



New performance indicators for water management in tourism



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HIGHLIGHTS

- Develops and updates data on direct and indirect water use in tourism.
- Provides first assessment of water embodied in foodstuffs consumed in hotels.
- Identifies water use 'lock-in' as a significant problem for water management.
- Calls for the development of a new set of indicators for water management.

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ABSTRACT

Tourism is increasingly recognized as a significant water-consuming sector on local, regional and global scales. As a consequence, the efficient use of water resources is now considered a key sustainability challenge for the tourism industry. To date, most research has focused on direct (on site) water consumption, with tourism water management based almost exclusively on direct water use benchmarks. This paper argues that such an approach overlooks the complexity of 'local' and 'global' water use, with local water use affecting sustainable water use in the destination and global water use representing the sustainability of water embodied in goods produced elsewhere, including fuels and food. Focussing on tourism accommodation as the locus of tourism water consumption, conventional water indicators are reviewed and discussed, and knowledge gaps identified. New data accounting for food consumption are then presented for a case study of resort hotels in Rhodes, Greece. The results are used to develop a novel set of performance indicators suitable for resort hotels and other accommodation, considering water availability, planning and operation, as well as complexities of direct *vis-à-vis* indirect water consumption. The findings suggest a significant potential for water and related cost savings, indicating that holistic water management should be an operational imperative.

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1. Introduction

Fresh water is an essential resource for tourism. It is consumed directly by tourists for hygienic purposes such as showering or flushing toilets; it is used for the irrigation of gardens and to fill up swimming pools; to provide opportunities for a wide range of leisure activities, such as golf; and it is needed for cleaning rooms and for washing bed and table linen. Water is often also part of the landscapes that are attractive to tourists (Hall & Härkönen, 2006). Indirectly, tourists consume water embodied in infrastructure (accommodation, roads, airports, etc.), food, fuel, consumption goods,

and other services (Chapagain & Hoekstra, 2008; Cazcarro, Hoekstra, & Sánchez Chóliz, 2014; Gössling, 2002; Pigram, 1995; Worldwatch Institute, 2004). Recent research suggests that the water footprint (WF)² of indirect (embodied, or global) water consumption may be far more significant than direct (local) water consumption alone (Cazcarro et al., 2014; Gössling et al., 2012; see also Sun & Pratt, 2014).

Though people also consume water at home, there is strong evidence that tourism increases overall water consumption (Gössling et al., 2012). In most countries, water use by tourism is less than 5% of domestic water use, but there are certain countries where tourism is not only the main economic activity but also the main factor in water use and where the sector has great relevance

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² 'Water footprint' (WF) is defined for the purpose of this paper as the total volume of water used to produce a unit of a good or service consumed by a tourist.

for water security and competition for scarce resources. Such water and tourism 'hot spots' include a number of small islands in the Caribbean and the Mediterranean. Even more important is the role of tourism in regions where abstraction levels are high due to concentrated tourism development, and where the natural recharge of aquifers is limited. This is the case in for instance Malta, Cyprus, Mallorca and other islands (Clarke & King, 2004; Gössling et al., 2012; Hadjikakou, 2014).

As freshwater availability is increasingly under pressure (WWAP, 2012), water consumption in tourism has received growing attention by organizations such as the World Tourism Organization (UNWTO, 2013), UNEP (2011), and OECD (2013), with calls made by these organizations to reduce water consumption. Water use in tourism has so far been studied from three different perspectives:

- i) Direct and indirect use, measured in L or m³ (e.g. Bohdanowicz & Martinac, 2007; Essex, Kent, & Newnham, 2004; Gössling et al., 2012).
- ii) Sustainability implications of water use, including water scarcity, competition for scarce resources between tourism and other economic sectors or local populations, as well as the transfer of water use between countries and continents as a result of global tourism flows (e.g. Cazcarro et al., 2014; Cole, 2012, 2013; Gössling, 2001a; Gössling et al., 2012; Hadjikakou, Chenoweth, & Miller, 2013; Page, Essex, & Causevic, 2014).
- iii) Water management, including all actions that can help to reduce water demand (Gössling et al., 2012; OECD, 2013; UNEP, 2011).

