

Landscape ecological assessment and eco-tourism development in the South Dongting Lake Wetland, China

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Abstract: As an important resource and the living environment of mankind, wetland has become gradually a highlight, strongly concerned and intensively studied by scientists and sociologists. The governments in the world and the whole society have been paying more and more attention on it. The Dongting Lake of China is regarded as an internationally important wetland. For a rational development and protection of the wetland, an investigation and studied on its resources and its value to tourism in the South Dongting Lake was conducted, to create an assessment system of the ecological landscapes, and to evaluate qualitatively and quantitatively the value of wetland landscape to the eco-tourism. The results showed that the scenic value of the South Dongting Lake Wetland satisfied the criterion of AAAA grade of China national scenic attraction. The eco-tourism value of the landscape cultures in the South Dongting Lake Wetland was discussed with emphasis. It were formulated that a principle and frame of sustainable exploitation of the wetland landscapes and it was proposed as well that establishing a Wetland Park and developing eco-tourism in the South Dongting Lake. Wetland is a fragile ecosystem with low resistance to the impact of the exploitation. Thus, we must pay intensively attention to the influence of exploitation on the landscape, take the ecological risk in account to employ a right countermeasure and avoid the negative affection.

Keywords: South Dongting Lake; wetland landscape; eco-tourism; Wetland Park; ecological assessment

1 The general situation of the South Dongting Lake Wetland

Located in the north of Hunan Province and the south bank of the Yangtze River middle reaches, the Dongting Lake is one of the five largest freshwater lakes and of the seven most important landscapes of internationally important wetlands in China. The Dongting Lake, as a typical water level regulator of the Yangtze River, receives four main rivers (namely the Xiang, the Zi, the Yang, and the Li River) flowing through the Hunan Province, and the water of the three lake entrances of the Yangtze River. It is a buffer and plays a key role in aspects of tourism, irrigation, transportation, fishing, flood and drought controlling, climate regulation, beautifying environments and landscapes (Zhong, 1999).

There are 2740 km² water area and 4080 km² wetland area in the whole Dongting Lake region. It was separated into three parts, namely the South Dongting Lake, the East Dongting Lake and the West Dongting Lake, due to sedimentation and reclaiming lands in the lake. The South Dongting Lake Wetland, which is the most important component of the whole Dongting Lake Wetland, is situated between 28°36'15"N—29°03'45"N and 112°18'15"—112°56'15"E. It consists of 917 km² water area and 1680 km² wetland area. It is also the national famous inland lake and the wetland nature reserve, which preserves the wetland eco-environment, the rare wild animals, migratory birds and the diversity of the ancient aquatic creatures (Zhong, 1999).

The South Dongting Lake Wetland has unique fascinating scenery, great potential value of eco-tourism and visual aesthetic of landscape characterized as vast, quiet, beauty and grace. Its landscape is especially well preserved and with primitive, natural and rare taste, and is an optimal land for developing sightseeing, recreation, entertainment, expedition, education and scientific research.

It is the premise and base of sustainable exploiting the plentiful and ecological landscape resources in the South Dongting Lake Wetland to evaluate accurately, scientifically and objectively the landscape culture value and its characteristics. Thus, we conducted a comprehensive investigation on the ecological landscape resources of the south Dongting Lake Wetland in 2001. Here now we give a primary analysis on the ecological and tourism importance of the wetland.

2 A qualitative evaluation of the eco-tourism value in the South Dongting Lake Wetland

2.1 Important in ecology, resources and wildness of landscapes

The South Dongting Lake Wetland, occupies one eighth of total area of subtropical wetlands in the world (Jin, 1998; Dou, 2000). It is the most important wetland landscape where between the deserts of hinter land and the tropic forests in Eurasia, and between the western high mountains and the eastern oceans. It occupies a non-fungible position in the landscape ecology. The wetland is less exploited and keeps an original appearance of nature, and shows a rare and primitive wetland landscape. Therefore, it is called "the pearl of the Yangtze River" (The Department of Wild Animals and Plants, State Forestry Bureau of China, 1996).

