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PAPER

Imported water risk: the case of the UK

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Abstract

While the water dependency of water-scarce nations is well understood, this is not the case for countries in temperate and humid climates, even though various studies have shown that many of such countries strongly rely on the import of water-intensive commodities from elsewhere. In this study we introduce a method to evaluate the sustainability and efficiency of the external water footprint (WF) of a country, with the UK as an example. We trace, quantify and map the UK's direct and indirect water needs and assess the 'imported water risk' by evaluating the sustainability of the water consumption in the source regions. In addition, we assess the efficiency of the water consumption in source areas in order to identify the room for water savings. We find that half of the UK's global blue WF—the direct and indirect consumption of ground- and surface water resources behind all commodities consumed in the UK—is located in places where the blue WF exceeds the maximum sustainable blue WF. About 55% of the unsustainable part of the UK's blue WF is located in six countries: Spain (14%), USA (11%), Pakistan (10%), India (7%), Iran (6%), and South Africa (6%). Our analysis further shows that about half of the global consumptive WF of the UK's direct and indirect crop consumption is inefficient, which means that consumptive WFs exceed specified WF benchmark levels. About 37% of the inefficient part of the UK's consumptive WF is located in six countries: Indonesia (7%), Ghana (7%), India (7%), Brazil (6%), Spain (5%), and Argentina (5%). In some source countries, like Pakistan, Iran, Spain, USA and Egypt, unsustainable and inefficient blue water consumption coincide. We find that, by lowering overall consumptive WFs to benchmark levels, the global blue WF of UK crop consumption could be reduced by 19%. We discuss four strategies to mitigate imported water risk: become more self-sufficient in food; diversify the import of water-intensive commodities, favouring the sourcing from water-abundant regions; reconsider the import of water-intensive commodities from the regions that are most severely water stressed altogether; and collaborate internationally with source countries with unsustainable water use where opportunities exist to increase water productivity.

1. Introduction

Since the beginning of this century there is a growing awareness that freshwater is a global resource, even though freshwater is still mostly considered and managed as a local resource (Hoekstra 2011, Vörösmarty *et al* 2015). This is very different from oil, which is broadly perceived as a resource of strategic international importance. The degree of dependence on oil imports is generally an area of governmental concern. In the case of freshwater, however, dependence on external water resources is still under the radar for most governments. Many countries though are heavily reliant on the import of water-intensive commodities from elsewhere. Dalin *et al* (2012) and Carr *et al* (2012) estimate that between 1986 and 2007 the number of trade connections and the volume of water associated with global food trade more than doubled. Similarly, Clark *et al* (2015) find a global trend towards an increased dependence on foreign water resources between 1965 and 2010. Suweis *et al* (2013) show that international water dependencies as they exist cannot be assumed to continue into the future given growing water scarcity (WS) in the countries currently using substantial volumes of water for producing export products.

As first shown by Hoekstra and Hung (2002), the water footprint (WF) of human consumption within a country consists of an internal WF, referring to the water use within the country itself for making products that are consumed domestically, and an external WF, referring to the WF in other countries for making products imported by and consumed within the country considered. Thus, trade in water-intensive commodities like crops results into so-called virtual water (VW) flows between exporting and importing regions (Hoekstra 2003). Various global assessments of the WFs of nations and international VW flows have been published: Hoekstra and Hung (2002), Hoekstra and Chapagain (2007b, 2008), Fader *et al* (2011), Mekonnen and Hoekstra (2011b), Hoekstra and Mekonnen (2012) and Chen and Chen (2013). These studies show that all countries have partly externalised their WF, albeit to different extents. According to Hoekstra and Mekonnen (2012), European countries like Italy, Germany, the United Kingdom, and the Netherlands have external WFs contributing 60%–95% to their total consumption-related WF, while the external WFs of countries like Chad, Ethiopia, India, Niger, DR Congo, Mali, Argentina, and Sudan are smaller than 4% of their total footprint.

