Research Article
Evaluation of Land Safety Degree of the Tourist Area Based on the Land Comprehensive Bearing Capacity

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Abstract: The regional land safety evaluation indicator system is built based on the land comprehensive bearing capacity in the study and the primary and secondary relationship of the land safety obstacle factors of Mengshan tourist area and influence degree of various obstacle factors on land safety are determined, so as to provide reference for sustainable utilization of land in Mengshan tourist area. The results indicate that: (i) The land comprehensive bearing capacity of Mengshan tourist area is at the safety state. Where, the social bearing capacity is at the weak safety state, which is the most critical factor influencing the land bearing capacity of Mengshan tourist area. (ii) The traveling and living ratio, the output values of the secondary industry and the tertiary industry of the unit construction land and the land utilization intensity are the key factors influencing the regional safety level.

Keywords: Land comprehensive bearing capacity, land safety evaluation, mengshan tourist area

INTRODUCTION

With rapid development of the tourism industry in recent years, the bearing capacity of some tourist attractions has been close to or exceeded the critical level, which endangers tourist safety, disturbs living of local residents, causes shortage of resources and deterioration in ecological environment in the tourist area and even threatens sustainable development of the tourist attraction. It is the only way to realize "triple win" of tourists, residents and local tourism to find out the land comprehensive bearing state of the tourist area and clarify the regional land safety level. At present, there are more researches on evaluation of land bearing capacity (Cao Yue-e *et al*., 2008; Li and Liu, 2014) and the evolution tendency from the land population bearing capacity to land comprehensive bearing capacity and from single indicator to comprehensive indicator system is shown (Cui and Liu, 1998). In summary, most current researches are emphasized on analyzing the relation between the number of visitors in the tourist area and the land bearing capacity and there are fewer researches on systematic analysis of bearing state in three aspects of environment, economy and society (Qian *et al*., 2009; Liu *et al*., 2009; Huang *et al*., 2013). There are more analyses on the current situation of land bearing capacity in the tourist area, with relatively insufficient researches on the regional land safety level and limiting factors from the land bearing capacity and it is difficult to provide specific measures for promoting the regional land safety.

Mengshan tourist area crosses four counties of Pingyi, Mengyin, Feixian and Yi'nan and consists of four scenery spots of Guimeng, Yunmeng, Tianmeng and Caimeng. From 2005 to 2013, the number of tourists in Mengshan tourist area was increased from 638 thousand person-times to 2.02 million person-times and the tourism income was increased from 271 million Yuan to 712 million Yuan. However, it is the important problem concerned and to be proven whether rapid development of tourism has damaged the natural environment of the tourist area and influenced normal living of local residents. Therefore, we construct the indicator system of the land comprehensive bearing capacity for systematic analysis of the land safety level in the area from the angle of bearing capacity, so as to provide basis for further development of the tourist area.

RESEARCH METHOD

Indicator system and weight: In combination of development characteristics of Mengshan tourist area, through expert suggestions and screening and in accordance with correlation analysis results, the regional land resource safety evaluation indicator system based on the land comprehensive bearing capacity is established, the extreme-value method is

Table 1: Land bearing capacity evaluation indicator and weight

Criteria layer and weight	Indicator layer and weight	Indicator meaning	Indicator type	Target value	Standardization value
Natural bearing capacity/0.347	Land utilization rate/0.184	Land area utilized/total land area	100%	0.91	100%
	Land utilization structure index [1]/0.249	Complete degree of regional land	1	0.75	1
	Agricultural acreage per capita/0.188	Regional agricultural acreage/total population	0.053~0.085	0.81	0.053~0.085
	Cultivated land pressure index/0.201	Minimum agricultural acreage per capita [2]/ actual agricultural acreage per capita	1	0.75	1
	Forest land per capita/0.178	Regional wooded area/regional total population	0.1784	0.99	0.1784
Economical bearing capacity /0.335	GDP per capita /0.209	GDP value/regional total population	10.1	0.42	10.1
	GDP annual growth rate/0.199	GDP of current year/GDP of last year	13%	0.86	13%
	Proportion of the tertiary industry/0.208	Increased value of the tertiary industry/GDP	55%	0.86	55%
	Output value of the secondary industry and the tertiary industry of unit construction land/0.205	Increased value of the secondary industry and the tertiary industry/construction land area	332.93	0.31	332.93
	Per capita net income of peasants/0.179	found from the statistical yearbook	1.5	0.66	1.5
Social bearing capacity /0.318	Population density/0.187	Regional population/regional total area	358.6	0.68	358.6
	Natural growth rate/0.203	found from the statistical yearbook	5‰	0.55	5‰
	Share of grain per capita/0.211	Regionall food output /regional total population	>1000	0.81	>1000
	Traveling and living ratio/0.217	Number of visitors /regional total population	0.67	0.18	0.67
	Land utilization intensity/0.182	Tourism land area/resident land area	0.33	0.21	0.33

