

ORIGINAL ARTICLE

Research about the Evaluation Index of Agricultural Sightseeing Garden Landscape Resources based on AHP

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Abstract

On the basis of conducting a comprehensive investigation to agricultural sightseeing garden landscape resources, we established a evaluation index system of agricultural sightseeing garden landscape resources. From the perspective of experts, comparing the importance of all levels indicators, we obtained the weights of landscape resources evaluation index through using the Analytic Hierarchy Process. The result showed that the descending order of the weights of influence of agricultural sightseeing garden nineteen evaluation index is: reach ability (0.128), safety (0.083), location (0.078), participatory (0.076), cultural value (0.058), ecological conditions (0.057), scenic beauty (0.0505), environmental quality (0.051), featured properties (0.0501), environmental tolerance (0.048), reputation (0.047), environmental capacity (0.045), humanize (0.041), spots configuration (0.034), applicable travel period (0.033), scientific value (0.032), art value (0.031), holistic (0.03), suitability (0.027), it can provide a framework and basis for the planning, management, protection and exploitation of agricultural sightseeing garden landscape resources.

Key words : Agricultural sightseeing garden, Landscape resources, Analytic hierarchy process

1. Introduction

With the improvement of people's aesthetic ability and the enhancement of people's environmental awareness, they have put forward higher requirements for the landscape, more and more like diversified leisure way, and eager to return to pastoral scenery. Agricultural sightseeing garden is a new industry with the combination of agricultural production and tourism, it develops rapidly in recent years(Madalenol, 2000). Its main tourism content includes agricultural production, plants, animals, roads, garden sketch, water scenery and so on. Currently, there are more

research on the design of agricultural sightseeing garden(Wang, 2008), while there no reports on the landscape resources evaluation of agricultural sightseeing garden. How to take the landscape agricultural sightseeing garden resources as an example to choose and determine the evaluation index, then establish the evaluation system, moreover apply various landscape resources to guidance, which will be a research topic which has the extremely practical significance. The paper puts the constituent elements of the agricultural sightseeing garden landscape as the basis, analyzing the landscape resources evaluation system in a quantitative way,

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screening and ranking the index affecting the effect of landscape resources, providing scientific basis for the planning and design of agricultural sightseeing garden.

2. Research Methods

In this paper, we use the analytic hierarchy process (AHP) method (Huang et al., 2002) and expert investigation method, and made multiple comparative evaluation. By using the 1-9 proportional scaling method to contrast quantitative factors, construct judgment matrix and calculate index weight. The

statistical respondents are teachers and students of the landscape architecture major in the Shan dong Agricultural University, a total of 27 questionnaires, recycling 27 copies, 25 effective copies. The recycling rate 100%, effective rate 92.5%.

3. Results and Analysis

3.1. Investigation results and analysis

3.1.1. Constituent elements of agricultural sightseeing garden landscape resources

On the basis of investigating constituent elements of agricultural sightseeing garden landscape resources

Table 1. Constituent elements of agricultural sightseeing landscape

Landscape resources	Type	Element
Natural landscape resources	Topographic features	Flat, convex, concave, mountains, hills, basins
	Animals	Chicken, duck and other poultry, cow, sheep, pig and other livestock, fish, frog and other aquatic animal, butterfly, bees and other insects, sparrows, larks and other birds
	Plants	Wheat, corn and other crops, vegetables, fruits, flowers and other economic crops, arbor-shrub-grass and other green plants, lotus reeds and other aquatic plants
	Water	Ponds, lakes, rivers, fountains, wall springs, waterfalls, etc
Human landscape resources	Folk customs	Ethnic festivals, weddings and funerals, food, clothing, architecture, religion, festivals, theatrical performances, paper cutting, embroidery, sculpture, pottery, Folk Museum, workshops, etc
	Local culture	Cultural relics, historical sites, historical celebrities, folklore, language and culture, farming culture, etc
	Farming activities	Picking fruits, adopting animals and plants, pruning and grafting, growing and collecting vegetables, feeding and milking cows, harvesting, picking tea-leaves, sowing, plough, agricultural products processing, etc
Artificial landscape resources	Experiencing entertainment	Outdoor fitness, flying a kite, tasting fruit, walking on stilts, bullock cart, tread water trucks, botanic labyrinth, science museum, gallery, exhibition hall, agricultural laboratory, etc
	Tourist facilities	Pavilions, sculpture, fountain, chairs, lamps and lanterns, flower beds, rockery, signs, sightseeing road, recreation road, hotels, transport vehicles, parking field, dining hall, public toilets, garbage box, fences, etc
	Agricultural machinery	Cultivation facilities, processing facilities, modern irrigation, agricultural machinery, farm implements, warehouse, barns, sheds, implements management house, soilless culture, transgenic technology, intelligent greenhouse, water wall technology, etc