2.2 Rich in diversities of landscape and natural beauty

The wetland has nearly all forms of inland wetland listed in the convention on wetlands of international importance especially as waterfowl habitat (The State Forestry Bureau of China, 2001). It is constituted by network of rivers and diversified with all kinds of landforms, includes the natural wetland landscapes such as lakes, ponds, forest marshes, reed marshes, and the humane wetland landscapes such as the farmlands, fishponds, irrigation channels, flood-relief lands. It is especially an attractive sight-view that the dynamic change of landscapes induced by the replacement between the lakes the sand-bars (beaches and islands). As the local saying goes "the water rises, the lake appears; the water falls, sand-bars form"; "water-rich season a sea shows up, water-poor season a few streams left". The rising and falling of the water in the lake makes its rich in the wetland landscape diversity and biodiversity (Zhang, 1999).

2.3 Comfortable weather and variety weather phenomenon landscapes

The South Dongting Lake Wetland is located in the subtropical continental monsoon region, which has a mild, humid weather, and has the four distinctive seasons. Because of the huge water body and the lake effects, the local weather in the lake region has somewhat difference, e.g. the temperature difference of day and night is large and there is often land-lake breezes, which makes a comfortable weather to human and a resource for summer resorts.

The special weather condition leads to many weather marvelous phenomena, for example, the unique marginal landscapes, the Dongting Autumn Moon, a Hazy, Tremendous View of the Wind and Moon. The much clouds and fogs enhance the sense of the landscape mystery and hazy aesthetic perception (Dou, 2000).

2.4 Rich in wild animal species and a paradise for rare, precious waterfowl and endanger species

The South Dongting Lake Wetland is a wetland paradise of the wild waterfowls and animals, and it is the most famous habitation and migration place of the migratory birds in China, even in the world. It is one of the best resorts for viewing landscapes and observing birds in the world (The Department of Wild Animals and Plants, State Forestry Bureau of China, 1996). There are 40 families and 164 species of the summer-winter and stay-travel birds and about 12 million migratory birds living in the wetland through the winter annually. There are 23 families and 114 species fish inhabits, including the *Lipotes vexillifer*, the *Neophocaena phocaenoides* which is the unique species in the world and regarded as "the panda in the water" and "living fossil", the species left over by the Cretaceous period such as the *Acipenser sinensis* Gray, the *Psephurus gladius* (Martens), the *Myxocyprinus asiaticus* (Bleeker), the *Anguilla japonice Temminck et Schlegel* (Jin, 1998; Dou, 2000).

2.5 Rich and colorful plant landscapes

The wetland is rich in plant landscape diversity. There are about 40 families, 75 genus and 131 species of the hydrophytes. Of which wetland plants are an important part of the vegetation (The Department of Wild Animals and Plants, State Forestry Bureau of China, 1996). Many wetland plants have not only great value in science but also in appreciation. The plant landscape is constituted by different type of landscapes as mosaics in the lake region. The landscape of green forests and quiet lake, the cropland and pastoral landscape are full of birds and fragrant flowers, and there is the second largest bulrush community landscape in the world (Jin, 1998). It is the typical landscapes in this region that the lotus field, the plain forest net, the wave and tide-break forest, the scenic forest, the fast-growing timber forest, the city forest, the non-timber forest, the cattle and sheep's grazing lands, the crisscross crop fields and the fragrant and wild plant community landscape, which create a charming, vigor and vital scenery.

Meanwhile, a culture of plant landscape was evolved and developed. It is mainly composed by the culture of lotus, which is symbolized pure, honest and faithful, the plant landscape culture of "the four wild vegetable rarities in the wetland" (i.e. Waterdropwort, Seleng Wormwood, Asparagus and the Knotweed seed), and the Xiang-Chu customs which is in honor of Qu Yuan, the culture of reeds symbolized as tenacity and solidarity and the culture of the cogongrass in the Yueshan Mountain that led to the war between China ancient Qi State and Chu State territories (The Office of Yuanjiang County Annals, 1991).

2.6 Precious value of the unique human landscapes

The South Dongting Lake Wetland has not only very high visual aesthetic value but also rich in landscape cultures. It is the cultural origin of Chinese Yangtze reaches, the cradle of Chu-culture, one of the important area of world ancient civilization, the center area and hotspot of Chinese modern revolution. It is also a place in where mankind lived one hundred thousand years ago. Before 5000 years ago, the primordial villages had been already well developed in the Shicheng Mountain of Lu-Lake, Beida Nanjing Hill, Qizhixia, Houlongxiang, Son and Mother Town in Huangmouzhou and so on. At the Bronze Ages, the collective villages in the Lu Lake, the Minglang Mountain, the Lianzitang were rather dense.