In this paper we aim to show that dependence on external water resources can constitute a substantial risk for a national economy and should therefore be a reason for governmental concern as well. The risk of external water dependence is known for highly water-scarce countries, like those in the Middle East and North Africa (Allan 2001, Fader *et al* 2013), but has gone unnoticed so far in more water-abundant regions. We take the UK as a case to trace, quantify and map the direct and indirect water needs of a population and consequently assess the 'imported water risk' by evaluating the sustainability of the water consumption in the source areas. Next, we assess the efficiency of the water consumption in the source areas in order to identify the room for water savings in crop production. Efficiency is measured by comparing the actual WFs of crops to certain specified benchmark levels. Potential water savings are calculated by considering the reduced water consumption if the WFs in crop production in the source regions of the UK's food were lowered to the benchmark levels.

The analysis undertaken in this study goes considerably beyond earlier studies. Regarding the first step of the research, quantifying, tracing and mapping a country's direct and indirect water needs, there are several previous national WF studies analysing national VW trade and the external WF of national consumption, but these studies identified source countries only, without further tracing within the source countries—see for example Hoekstra and Chapagain (2007a) and Van Oel *et al* (2009) for the Netherlands, Chapagain and Orr (2008) for the UK, Schyns and Hoekstra (2014) for Morocco and Dalin *et al* (2014) for China—or did quantify VW imports but not specifically traced the source countries of imported water-intensive products at all—e.g. Ma *et al* (2006), Liu *et al* (2007) and Dalin *et al* (2014) for China, Bulsink *et al* (2010) for Indonesia, Yu *et al* (2010) for the UK and Aldaya *et al* (2010) for Spain. Tracing the origin of products is relevant if it comes to assessing the sustainability and efficiency of water use at the place of origin, because WS and water management practices can widely vary within countries. A few studies mapped the external WF of a country's national consumption at a high resolution of 5 × 5 arc minute, but the method to trace down the source regions of imported products was rather crude, based on tracing imported food back to the main agricultural areas rather than tracing crop by crop—see Hoekstra and Mekonnen (2012) for the US, Ercin *et al* (2013) for France, Mekonnen and Hoekstra (2014a) for Kenya, and Pahlow *et al* (2015) for South Africa. The current work considers the origin of production crop by crop. Regarding the second step of the research, assessing the sustainability and efficiency of the water consumption in the source areas, this is the first time this is done altogether.

2. Method

We follow the definitions of WF and WS as in the Global Water Footprint Standard developed by the Water Footprint Network (Hoekstra *et al* 2011). The WF, as a multi-dimensional measure of direct and indirect freshwater use, enables to analyse the link between human consumption and the appropriation of water. The consumptive WF of producing a crop includes a green and blue component, referring to consumption of rainfall and irrigation water, respectively, thus enabling the broadening of perspective on water resources use as proposed by Falkenmark and Rockström (2004). The consumptive WF is distinguished from the degradative WF, the so-called grey WF, which represents the volume of water required to assimilate pollutants entering freshwater bodies. In the current study we focus on the consumptive WF, distinguishing between the green and blue component.

