Synthetic Evaluation on Health Quality of Liaoning Tourism Ecosystem[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 of Liaoning province 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, and which proposes the new research mentality for the tourism sustainable development in Liaoning province.
Key words: tourism ecosystem; health; indicator system; evaluation

1.   INTRODUCTION

The tourism ecosystem healthy question is one of the major issues during the process of tourism economy development(Zhang Jia-en, 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,et al, 2006; SHANG & XIAO, 2006; LI & WEI, 2005; STEFAN GOSSLING, 2002), Study of tourism ecosystem (LIN, 2002; JIA, 2005; TONG, 2000) and sustainable development (GAO,

2001; Li, 2007) and safety evaluation tourism (CAO, 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.   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, 2002; ZHANG, et al, 2005; MA & Li, 2006; WANG & QIU, 2007; CHENG, 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 the table 1.

3.   LIAONING TOURISM ECOSYSTEM HEALTH EVALUATION INDEX CALCULATION BASED ON THE FRAMEWORK OF THE PSR

After identifying tourism ecosystem health evaluation index system, combined with the actual development of tourism in Liaoning, through access to a lot of statistics, this paper selects statistics of Liaoning Province from 2000 to 2007 to do some important analysis. The main indicator data are from the "Statistical Yearbook of Liaoning", "Liaoning Province Environmental Status ", "Table of Change of Land-Use in Liaoning Province", and "Liaoning Provincial Tourism Official Gazette ", Liaoning and Information Network database. As the indicator data are dimensional, the following methods require the original data to be normalized.

$$T = T_{\min} + \frac{T_{\max} - T_{\min}}{X_{\max} - X_{\min}}(X - X_{\min})$$

X in the formula stands for Raw data; $X_{\max}$、$X_{\min}$ mean maximum and minimum value to raw data; T means transformed data, also known as target data; $T_{\max}$ and $T_{\min}$ are maximum and minimum value to the transformed data, where $T_{\max}$ gets 1, and $T_{\min}$ gets 0. Besides, normalized data are shown in Table 2.

4. EVALUATION RESULTS ANALYSIS OF LIAONING TOURISM ECOSYSTEM HEALTH STATUS

4.1   Liaoning ecosystem health index analysis

Liaoning Provincial Tourism comprehensive indicator of ecosystem health results are shown in Figure 1.

According to the figure, Liaoning Tourism ecosystem health overall Composite Index is on the rise, due to the relatively fast socio-economic development in the 21st century with the growth of GDP from 8.9% in 2000 to 14.5% in 2007. Because of rapid growth on economy, people are free to increase disposable income, and tourism has become a way of life. Additionally, tourism revenue rose from 25.5 billion in 2000 to 130.7 billion Yuan in 2007; tourism revenue in the proportion of GDP increased from 5.46% in 2000 to 11.9 percent in 2007 and the growth rate of tourism revenue grew from 21.4 percent in 2000 to 34.7 percent in 2007.The growth rate of the tourism industry has caused a lot of pressure on travel Liaoning ecosystem, particularly on ecosystem health is threatened, although the response to the index from 2000 to 2007 showed the trend of growth, environmental protection efforts, but still lags behind economic growth.

Liaoning tourism ecosystem includes 3 sub-systems: pressure system, state sub-system response sub-system, and its comprehensive evaluation of the results is shown in Figure 2. Figure 2 shows, travel, Liaoning ecosystem pressure has been eased, but the overall situation is increasing as well as state index. This explains that the ecological environment quality of Liaoning tourism improved. Overall, ecosystem health status of Liaoning tourism is becoming a turn for the better.

4.2   Sub-system analysis of Liaoning eco-tourism system health status
4.2.1   Pressure subsystem

Liaoning tourism ecosystem, including 3 sub-systems: pressure system, state and sub-system response to the sub-system, and its comprehensive evaluation of the results shown in Figure 2. Figure 2 shows, travel, Liaoning ecosystem pressure has eased, but the overall increase in; Index high state on Tourism Liaoning improved the ecological environment quality; sub-system response to the rapid pace of growth, but also efforts Not enough. Overall, Liaoning ecosystem health tourism is becoming a turn for the better.