The soul of the South Dongting Lake culture is wetland culture, water culture, rice cultivation culture and Chu culture. It can be divided into three categories: the substance culture, spirits culture and system culture (behavior culture), which include mainly the rice cultivation culture, high-balustrade dwelling, nuo culture, ship culture, dragon boat culture, celerity culture like Qu Yuan and so on. There are the only pure professional fishing villages within the Hunan Province.

2.7 Season dynamic changing of wetland landscapes

The South Dongting Lake has not only rich diversity of beautiful landscapes but also a seasonal changing of landscapes. It changes with seasons in a year. The most typical seasonal landscapes are the water body, the migratory waterfowls, the pastoral landscape alternation, the plant seasonal change, fishing and field activity in a year, which enhance greatly the appreciation value of the wetland landscapes (Deng, 2000).

3 A quantitative evaluation on the eco-tourism value of the South Dongting Lake Wetland landscape

According to the eco-tourism features of the wetland landscape resources in the South Dongting Lake, we evaluated quantitatively on the eco-tourism value of the wetland landscape by Delphi and AHP (Wu, 1999; Li, 2000; Turner, 1990; Goodall, 1997).

3.1 The classification assessment of the national scenic attracts

According to "the detailed score regulations on landscape quality assessment" (China National Tourism Administration, 1999) we defined and set up the assessment modeling of the wetland landscape quality in the South Dongting Lake (Table 1).

The landscape resources were divided into the landscape resource elements and the landscape market factors, each with nine items of assessment, and each item included four classes, and the full score of assessment is 100. Table 2 is the classification criterion of national scenic attraction.

We employed the appraisal method of expert school (ES) and according to the detailed score regulations on landscape quality assessment to assess the value of the wetland. Then we scored the factors and items (China National Tourism Administration, 1999) and figured out the average score of each factor and item. At last, we calculated landscape quality comprehensive index of the South Dongting Lake Wetland according to the following formula of the landscape quality comprehensive index:

$$A = C_1 + C_2 = S_1 + S_2 + \dots + S_n = \sum S_i, \quad (1)$$

Table 1 The modeling tree and landscape quality assessment standard

Item and points	Factor and points	Level and fuzzy points	
		Grade and base	Fuzzy points
Value of landscape elements(65) C_1	Value of appreciation and recreation (25) $S_1 = 20,3$	I Highest	25—20
		II Higher	19—13
		III Average	2—6
		IV Poor	5—0
	Value of history, culture and science (15) $S_2 = 15$	I Highest, or world significance	15—13
	II Higher, or national significance	12—19	
	III High, or provincial significance	8—4	
	IV Common, or regional significance	3—0	
	Biodiversity, Rarity and Wonder (10) $S_3 = 8.9$	I Richest, rarest, world significance	10—8
		II Richer, rarer, national significance	7—5
		III Rich. rare. provincial significance	4—3
		IV Common, common, regional significance	2—0
	Scale and density of Scenery (10) $S_4 = 9.3$	I Largest bulk capacity, basic type > 40, highest	10—8
		II Larger, > 30 higher	7—5
		III Large, > 20 high	4—3
		IV Common, > 10 average	2—0
	Integrity of Scenery (5) $S_5 = 3$	I Perfect, fully natural feature	5—4
		II Good, no obvious change	3
		III Better, no great change	2
		IV Average, no basic change	1—0
Value of landscape market(35) C_2	Reputation (10) $S_6 = 8.3$	I World	10—8
		II National	7—5
		III Provincial	4—3
		IV Regional	2—0
	Admiration and appreciation degree (10) $S_7 = 7$	I Excellent, over 90% tourists and experts	10—8
	II Better, 80%—90%	7—5	
	III Good, 70%—80%	4—3	
	IV Average, 60%—70%	2—0	
	Market potential(10) $S_8 = 8.8$	I Greatest	10—8
		II Greater	7—5
		III Great	4—3
		IV Average	2—0
	Tourism days (d) (5) $S_9 = 3$	I > 300d	5—4
		II > 250d	3
		III > 150d	2
		IV > 100d	1

here, A is the comprehensive index of landscape quality; S and C see Table 1.