As a starting point we took the consumptive WF of UK consumption as was estimated by Hoekstra and Mekonnen (2012), with which we got a matrix showing the WF of UK consumption per consumption category specified by country of origin and in terms of blue and green components, in the form of an average for the period 1996–2005. This work has been based on data on food consumption from FAOSTAT (FAO 2015) and international trade in agricultural and industrial products from the Statistics for International Trade Analysis from the International Trade Centre (ITC 2007). For agricultural goods, consumption and imports are specified per crop and animal product, measured in terms of kilogram per year. Industrial goods form one category as a whole, with consumption and imports measured in monetary units. In the current study we traced the origin of products down to a 5 × 5 arc minute grid level and mapped the related water consumption at that level. For imported crops and crop products, we traced the origin based on the production pattern per crop per country. We mapped the WF per crop per origin country, based on the ratio of the WF of the imported crop to the total WF of the crop production in the origin country. Per origin country, we multiplied this ratio with the 5 × 5 arc minute resolution map of the WF of the crop under consideration in the origin country obtained from Mekonnen and Hoekstra (2011a). The WFs of crop production were estimated by simulating the daily soil water balance and evapotranspiration of green and blue water over the growing season, thereby specifying the WFs by colour and in time (Mekonnen and Hoekstra 2011a). We also traced the origin of feed eaten by animals raised in the UK by accounting for feed crop imports while we traced the origin of the feed behind the live animals and animal products imported to the UK by assuming that those animals are fed with local crops in the origin countries and by tracing where those feed crops are produced in the origin countries. For imported live animals and animal products, we mapped the feed-related WF of these animals and products, per origin country, based on the ratio of the WF of the imported live animals and animal products to the total WF of agricultural production in the origin country. Per origin country, we multiplied this ratio with the 5 × 5 arc minute resolution map of the WF of agriculture in the origin country obtained from Mekonnen and Hoekstra (2011a). For imported industrial products, similarly, we mapped the WF of these products, per origin country, based on the ratio of the WF of the imported industrial products to the total WF of industrial production. Per origin country, we multiplied this ratio with the 5 × 5 arc minute resolution map of the WF of industry in the origin country as from Hoekstra and Mekonnen (2012). The WF related to the UK's domestic water supply at 5 × 5 arc minute resolution was obtained from Hoekstra and Mekonnen (2012).

We estimate where the UK's global blue WF is sustainable and where unsustainable by checking for each grid cell with a UK-consumption related blue WF what is the blue WS level in that grid cell. We characterize the UK's blue WF in a particular grid cell as 'unsustainable' when the annual average monthly blue WS in that grid cell exceeds 1 (because in such case environmental flow requirements are not fulfilled). We computed the annual average monthly blue WS in the world at 30 × 30 arc minute resolution level, using data of Hoekstra and Mekonnen (2012) for the ten-year period 1996–2005 (Mekonnen and Hoekstra 2016), and downscaled these data to 5 × 5 arc minute resolution. Monthly blue WS is here defined as the ratio of the total blue WF in a grid cell in a certain month to the maximum sustainable blue WF in that grid cell in that month (Hoekstra *et al* 2011, Hoekstra *et al* 2012). The maximum sustainable blue WF in a grid cell represents blue water availability and is calculated as the sum of the runoff generated within the grid cell plus the runoff generated in all upstream grid cells minus the environmental flow requirement and minus the blue WF in upstream grid cells. Monthly environmental flow requirements were assumed at 80% of monthly natural runoff, following Richter *et al* (2012). Annual average monthly blue WS per grid cell was estimated by averaging the monthly scarcity values. Blue WS is called 'low' when in a grid cell $WS < 1$, 'moderate' when $1 \leqslant WS \leqslant 1.5$, significant when $1.5 < WS \leqslant 2$ and 'severe' when $WS > 2$.

We estimate the fraction of the consumptive WF of the UK's direct and indirect crop consumption (including both food and feed crops) that is efficient by quantifying, per grid cell, the percentage of the WF of UK consumption that meets crop-specific WF benchmark levels. Per crop, we take as a benchmark level the WF (in $m^3\ ton^{-1}$) below which 25% of global production takes place, taking the values from Mekonnen and Hoekstra (2014b). These benchmark levels are reasonably achievable under all climates, as analysed by Mekonnen and Hoekstra (2014b). Yields are rather sensitive to climate, but WFs of crops per unit of weight are much less sensitive to climate, as shown in Mekonnen and Hoekstra (2011a). We characterize the WF related to production of crops for UK consumption within a grid cell as 'efficient' when at least half of that WF is *below* benchmark levels, and 'inefficient' when that is not the case. We calculate potential water savings per grid cell, both the green and blue water savings, by considering the reduced consumptive WF when we reduce those WFs that are beyond benchmark levels down to the benchmark level. We assume that the green–blue ratio in the water saving, per crop and per grid cell, is proportional to the green-blue ratio in the current WF of that crop in the grid cell.

