**WATER FOOTPRINT FAQ – TECHNICAL QUESTIONS**<http://www.waterfootprint.org/?page=files/FAQ_Technical_questions>

**1 What is a water footprint?**

 The water footprint of a product is an empirical indicator of how much water is consumed, when and where, measured over the whole supply chain of the product. The water footprint is a multidimensional indicator, showing volumes but also making explicit the type of water use (evaporation of rainwater, surface water or groundwater, or pollution of water) and the location and timing of water use. The water footprint of an individual, community or business, is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. The water footprint shows human appropriation of the world’s limited freshwater resources and thus provides a basis for assessing the impacts of goods and services on freshwater systems and formulating strategies to reduce those impacts.

**2 What is new about the water footprint?** Traditionally statistics on water use focus on measuring ‘water withdrawals’ and ‘direct water use’. The water footprint accounting method takes a much broader perspective. First of all, the water footprint measures both direct and indirect water use, where the latter refers to the water use in the supply chain of a product. The water footprint thus links final consumers and intermediate businesses and traders to the water use along the whole production chain of a product. This is relevant, because generally the direct water use of a consumer is small if compared to its indirect water use and the operational water use of a business is generally small if compared to the supply-chain water use. So the picture of the actual water dependency of a consumer and business can change radically.

The water footprint method further differs in that it looks at water consumption (as opposed to withdrawal), where consumption refers to the part of the water withdrawal that really gets lost through evaporation, i.e. the part of the water withdrawal that does not return to the system from which it was withdrawn. Besides, the water footprint goes beyond looking at blue water use only (i.e. use of ground and surface water). It also includes a green water footprint component (use of rainwater) and a grey water footprint component (polluted water).

**3 Is the water footprint more than a nice metaphor?** The term “footprint” is often used as a metaphor to refer to the fact that humanity appropriates a significant proportion of the available natural resources (land, energy, water). However, just like the “ecological footprint” and the “carbon footprint”, the “water footprint” is more than a metaphor: there is a rigorous accounting framework with well-defined measurable variables and well-established accounting procedures to calculate the water footprints of products, individual consumers, communities, nations or businesses. We discourage people to use the water-footprint concept as a metaphor, because its strength lies in its effectiveness when used in a context of strict accounting and measurable reduction targets.

**4 Water is a renewable resource, it remains in the cycle, so what’s the problem?** Water is a renewable resource, but that does not mean that its availability is unlimited. In a certain period, precipitation is always limited to a certain amount. The same holds to the amount of water that recharges groundwater reserves and that flows through a river. Rainwater can be used in agricultural production and water in rivers and aquifers can be used for irrigation or industrial or domestic purposes. But in a certain period one cannot use more water than is available. A river can be emptied and in the long term one cannot take more water from lakes and groundwater reservoirs than the rate with which they are recharged. The water footprint measures the amount of water available in a certain period that is consumed (i.e. evaporated) or polluted. In this way, it provides a measure of the amount of available water appropriated by humans. The remainder is left for nature. The rainwater not used for agricultural production is left to sustain natural vegetation. The ground- and surface water flows not evaporated for human purposes or polluted is left to sustain healthy aquatic ecosystems.

**5 Is there agreement on how to measure a water footprint?**

 The methods for water footprint accounting have been published in peer-reviewed scientific journals. In addition, there are also practical examples available of how one can apply the methods to calculate the water footprint of a specific product, an individual consumer, a community or a business or organisation. In generic sense there is agreement about the definition and calculation of a water footprint. However, every time one applies the concept in a situation not done before new practical questions arise. These are practical questions like: what should be included and what can be excluded, how to deal with situations where the supply chain cannot be properly traced, what water quality standards to use when calculating the grey water footprint, etc. Discussion therefore focuses on how to handle those practical issues. There is also still discussion about the precise method of how to estimate the local impacts of a water footprint.

