THE ASSESSMENT INDICATORS OF TOURISM ECOSYSTEM HEALTH[1]

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Abstract: The tourism ecosystem is the kind of special ecosystem in which destination residents, the external tourists and its surrounding environment are tightly interacted, and it is also the nature -economy-society complex that mainly carries out the tourism activity. As a multiplexed system, the tourism ecosystem also has the healthy problems. From the angle of forced system, this paper analyzes reasons of the system's healthy problems and successfully builds tourism ecosystem health evaluating indicator system with the utilization pressure, the state, the response model. Besides, this paper carries on the synthetic evaluation and the analysis to the tourism ecosystem health's indicator system through bestowing on the weights, which proposes the new research mentality for the tourism sustainable development.
Key words: tourism ecosystem, health, indicator system, evaluation

1. INTRODUCTION

Ecosystem health is the comprehensive characteristic of ecosystem, which has the vigor, stable and self-regulation ability. In other words, if the structure and the function of an ecosystem biological community is close to theoretical descriptions, then it is healthy, otherwise unhealthy. An unhealthy

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ecosystem is often in the decline, and gradually tends to the irreversible collapse process. The healthy ecosystem has the elasticity, maintaining its stability inside. In fact, the ecosystem health possibly more displays on the ability about how to use the coercion creatively, but not on that about how to resist the coercion completely. The healthy ecosystem has the elasticity to the disturbance, and has ability to resist disease. Facing the disturbance, it can maintain its structure and function. The larger the elastic ability is, the healthier is the system. The elasticity emphasized the adaptation attribute of system, but not to get rid of it.(Ren Zhiyuan& Zhang Yanfang, 2003).

The tourism ecosystem is the kind of special ecosystem in which destination residents, the external tourists and its surrounding environment are tightly interacted, and it is also the nature -economy-society complex that mainly carries out the tourism activity.(Geng Qinghui, 2005) the essence of the question is imbalance between the environment and local resident and tourists. The most obvious characteristic of this kind of imbalance is the drop of ecological environment quality, as well as the drop of traveling experience quality.

The tourism ecosystem healthy question is one of the major issues during the process of tourism economy development(Zhang Jiaen, 2005).Tourism should be a win-win industry which can promote the environmental protection and the economic development at the same time, but the truth of recent development indicated that the ecological environment question is also serious, and the tourism economy, the environment, and the ecology were at the irreconcilable contradictory condition. The tourism ecosystem health has been threatened. How to solve this problem; making the tourism ecosystem be at the healthy condition, and how to achieve the sustainable development tourism? Many ecology scholars and the traveling scholars' research stresses mostly in the eco-tourism supporting capacity（XU Wenjun,et al，2006；SHANG Tiancheng & XIAO Lan，2006；LI Chaohui & WEI Guichen，2005；STEFAN GOSSLING，2002）、Study of tourism ecosystem（LIN Zhili，2002；JIA Xiuhai，2005；TONG Yuquan，2000）and sustainable development（GAO Zhanxi，2001；Li Na，2007）and safety evaluation tourism CHAO Xiangxin，2006；），but not many studies are focused on the analysis and evaluation of tourism ecosystem. This article utilizes the PSR model to build the evaluating indicator system about tourism ecosystem health, and carries on the generalized analysis to the tourism ecosystem health. The objective of this article is to make the tourism ecosystem develop optimized, healthily and sustainably through the tourism ecosystem generalized analysis appraisal, which has the important theory significance and the practice guiding sense regarding the ecology civilization construction and the harmonious social construction.

2. METHODOLOGIES

Two major methods are usually used to check the health status of Ecology Economic System They are instruction species diagnostic method and indicator system diagnostic method. This article uses the indicator system diagnostic method, of which the goal is to more comprehensively and reflects the traveling society, the economical, the ecology multiplexed system's characteristic and the state of health on multi-levels. From he angle of threatened ecology economic system, This article proposes the traveling ecosystem's pressure index, the condition index and the response index and finally the constituted traveling ecosystem health check-up quality synthetic evaluation indicator system, and carries on the generalized analysis and the appraisal to various indexes.

3. TOURISM ECOSYSTEM HEALTH CHECK-UP INDICATOR SYSTEM AND WEIGHT DETERMINATION BASED ON PSR

In environment economy warning system, there are two most important aspects: index design; and

model choice. Firstly, it has to choose aspects on which the determinations must be made about environment and economy, and related indexes, and thus determination environment economy early warning standpoints. We have to choose persuaded and representative indexes, and establish their mutual relational model, enabling the index to have the persuasive power, also quite good operation. According to this principle, in the predecessor studies in the foundation (WU Bihu, 2002; ZHANG Guangrui,et al, 2005; Ma Yong and Li Xi, 2006; WANG Huimin and QIU Lei, 2007; Cheng Shenggao, 2004), and from the angle of threatened ecosystem, we established tourism ecosystem health evaluating indicator system including pressure index, the condition index with responding index. This system is described as following Table 1.