3. Results

3.1. Sustainability of the UK's global WF

We find that 49% of the UK's global blue WF is located in places where the blue WF exceeds the maximum sustainable blue WF (figure 1). About 55% of the unsustainable part of the UK's blue WF is located in six countries: Spain (14%), USA (11%), Pakistan (10%), India (7%), Iran (6%), and South Africa (6%). Next on this list come France, Israel and Egypt. These countries can be considered as the hotspots of concern from the UK consumer perspective, because the UK's economy significantly relies on the water resources in these countries while the water consumption in the specific

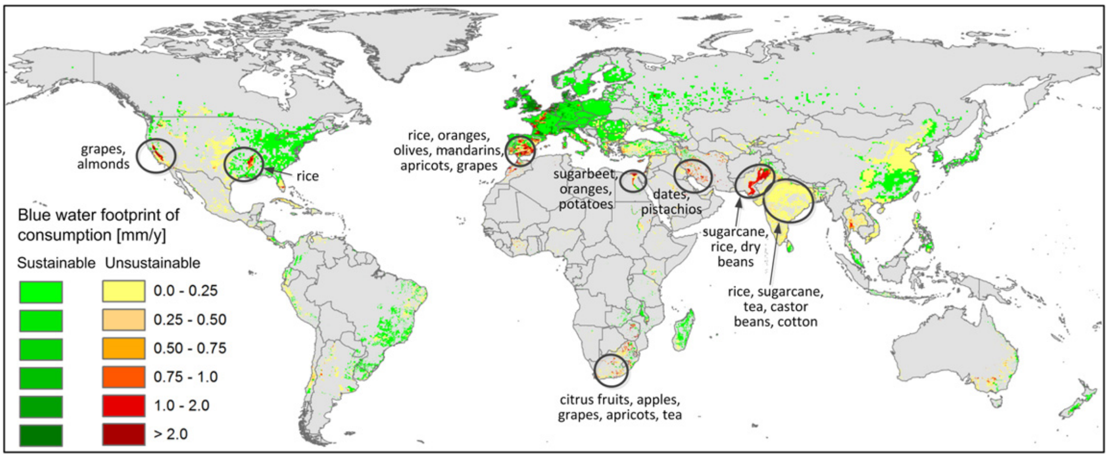

Figure 1. The sustainable (green) and unsustainable (yellow to red) parts of the global blue water footprint of overall UK consumption, with an indication of critical products that significantly contribute to the UK's water footprint in some hotspot areas.

regions within those countries where export products for the UK are produced is not sustainable.