Pressure sub-systems of ecosystem on the Liaoning tourism include the abundance level of tourism resources, socio-economic growth and the pressure of human activity intensity area. The results of comprehensive analysis are shown in Figure 4. Figure 4 shows, socio-economic growth increased the pressure year after year, the intensity of human activities in recent years has increased, but diagram also see that the resource consumption is also growing with the development of social-economy. Water per capita reduces, meanwhile, forest area per capital changes a lot. Good tourist attractions are in the increase owned by every million people ,showing that the fast development of tourism and tourism development and more attentions to environmental protection at the same time.

4.2.2   Sub-state system

Liaoning ecosystem health tourism sub-index value is shown as Figure 5. We can see from Figure 5, Liaoning tourist state of the ecosystem as a whole situation turned for the better year by year. SARS period in 2003, state of the ecosystem of Liaoning Tourism was poor. The ecosystem health sub-index rose from 2.0452 to 3.7433 in 2007, with an increase in the basic state, and more changes.

This is the revitalization of old industrial base of Liaoning vigorously develop the tertiary industry, so that the rapid development of tourism economy.

State sub-system of Liaoning tourism ecosystem includes the ecological environment quality, level of economic development, and environmental awareness of the tourists. Results of analysis are shown in Figure 6. We can see from Figure 6, Liaoning Provincial Tourism ecological environment quality is getting worse, the level of economic development and a significant increase in tourists' awareness of environmental protection.

Ecological environment is the basis of Eco-tourism environmental quality .Currently quality of the environment in Liaoning Province declines annually, and the province's area of soil erosion are still 4,294,000 hectares, the phenomenon of desertification is still very serious. Water Environment index is still high compared with the serious pollution of water resources in general.

Economic development of Liaoning Tourism is on a high level. We can see from Figure 6, tourism revenue rose from 25.5 billion in 2000 to 130.7billion Yuan in 2007, the growth rate from 21.4 percent to 34.7 percent. Tourism revenue in the proportion of GDP came from 5.46% in 2000 to 11.9 percent. Development of the tourism industry has led to great social effect. Tourism employment rose from 30 million in 2000 to 105 million people in 2007.The development of tourism has brought a multiplier effect.

Environmental awareness of the tourists has been strengthened, but the growth rate is lower than the level of economic growth in tourism.

4.2.3 Response sub-system

Response sub-system of the health index value to Liaoning tourism ecosystem is shown in Figure 7. We can see from Figure 7, in response to the health of the larger changes in the index, particularly after the 2001 change significantly.

The indicators in the figure show that with the development of the tourism economy, it is a growing recognition of human activities on the ecological environment, a concern of the ecological environment construction, and to take active measures to improve the ecological environment. In particular, the Government takes more efforts to protect environment in the development of tourism-oriented development; particularly enlarges the area of nature reserves and takes great efforts to carry out eco-tourism; and also steps up efforts to increase environmental protection investment to upgrade their technological level and improve the environmental technology to deal with the ecological environment.

Response sub-system in Liaoning Province includes the tourism-oriented policy and efforts to environmental protection. Its comprehensive analysis results are shown in Figure 8. We can see from Figure 8, Liaoning province has done a lot of work on tourism policy and environmental protection, especially after 2002, it has been increasing infrastructure construction, the proportion of tertiary industry investment. In the tourism development projects, the government focuses on the construction of nature reserves and actively carries out eco-tourism projects, in order to improve the tourism environment. Environmental Protection efforts are increasing year by year, and have achieved certain results, but it should also improve the rate of response index.

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 Liaoning 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 Liaoning tourism ecosystem health's indicator system through bestowing on the weights, which proposes the new research mentality for the tourism sustainable development in Liaoning province.

