

The history of the grey water footprint, or let's quote the originator of the idea

The water footprint was introduced in 2002 [1] and quickly became a popular tool for assessing anthropogenic impacts associated with human activities. The basic methodological document that describes the water footprint methodology is the *Water Footprint Assessment Manual* from 2011 [2]. The water footprint consists of three components, depending on the source and type of water use:

1) the blue water footprint represents water consumption from water sources, i.e. taken from rivers, lakes, and aquifers,

2) the green water footprint represents the consumption of water that comes from precipitation and is stored on the surface of the soil or plants or as soil moisture, and is consumed mainly by evapotranspiration,

3) the grey water footprint represents the amount of water needed to assimilate anthropogenic pollution based on the natural background concentration and existing environmental water quality standards.

The grey water footprint is calculated by dividing the amount of discharged pollutant L [mass/time] by the so-called assimilation capacity of the receiving water body, i.e. the difference between the ambient water quality standard for the pollutant (maximum acceptable concentration) C_{\max} [mass/volume] and the natural concentration of the pollutant in the receiving water body C_{nat} [mass/volume]. The grey water footprint is thus not tied to the amount of water in the receiving water body, but is the theoretical amount of water that is needed to "dilute" the pollution discharged in wastewater. In other words, the grey water footprint is the sum of the volume of polluted wastewater discharged into a watercourse and the additional amount of water needed to dilute the pollutant to an acceptable concentration in a watercourse [3]. It is surprising that many authors do not include the amount of wastewater discharged into the grey water footprint, which can be considered a mistake [4]. However, cases where only waste water is included in the grey water footprint can be considered the same error (unfortunately, such cases can also be found and we deliberately do not cite these works here).

When the water footprint was introduced in 2002, only the blue and green water footprint were introduced. The grey water footprint did not become part of the water footprint concept until a few years later. Nevertheless, we encounter cases where, for the definition of grey water footprint, a document is cited that does not contain the grey water definition; sometimes the grey water footprint is not even mentioned. At the same time, the correctness of references is one of the pillars of scientific publishing because a well-written argument is based on existing scientific knowledge in the given field; it is supported by important assumptions, technical information, and opinions with precise identification, i.e. citing source material [5].

The question of water pollution in the context of the water footprint was first addressed in a 2005 cotton water footprint study [6], which was subsequently published as an article in the journal *Ecological Economics* in 2006 [7]. Neither the 2005 study [6] nor the follow-up article [7] include the concept of grey water footprint, but the idea that the impact of water pollution can be expressed by converting the volume of emitted chemicals to the volume of dilution needed to assimilate the pollution. The term grey water footprint only appears a year later, i.e. in 2007, in an article by Hoekstra and Chapagain [8]. According to the information attached to the article [8], the revised manuscript of this article was submitted to the editors in February 2007. This is quite an interesting fact because both the *Water Footprint Assessment Manual* [2, p. 31] and Hoekstra himself [9] state that all the three components of the water footprint were only presented in a comprehensive framework in a book from 2008

[10]. This is probably because the book allows for a much more detailed description of the links between the individual components of the water footprint. The methodological issues of the grey water footprint were then elaborated by the *Water Footprint Network* working group, whose work resulted in a number of refinements, including taking into account the quality of the water abstracted, and a multi-level approach to distinguish different levels of detail when assessing the grey water footprint of diffuse pollution. The work of this group was reflected in the *Water Footprint Assessment Manual* [2].

Two important documents should be mentioned in connection with the grey water footprint. The predecessor of the *Water Footprint Assessment Manual* [2] was a working "live" report published in 2009 called *Water Footprint Manual: State of the Art 2009* [11]. Although this document assumed an annual update, the already mentioned *Water Footprint Assessment Manual* [2] followed only in 2011 and further updates did not take place.

The *Water Footprint Assessment Manual* [2] recommends (on the basis of the above-mentioned outputs of the working group) a three-step approach to estimating the load of diffuse pollution entering a water body. In 2013, the *Water Footprint Network*, which advocates the development of water footprint methodology, published a methodological guide on the use of Tier 1 to estimate the load of diffuse pollution entering a water body [12].

Either way, the origins of the grey water footprint idea are well documented in the literature. In relation to the grey water footprint definition, there is therefore no reason to cite other articles than those that first dealt with the grey water footprint [6–8, 10]. An understandable alternative to these articles is the *Water Footprint Assessment Manual* [2], which is the basic methodological framework of the entire water footprint methodology, or a subsequent methodology for Tier 1 applications [12].

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