Hydrol. Earth Syst. Sci. Discuss., 6, C2067–C2072, 2009
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Consumptive water use associated with food waste: case study of fresh mango in Australia" *by* B. G. Ridoutt et al.

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Received and published: 17 September 2009

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There is an increasing interest within the LCA community in water (Koehler, 2008; Milà i Canals et al., 2009). The paper 'Consumptive water use associated with food waste: case study of fresh mango in Australia' by Ridoutt et al. addresses the important topic of water implications of food waste. They conclude that the generation of large waste streams that go along with the production and consumption of mango in Australia is not

efficient from the perspective of water. We can very well follow this argument, but have difficulty with the methodological side of the manuscript. The paper claims to introduce a more advanced version of the water footprint (WF) methodology. The authors make a caricature of the established WF definition and method by suggesting that it ignores important issues like source of water used and spatial detail. Unfortunately, the paper fails to acknowledge that the existing methodology is advanced, well established in scientific literature, widely adopted and successfully practiced in a wide variety of applications (national water studies, catchment studies, corporate water footprint studies, product water footprint studies, risk analysis, IO modelling, local impact assessment studies). The paper lacks a proper review that would be necessary before proposing a revision that claims to advance the concept. Moreover, the revision proposed is absolutely useless for most WF applications, so cannot be proposed as an improvement.

A number of LCA authors have suggested redefining the WF from a volumetric measure to an index that results from multiplying volumes by impact factors (Pfister et al., 2009; Ridoutt et al., 2009). The current manuscript by Ridoutt et al. follows up along the same argument. By framing the argument within the logic of LCA, the primary and established role of the WF in water resources management (WRM) is ignored. Redefining the WF does not make sense from the WRM perspective, which requires spatially and temporally explicit information on WFs in real volumes and impacts in real terms. Aggregated indices without physical interpretation are meaningless in a WRM context aimed at reducing WFs and their local impacts.

The WF has been devised as a comprehensive indicator of freshwater appropriation (Hoekstra, 2003; Hoekstra and Chapagain, 2008). The WF of a product is the volume of freshwater used to produce the product over the full supply chain. It shows, specified in space and time, water consumption volumes by source (green, blue –ground and surface- WFs) and polluted volumes (grey WF) by type of pollution. WF studies serve two discourses in WRM. First, data on WFs of products, consumers and producers inform the discourse about sustainable, equitable and efficient freshwater use and allocation (Hoekstra and Chapagain, 2007, 2008). The concept has been widely adopted to study water issues in national, river basin and international context (WWAP, 2009; Garrido et al., in press). Freshwater is scarce; its annual availability is limited. It is relevant to know who receives which portion and how water is allocated over various purposes. That is what volumetric accounts show. Water used for e.g. bioenergy cannot be utilized for food (Gerbens-Leenes et al., 2009). Second, WF accounts help to estimate local environmental, social and economic impacts. Environmental impact assessment should include a comparison of each WF component to available water at relevant locations and time minus environmental water requirements and inaccessible flood and remote flows.

The call for an aggregated impact index is justified from an LCA perspective. To serve both WRM and LCA, one best distinguishes three steps (Table 1). From LCA viewpoint, step 1 contributes to life-cycle inventory; steps 2-3 are part of life-cycle impact assessment. The proposal to use the term WF for the final aggregated index obtained in step 3 is confusing. This may be instrumental for LCA but not helpful for other purposes. The WF can best be used solely in its original and well-established meaning, which means it excludes impact. The non-volumetric index obtained in step 3 is not a WF, but an aggregated, weighted WF Impact Index.

The paper by Ridoutt et al. claims that the established and widely used volumetric and empirical definition of the WF is misleading. They propose to replace it by a weighted indicator that would reflect impacts of water use. For this purpose, they follow the weighting methodology proposed by Pfister et al. (2009). They prefer to replace volumetric, empirical and spatiotemporally explicit WF accounts that form a very sound basis for multi-dimensional impact assessment by a zero-dimensional weighted impact factor that fails to reflect real issues and includes so many arbitrary assumptions and implicit trade-offs that one really has no idea about how to interpret the resulting figures. So we would rather reverse the claim made and argue that the so-called revised definition of the WF concept introduces a highly disputable and meaningless number.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5085, 2009.

Table 1: The three subsequent water footprint assessment steps and how they feed different discourses

	Step	Outcome	Physical meaning	Resolution	Usefulness	Field
1.	Water footprint accounting	Blue, green and grey water footprints (volumetric)	Water volume consumed or polluted per unit of product	Spatio-temporal explicit	Discourse on sustainable, equitable and efficient water use/allocation	Water resources management
2.	Water footprint impact assessment	Environmental, social and economic impacts	Various measurable impact variables	Spatio-temporal explicit	Discourse on reducing local impacts	
3.	Aggregated water footprint impact assessment	Aggregated water footprint impact index	None	Non spatio-temporal explicit	Discourse on aggregated environmental impacts of products	Life cycle assessment

Fig. 1.