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An integrated approach to evaluating the coupling coordination between tourism and the environment

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HIGHLIGHTS

- The method combining CCDM with IEW is developed between tourism and the environment.
- The dynamic of the degree of coupling coordination shows an upward tendency.
- Economic benefit and ecological quality make greatest contributions to system.
- Aggregated indexes and integrated approach help to understand the coupling relationship.

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ABSTRACT

The understanding of the coupling relationship between tourism and the environment is important due to the complex interaction in environmental effects induced by tourism. This paper aims at introducing an index system and developing an integrated approach to evaluate the coupling coordination between tourism and the environment. The aggregated index system comprised two hierarchies, five aspects and 20 indexes, which were weighted by the information entropy weight (IEW). Furthermore, a coupling coordination degree model (CCDM) was established using panel data from 1995 to 2012 for Heilongjiang Province, China. The findings revealed that the degree of coupling coordination showed an upward tendency. Specifically, economic benefit and ecological quality had the greatest effect on the coupling system, indicating that they are the critical factors to be considered during macro policy-making. The results showed that the method combining CCDM with IEW can be implemented as an effective approach to evaluating the coupling relationship.

1. Introduction

Tourism development is largely dependent on the natural environment. The friendly environment is not only an important foundation for tourism sustainable development, but also can be the unique attractions for tourists. Therefore, it is necessary to maintain or improve the quality of tourism environment for a destination (Butler, 1991). However, tourism development is often a two-edged sword. It can promote economic growth; meanwhile it can cause environmental pollution and ecological damage, if not well planned (Zhong, Deng, Song, & Ding, 2011). It is important for the tourism industry to consider its environmental impacts, because its products mainly rely on the appeal of attractive natural resources, e.g. pleasant climate, clean waters, and diversified animals and plants. Tourism may consequently be vulnerable to its local impacts; for instance, water pollution, degradation of vegetation, or biodiversity loss (Kuo & Chen, 2009). Accordingly, it is essential to develop methods of enabling rapid tourism development in a sustainable manner, while maintaining a high quality of environment through coordination of tourism and the environment.

In recent years, environmental issues associated with rapid tourism are becoming critical concerns. Growing literatures have indicated that most tourism activities contribute to environmental pressure (Day & Cai, 2012; Duffy, 2001). Global tourist activities will substantially impact on the environment, resulting in "change of land cover and land use", "use of energy and its impacts", "exchange of biota and species extinction", "dispersion of diseases",

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and "psychological consequences of travel" (Gössling, 2002). Tourism is a major agent in global environmental change, and it will in itself be affected by this change (Gössling, 2002). Environmental attitudes toward tourism are very important (Bestard & Rosselló, 2007). The environmental ethics of the market is deterministic to the balance of the tourism–environment relationship (Holden, 2009). Additionally, environmental pollution taxes provide a double dividend of less pollution and improvements in the tourism terms of trade (Beladi, Chao, Hazari, & Laffargue, 2009). Tourism also contributes to climate change through the emission of greenhouse gases (GHGs) through transportation, accommodation and other tourist activities (Becken & Patterson, 2006; Nielsen, Sesartic, & Stucki, 2010; Simpson, Gössling, & Scott, 2008; UNWTO & UNEP, 2008). The negative environmental impacts resulted from tourism have been discussed in some countries/areas, such as Tanzania (Gössling, 2001), Seychelles (Gössling, Hansson, Horstmeier, & Saggel, 2002), Australia (Pickering & Hill, 2007), Italy (Patterson, Niccolucci, & Marchettini, 2008), and India (Geneletti & Dawa, 2009) based on questionnaires, ecological footprint analysis, eco-efficiency, and so on.

With the rapid development of tourism industry, China has experienced an increasing use of its natural environment for tourism, resulting in tourism environment being adversely impacted in many tourism destinations (Zhong et al., 2011). Increasing concerns over the environmental impacts of tourism have also emerged in tourism-related fields as a result of rapid tourism development since 1980s (Zheng, Chen, & Hou, 2010; Zhong et al., 2011). A number of studies has focused on negative tourism impacts on water environment (Lv, 2003), atmospheric environment (Li, Zheng, & Zhang, 2003), sound environment (Gong, Jin, Nan, & Lu, 2008), land-cover change (Dong, Yu, & Liu, 2008), and vegetation and wildlife (Pang, 2004; Zheng, Zhu, & Pan, 2008). These tourism-related environmental problems not only influenced the images of tourist destinations, but also impeded the sustainable development of the local tourism industry. Consequently, some scholars carried out studies on tourism environmental carrying capacity (Huang, Yuan, Ge, & Gu, 2008), tourism environmental quality assessment (Liu & Zhang, 2009), tourist ecological footprint (Li & Yang, 2007), tourism environmental protection (Lin, 2007), and low-carbon tourism (Cai & Wang, 2010).