The landscape quality comprehensive index of the South Dongting Lake Wetland is 85.6 scores and surpassed the standard of the AAAA of the national scenic attractions. It implies that the landscape resource in the South Dongting Lake has great potential in exploitation, and that it could be one of the most ten biggest and prospective new eco-tourism attractions in China in the future(Dou, 2000; Deng, 2000; Jin, 1998).

3.2 Valuation of region division structure

3.2.1 Building the recurrence class structure of wetland landscape quality evaluation

In accordance with the newest research achievements domestic and abroad(Zhong, 1999; Turner, 1990; Zube, 1982; Smardon, 1983; Laughlin, 1986; Auther, 1977), the actual wetland eco-tourism resources, and national regulations and standards(Protection Dept Wild Animals and Plants, 2001), we built up a system of the recurrence class structure of quality evaluation in the South Dongting Lake Wetland landscape(Table 3).

According to the suggested indexes, the evaluation indexes and Delphi and AHP, we evaluated and compared the relative

Table 2 The classification standard of the national scenic attractions

Class	AAAA	AAA	AA	A
Scores	85—100	75—84	60—74	50—59

importance of factors, and given their judgment on c_{ij} of each two factors, and established the judging matrix C as the following:

$$C = \begin{bmatrix} c_{11} & c_{12} & \dots & c_{1n} \\ c_{21} & c_{22} & \dots & c_{2n} \\ \dots & \dots & \dots & \dots \\ c_{n1} & c_{n2} & \dots & c_{nn} \end{bmatrix}$$

After fixing the appraisal modeling and the weight of each factor and item, we applied the 100-score method of the fuzzy mathematics, in accordance with the scoring requirements and the standard of the factors and items' gradation, to figure out score of items and factors (Table 3).

Table 3 The modeling tree and the standard of eco-tourism value assessment in the South Dongting Lake Wetland Landscape

Sorts (C)	Items (F)	Factors (S)	Classification standards and fuzzy scores						
			10—8	8—6	6—4	4—2	2—0		
Wetland feature $C_1 = 28.82$	Landforms $F_1 = 5.80$	Sorts and typical	2.23	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Visual image	1.70	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Wetland vegetation $F_2 = 3.41$	Environ.	1.87	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Diversity	1.53	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Comm. environ.	0.20	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Rarity	1.17	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Type and status	0.51	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Animal $F_3 = 5.69$	Waterfowl	3.08	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Rarity	2.50	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Sound	0.11	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Water body $F_4 = 10.21$	Size	8.03	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Shape	1.35	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Inverted image	0.83	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Eco-environ. $F_5 = 3.71$			☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Landscape quali. $C_2 = 49.31$	View value $F_6 = 25.62$	Aesthetics	13.01	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆
			Peculiarity	6.12	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆
Scales			4.58	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Color			1.91	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Science $F_7 = 4.35$		Research	3.83	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Popularity	0.52	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Culture $F_8 = 19.34$		History	6.84	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Customs	5.97	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Arts	1.85	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Reputation		4.68	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆		
Capacity $F_9 = 3.35$				☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Orientation $C_3 = 13.46$	Feature structure $F_{10} = 8.72$	Sorts & density	3.01	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Number & combination	2.67	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Clarity	2.01	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Region combination	1.03	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆		
Tourist days $F_{11} = 1.39$			> 300 days	300—250	250—150	150—100	< 100		
Condition $C_4 = 8.41$	Facility $F_{12} = 4.23$	Basic	0.71	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Tourism	1.43	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Elements	1.03	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
		Service	1.06	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
	Transport $F_{13} = 4.18$	Accessibility	2.13	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆	
Safety	2.05	☆☆☆☆☆	☆☆☆☆	☆☆☆	☆☆	☆			