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TABLES

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）

Table 2. Standard data of health indicators of Liaoning eco-tourism system

Target layer	Principle layer	Factor layer	Index layer	2000	2001	2002	2003	2004	2005	2006	2007
Health indicators Evaluation system of Liaoning eco-tourism system	A_1	B_1	C_1	1	0.875	0.7917	0.7222	0.7083	0.7917	0.3056	0
			C_2	1	0.4516	0.5161	0.9677	0.7419	0.7097	0.2903	0
			C_3	0	0.0663	0.1429	0.4025	0.5942	0.8055	0.9333	1
		B_2	C_4	0	0.239	0.358	0.627	0.821	0.761	0.806	1
			C_5	0	0.1069	0.1968	0.2921	0.4009	0.5716	0.7413	1
			C_6	0	0.0179	0.2321	0.4643	0.6964	0.6071	0.875	1
			C_7	0	0.3548	1	0.9677	0.8710	0.6452	0.4516	0.2258
		B_3	C_8	0	0.1186	0.1949	0.2542	0.3136	0.3475	0.7712	1
			C_9	1	0.6727	0.4	0.1545	0	0.0636	0.1818	0.5727
			C_{10}	0	0.0227	0.0530	0.0909	0.0833	0.1894	0.9091	1
	A_2	B_4	C_{11}	0	0.0917	0.2417	0.4083	0.5917	0.925	0.9417	1
			C_{12}	1	0.7432	0	0.5311	0.4669	0.3998	0.3337	0.2004
			C_{13}	0.9819	0.9593	0.8709	0.6753	0.9385	1	0.2679	0
			C_{14}	1	0.2214	0.3825	0.2466	0.0796	0	0.1650	0.1631
		B_5	C_{15}	0.504	0.530	1	0	0.665	0.684	0.759	0.824
			C_{16}	0	0.1094	0.4063	0.2969	0.4375	0.5938	0.7813	1
			C_{17}	0	0.44	0.57	0.61	0.68	0.75	0.81	1
			C_{18}	0.779	0.971	0.926	0	0.838	0.441	0.279	1
		B_6	C_{19}	0	0.0593	0.1675	0.1661	0.3072	0.4577	0.7273	1
			C_{20}	0	0.1545	0.3171	0.4553	0.6016	0.7724	0.8862	1
			C_{21}	0.67	0.69	0.73	0.73	0.75	0.77	0.78	0.8
	A_3	B_7	C_{22}	0	0.0532	0.0890	0.1631	0.2914	0.4750	0.7336	1
			C_{23}	0	0.4722	0.6389	0.6389	0.7222	0.7778	0.8611	1
		B_8	C_{24}	0.0761	0	0.3307	0.3228	0.2073	0.3543	0.9055	1
			C_{25}	0.2887	0.0825	0.3024	0	0.1993	0.2337	0.3986	1
			C_{26}	0.1497	0.0909	0.2620	0	0.5989	0.5561	0.2086	1
			C_{27}	0	0.081	0.218	0.528	0.706	0.863	0.914	1
			C_{28}	0.125	0	0.292	0.625	0.792	0.792	0.958	1

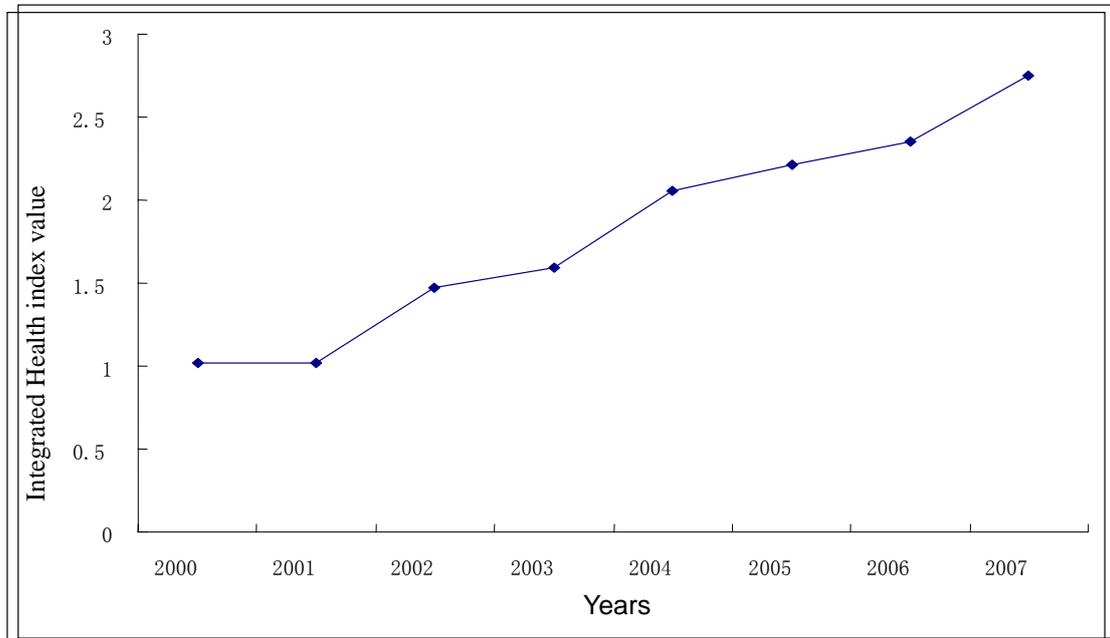**Table 3. Calculation Results of Liaoning Province Tourism Ecosystem Health Status**