As water is considered an increasingly scarce resource, various indicators to assess its availability and use intensities have been developed, generally with a view to reduce water consumption. Current use of indicators is largely focused on *direct* water use, i.e. the volume of local water consumed per tourist per day, which is usually restricted to accommodation. This excludes other areas of water consumption – such as activities, shopping or services –, as well as indirect (or imported/embodied) water needed for the production of infrastructure, fuels and foodstuffs. The magnitude of the omission of focussing solely on direct water use is evident. For instance, Gössling (2002) estimated that the world's direct water footprint of tourism amounted to 1 km³ of fresh water. In comparison, Cazcarro et al. (2014) presented an assessment of the net water footprint of tourism in Spain, i.e. the water embodied in goods and products consumed by tourism in this country. Including national water resources and adding imported water, but subtracting water exports, Cazcarro et al. concluded that the Spanish tourism system requires 6.9 km³ of fresh water annually, which is almost seven times Gössling's (2002) global estimate. This implies that, on a global scale, tourism, as a sector reliant on inputs of goods from other sectors (Briassoulis, 1991), has a considerable indirect water footprint.

The insight that tourism is a far more relevant water-consuming sector than previously assumed requires a reconsideration of current approaches to water management. The locus of most water consumption in tourism is accommodation; it is here that tourists consume water directly during their stay, sign up to different activities, and eat a share or all of their food. Although most research on water consumption in tourism has, in fact, already focused on hotels and other accommodation, considerable knowledge gaps remain. Given recent changes in the understanding of the importance of different direct and indirect water use sub-sectors and resulting uncertainties, the following sections aim to provide an updated review of water footprints, specifically with regard to the

role of food and energy consumption; to better differentiate various end-use sectors of water consumption and their relevance, and to assess the role of food in water consumption, one of the main remaining research gaps. In order to overcome the paucity of data in some areas, additional results from a case study in Rhodes, Greece, are included in the analysis.

2. Water use in tourism

While there is now a fair amount of information on direct water consumption, indirect water use values for food, constructions, and fuels are still poorly understood (Gössling et al., 2012), and research on water footprints is generally not as far developed as, for instance, studies of direct and indirect greenhouse gas emissions from tourism (e.g. Filimonau, Dickinson, Robbins, & Reddy, 2013). Recent studies indicate that the consideration of imported and exported water, as well as the amount of water abstracted 'locally', compared to 'global' water, is important (Cazcarro et al., 2014; Gössling et al., 2012; Hadjikakou, 2014; Hadjikakou et al., 2013). As the focus of this paper is the development of new indicators for water use occurring in accommodation, Table 1 suggests two 'direct' and six 'indirect' water use categories. It is thus conceptually similar to the 'total water footprint' concept developed by Hadjikakou et al. (2013), which is based on a bottom-up component-based approach, i.e. including an accommodation and activity footprint (direct) and a diet and fuel footprint (indirect). Even though the WF assessment in Table 1 has been extended to also include infrastructure, it is incomplete in that it excludes marketing & sales as well as shopping and other tourism-related services, for which limited data exists. It is also fundamentally different from the top-down input–output approach provided by Cazcarro et al. (2014) for 76 sub-sectors of the Spanish economy. Both bottom-up and top-down water footprint approaches have merits and weaknesses (see e.g. Feng et al. 2011). For the purposes of the present study, where the focus is water use in accommodation, a component-based bottom-up approach is used to generate new data and insight.

Direct water use in accommodation ranges between 84 and 2425 L per tourist per day, including water use in rooms, for gardens and pools irrigation, with activities adding 10–875 L/guest night (Deyá Tortella and Tirado 2011; Gössling et al., 2012; Hadjikakou et al., 2013). The higher value for activities relates to golf, which appears to be the most water-intensive activity in tourism: According to Deyá Tortella and Tirado (2011) – who conducted a comprehensive study of 196 hotels in Mallorca –, accounting for golf courses as part of the hotel direct water

Table 1
Direct and indirect water use in tourism.

Water use category – direct	Min-max in L/guest night	Estimated average L/guest night
Accommodation	84–2425	350
Activities	10–875	20
Water use category – indirect		
Infrastructure	L/guest night	0.2
Fossil fuels for transport	5–2500	130
Energy use at hotel	0.3–200	75
Biofuels	2500	–
Food	4500–8000	6000
Other consumption	n.a.	n.a.
Total per tourist/guest night	4600–12,000	6575

Source: Gössling et al., 2012, updated based on Energies Nouvelles (2011), Roselló-Batie, Molá, Cladera, and Martínez (2010), US Department of Energy (2012).

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