Table 1. Tourism ecosystem health evaluating indicator system and weighs

Target layer H	Principle layer A	Factor layer B	Index layer C
H Tourism ecosystem health evaluating indicator system	A_1Presure（0.4）	B_1Abundance of tourism resources（0.12）	C_1 Average water area per capita0.04） C_2 Average forest land area per person（0.04） C_3Quantities of A-level tourist scenic zones every million people（0.04）
		B_2 Social economy growth pressure（0.15）	C_4 GDP per capita(0.04) C_5 resident income Per capita (0.04) C_6Growth rate of GDP(0.05) C_7Safety degree of society(0.02)
		B_3 Human activity intensity（0.07）	C_8 Population density(0.03) C_9 The natural population growth rate (0.02) C_{10} Urbanization rate (0.02)
	A_2Status（0.4）	B_4 Quality of tourism ecological environment（0.15）	C_{11} Afforestation rate(0.03) C_{12} Soil erosion area (0.02) C_{13} Desertification rate (0.05) C_{14} Water environmental index (0.05)
		B_5 Tourism economy development level（0.15）	C_{15} Increment rate of Tourism revenue(0.03) C_{16} Tourism revenue in the proportion of GDP(0.05) C_{17} Tourism employment(0.04) C_{18} Catering retail growth rate(0.03)
		B_6Tourist's environmental consciousness (0.1)	C_{19} The number of tourists visiting(0.04) C_{20} The education level of tourists(0.03) C_{21} Popularization rate of environmental protection publicity and education (0.03)
	A_3Response（0.2）	B_7 Tourism industry favorable policy（0.08）	C_{22} The proportion of tertiary industry investment（0.05） C_{23} The proportion of the total area of nature reserves（0.03）
		B_8Environmental protection dynamics（0.12）	C_{24} Environmental protection into account the proportion of GDP（0.03） C_{25} Growth rate of investment in science and technology（0.02） C_{26} Growth rate of investment in education（0.02） C_{27} Sewage treatment rate（0.03） C_{28} Garbage disposal rate（0.02）

4. TOURISM ECOSYSTEM HEALTH EVALUATION

4.1 Target layer: the overall objective of the tourism ecosystem health assessment, which is the highest level to achieve the health of regional tourism ecosystem.

4.2 Principle layer: a major system-level ensuring the realization of the overall objective which is divided into sub-system, the body subsystems and responding sub-systems.

4.3 Factor layer: The secondary level of principle level, of which each essential factor includes certain concrete index.

4.4 Index layer: The most basic level of this system, including all concrete indexes of tourism ecosystem health check-up warning system and these indexes are directly measurable factors for the diagnosis process.

Evaluation of a comprehensive analysis of specific indicators are as follows:

1st. Abundance of tourism resources (B1): It is the foundation and prerequisite for the development of tourism industry, is an important measure indicator of ecosystem health status which includes the area of water per capita (C1), the per capita forest area (C2) and Quantities of A-level tourist scenic zones every million people (C3), and other indicators. The lower degree of the abundance of tourism resources, the greater the pressure on the health system.

2nd. Social economy growth pressure（B_2）: main social-economic factors influencing the tourism development, including GDP per capita(C_4),Resident income Per capita (C_5),Growth rate of GDP(C_6) and Safety degree of society(C_7),etc. These factors will much influence tourism development. Social indicators are mainly shown by crime rate and unemployment rate. Currently China has low crime rate index, so the social security are always evaluated by unemployment rate. Urban unemployment rate is a reflection of social security indicator. The greater the unemployment rate, the greater the pressure on the health system. In short, the faster the pace of socio-economic growth, the greater pressure on the tourism ecosystem health conditions.

3rd. Human activity intensity（B_3）: including Population density(C_8),The natural population growth rate (C_9) and Urbanization rate (C_{10}). Population is an important indicator of the tourism market, and the population density reflects the distribution of the population density. The greater density of population, the greater the pressure on the health system. The lower the urbanization rate, the lower the population density, and the greater the pressure on the eco-tourism environment. The higher the natural population growth rate, the greater the pressure on the environment. In short, the greater the intensity of human activities, the greater pressure on health of tourism ecosystem.

