water footprint implementation

fair & smart use of the world's freshwater

General information water footprint concept

The 'water footprint' measures the consumption of freshwater resources for producing goods and services. The water footprint shows water consumption and is different from water withdrawal. Water withdrawal is the amount of water taken from a source, while water consumption is the amount of that water that is used up and not returned to the source. Therefore, that amount of water is not available for other users. It is an indicator that shows the volume of freshwater consumed and polluted to produce a product, measured over the entire supply chain.

Green WF

The green water footprint refers to the direct consumption of rainwater and is relevant for agriculture, forestry, and horticulture. The green water footprint measures the amount of rainwater that is not available for nature because the area is allocated to human use. The green water footprint indicates dependence on precipitation, thus vulnerability to drought conditions.

Blue WF

The blue water footprint refers to the consumption of surface and groundwater and is relevant for domestic, industrial, and agricultural use. It indicates a dependency on rivers, lakes, or aquifers and shows vulnerability to water scarcity and contribution to pressure on water resources.

Grey WF

The grey water footprint refers to pollution and defines the volume of freshwater required to assimilate a load of pollutants to reach ambient water quality. In other words, if a pollutant enters a freshwater body, accidentally discharged on purpose, the grey water footprint indicates how much freshwater is necessary to neutralize the pollutant load.

Together, these components provide a comprehensive picture of water use by source either as rainfall/soil moisture directly absorbed by the plants (green water), surface/ground water abstracted for irrigation/industrial or domestic purpose (blue water), or the volume of fresh water required for assimilation of pollutants (grey water). A water footprint is also defined by a geographical and temporal element, meaning it specifies where and at which time of the year and for what period it is measured. It is expressed as volume per day, month, year, or average for a reference period, but also as volume per unit of product.

General comments products

Generally, animal products have large water footprints because the animals require feed which is an agricultural product and requires water to grow. This feed is often grown in regions outside of the animal grazing/keeping grounds. Indicating there is an impact on other water systems outside the grazing/keeping grounds.

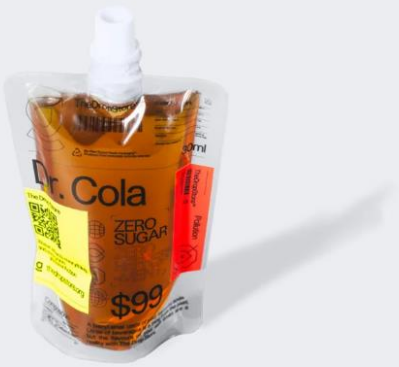
Second, the water footprint value only shows the quantity of water consumed, it does not show the context/impact of the water footprint. The impact of the water footprint depends on where and when the water is consumed. A certain amount consumed might not have a negative impact in a region during the wet season, but the same amount might have a negative impact during the dry season. Similarly, an amount of water consumed at a specific location might not have a negative impact, but the same amount might have a negative impact at a different location.

The grey water footprint for all products is underestimated. The grey water footprint is related to the water pollution attributed to a product. Water pollution can consist of many different harmful components and is a complicated concept to understand and calculate. Therefore, the calculation of the grey water footprint is often simplified leading to an underestimation. The simplification is applied to most of the products presented in this document.

Soda (cola 0.5 liter)

The production of a 0.5 liter bottle of soda/cola costs 35.6 liters of water, including the manufacturing of the plastic bottle. The majority of this water footprint, 78%, can be attributed to sugar beet cultivation. Almost one-fifth of the water footprint is due to the manufacturing of plastic bottles and 1% is the result of water during processing[1]. Whether or not the production of sugar beets adds to local water scarcity issues depends on the production location and the water sources used to produce the sugar beet.

Sugar beet is often a rainfed crop. The crop depends on green water/rainwater for its production. Rainfed crops do not necessarily add to local water scarcity directly. However, it does mean that the production is vulnerable to droughts. In addition, locations with high-intensity rainfed sugar beet production lead to biodiversity reduction in the area because the agricultural land and rainwater are not available to nature anymore. There are locations where sugar beet is irrigated. This irrigation adds to the blue water footprint. If the irrigation occurs in a water-scarce area and/or during a water-scarce period of the year, the sugar beet cultivation adds to local water scarcity issues.

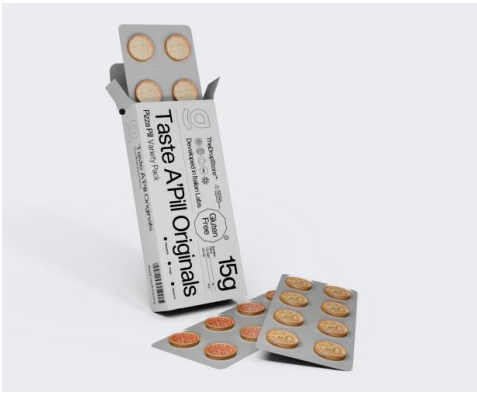


Water used per 0.5L of Cola	
TOTAL WATER USED	36L
RAINWATER	16L
SURFACE AND GROUNDWATER	9L
WATER POLLUTION	11L
SODA (SUGAR BEET)	80%
PROCESS	1%
SOURCE	WWF & Coca-Cola (2011)

[1] https://waterfootprint.org/media/downloads/CocaCola-2011-WaterFootprintSustainabilityAssessment_1.pdf

