAVE WATER

Most consumers choose foods based on price, taste and quality, but some are also starting to consider inherent environmental costs (Vanham).

For these people, clearly stated water footprints can inform choices between products with varying water footprints, or prompt greater awareness of how much water is actually used in producing their meals. Vanham argues consumers are more likely to understand litres of water use because they deal with this measure every day, unlike concepts such as carbon or nitrogen footprints.

Several studies have shown that plant-based diets overall are healthier and have smaller water footprints than diets including animal products. But Mekonnen and Fulton point to research indicating it is just as important to reduce food loss and waste, as this would save twice as much water as going vegetarian or vegan.

To achieve a healthier population and improve environmental or eco-systems benefits means transforming how we think of water use and waste when producing. As such, Ray et al. suggest water footprint labels may join other labels that seek to improve environmental sustainability, such as those certifying palm oil and soy to reduce rainforest deforestation, or sustainable seafood to protect marine life.

PROFIT NOW, PAY LATER

Irrigation is vitally important for food supplies, trade and the economic viability of farm communities. The question is whether short-term gain outweighs long-term sustainability. The Ogallala Aquifer underlying the United States' Midwest is a case in point. Inconsistent and inadequate regulations and perverse production incentives are depleting the aquifer faster than replenishment. The price of most food does not factor in the use of water (and other natural capital) in producing food. Low food prices hide unsustainable production practices from consumers (Ray et al.).

The issue has geopolitical and ethical ramifications. Wealthier economies import food from water-stressed regions. Consumers benefit from broader food choices and out-of-season produce, but are unaware of the offshore cost of water depletion (Hess and Sutcliffe).

Drought and water reform in Australia's semi-arid Murray-Darling Basin are driving dairy farmers to replace intensively irrigated pastures with more water-efficient fodder crops to feed their cows. © Claire Miller.

Reducing blue and grey water footprints is desirable but complicated when trade in virtual water involves social, economic and cultural trade-offs, such as to countries with high meat consumption. Wichelns notes that jobs and income from food exports can also benefit disadvantaged communities.

The solution lies in more water-efficient technology, along with transparent policies to achieve sustainable water use. Better data and analytics are essential. Dietary preferences will also need to shift. Managing aquifers and food supply chains demand an integrated approach.

WATER IS NOT THE ONLY INDICATOR

Water footprint and virtual water measures have limitations. These must be well understood if the concepts become widely used to inform policy and marketplace practices. Footprints are a simple ratio of water used per unit, but water is not the only input to consider. Other important information includes access to arable land, energy, skilled labour and other inputs. All variables play a role in determining optimal strategies (Wichelns).

Virtual water is only one piece of the policy puzzle.

Cutting food waste reduce water footprints. The University of Hong Kong. © JC-WISE.

Footprints value water used in agriculture by its availability. Hence, water-intensive food and fibre would be imported into arid regions, to reduce the pressure on their own scarce water resources. Similarly, people would be encouraged to eat less meat, assuming more water will then be used for more plant crops.

However, such policy prescriptions overlook the impacts of such changes on food prices, farm incomes, or cultural and religious food practices.

IT'S NOT JUST ABOUT LOCATION

Relocating crops based on water footprints is risky. Wichelns describes how each of Morocco's eight river basins produce a diverse mix of food and fibre crops, providing an economic buffer as prices in one or other commodity rise and fall. Deciding what to grow based on water footprints alone would turn four of these basins into monocultures, leaving farm households devastated if the crop or its market failed.

Virtual water is only one piece of the policy puzzle. Proposed water, agricultural and trade policies must also take account of agronomy, hydrology, climate change, technology, human capital, input and output markets, culture, and the likely livelihood impacts.

POLICY IMPLICATIONS

Global trade and agricultural subsidies

Subsidies may be well-intentioned but hide the true cost of water and encourage unsustainable agricultural practices. Charging the full environmental cost of water use is controversial. Politicians, citizens and the agri-food sector need to confront the trade-offs associated with subsidies.

Not all subsidies are bad but they may have unintended consequences. For instance, subsidised fertilizer in India has helped poor farmers, but subsidised power to pump water has led to depleted aquifers. Policymakers need transparency to clearly understand the causes and effects of their decisions.

Supply chain risk and resilience

Global processors and retailers depend on resilient production systems to supply ingredients and foods. Supply reliability is put at risk from climate change and extreme weather; put simply, water-stressed growing regions are more vulnerable to drought.

Many food companies are focusing more on working with their supply chains to secure ingredient supply and are supporting producers who adopt sustainable practices. Reputations are at stake.

Consumers, health and trust

Demands for sustainable food production are becoming more pronounced, particularly in wealthier countries. Water use and sustainability are attracting more and more interest. This creates new collaborative opportunities. Farmers, processors, retailers and regulators, among others, must decide on the best water policies to maintain trust in the food supply chain and enhance food production resilience. The pandemic of 2020 and associated lockdowns create increased urgency in addressing these issues.

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Authors: Chittaranjan Ray & Matthew Sanderson.
IWRA Policy Brief Editors: Claire Miller and James E. Nickum
Layout: Nathalie Lyon-Caen