of many places, we summarized landscape resources as natural landscape resources, human landscape resources and artificial landscape resources, as shown in Table 1.

3.1.2. The selection of evaluation index of landscape resources in agricultural sightseeing garden

On the basis of on-the-spot investigation of the landscape resources of agricultural sightseeing garden, we consulted the relevant literature materials, and selected the evaluation indexes according to the scientific and operational principle.

1) The selection of evaluation index of natural landscape resources

(1) Characteristics: The natural landscape shaped by geological land forms and its causes are attractive to tourists. Different terrain conditions can create different landscape types in agricultural sightseeing garden, for instance, dig lake in accordance with the low terrain, pile mountain in accordance with the high terrain or flat land, these are all sightseeing features in garden, so characteristics should be evaluation index.

(2) Scenic beauty: Agricultural Sightseeing Garden not only need to create a beautiful landscape, but also need to combine with agricultural production to reflect the characteristics of agricultural landscape, it emphasizes the nature of tourism agriculture. The shape of animals, gorgeous colors, sweet sound, colorful plants, as well as auspicious meaning can increase the beauty of the garden. Water in agricultural sightseeing garden is an indispensable element of landscape, which can be divided into natural and artificial water body. The waterscape is designed according to the characteristics of the garden production and tourism, by using the variation of the water and revetment landscape, create water scenery, its sound and hue complement each other, the dynamic and static existence together, the real

shadow and virtual shadow reflecting each other, create graceful water body. So the scenic beauty should be evaluation index.

(3) Integrity: the beauty of the natural landscape is closely related to the integrity, which emphasizes the relationship between elements of natural landscape resources, such as the coordinated collocation between the elements forming a sense of rhythm and rhyme, countless fruits, layers of forest and meandering stream showing a kind of staggered beauty, so the integrity is suitable for the evaluation of natural landscape.

(4) Environmental quality: Environmental quality refers to the air quality, water quality and soil quality. Environmental quality is closely related to the life quality of living organisms, so the environmental quality can be chosen as the evaluation index of the landscape resources of agricultural sightseeing garden.

(5) Ecological condition: Animal and plant landscape quality is closely related to environmental quality and ecological conditions. The better the ecological conditions, the more rich biological landscape, so the ecological situation can be chosen as the evaluation index of the landscape resources of agricultural sightseeing garden.

(6) Environmental tolerance: Environmental tolerance is the ability to withstand the human activities on the environment, under normal circumstances, the environment will have a certain response to human activities. Strong environmental tolerance showed that the environment is not sensitive to the human activity, and vice versa. The lower the environmental tolerance, the more need to protect, because the impact of the same disturbance on the landscape resources will be bigger, more serious and even difficult to restore, it can be seen that the environmental tolerance should be regarded as the evaluation index of the landscape resources of agricultural sightseeing garden.

(7) Environmental capacity: environmental capacity is, under certain conditions, the maximum number of tourists the garden can accommodate at a certain amount of time and space, agricultural sightseeing garden in landscape planning and management should mainly focus on the accommodation capacity of the garden. Once the number of visitors exceeds the maximum capacity, it need to take measures actively in order to avoid damage to the natural landscape resources, environmental capacity should be regarded as the evaluation index of landscape resources of agricultural sightseeing garden.

2) The selection of evaluation index of human landscape resources

Human landscape, also known as cultural landscape, is composed of the cultural characteristics on the basis of the natural landscape, in order to meet the needs of some material and spiritual aspect in people's daily life, in agricultural sightseeing garden. From the perspective of rural landscape evaluation to establish the evaluation index system, human landscape resources mainly includes the folk customs, local culture, farming activities and entertainment experience, which are not related to agricultural sightseeing garden(Chen, 2003). They are precious resources to attract tourists.