1: Gibbs-Mirtin diversification index is adopted in the paper to measure the land utilization structure diversity index; 2: According to related research (Cai *et al*., 2005), it is obtained that the food consumption level is 300 kg/person and 400 kg/person and the minimum agricultural acreage per capita in the tourist area is 0.064 ha and 0.085 ha

selected for standardization treatment and the analytic hierarchy process is adopted to determine the indicator weight (Table 1).

The additive model is adopted to measure and calculate the land bearing capacity:

$$B_i = \sum_{j=1}^{n} P_{ij} \times W_{ij} \qquad (1)$$

wherein,

B_i = Comprehensive evaluation value of ith criteria layer

P_{ij} = Standardization value of jth indicator in ith criteria layer

W_{ij} = Weight of jth indicator in ith criteria layer

n = Number of indicators in jth indicator layer

Diagnostic method of limiting factor: The "factor contribution", "indicator deviation degree "and" obstacle degree" (Qu *et al*., 2014) are introduced in the study, the obstacle degree values of various land safety indicators are calculated and sequenced according to the value and the primary and secondary relationship of the land safety obstacle factors of Mengshan tourist area and influence degree of various obstacle factors on

land safety are determined, so as to adjust the land utilization behaviors of the area:

$$R_{ij} = r_i \times W_{ij} \qquad (2)$$

$$D_{ij} = 1 - P_{ij} \qquad (3)$$

$$A_{ij} = \frac{D_{ij} \times R_{ij}}{\sum_{i=1}^{m} \sum_{j=1}^{n} (D_{ij} \times R_{ij})} \times 100\% \qquad (4)$$

wherein,

R_{ij} = Contribution of jth indicator in ith criteria layer on the overall objective

r_i = Weight of ith criteria layer

D_{ij} = Gap between jth indicator of ith criteria layer and the land safety objective (the indicator deviation degree), i.e., the difference between the appraised value of jth indicator in ith criteria layer and 100%.

A_{ij} = Influence value of jth indicator of ith criteria layer on the land comprehensive safety level, which is the objective and results of obstacle diagnosis.

m = Number of indicators in ith criteria layer. The meanings of P_{ij} and W_{ij} are same with Formula (1):

Table 2: Comparison of land comprehensive bearing capacity index and land safety level

Comprehensive bearing index value	Living standards	Land resource safety level
>0.9	Modern	Very safe
0.8~0.9	Rich	Safety
0.6~0.8	Well-off	Relative safety
0.4~0.6	General	Weak safety
<0.4	Subsistence level	Not safety

RESULTS AND ANALYSIS

Land safety level value determination and analysis:
There is a certain relation among the regional bearing value, the land safety level and people's living standards and there is no uniform standard. The land safety levels are divided according to the actual characteristics of Mengshan tourist area, which is more targeted. The GDP per capita of the tourist area in 2012 is 4,300 Yuan, which is at the level of moderately prosperous society. Meanwhile, according to existing research findings of the ideal state of regional natural, economic and social bearing capacity (Huang *et al*., 2010; Liu *et al*., 2014), the land resource safety bearing capacity in the tourist area is divided into five levels (Table 2).