3.2.2 The quality evaluation of wetland landscape division

According to the standard of the natural and humane landscape assessment in the South Dongting Lake Wetland (Table 3), we scored fuzzy points of the items and items of the scenic division by the following fuzzy mathematics modeling of landscape quality comprehensive index in the South Dongting Lake Wetland, then calculated the landscape quality comprehensive index of the different scenic spot divisions (Shi, 1997; Wang, 1992; Smardon, 1983).

$$A_{ij} = S_{ij} \cdot W_i; \tag{2}$$

$$B = \sum S_i \cdot W_i. \tag{3}$$

Here, *A* is the comprehensive index of landscape quality; *B* is the landscape quality comprehensive index of the scenic spots division; *S* is the fuzzy scores of the evaluation elements; *W* is the weight of evaluation elements; *i* is the No. *i* landscape factor; *j* is the No. *j* scenic spot division.

The eco-tourism landscapes of wetland were divided into five classes as in Table 4. The landscape qualitative comprehensive indexes of the scenic division in the South Dongting Lake Wetland are shown in Table 5.

The results showed that the wetland landscape of South Dongting Lake was fairly attractive. The Wanzi Lake Scenic Area, Minglangshan Island Scenic Area, Chishan Island Scenic Area are listed in class I. Their scores were 95.96, 94.03, 91.70 respectively. The Yangzi Lake Scenic Area was in class II, then Yuanjiang Scenic Area, the III.

3.3 Landscape quality index, classification and ranking

The landscape quality index, classification and ranking in the wetland serves the landscape protection, planning and construction, and are the premise and essential presupposition of the scenic spots, protection division, tour roads organization, the spots choice of architecture and tourism facilities (The Office of Yuanjiang County Annals, 1991; Deng, 2000) and so on.

According to the landscape evaluation standard (Table 3), we calculated and classified the landscape quality index in the South Dongting Lake Wetland by the fuzzy mathematics method and the equations (2) and (3). The results are shown in Table 6 and 7.

Table 4 Classification standard of the eco-tourism landscapes in South Dongting Lake Wetland

Classifications of the scenic division	Scores	Class
Excellent scenic area	≥ 85	I
Better scenic area	75—84	II
Good scenic area	65—74	III
Average scenic area	55—64	IV
Poor scenic area	≤ 54	V

Table 5 The analysis of landscape resource divisions & structure in the South Dongting Lake Wetland

Attraction name	Wetland feature C ₁					Quality C ₂			Orientation C ₃			Condition C ₄		Σ	Class
	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉	F ₁₀	F ₁₁	F ₁₂	F ₁₃		
Chishan Island area	5.39	3.40	4.83	9.10	2.39	25.32	4.10	18.32	3.12	6.41	1.39	4.17	3.76	91.70	I
	25.11					47.74			10.92			7.93			
Minglangshan Island area	5.80	2.89	5.31	10.21	3.66	25.53	4.30	19.28	3.28	8.41	0.81	2.12	2.43	94.03	I
	27.87					49.11			12.50			4.55			
Yuanjiang area	4.50	1.20	2.31	6.10	2.41	18.63	3.14	13.86	1.89	5.36	1.39	4.19	4.18	69.16	III
	16.52					35.63			8.64			8.37			
Wanzi Lake area	5.80	3.28	5.69	10.21	3.71	26.62	4.32	18.36	3.31	8.69	0.70	2.18	2.69	95.56	I
	28.69					49.30			12.70			4.87			
Yanzi Lake area	3.71	1.30	3.91	8.93	3.10	21.48	3.10	14.12	2.30	5.31	1.10	4.10	4.02	76.48	II
	20.95					38.70			8.71			8.12			
Gongda area	4.10	3.12	1.39	3.91	2.63	21.61	1.12	8.34	2.30	2.10	1.21	2.13	1.89	55.85	IV
	15.15					21.07			5.61			4.02			
Σ	29.30	15.19	23.44	48.46	17.90	139.19	20.08	92.28	16.2	36.28	6.60	18.89	18.97	482.78	I

The wetland scenic spots in the South Dongting Lake were divided into five grades (Table 7).