Pizza

The total water footprint of a pizza margarita (725 grams) with its complete supply chain in Italy is 1,259 liters. The green, blue, and grey water footprint contribute 76%, 14%, and 10% to the total water footprint. The water footprint of mozzarella has the largest share in the water footprint of 70%. Wheat and wheat flour accounts for 24%, and tomato puree for 6% of the total water footprint. The impact of the water footprint of an Italian pizza is concentrated in the first step of the supply chain of tomato puree and mozzarella. The impact of the water footprint related to mozzarella depends, like for all animal-related products, depends on the production of feed ingredients for the dairy cow[2]. So, mozzarella production could have an impact on water scarcity depending on the feed composition and location of cultivation. The water footprint impact of tomato production could have an impact in case it is cultivated in water-scarce areas.



Water used per Pizza Margarita (725Gr)	
TOTAL WATER USED	1259L
RAINWATER	957L
SURFACE AND GROUNDWATER	176L
WATER POLLUTION	126L
WHEAT, FLOUR	24%
TOMATO PURREE	6%
MOZZARELLA	70%
SOURCE	Aldaya & Hoekstra (2010)

Cheese

The global average water footprint of cheese is 3,178 liters per kilogram. The green, blue, and grey water footprint contribute 85%, 8%, and 7% to the total water footprint[3]. The presented value is the water footprint for cheese based on cow milk. Therefore, the distribution of the water footprint over the supply chain and the impact of the water footprint is similar to that of beef. The water footprint related to animal feed takes by far the largest share in the total water footprint of cheese. One piece of cheese can be very different from another piece. The precise water footprint of cheese strongly depends on the production system from which the cheese is derived (grazing, mixed or industrial), the composition of the feed, and the origin of the feed.

Water used per 1KG of cheese	
TOTAL WATER USED	3178L
RAINWATER	2687L
SURFACE AND GROUNDWATER	266L
WATER POLLUTION	225L
SOURCE	M. M. Mekonnen and A. Y. Hoekstra (2012)

[2] https://waterfootprint.org/media/downloads/Aldaya-Hoekstra-2010.pdf
[3] https://waterfootprint.org/media/downloads/Mekonnen-Hoekstra-2012-WaterFootprintFarmAnimalProducts.pdf

Corn

The global average water footprint of rice is 1,222 liters per kilogram. The green, blue, and grey water footprint contribute 77%, 7%, and 16% to the total water footprint[4]. Global corn production contributed 10% to the total water footprint of crop production in the world. The US, China, and Brazil contributed 25, 18, and 8% to the total water footprint of corn production. Also, corn is a crop with a large contribution to the unsustainable portion of the blue water footprint in the world. Irrigated corn production adds to blue water scarcity in Northwest China and the US High Planes[5]. However, there are also locations around the world where there are no blue water scarcity issues related to corn production. The production location of the corn consumed determines the impact of consumption.

Water used per KG of Corn	
TOTAL WATER USED	1222L
RAINWATER	947L
SURFACE AND GROUNDWATER	81L
WATER POLLUTION	194L
SOURCE	M. M. Mekonnen and A. Y. Hoekstra (2011)

Farmed mealworms

The water footprint of farmed mealworms is 4,341 liters per kilogram. This water footprint is almost entirely the result of feed production and feed mixing. Similarly to beef and other meat products, the feed composition for the farmed mealworms determines its water-related impact. The feed of mealworms mainly consists of mixed grains (corn, rye, oats, soybeans, and wheat bran) and/or carrots and turnips. For mixed grains, there could be some water scarcity-related issues as a result of corn and soybeans. Nonetheless, the actual feed composition and feed production locations determine the water-related impact of the farmed mealworms[6].

Water used per KG of mealworms	
TOTAL WATER USED	4341L
FEED PRODUCTION	100%
SOURCE	Miglietta et al. (2015)

[4] https://waterfootprint.org/media/downloads/Mekonnen-Hoekstra-2011-WaterFootprintCrops.pdf
[5] https://ris.utwente.nl/ws/portalfiles/portal/250562543/1_s2.0_S0309170820300221_main.pdf
[6] https://www.mdpi.com/2073-4441/7/11/6190

Rice

The global average water footprint of rice is 1,674 liters per kilogram. The green, blue, and grey water footprint contribute 69%, 20%, and 11% to the total water footprint[4]. Global rice production accounts for about 22% of the world's blue water footprint related to crop production. Multiple areas where rice is irrigated are located in water-scarce basins. Irrigated rice might add to water scarcity issues in these basins. Almost half of global blue water footprint related to irrigated rice production is unsustainable. Nearly a third of the unsustainable irrigated rice production is located in Indus, Pakistan, and Ganges, India, basins, 21% and 10% respectively. Other locations of unsustainable irrigated rice production are located in the Mississippi,US, (5%), Huai He, China, (4%), and Krishna, India, (5%) basins[5]. However, there are also locations around the world where there are no blue water scarcity issues related to rice production. The production location of the rice consumed determines the impact of consumption.

Water used per 1KG of rice	
TOTAL WATER USED	1674L
RAINWATER	1146L
SURFACE AND GROUNDWATER	341L
WATER POLLUTION	187L
SOURCE	M. M. Mekonnen and A. Y. Hoekstra (2011)