Tourism Water Footprint of China

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Abstract:

China is a worldwide famous tourism country and attracts millions of domestic and foreign tourists to enjoy various tourism activities. Among the supporting tourism resources, water resource is important for the sustainable development of tourism. In order to understand and efficiently manage the precious water resource for tourism, the tourism water footprint of China is investigated in this study. A top-down approach was adopted to analyze the water footprint by using the collected 2012 input-output table with 139 sectors, the 2012 tourism satellite account (TSA) and water consumption data of different sectors. The result of this study reveals that China's total foreign tourist water footprint is approximately 2,465,000,000 m^3 in the year of 2012, whereas the total domestic tourist water footprint is approximately 16,642,000,000 m^3.

Keywords: China, Input-output analysis, Tourism, Water footprint

1.   Introduction

Water is important for human and it is fair to say that no life can be sustained without water. Recently, the term of water footprint which was introduced in 2002 (Hoekstra, 2002) has become a popular indicator for water consumption along with supply chains. Water footprint represents not only as an indicator for director water use of a product or service but also for the indirect water use. Direct water use means the water consumption during the production of a product or service. Indirect water use means the water consumption in the supply chain of products or services. The water footprint of a product or a service is measured over the entire supply chain for the volume of water consumed to produce the product or provide the service (Hoekstra, 2012; Hoeksera and Chapagain, 2007). The water footprint can be applied to a single service such as clothes washing or to a product such as a computer. It can also be used to measure the water volume used for a particular country or a multi-national enterprise.

Thus, the water footprint can be used as an indicator to understand the entire related water consumed for a product or a service. It only services as a volumetric measurement of water use, but not a measurement for the severity of environmental impact of water consumption. Water footprint can give clear message on the correct use of water for various human activities geographically and temporally. It is useful for the evaluation of sustainable use and allocation of water resource. It is also can be used as a fundamental basis for the assessment of local environmental, social and economic impacts (Arjen, 2012).

With 5000 years of history and vast landscape, China is a famous tourism country in the world. Millions of international and domestic tourists are attracted to China to experience various tourism activities. Besides the rich historical events and beautiful scenery, water is also one of the important resources to support the huge and growing tourism industry in China. The understanding of tourism water consumption is essential for the sustainable development of China's tourism. By measuring the tourism water footprint and implement the necessary actions to keep water consumption level as low as possible is important for China's tourism industry. Thus, the water footprint of China's tourism is investigated in this study. Using the regional input-output model and TSA report, this paper calculates the tourism water footprint of domestic tourist and inbound tourist in China in 2012, and explores the 139 sectors of water footprint made by tourism activities. The empirical results show that: (1) the water consumption coefficient in 139 sectors. (2) The tourism water footprint of for 139 sectors in 2012.

2.   Methods

This study adopts a top-down approach by using the collected 2012 input-output table with 139 sectors, the 2012 tourism satellite account (TSA) and water consumption data of different sectors to calculate the tourism water

footprint of domestic tourist and inbound tourist in China in 2012. The tourism water footprint is calculated as follow: (Sun, 2014; Zhao et al., 2009; Zhang and Anadon, 2014; Zhang and Qi, 2012; Lenzen et al., 2018)

$$\overline{W}_{tourism} = W\ (I-A)^{-1}\ Y^* \qquad (1)$$

Where $\overline{W}_{tourism} = (\overline{W}_1, \overline{W}_2, \cdots, \overline{W}_{139})$ is the tourism water footprint of 139 sectors. $W = (W_1, W_2, \cdots, W_{139})$ is the water use coefficient of 139 sectors. The Y^* is the tourist final consumption which collected from TSA report. The A is the direct consumption coefficient matrix. I is the identity matrix and has the same order as matrix A.

3. Results

The result of this study presents that the total inbound tourist water footprint of China is approximately 2,465,000,000 m^3 in the year of 2012, whereas the total domestic tourist water footprint of China is approximately 16,642,000,000 m^3. The top 10 sectors of tourism water footprint of China in 2012 are given in Table 1. It shows that The sectors of Fishing sector, Electricity and heating supply sector and Agriculture sector are the top three water footprint sectors for China's tourism and their total water footprints are 3,873,940,826 m^3, 2,212,936,272 m^3 and 2,149,882,231 m^3, respectively. These three sectors are consider as the indirect water footprint of tourism. The top 2 sectors of direct tourism water footprint of China are accommodation service activities sector and air transport sector. Their tourism water footprint are 1,274,300,073 m^3 and 526,107,359 m^3, respectively.

Table 1. The top 10 sectors of tourism water footprint of China in 2012

Domestic tourists		Inbound tourist	
Top 10 sectors	**water footprint (m^3)**	**Top 10 sectors**	**water footprint (m^3)**
Fishing	3,374,049,597	Fishing	499,891,230
Electricity and heating supply	1,927,380,172	Electricity and heating supply	285,556,100
Agriculture	1,872,462,591	Agriculture	277,419,641
Forestry	1,775,613,488	Forestry	263,070,706
Agriculture, forestry, animal production and fishing related service activities	1,689,754,850	Agriculture, forestry, animal production and fishing related service activities	250,350,093
Animal production	1,363,661,414	Animal production	202,036,858
Accommodation service activities	1,109,865,081	Accommodation service activities	164,434,992
Air transport	458,218,750	Air transport	67,888,609
Petroleum and nuclear fuel processing products	418,375,277	Petroleum and nuclear fuel processing products	61,985,494
Wholesale and retail trade	306,340,081	Wholesale and retail trade	45,386,623

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