**6 Why distinguish between a green, blue and grey water footprint?**

 Freshwater availability on earth is determined by annual precipitation above land. One part of the precipitation evaporates and the other part runs off to the ocean through aquifers and rivers. Both the evaporative flow and the runoff flow can be made productive for human purposes. The evaporative flow can be used for crop growth or left for maintaining natural ecosystems; the green water footprint measures which part of the total evaporative flow is actually appropriated for human purposes. The runoff flow – the water flowing in aquifers and rivers – can be used for all sorts of purposes, including irrigation, washing, processing and cooling. The blue water footprint measures the volume of groundwater and surface water consumed, i.e. withdrawn and then evaporated. The grey water footprint measures the volume of water flow in aquifers and rivers polluted by humans. In this way, the green, blue and grey water footprint measure different sorts of water appropriation. When necessary, one can further classify the water footprint into more specific components. In case of the blue water footprint, it can be considered relevant to distinguish between ground and surface water use. In case of the grey water footprint, it can be considered valuable to distinguish between different sorts of pollution. In fact, preferably, this more specific pieces of information are always underlying the aggregate water footprint figures.

**7 Why should we look at the total green water footprint of a crop? Why not look at the additional evaporation if compared to evaporation from natural vegetation?**

 It depends on the question that one would like to address. The green water footprint measures total evaporation and is meant to feed the debate about the allocation of water to different purposes in a context of limited availability. Information about increased or reduced evaporation is relevant from the perspective of catchment hydrology and potential downstream effects.

Research has shown that crops can sometimes result in increased evaporation when compared to natural vegetation (particularly in the period of rapid crop growth), and other times in reduced evaporation (e.g. because of soil deterioration or reduced aboveground biomass). In many cases the differences are not very significant at basin scale. The change in evaporation is interesting from the perspective of catchment hydrology and potential downstream effects, but not for the debate on how limited freshwater resources are allocated over different purposes. The water footprint is designed for the latter debate. The purpose of the green water footprint is to measure human’s appropriation of the evaporative flow, just like the blue/grey water footprint aims to measure human’s appropriation of the runoff flow. The green water footprint measures the part of the evaporated rainwater that has been appropriated by human being and is therefore not available for nature. The water footprint thus expresses the cost of a crop in terms of its total water use.

**8 Isn’t it too simplistic to add all cubic metres of water used into one aggregate indicator?**

 The aggregate water footprint of a product, consumer or producer shows the total volume of fresh water consumed or polluted annually. It serves as a rough indicator, instrumental in awareness raising and for getting an idea of where most of the water goes. The water footprint can be presented as one aggregate number, but in fact it is a multidimensional indicator of water use, showing different sorts of water consumption and pollution as a function of space and time. For developing strategies for sustainable water use, one will need to use the more detailed layer of information embedded in the composite water footprint indicator.

**9 Shouldn’t we weigh the different water footprint components based on their impact?**

 The idea of 'weighing factors' sounds like an attractive idea, because not every cubic metre of water used has the same impact. However, we strongly discourage this approach for three reasons. First, weighing is and will always remain very subjective, because there are many different sorts of impacts, some of which cannot even be easily quantified. Second, impacts are always fully local-context dependent, which means that it is impossible to design universally valid weighing factors. As a matter of fact, the impact of one cubic metre of water withdrawn from one particular point in a river at a certain point in time depends on the characteristics of that river, like the volume and variability of water flow in the river, the competition over water at that point in the river at that particular moment and the effects of withdrawal on downstream ecosystems and other users. Third, weighing would take away the beauty of the current approach, namely that the water footprint figures actually mean something (they refer to actual volumes of water used).

In order to properly address the fact that different water footprint components do indeed have different impacts, we emphasize that the water footprint is a multidimensional indicator, showing volumes, but also the type of water use and the locations and timing of water use. The aggregate water footprint figure is always composed of various components, so that one can precisely tell where and when what type of water is used or polluted. ‘Water footprint accounting’ means that one quantifies the water footprint in all its details. This forms the proper basis for an impact assessment, in which one assesses the various impacts for each separate water footprint component in time and space. Obviously, the impact assessment will show that the impact is different for each separate water footprint component. For formulating water policy aimed to reduce water footprint impacts it is more useful to know how different water footprint components link to various impacts than to have a weighed water footprint indicator. The risk of making a seemingly advanced weighed water footprint indicator is that such indicator hides all information related to impacts instead of making the impacts explicit. Some people have suggested that weighing has been successful in other fields, like the weighing of different greenhouse gasses by looking at their so-called ‘global warming potential’. Suffice here to say that the cases are simply not similar, which makes copying the idea of weighing a thoughtless thing to do.