(Table 3-a)

Year	B_1	B_2	B_3	B_4	B_5	B_6	B_7	B_8
2000	8	0	2	11.9095	3.849	2.01	0	1.3551
2001	5.5716	1.4567	1.7466	7.665	6.81	2.7707	1.6826	0.5898
2002	5.8028	4.4441	1.4907	6.9921	10.0895	3.8113	2.3617	3.3589
2003	8.3696	6.2725	1.2534	6.8966	3.9245	4.2203	2.7322	3.8024
2004	8.1776	8.2452	1.1074	7.7994	9.4165	5.2836	3.6236	5.9203
2005	9.2276	8.7667	1.5485	8.5746	9.344	6.458	4.7084	6.8155
2006	6.1168	11.1466	4.4954	5.657	10.2605	7.9078	6.2513	8.5889
2007	4	13.4516	6.1454	4.2463	14.472	9.4	8	12

(Table 3-b)

Year	A_1	A_2	A_3	H
2000	1.1	2.5648	0.163	1.0182
2001	1.0094	2.4484	0.2054	1.0192
2002	1.4681	2.9433	0.5920	1.4685
2003	2.033	2.0452	0.6749	1.5906
2004	2.2956	3.1108	1.0003	2.0525
2005	2.5307	3.3336	1.1946	2.2102
2006	2.7267	3.1785	1.5308	2.3556
2007	2.9279	3.7433	2.08	2.7519