3.3.1 Perfect grade scenic spots

The landscapes over 85 scores were in this class, it included the Swan Lake, the Xiang Lu Hill, the Liujia Lake, Minshan Swamp, the Sole Island Forest Swamp, Zhenjiang Tower, the Xiaokouzhai Lake, the Yanzi Lake, and the Guaignzhou Park, whose are natural scenery. They are the main components of the wetland landscape and the core of eco-tourism in the South Dongting Lake. The thoughts of the ecological planning and exploitation should be applied to strive for the characteristic and charming projects of wetland eco-tourism in the South Dongting Lake.

3.3.2 Grade I scenic spots

The landscapes scored 75 to 84 included the Junma Linjiang, the Ancient Tombs during the Warring States Period, the Sites of the Primitive Society, Fanli Temple, the Reed Field in the Wanzi Lake, the Lianhua'ou Reed fields, and the Lotus Pool and the Moon Scenery. They are the rare, precious landscapes that have important national protection value and a representative importance. They possess an international attraction. Thus, these landscapes should be exploited step by step with emphasis on protection and developed to be the main parts of eco-tourism and protection in the South Dongting Lake wetland landscapes.

3.3.3 Grade II scenic spots

The Grade II scenic spots there such as the Guangong Shazui, the Golden Cock Cliff are mainly the wetland natural scenery with the cultural landscapes in part. They play a key role of the province-level value, of regional importance and representative, and have a potential of appealing to the tourists inside and outside Hunan Province.

3.3.4 Grade III and IV scenic spots

These two grade landscapes have an auxiliary scenery function and an average value. But they are basic part of landscape resources, constructed the background of landscape and have an attraction to the local and nearby regions. In general speaking, they do not have significant value of protection, thus they leave a large room for future development. They are the main places to the activity of construction and restoration of the landscape.

Table 6 The ranking and index of eco-tourism value of scenic spots in the South Dongting Lake Wetland

No.	Attractions	Index	Scenic spots	No.	Attractions	Index	Scenic spots
1	Swan Lake	96.39	WLSL	41	Han Dynasty tobms	76.38	MSD
2	Xianlu Mountain	96.12	CSD	42	Dragon & Tiger Hill forest park	76.29	CSD
3	Liujia Lake	96.10	WLSL	43	Longhushan sunrise	76.06	CSD
4	Mingshan reed swamp	95.94	MSD	44	Shi li Lotus Pool	75.69	CSD
5	Gudao forest swamp	95.21	MSD	45	Yishi Village	75.36	CSD
6	Zhenjiang Tower	94.69	WLSL	46	Jiangzhutou Lake	75.24	CSD
7	Xiaokouzai Lake	92.13	WLSL	47	Guangong Shazui	74.98	CSD
8	Yanzi Lake	92.08	YLD	48	Bian Lake fishing	73.69	CSD
9	Guaiguizhou forest park	91.44	GSD	49	Golden chicken cliffs	72.97	CSD
10	Chaguan swamp	91.15	CSD	50	Guoxian Relics	72.26	MSD
11	10000 mu lotus ponds	90.49	CSD	51	Shi lake autumn moon	71.67	YSD
12	Fish island outlook	90.38	MSD	52	Chi River Calling Ferry	71.28	YSD
13	Lingyun Tower	89.96	YSD	53	Liuti Chunzhang	70.98	YSD
14	Liaodaokou Lake	88.98	WLSL	54	Fish Village Sunrise	70.63	WLSL
15	Lianhua'ao Lake	88.84	WLSL	55	Zhiyun Palace Relics	70.39	MSD
16	Baota Lake	88.58	WLSL	56	Farmer Villige	69.30	YLD
17	Guzhang Shengla Tree	87.99	CSD	57	Farmer museum	68.18	YLD
18	Mingshan outlooks	87.91	MSD	58	Lake customs village	67.94	YLD
19	Lu lake reed field	86.32	GSD	59	Datong lake yard	67.32	GSD
20	Mingyue Chengwang	85.38	CSD	60	Gongshuang Cha yard	67.02	GSD
21	Junma Linjiang	84.97	CSD	61	Water City Outlooks	66.38	YSD
22	Zhangguo Tobms	84.63	MSD	62	Yangming yuan Tobm	65.24	MSD
23	Primitive Society Sites	84.19	MSD	63	Langju Xian Orchard	65.12	MSD
24	Fanyi Temple	84.01	CSD	64	Dongting Pavilion	64.96	YSD
25	Wanzy lake reeds	83.91	WLSL	65	South-East lake forest garden	64.27	GSD
26	Caowei forest garden	83.24	GSD	66	Shuishang village forest garden	63.91	GSD
27	Dongguanzui forest park	83.09	GSD	67	Niugao Shuanna Tree	63.41	YSD
28	Zhiqingzhijia	82.93	YLD	68	Hunan 1st prison sites	62.99	MSD
29	Hetan Yuese	82.38	YLD	69	Fishing in the lake	62.98	WLSL
30	Forest model base	81.79	CSD	70	Wild vegetables treasure	62.97	WLSL
31	Wetland animal museum	81.24	YSD	71	Wugangzhou Patriotic Base	62.81	GSD
32	Qiong Hu park	81.03	YSD	72	Chishan wanmu orange garden	62.42	CSD
33	Five lake resorts	80.99	YSD	73	Changyao Massacre Tower	61.93	GSD
34	Dongting bridge	80.38	CSD	74	Wang Fu Cliff	61.63	YLD
35	Fenghuang yard	79.42	YLD	75	Baisha Ferry	61.27	CSD
36	Heyiezhui	79.21	YLD	76	Shangubang drama	61.26	CSD
37	Yanzi Lake Yard	78.81	YLD	77	Kuixing Pavillion	61.13	YSD
38	Dongting museum	78.03	YSD	78	Yangmuo Army Sites	61.04	WLSL
39	Lianhua'ao reeds field	77.34	WLSL	79	Chishan old lithic ages site	60.97	CSD
40	Dragon boat race	76.84	YSD	80	Sites of Qing Dynasty Town	60.93	MSD