Originating from physics, coupling is a phenomenon in which two or more systems influence one another through various interactions (Li, Li, Zhou, Shi, & Zhu, 2012). These interactions are complicated, as they simultaneously involve various system components; meanwhile they dynamically change over time (Guan, Gao, Su, Li, & Hokao, 2011). As one of the approaches for measuring interactive effects, coupling is now widely applied in the studies of climate change and the environment. Recently, empirical studies have been conducted to investigate the coupling relationship between tourism and the environment in Shanghai City (Cui, 2008), Inner Mongolia (Yang & Lv, 2010), Xi'an City (Pang, Ma, & Tang, 2011), and Anhui Province (Liu & Yang, 2011). These relevant studies have revealed interactions and the importance of context in a coupled tourism subsystem and environment subsystem.

Developing tourism has become an important means for economic growth in China. Academics have showed considerable interests in conducting research on tourism and the environment. Nevertheless, a more accurate understanding of coupling relationship between tourism and the environment is a challenging task as its measuring is rather complicated without a set of suitable indicators. In addition, most previous studies pay much more attention to negative environmental effects resulted from tourism, yet there is still a lack of consensus not only on coupling coordination, but also the approach favored. Therefore, it is necessary to conduct more in-depth investigations of the coupling relationship between tourism and the environment (Li et al., 2012).

An aggregated index system representing the coupling relationship between tourism and the environment was introduced in this study. The information entropy weight (IEW) was used to obtain the weight objectively. Then the coupling coordination degree model (CCDM) was applied in a case study to fully and objectively evaluate the degree of coupling coordination between tourism and the environment. The purposes of this study are: 1) to reveal the dynamic trends in the development of the coupling of rapid tourism and the environment; 2) to identify the indicators making the greatest contribution to the two subsystems; and 3) to provide references for more coordinated development of tourism–environment system during macro policy-making.

2. Study area

Heilongjiang Province is located in northeast China and extends from 121°11′E to 135°05′ E and 43°25′N to 53°33′N. Its area spans over 454,000 km^2, accounting for 4.9% of entire land area in China (Fig. 1). Heilongjiang Province is rich in natural resources, such as forest resources, wetland resources, cultivated land resources, and ice-snow resources. As one of the most developed provinces in the tourism of China, Heilongjiang Province is presently undergoing rapid tourism development. In 2012, Heilongjiang Province received about 253.82 million tourists, with tourism revenue of 130.03 billion yuan, increasing by 24.2% and 19.1% over the previous year, respectively. The total tourism incomes accounted for 9.5% of GDP of Heilongjiang Province, which means that the tourism industry has become a strategic pillar industry of the province. The tourism industry of Heilongjiang Province has entered a rapid growth stage, in which catering, accommodations, transportation, sightseeing, shopping and entertainment have significant influence on the environment. Correspondingly, a series of environmental impacts posed by tourism has become important challenges to restrict tourism sustainability in Heilongjiang Province.

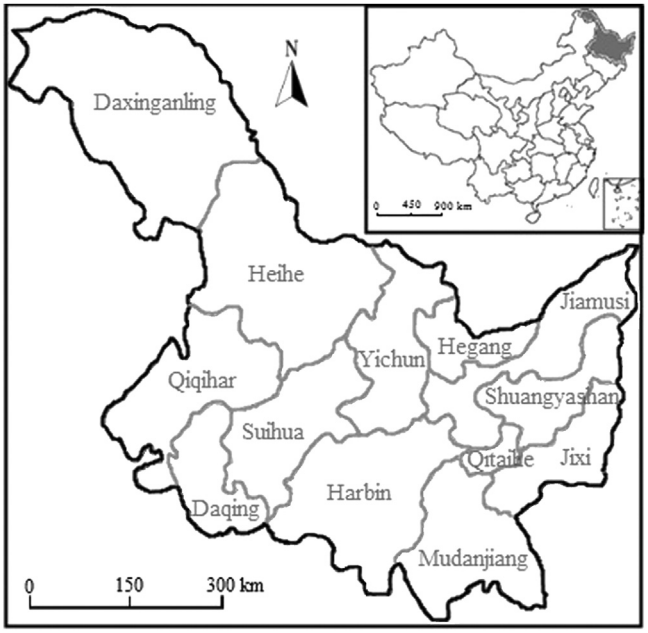

Fig. 1. Location of Heilongjiang Province in China.