FIGURES

Figure 1.   Liaoning Province Tourism ecosystem health index value

	2000y	2001y	2002y	2003y	2004y	2005y	2006y	2007y
▨ Pressur	1.	1.118	1.607	2.279	2.575	2.664	2.768	2.927
▨ Statu	2.564	2.448	2.943	2.045	3.110	3.333	3.178	3.743
▢ Respons	0.16	0.205	0.59	0.674	1.000	1.194	1.530	2.0
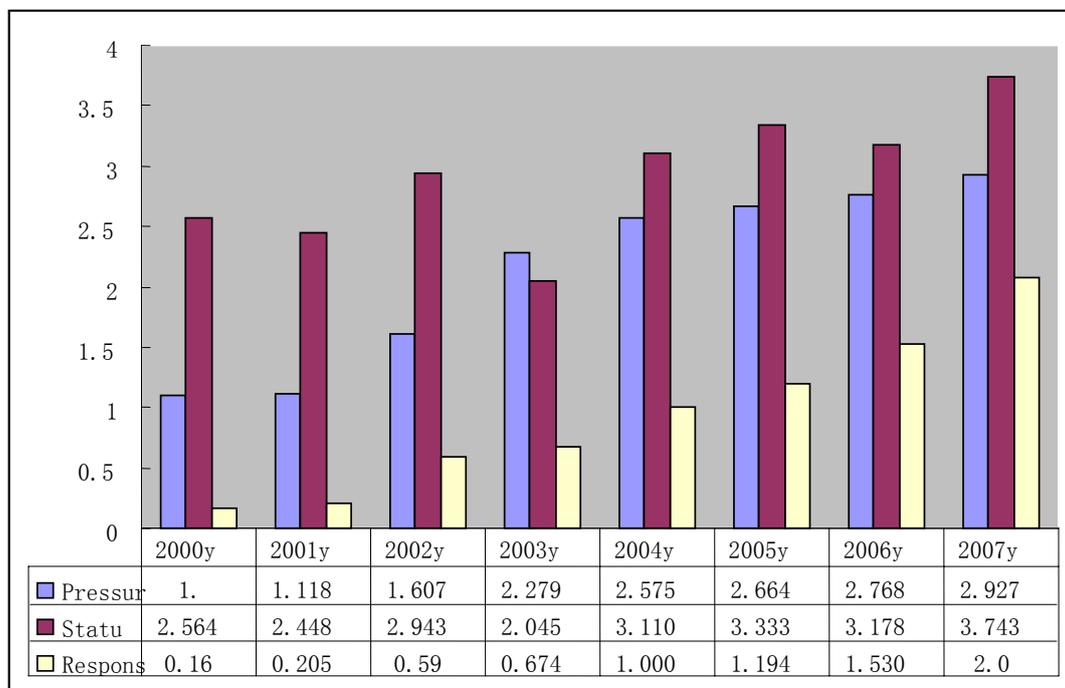
Figure 2.   Health index value to subsystem of the Liaoning Tourism ecosystem
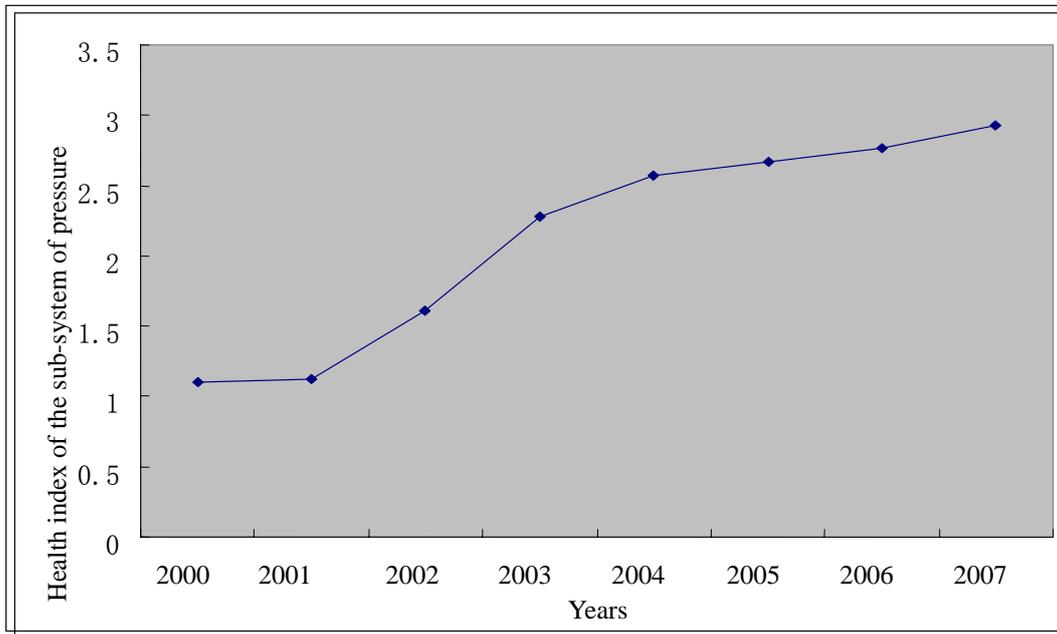
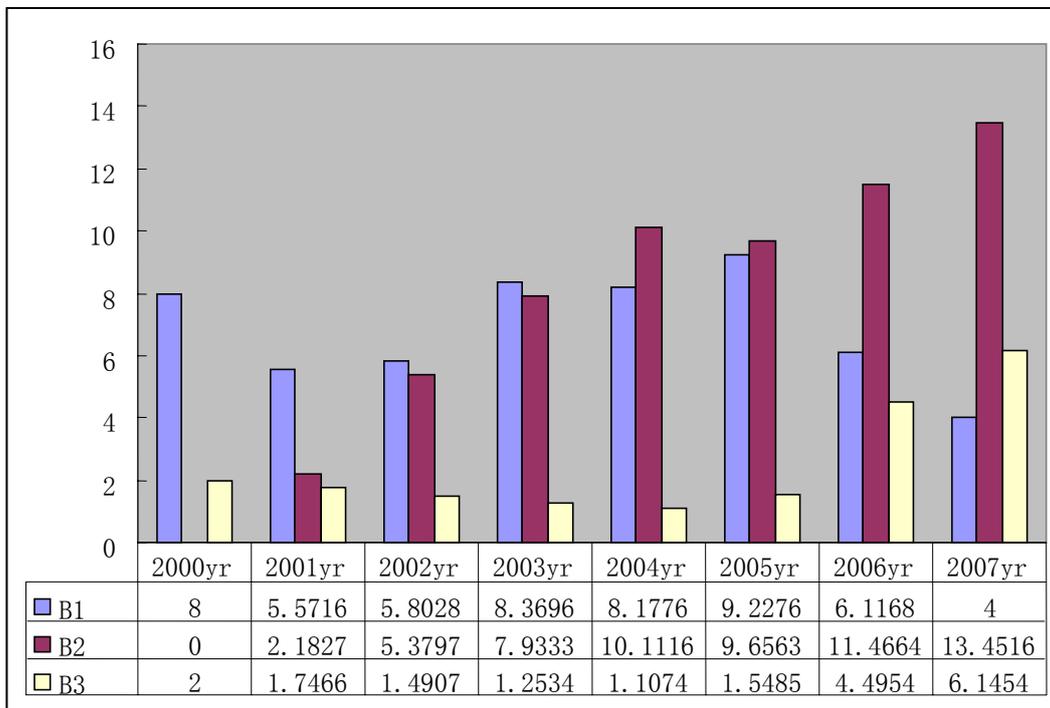**Figure 3.   Ecosystem health index value of the sub-system of pressure on Liaoning Province tourism**