In each hotspot we can identify specific products that most significantly contribute to the unsustainable water use. In Spain these products include rice (responsible for 15% of the UK's unsustainable blue WF in the country), oranges (13%), olives (12%), mandarins (8%), apricots (8%) and grapes (5%). The biggest water problems occur in the southern part of the country, in the Guadiana and Guadalquivir river basins (Cazcarro *et al* 2015). In the USA, the critical products are rice (26%), grapes (13%), almonds (10%) and industrial products (10%). Almonds are mainly grown in California, and rank highest on the list of large water consumers in that state, after feed crops and before residential areas (Fulton *et al* 2012). While California, together with Spain the world's most important almond producer, suffers great WS, consumption of almonds in the UK is on the rise, thus indirectly contributing to the worsening of the WS in the source regions. This increasingly results in a public debate about the link between consumption and WS (Buchanan *et al* 2015, Westervelt 2015). In Pakistan, the critical products are sugarcane (responsible for 65% of the UK's unsustainable blue WF in the country), rice (24%) and dry beans (6%). Both sugarcane and rice production are main contributors to water stress in the Indus basin, with 212 million people facing severe WS during eight months a year (Hoekstra *et al* 2012) and widespread groundwater depletion (Qureshi *et al* 2010, Karimi *et al* 2013). In India, the critical products are rice (25%), sugarcane (18%), tea (14%), castor beans (8%), cotton products (6%), groundnuts (5%), rubber (4%) and industrial products (9%). In Iran there are just two critical products: dates (63%) and pistachios (33%). The country uses very substantial amounts of its highly scarce water resources in its southern provinces for producing these products for export (Arabi *et al* 2012). The critical products in South Africa are citrus fruits (oranges, tangerines, mandarins), apples, grapes, apricots, tea, sugarcane and avocados. In France the critical products are maize, animal products and industrial products, which is problematic for instance in the basins of the Loire, Seine, Garonne and Scheldt, which all experience moderate to severe WS at least one month a year (Ercin *et al* 2013). The critical products in Israel, still from the UK import perspective, are papayas, citrus fruits, dates, cherries and potatoes. Water consumption in Israel is contentious given the disputes over freshwater the country has with its neighbours, including Jordan and the Palestinians. In Egypt the critical products are sugar beet, oranges, potatoes, sugarcane and rice, with the major problems in the Nile Delta.

3.2. Efficiency of the UK's global WF and potential water savings

In estimating the efficiency of the UK's global WF we focus on the footprint related to direct and indirect crop consumption. The indirect crop consumption includes the feed crops behind animal products consumed in the UK. Our analysis shows that 50% of the global consumptive WF of the UK's direct and indirect crop consumption is inefficient, which means that the consumptive WF exceeds the WF benchmark level (figure 2). About 37% of the inefficient part of the UK's consumptive WF is located in six countries: Indonesia (7%), Ghana (7%), India (7%), Brazil (6%), Spain (5%), and Argentina (5%).

The global consumptive WF of the UK's direct and indirect crop consumption can be reduced by 17% if the WF of imported food products at the places of production is lowered to benchmark levels. About 90% of the resultant water saving is green water, while the remainder is blue water. About 28% of the reduction in the UK's consumptive WF is located in just three countries (Indonesia, Ghana, India); another 20% of

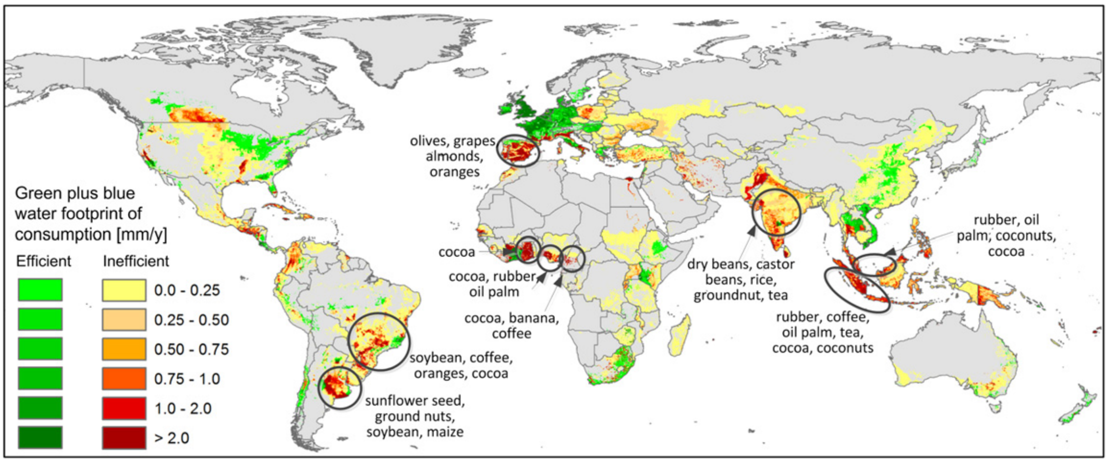

Figure 2. The efficient (green) and inefficient (yellow to red) parts of the global consumptive water footprint of the UK's direct and indirect crop consumption, with an indication of crops for which water productivity can be substantially increased and through which water footprints can thus be reduced.