(1) Cultural value, scientific value, artistic value, folk customs have formed the special connotation of cultural landscape of agricultural sightseeing garden, which integrates local characteristic culture into the landscape garden, forming a unique cultural landscape, attracting visitors linger. Folk custom emphasizes on the human-centered skills, experience and spirit, have the active rheological state, high historical and cultural value, scientific research value and artistic value, so cultural value, scientific value and artistic value should be the indispensable index of evaluation. Local culture reflects the living habits and aesthetic taste of the local residents, bearing the values and

ethics of the people on this land(Tribe et al., 2002). They only studied the local culture carrier and manifestation of landscape and failed to analyze the relationship between tourists and local culture. Visitors can learn the local folk culture and experience the local life style in the garden. When in Rome, do as the Romans do, feel the charm of the local culture.

(2) Participation: Farming activities and entertainment experience mainly refers to a series of tourism activities of visitors in the garden, is the embodiment of the cultural flavor of garden life. In order to meet a variety of needs of tourists, like leisure, sightseeing, catering, accommodation, learning, experiencing of tourists, it need to make a scientific recreation planning, fully excavating and reasonably integrating the landscape resources, developing diversified tourism activities, so participation should be evaluation index.

3) The selection of evaluation index of artificial landscape resources

Safety, Suitability and Humanization: the artificial landscape resources in the agricultural sightseeing garden are mainly the tourism facilities and agricultural facilities. Tourism facilities are the facilities and equipment, including service facilities and infrastructure, which provide services to tourists. Tourism facilities are the material guarantee for the development of the tourism industry, and is the basis for providing a variety of tourism needs for the tourists. Firstly, all kinds of tourism facilities must have safety precautions, secondly, tourism facilities not only need to meet the function demands of different tourists, but also need to meet the psychological needs of tourists, by providing the humanized service to create a harmonious and comfortable travel environment (Han, 2008). The analysis is more general, the other factors of tourist facilities are unconsidered. In addition, the location, characteristics, taste, configuration and so on of the tourism facilities also need to be suitable,

then can create a certain landscape and environmental benefits. So, safety, humanization, suitability should be used as evaluation index of tourism facilities.

4) The selection of evaluation index of exploitation and utilization conditions

(1) Location conditions: Location conditions are the objective existence of the conditions or status of a certain area in the aspect of economic development. In the evaluation of agricultural sightseeing garden landscape resources, the location condition mainly considers the geographical position and the accessibility of the scenic spot(Liu, 2012).

① Geographical location: it is the natural geographical location of the agricultural sightseeing garden, the advantages and disadvantages of the geographical location of the garden, determine the tourism market and the number of visitors of the agricultural sightseeing garden, so it should be the evaluation index.

② Accessibility: it refers to traffic conditions of the agricultural sightseeing garden connecting the tourist source, including the external transportation, the convenience degree of arriving at garden relying on urban, road, passenger transport channel is a prerequisite for the development the garden, it has a very important influence on the success or not of agricultural sightseeing garden, so accessibility should be evaluation index.

(2) The Status Quo Condition

The status quo condition can be explained as the current situation of the agricultural sightseeing garden, landscape configuration and suitable travel time are the main factors describing of current situation of agriculture sightseeing garden.

① Popularity: It refers to the popularity of social organization in the public. The popularity of agricultural sightseeing garden refers to the real and potential tourists' memory situation to the scenic spot. Popularity is a quantitative evaluation index of

tourist impression to the garden, so it should be the evaluation index of the status quo condition.

② Landscape resource configuration: It refers to whether the landscape configuration is reasonable and scientific in the tour line or is in line with people's travel demand, which is reliable basis for the planning of the garden. Landscape configuration should be an evaluation index.

③ Suitable travel period: It is a tourism period of the agricultural sightseeing garden showing the best scenery for visitors, with the seasonal changes, the garden presents different scene, general, the optimal travel period is from May to October each year, suitable travel period should be used as evaluation index. Each index is shown in Table 2.