	2000yr	2001yr	2002yr	2003yr	2004yr	2005yr	2006yr	2007yr
B1	8	5. 5716	5. 8028	8. 3696	8. 1776	9. 2276	6. 1168	4
B2	0	2. 1827	5. 3797	7. 9333	10. 1116	9. 6563	11. 4664	13. 4516
B3	2	1. 7466	1. 4907	1. 2534	1. 1074	1. 5485	4. 4954	6. 1454

Figure 4.   Liaoning ecosystem pressure on the tourism sub-index value of all elements of health status
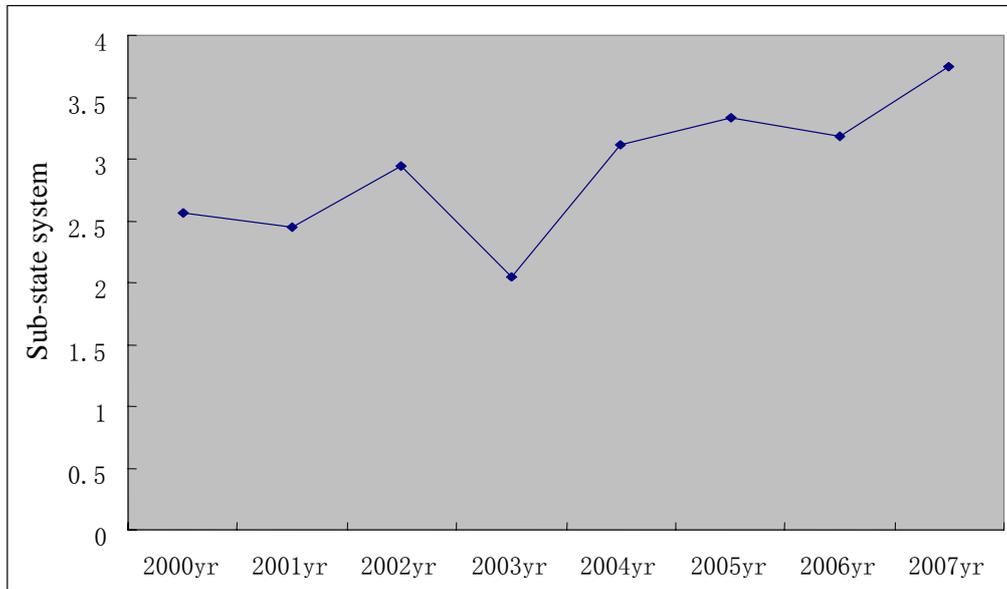
Figure 5. Liaoning ecosystem health tourism sub-index value