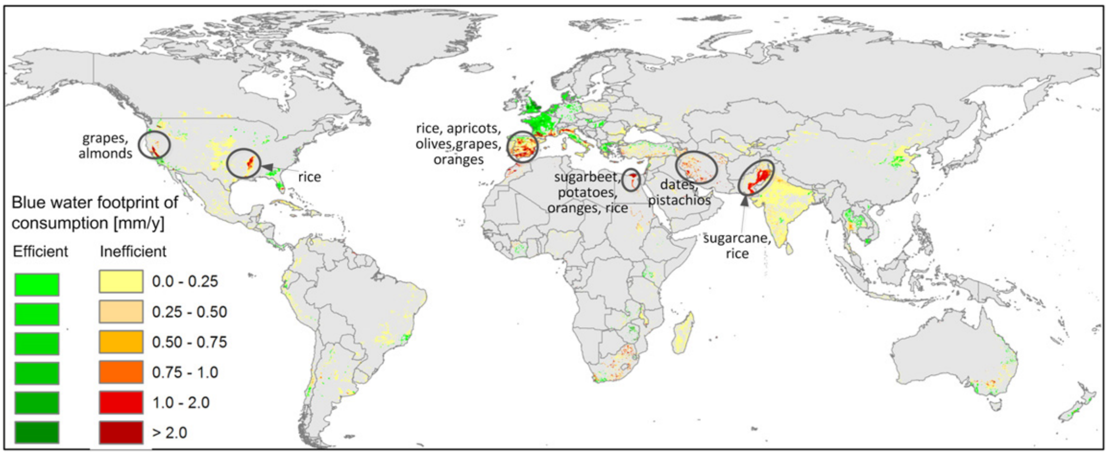

Figure 3. The efficient (green) and inefficient (yellow to red) parts of the global blue water footprint of the UK's direct and indirect crop consumption, with an indication of crops for which water productivity can be substantially increased and through which blue water footprints can thus be reduced.

the reduction is located in yet five other countries (Spain, Brazil, Nigeria, Malaysia, Cameroon). Per country, the analysis shows which crops are produced relatively inefficient (with WFs beyond the benchmark), so that we also know which crops are most promising in terms of water saving potential. In Indonesia, the greatest green water saving potential, insofar relevant for UK consumer products, is in the cultivation of rubber, coffee, tea and palm oil, while the largest blue water saving potential is in the case of pepper and sugarcane. In Ghana, the most important potential green water saving, again insofar relevant for UK consumer products, is in cocoa production, while the largest potential blue water saving is in sweet potatoes. In India, the largest green water savings in relation to products exported to the UK can be achieved for dry beans, groundnuts, rice, cotton, pepper and walnuts, and the largest blue water savings in the growth of rice, sugarcane, cotton and groundnuts.

The blue WF of the UK's direct and indirect crop consumption is shown in figure 3, showing where the WF is efficient and inefficient (relative to crop WF benchmarks). We find that, by lowering overall consumptive WFs to benchmark levels, the global blue WF of UK crop consumption could be reduced by 19%. About 62% of the reduction in the UK's blue WF is located in five countries (Pakistan, Iran, Spain, USA and Egypt), in all of which UK has a substantial unsustainable blue WF. This is a very important finding, because it implies that most blue water saving potential is in five of the countries that were identified as hotspots from the UK consumption perspective (figure 1). The largest impact can be achieved in Pakistan, through increasing the water productivity in sugarcane and rice. Next biggest blue water saving can be obtained in Iran, mainly by improving dates and pistachios cultivation. The potential blue water saving in Spain in relation to crops exported to the UK is mostly in the cultivation of rice, apricots, olives, grapes and oranges. In the USA, the relevant crops are rice, grapes, almonds, apricots and apples, and in Egypt these are sugar beets, potatoes, oranges, sugarcane, rice, and cotton.