4th. Quality of tourism ecological environment（B_4）: including Afforestation rate(C_{11}),Soil erosion area (C_{12}),Desertification rate (C_{13}) and Water environmental index (C_{14}) .The higher the forest cover, the better the health status of the system. Desertification is shown by the rate of desertification area accounting for the ratio to the total area. Desertification is the main environmental issue affecting the tourism ecosystem health of, and is the degradation process of productive potential recession and undermine of lands. Water Environment Index refers to the ability of water pollutant that is water bearing capacity of the environment, that is, a allowing emission of pollutants in particular body of water environment. The greater the index, the poorer the health of the system.

5th. Tourism economy development level（B_5）: including Increment rate of Tourism revenue(C_{15}),Tourism revenue in the proportion of GDP(C_{16}),Tourism employment(C_{17}) and Catering

retail growth rate(C_{18}). Tourism revenue growth reflects the scale and pace of the development of tourism industry. Tourism revenue in GDP reflects the proportion of tourism in the national economy, meanwhile, tourism employment in the tourism industry reflects the social benefits. Catering retail growth rate reflects the tourism capacity. The higher the level of economic development of tourism, the greater pressure on ecosystem health.

6^{th}. Tourist's environmental consciousness（B_6）: including The number of tourists visiting(C_{19}),The education level of tourists(C_{20}) and Popularization rate of environmental protection publicity and education (C_{21}).The main indicator of the number of tourists visiting reflects the overall feeling of tourists to that destination. Education status of tourists reflects the degree to the quality of tourists, efforts of environmental protection publicity. All in all, the stronger the environmental awareness of the tourists, the better the system's state of health.

7^{th}. Tourism industry favorable policy（B_7）: including The proportion of tertiary industry investment （C_{22}）and The proportion of the total area of nature reserves（C_{23}）.The proportion of tertiary industry investment in the tourism industry reflects the Government's preferential policies, as the tourism industry belongs to the third industry. The greater the investment in the tertiary sector, more beneficial to the tourism environment and health system. Ratio of the nature reserves in total area reflects the Government's efforts of the tourism environment construction. The greater the area of nature reserves, the higher level of response to health system.

8^{th}. Environmental protection dynamics（B_8）: including Environmental protection into account the proportion of GDP（C_{24}）,Growth rate of investment in science and technology（C_{25}）,Growth rate of investment in education（C_{26}）,Sewage treatment rate（C_{27}）and Garbage disposal rate（C_{28}）. The greater proportion of environmental input, the greater intensity of environmental protection and management, the higher level of response to health system. The greater the investment growth rate of science and technology, the higher the level of knowledge of the residents, the stronger the ecological environment and sustainable development concept, and the stronger of abilities to accept science and technology. To conclude, the greater the environmental protection efforts, the higher the level of response to the system, the more healthy of the system.

Eco-tourism system, good or bad, is shown by the state of health index. The comprehensive index is decided by the pressure index, state index and response index. "Pressure index" shows reasons that tourism ecosystem health took place deterioration, which is indicated with its abundant tourism resources, socio-economic development pressure and intensity of human activity. Status Index refers to the situation of the quality of the eco-tourism system under the current period, shown by the quality of eco-tourism environment, the level of tourism development, and environmental awareness of the tourists. Status is the result that we continually put pressure on our natural environment, which decides anti-interference ability and buffering capacity or ability to the pressures. In the face of the state of the tourism ecosystem under the pressure, we have to take some of the policies and measures, which is response index which is characterized by preferential policies and environmental protection efforts.

As a result of this study belong to the issue of multi-objective decision-making, as well as specific analysis of the levels established by the index system, using layer-analysis and expert investigation methods to determine weight of the indicators. The results are shown in table 1.

After identifying tourism ecosystem health evaluation index system, we can combine with the actual development of regional tourism through a great deal of statistical analysis of survey data to calculate regional tourism ecosystem health index, and analyze and predicts ecosystem health status through appropriate antitheses of the tourism indicators and carries out the health diagnosis of tourism ecosystem, and finally proposes countermeasures.

5. CONCLUSIONS

It is a new attempt to carry out comprehensive evaluation and analysis on the health of the ecosystem using the model of pressure, the state and response index.

Eco-tourism system is a complex system. It is considerable to introduce more interdisciplinary approach to do research. The complexity of tourism and eco-system determines the complexity of the evaluation of the tourism indicators of ecosystem health.

Tourism ecosystem health assessment, is taking into account not only the reasons affecting the health system, but also considering the possibility of statistical data collection.From the angle of forced system, this paper analyzes reasons of the system's healthy problems and successfully builds tourism ecosystem health evaluating indicator system with the utilization pressure, the state, the response model. Besides, this paper carries on the synthetic evaluation and the analysis to the tourism ecosystem health's indicator system through bestowing on the weights, which proposes the new research mentality for the tourism sustainable development.

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