**10 How does water footprint accounting relate to life cycle assessment?**

 The water footprint can be an indicator in the life cycle assessment (LCA) of a product. Being applied in an LCA is one of the many applications of the water footprint. In an LCA, the multi-dimensional, spatial explicit water footprint should first be overlaid with a water-stress map in order to arrive at a spatial-explicit water footprint impact map. The various impacts should subsequently be weighed and aggregated in order to arrive at an aggregated water footprint impact factor. For LCA an important question is how impacts can be aggregated – which is a specific requirement for LCA and not relevant to other applications of the water footprint. Other applications of the water footprint are for example identifying hotspot areas of the water footprints of certain products, consumer groups or businesses, and formulating response strategies to mitigate water footprint impacts. For those purposes aggregation is not functional, because specification in type of water and space-time is essential in those applications.

**11 How does the water footprint relate to ecological and carbon footprint?**

 The water-footprint concept is part of a larger family of concepts that have been developed in the environmental sciences over the past decade. A “footprint” in general has become known as a quantitative measure showing the appropriation of natural resources or pressure on the environment by human beings. The ecological footprint is a measure of the use of bio-productive space (hectares). The carbon footprint measures the amount of greenhouse gases produced, measured carbon dioxide equivalents (in tonnes). The water footprint measures water use (in cubic metres per year). The three indicators are complementary, since they measure completely different things. Methodologically there are many similarities between the different footprints, but each has its own peculiarities related to the uniqueness of the substance considered. Most typical for the water footprint is the importance of specifying space and time. This is necessary because the availability of water highly varies in space and time, so that water appropriation should always be considered in its local context.

**12 What is the difference between water footprint and virtual water?** The water footprint is a term that refers to the water used to make a product. In this context we can also speak about the ‘virtual water content’ of a product instead of its ‘water footprint’. The water footprint concept, however, has a wider application. We can for example speak about the water footprint of a consumer by looking at the water footprints of the goods and services consumed or about the water footprint of a producer (business, manufacturer, service provider) by looking at the water footprint of the goods and services produced by the producer. Furthermore, the water footprint concept does not simply refer to a water volume only, like in the case of the term ‘virtual water content’ of a product. The water footprint is a multidimensional indicator, not only referring to a water volume used, but also making explicit where the water footprint is located, what source of water is used, and when the water is used. The additional information is crucial in order to assess the impacts of the water footprint of a product.

**Water footprint**

The best databases on water needs and availability with global coverage are probably the ones available through the Food and Agriculture Organisation (FAO). Research on water footprints is carried out for instance at University of Twente, UNESCO-IHE, the World Water Council, IWMI and WWF.

**Ecological footprint**

The water footprint concept was introduced in 2002 by Arjen Hoekstra in analogy to the well known concept of ‘ecological footprint'. The ecological footprint concept was developed in the mid 1990s by Mathis Wackernagel and William Rees. They were worried about the amount of land required to supply the world population with food energy etc, particularly if everybody in this world would adopt a western lifestyle. First of all people need land for living and moving (towns, cities, roads, etc.). Second, there is agricultural land (cropland and pasture) needed to produce the food required. Third, forested land is needed to supply things like wood and paper. Finally, Wackernagel and Rees argued, there is forested land needed to transform the carbon dioxide emitted by human activities into organic matter. They assumed that for every 100 GJ per year of energy consumption from fossil fuels, we need one hectare of forest. The land requirement to compensate for burning fossil fuels is a bit disputed, but apart from this, the idea of calculating an ‘ecological footprint' for individuals or whole nations has become very popular. Land areas that are used in support of more than one person (actually most of the land apart from people's own houses and gardens) can be attributed to individuals based on their proportional share in the use of the land.

**Carbon footprint**

The carbon footprint is a measure of the impact that human ac-tivities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide. It is an indicator for individuals and organizations to conceptualize their personal or organizational contribution to global warming. The carbon footprint can be seen as the total amount of carbon dioxide (CO2) and other greenhouse gases emitted over the full life cycle of a product or service. A carbon footprint is usually expressed as a CO2 equivalent (in kilograms or tonnes), in order to make the global warming effects of different greenhouse gases comparative and addable.