4. Discussion

This is the first study to trace and map the global WF of a national population at such high level of detail, crop by crop and at high spatial resolution level. The data we present are rough estimates, given the uncertainties in the underlying trade data and the assumptions we made. We traced the origin of imported crops based on the production pattern per crop per country, assuming proportionality between production for export and production for domestic consumption per grid cell. In reality it may be the case that the UK sources a crop from a specific region within a country that is specialised on producing for export to the UK, while other production regions within the country produce for local markets or for export to other countries. Such information, however, is not available, so that our assumption is reasonable for a first global assessment. We have identified hotspots and critical products per hotspot that deserve further study. Relevant questions are for instance: which major companies are involved in the trade, are the supply chains sufficiently transparent to establish the precise source areas or even farms of the products exported to the UK, and what is currently done and what stakeholders are involved in addressing local sustainability and efficiency of water use?

Our estimated potential water savings in the source areas of the UK's consumer goods are rough estimates as well. We assume that reducing WFs down to benchmark levels will generally be largely achieved through increases in yields, and to a much smaller extent through reduction in evapotranspiration (Mekonnen and Hoekstra 2011a, Chukalla *et al* 2015). Yield increases and accompanied water productivity increases can be substantial in many parts of the world (Foley *et al* 2011, Brauman *et al* 2013). With yield increases, green and blue WFs will be reduced proportionally to their original size, hence our assumption that the green–blue ratio remains the same when reducing WF down to benchmark levels. If WFs are reduced through reduction in evapotranspiration (e.g. by reducing soil water evaporation of irrigation water), our approach becomes questionable. In that case—by assuming that green and blue water are equally saved (proportionally)—we make a *conservative* estimate of blue water saving.

In a global study, Mekonnen and Hoekstra (2014b) found that if we would reduce the consumptive WF of crop production everywhere in the world to the level of the best 25th percentile of current global production, global water saving in crop production would be 39% compared to the reference water consumption. The 39% is thus a global reference for the potential saving by moving down to benchmark levels. The potential water saving of 17% that we found for UK consumption is relatively small compared to this global number, which relates to the fact that—as an average over all crop and animal products consumed by UK citizens—the WF per unit of the food consumed in the UK is relatively low compared to the global average, with relatively less potential for saving.

The choice in the current study to evaluate water use efficiency per crop based on the WF benchmarks set by the best 25% of global production is subject to debate. It may be argued that it would be better to use different benchmark levels for different types of climate. According to Zwart *et al* (2010), highest levels of water productivity (smallest WFs per kg of crop) are to be expected in temperate climates with high precipitation. However, Mekonnen and Hoekstra (2014b) argue that, although climatic factors are important in determining evapotranspiration from crop fields and yields, the consumptive WF of crops in m^3 ton^{-1} is largely determined by agricultural management rather than by the climate under which the crop is grown. A large increase in crop yields, without an increase or even with a decrease in water use, is achievable for most crops across the different climate regions of the world through proper nutrient, water and soil management (Mueller *et al* 2012). Mekonnen and Hoekstra (2014b) show that even water productivities set by the best 10th percentile of global crop production can be achieved irrespective of climate. Therefore, using the WF benchmarks set by the best 25th percentile of global production is realistic, but indeed efforts to achieve these levels will vary from region to region. WFs in m^3 ton^{-1} can be reduced by reducing evapotranspiration (for example through better irrigation techniques, a deficit irrigation strategy, and mulching), increasing yields (e.g. through better nutrient and soil management and pest control), or a combination of both (Chukalla *et al* 2015).