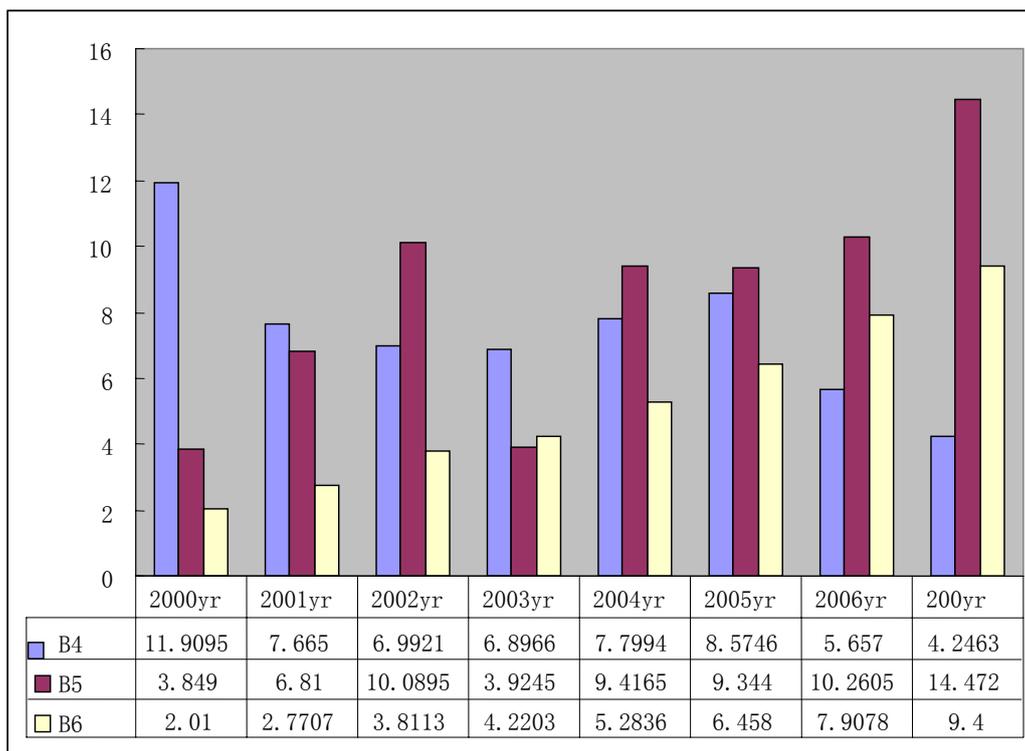|	2000yr	2001yr	2002yr	2003yr	2004yr	2005yr	2006yr	200yr
B4	11.9095	7.665	6.9921	6.8966	7.7994	8.5746	5.657	4.2463
B5	3.849	6.81	10.0895	3.9245	9.4165	9.344	10.2605	14.472
B6	2.01	2.7707	3.8113	4.2203	5.2836	6.458	7.9078	9.4