Notes: WLSL is the Wanzy Lake Scenic Division; MSD is the Minglangshan Island (The Mountain Minglang) Scenic Division; CSD is the Chishan Island (Mountain Chi) Scenic Division; YLD is the Yanzy Lake Scenic Division; YSD is the Yuanjiang City Scenic Division; GSD is the Gongda Scenic Division. the score of any item or factor was an average of scores given by at least twenty experts

Table 7 The classification standard of the eco-tourism scenic spots in the South Dongting Lake Wetland

Classifications of the scenic spots	Index scores
Perfect grade scenic spot	≥ 85
Grade I scenic spot	75—84
Grade II scenic spot	65—74
Grade III scenic spot	55—64
Poor grade scenic spot	≤ 54

4 The sustainable exploitation of the South Dongting Lake Wetland landscapes

The results showed that the South Dongting Lake Wetland kept still its original appearance of nature and good ecological environment. It accumulated and sediment unique humane cultures and rich customs during the development and evolution. However, a wetland is a sensitive and fragile eco-system, we must keep always that conception in mind, otherwise, its natural, humane landscapes and environment could be destroyed over night.

Thus, to set up a wetland park and conduct eco-tourism is the best way of exploitation in the region, which will content the ecological demands, regional social and economical development.

4.1 Philosophy of exploitation

It is the basic principal that sustainable and coordinately development of population, resources and environment for the exploitation in the South Dongting Lake Wetland landscapes. An ecological principal of fragile ecosystem must be obeyed and be kept in mind all the time. We should work out a way of the regional development with benefits simultaneously to economics, resources and environment. Thus, a protective featured eco-tourism is the best way to meet such a task.

4.2 Exploitation principles

The exploitation of the landscape in the wetland must persist in the principles in following: the scientifically programming, the sustainable development, the maximum community participation, the specialist participation, the whole region development, the multiple tourism products development, the environment and culture sensitivity consideration (Zhong, 1999).

It is the key and core of the sustainable development of wetland landscapes that conducting an ecological planning in the exploitation of wetland resources. The main considerations of ecological planning are: natural following (minimum or no impact on culture, environment and life style), harmony of resource and products, the eco-relationship between elements, relaxation activities (appreciation, participation and entertainment), environment system (sign, facilities, ecology), presentation of cultural evolution (ancient, recent and modern times), operation processing (construction, management, administration), interest groups (ecology, economy and society) and sustainability (long, middle and short term).