5. Conclusion

'Imported water risk' to a national economy as we have illustrated for the UK is what 'supply-chain water risk' is for businesses. While the latter type of risk is receiving an increasing amount of attention recently (Sarni 2011, Larson *et al* 2012), the imported water risk for national economies as a whole is not appropriately appreciated by most national governments. Our study shows that half of the WF of the UK's consumption is located in places where water use is not sustainable. This implies the risk that exports from these regions in the future will decline or become impossible altogether. Imported water risks as we have shown for the UK are likely to increase, due to increasing water demands in the source regions that will result from growing populations and changing consumption patterns (Ercin and Hoekstra 2014), while climate change may affect water supply in the source regions (Orlowsky *et al* 2014). Importing goods that are produced with water in locations where water is being overexploited (with WFs exceeding maximum sustainable levels) bears a risk. Where WFs are unnecessarily large (with WFs per unit of production exceeding benchmark levels), there is potential for water saving and reduction of WS.

There are basically four risk mitigation strategies that national governments may pursue: (1) move to a greater degree of food self-sufficiency; (2) diversify the import of water-intensive commodities, preferably targeting water-abundant countries; (3) reduce the reliance on import of water-intensive commodities from regions where water use is unsustainable and where little opportunities exist to improve that; and (4) collaborate internationally with source countries with unsustainable water use where opportunities exist to increase water productivity and thus reduce WFs.

With respect to the first strategy—greater food self-sufficiency—the results of the current study can feed into the on-going discussion within the UK on how to increase food security, against the trend in the past few decades of increasing food imports and decreasing self-sufficiency (DEFRA 2008, 2009a, 2009b, Hubbard and Hubbard 2013). Crop production in the UK is relatively efficient and sustainable from a water resources perspective, so that increasing food self-sufficiency seems feasible. Food self-sufficiency could further be increased by reducing the consumption of meat and dairy and by reducing food waste, thus reducing the land, water and carbon footprints of the UK's consumption (Chapagain and James 2011, Foley *et al* 2011, Kummu *et al* 2012, Vanham *et al* 2013, West *et al* 2014).

The second strategy—diversifying imports—is against another historical trend, the specialisation of regions in single crops that supply a large share of the world market. For instance, in the period 2001–2012, 44% of the dates imported by the UK came from Iran, 28% of the imported oranges came from Spain and 22% from South Africa, 64% of the imported almonds came from the USA (mainly California), and 71% of the imported soybean came from Brazil (FAO 2015).

The third strategy requires a reconsideration of import of water-intensive commodities from the regions that are most severely water stressed. One may wonder whether it is wise to import crops like sugar cane from the scarce Indus basin in Pakistan or sugar beets and potatoes from the highly water-scarce Nile Delta in Egypt. These questions become even more pressing given the fact that the UK can produce sugar and potatoes perfectly well within its own territory.

The fourth strategy is international collaboration on sustainable water use. Since the export of a crop from a country to specifically the UK is always relatively small, given that the largest fraction of crops is generally for the domestic market or export to other countries, one cannot expect that improving the production of only those crops that are actually exported to the UK will make a big impact in the source areas as a whole. We identified five highly water-scarce countries where the UK economy significantly relies on but which have relatively great blue water saving potentials. If UK wants to secure its supplies from these countries, it does not help if it focuses only on increasing water productivity at the farms from which it sources most of its imports. What is really needed is overall sustainable water use in the source regions of its most important water-intensive import products. Therefore, the UK government could aim to work with other countries on internationally shared targets on sustainable water use. The Sustainable Development Goals (SDGs) of the United Nations offer a good starting point for intensified international collaboration on sustainable and efficient water use. The fourth target of the SDG on water is to 'substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address WS and substantially reduce the number of people suffering from WS'. This is a rather vague target and requires operationalization in quantitative terms per country, but at least offers a good basis for further cooperation and more specific target setting.

The first three strategies mentioned above require flexibility in directly or indirectly influencing international trade flows. International free trade agreements that will reduce this flexibility or make it impossible altogether to implement measures that discourage certain unsustainable trade flows and/or favour sustainable trade flows will reduce the UK's potential to mitigate its imported water risk.

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