The bearing capacity index of the land natural system is 0.84 and the natural system is at the safety state, which indicates that the natural resource conditions of Mengshan tourist area are superior. The tourism project development does not cause significant impact on the ecological environment and there is still a certain development space. The land development strategy can be adopted in accordance with local conditions, the foreign investment is accelerated, the resource development force is strengthened, the integrated development capability of the industry is cultivated, construction of supporting facilities of tourism is perfected and the rapid development of social economy at the land safety state is searched.

The land economical bearing capacity index is 0.62 and the economic system is at relative safety state. During construction of the tourism development pattern of "Damengshan", relying on the exceptionally gifted natural conditions, the health pension industry is cultivated and three pension and health industry bases of Mingguang Temple, Mengyang Valley and Dawa are

established and the surrounding apartments for the elderly and health properties of Mengshan are developed. With development of "leisure agriculture, sightseeing agriculture and ecological agriculture" as the main line, the high-efficient ecological agriculture is vigorously expanded.

The social bearing capacity of the land is 0.49 and it is at the weak safety state, which indicates that the social factor is the most critical factor influencing the land bearing capacity of Mengshan tourist area at present, which has large binding force on future development. It is known from the land utilization intensity indicators that the tourism land area of Mengshan tourist area is too small, but the resident land area is too large. The land of rural residents per capita is 226 m^2, which is far more than the upper limit specified in Standard for Planning of Town (GB50188-2007). It can be known from further analysis that the tourism land area accounts for 1/3 of the resident land area in Yunnan. However, the proportion of tourism land area in resident land area is less than 1/10 in Mengshan tourist area. There is a large gap, which also indicates that it has large potential. Overall, the land comprehensive bearing capacity index of Mengshan tourist area is 0.66 and the land comprehensive bearing is at relative safety state, which is consistent with the actual situation.

Analysis of limiting factors of land bearing capacity:
It can be known from Table 3 that the main limiting factors of land safety include the traveling and living ratio, output value of the secondary industry and the tertiary industry of unit construction land and land utilization intensity.

The traveling and living ratio and the land utilization intensity are the optimum value factors, but do not reach the optimum value, which indicates that the number of visitors and tourist land in the tourist area are within the affordable range.

The output value of the secondary industry and the tertiary industry of the unit construction land is ranked at the second place, which indicates that the intensification utilization degree of construction land in the area is relatively low. Mengshan tourist area is at the key stage of transformation from extensive

Table 3: Obstacle degree values of land safety indicators in Mengshan tourist area

Indicator layer	Sequence	Obstacle degree	Indicator layer	Sequence	Obstacle degree
Traveling and living ratio	1	14.48	Cultivated land pressure index	9	5.18
Output value of the secondary industry and the tertiary industry of unit construction land	2	14.11	Agricultural acreage per capita	10	3.69
Land utilization intensity	3	13.51	Grain per capita	11	3.67
GDP per capita	4	11.94	Proportion of the tertiary industry	12	2.80
Natural growth rate of population	5	8.54	GDP annual growth rate	13	2.64
Land utilization structure index	6	6.22	Land utilization rate	14	1.54
Per capita net income of peasants	7	5.94	Forest land per capita	15	0.10
Population density	8	5.63	-	-	-

economy to intensive economy. The village land area in the tourist area accounts for 68.25% of the total area of construction land. Therefore, it is very important for promoting intensive land use and improving land safety level to conduct intensive utilization of village land.

CONCLUSION AND DISCUSSION

The land comprehensive bearing capacity of Mengshan tourist area is 0.66, the land safety degree belongs to relative safety state and people are at the well-off level. There is still a certain development space in the research area and one shall also notice that the social bearing capacity has been close to the unsafe level.

There are the problems of low tourism development degree and poor intensive land use degree in Mengshan tourist area and the important factors limiting land safety of Mengshan tourist area include the traveling and living ratio, output value of the secondary industry and the tertiary industry of the unit construction land and the land utilization intensity. It is suggested to clarify the land function positioning, optimize the land utilization structure and layout and realize ecological protection, peasant income increase and good economic development in the tourist area.

Subject to restrictions of data access, the dynamic characteristics of the land comprehensive bearing capacity of Mengshan tourist area are not revealed in the research, which is the important direction for future improvement.

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