Employing the landscape ecological principle and based on the local geographical landforms and cultural tradition, one should divide the landscape into different functional divisions. Thereafter, we must construct the special products of eco-tourism according to the feature of each division and combine harmoniously "the patch, the corridor" of artificial construction with natural ones to avoid the man-made destroy. The protection of wetland landscape and its biodiversity must be concerned and improved greatly by means of the technical and theory of ecology (Xiao, 1998a; 1998b).

4.3 Establishing the South Dongting Lake Wetland Park and developing eco-tourism

The base of eco-tourism is the resource of eco-tourism. In the South Dongting Lake, the main resource is natural and cultural landscapes. A wetland park is, based on the landscape elements, such as the wetland, vegetation, culture, waterfowl, ecological environment and the like, one of the best form of development in protection and economy. There are 2731 km² of wetland in China and without any park of wetland up to now. The Dong Ting Hu wetland is the largest one of fresh water. It is necessary to set up the first wetland park in the South Dongting Lake in China, which will provide an example of wetland protection and the international level ecological tourism resorts at the same time.

The park should be design to realize the goal of protection economic development. Thus, it must be taken into account in design that the eco-tourism activities, such as sightseeing, entertainment, relaxation, inspection, expedition, accommodation, scientific research and so on, and that the resources protection activities, namely education, pollution control, fir control, ecological and eco-tourism capacity control and so on. It should be established during the operation of the park that a conception of harmonization among the nature, cultural landscape and eco-tourism.

The wetland eco-tourism in this region is the best way to satisfy the sustainable development in society, economy and ecology. To reach the goal of eco-tourism, we must conduct eco-tourism under the guide of ecological engineering, wetland science, ecology and landscape ecology. Then, it will be archived that simultaneous benefits of social, economic ecological environment protection.

Therefore, an eco-tourism program in the wetland region should content not only the tourism part, which amuse people and make a atmosphere of entertainment, but also embody fully the protection activity to be a tourism attraction, which is the most important part of the eco-tourism. The local people should not be forgotten in the program. They should be benefited and involved into the eco-tourism as manager, resources and stockholder. Thus, a community participation of local people is an important aspect to have a successive eco-tourism there.

The whole wetland should be divided into different parts, a core area of protection, an experimental area, a buffer and a developmental. Of which a core area of protection is an important district of the wetland-park where any action beyond protection is not allowed. The others are the place where eco-tourism taking place. However, a conception of fragile ecosystem must always be kept in mind and any action in wetland has to be in accordance with their ecological feature and social character and cultural tradition. Otherwise, an irrational exploitation will damage the resource in wetland in a very short period.

4.4 Ecological conservation and the restoration engineering

There are different action models in development of natural resources. The main types are the absolute conservation, exploitation conservation, rebuilding conservation and the substitution, and so on.

The wetland, because of the expanding of the farming land in recent 50 years, has shrank very much. Dams, farming land and living place have occupied much area of the wetland, which destroy, disturb and change the nature of the wetland. Thus, it is necessary that return the occupied land to the lake to have the wetland restored and recovered. A lake landscape restoration engineering program should be set up. The environment construction inside and outside lake yard, the rebuilding and utilization, the engineering and administration, the science techniques and ecological engineering must be combined closely in order to maintain, restore and increase the diversity of the lake wetland landscape.

The perfect grade scenic spots and the Grade I scenic spots should be put under fully protection and only pure "eco-activity" is allowed to be take place, which protects the wetland sorts, the terrain and landforms, plants and animals, the primitive, wild ecological environments. Only the most necessary constructions are allowed built in the Grade II scenic spots in the light of local condition. The common constructions can be built in the Grade III and IV scenic spots. The tourism must be conducted by means of no pollution and by realizing the reuse of natural resources. Thus, it should be stressed that a combining of eco-planning, modern technology, development and resource protection in the eco-tourism.

Development and conservation are always somewhat of contradictions. In a fragile area like wetland this contradictory is often even sharper. However, an eco-tourism program is the best way to harmony it. It should be carried out in advance that an environmental supervision and the ecological restoration in the wetland in the South Dongting Lake. It will be helpful to employ CQE, which is the Capacity Investigation, the Quality Control, and the Evolution Protection, in conservation and restoration programs (Cohn, 1988; Boo, 1991; Ceballos, 1991; Mensing, 1998).

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