Figure 6.   The health status of the sub-index value of all elements to Liaoning Tourism ecosystem
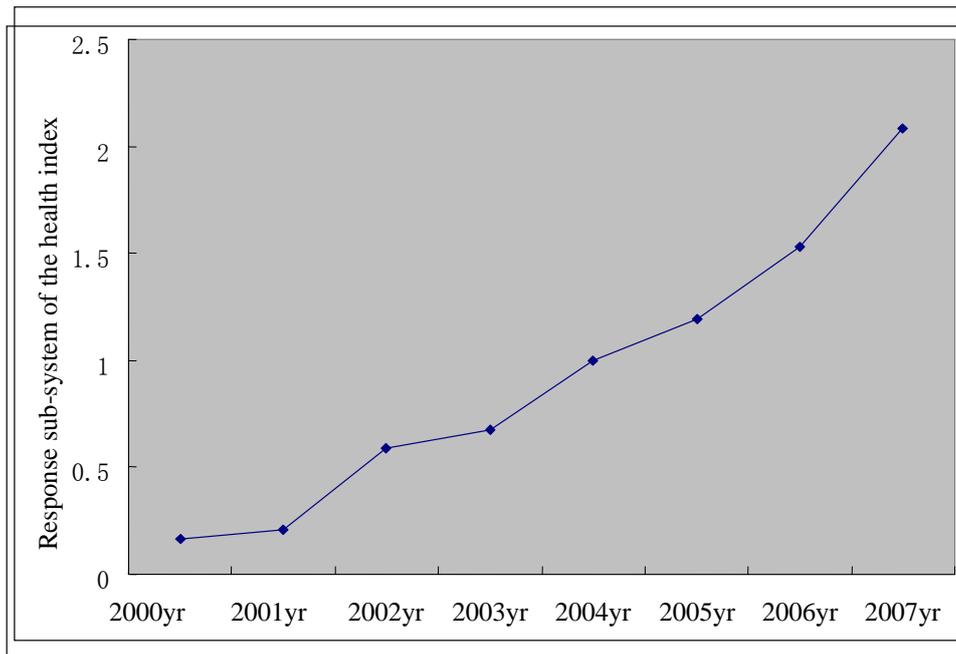
Figure 7.   Response sub-system of the health index value to Liaoning tourism ecosystem

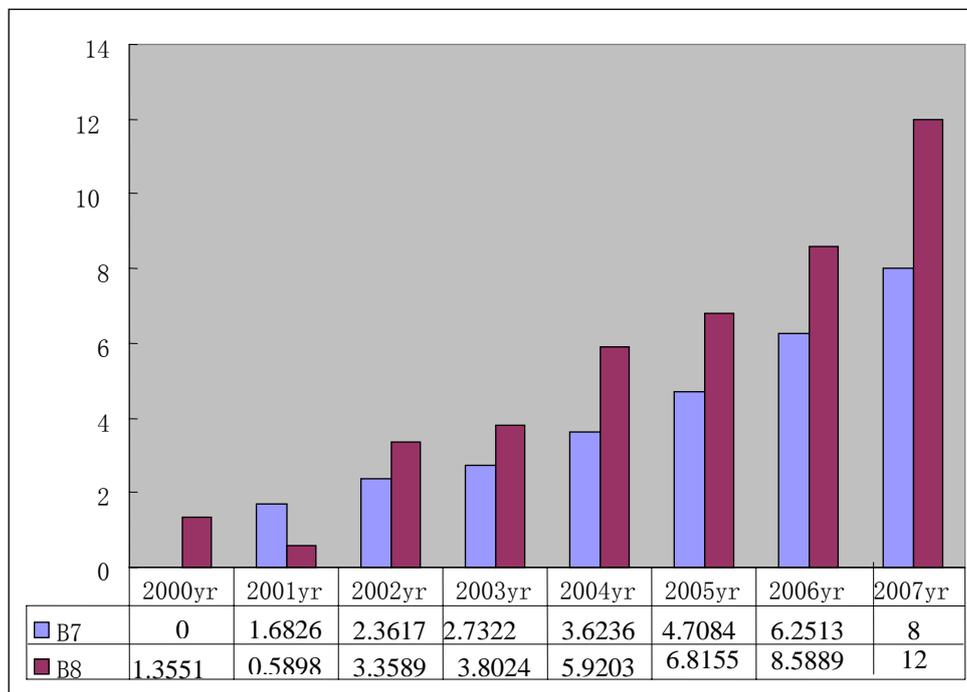|	2000yr	2001yr	2002yr	2003yr	2004yr	2005yr	2006yr	2007yr
B7	0	1.6826	2.3617	2.7322	3.6236	4.7084	6.2513	8
B8	1.3551	0.5898	3.3589	3.8024	5.9203	6.8155	8.5889	12

Figure 8.   Response sub-index values of all elements to Liaoning tourism