3.2. Process of weight calculation

First of all, we designed questionnaires based on the analytic hierarchy process (AHP)(Huang et al., 2002). Then used the Delphi method to compare various indicators and weighted data that collected by expert evaluation questionnaires. Next, constructed judgment matrix to calculate index weight, brought the formula into EXCEL(Yan , 2005):

$$\text{matrix B: } W=(0.686, 0.3063)^T,$$

$$\text{matrix C1: } W=(0.495, 0.285, 0.2203)^T,$$

$$\text{matrix C2: } W=(0.636, 0.3642)^T,$$

$$\text{matrix D1: } W=(0.1487, 0.148, 0.101, 0.1542, 0.171, 0.1433, 0.134)^T,$$

$$\text{matrix D2: } W=(0.2963, 0.1595, 0.1598, 0.3844)^T,$$

$$\text{matrix D3: } W=(0.547, 0.1823, 0.2699)^T,$$

$$\text{matrix D4: } W=(0.3913, 0.6087)^T,$$

$$\text{matrix D5: } W=(0.4117, 0.3009, 0.28713)^T.$$

Tested the consistency of eight matrices, we found that CR were all less than 0.1, which means passed the consistency check. Calculation process was shown at Fig. 1, the results were shown in Table 3.

Table 2. Evaluation index of agricultural sightseeing garden landscape resources

Target layer	Comprehensive evaluation layer	Project evaluation layer	Factor evaluation layer	Factor description
The evaluation index of agricultural sightseeing garden landscape resources	Landscape resource quality B1	Natural landscape resources quality C11	Scenic beauty D111	the beauty degree of the landscape
			Characteristics D112	features of scenic spots or scenic spots
			Integrity D113	integrity and unity of the landscape
			Environmental quality D114	the extent to which the environment is not polluted
			Ecological status D115	biological richness and vegetation coverage
			Environmental tolerance D116	the ability of the environment to bear human activities
			Environmental capacity D117	the number of tourist that can be accommodated by the environment.
	Human landscape resources quality C12	Cultural value D121	historical and cultural value of landscape resources	
		Scientific value D122	the value of scientific research on landscape resources	
		Artistic value D123	the artistic value of landscape resources	
		Participatory D124	visitors can easily participate in activities	
	Artificial landscape resources quality C13	Safety D131	the safety of tourism facilities and agricultural facilities	
		Suitability D132	the coordination of tourism facilities, agricultural facilities and scenic spots or scenic spots	
		Humanization D133	tourism facilities, agricultural facilities and related services to meet the needs of different levels of tourist	
	Exploitation and utilization conditions B2	Location condition C21	Geographical position D211	the location of the garden
Accessibility D212			to the extent of the convenience of the garden	
Current conditions C22		Popularity D221	social influence of scenic spot	
		Landscape configuration D222	landscape resources in the tour online configuration	
		Suitable travel period D223	the best time for the tourists to travel	

Table 3. Index weight about the evaluation of agriculture sightseeing garden landscape resources

The target layer	Comprehensive evaluation layer	Weights	Project evaluation layer	Weights	Factor evaluation layer	Weights
Index about the evaluation of agriculture sightseeing garden landscape resources A	Quality of landscape resource B1	0.686	Quality of natural landscape resource C11	0.339	Scenic beauty(D111)	0.0505
					Characteristic(D112)	0.0501
					Integrity(D113)	0.03
					Environmental quality(D114)	0.051
					Ecological status(D115)	0.057
					Environmental tolerance(D116)	0.048
					Environmental capacity(D117)	0.045
	Quality of human landscape resource C12	0.196	Cultural value(D121)	0.058		
			Scientific value(D122)	0.032		
			Artistic value(D123)	0.031		
	Quality of artificial landscape resource C13	0.151	Participatory(D124)	0.076		
			Security(D131)	0.083		
	Condition of exploitation B2	0.314	Geographical condition C21	0.199	Suitability(D132)	0.027
					Humanized(D133)	0.041
Current condition C22			0.115	Geographical position(D211)	0.078	
				Accessibility(D212)	0.128	
Reputation(D221)			0.047			
Landscape configuration(D222)			0.034			
Applicable travel period(D223)	0.033					

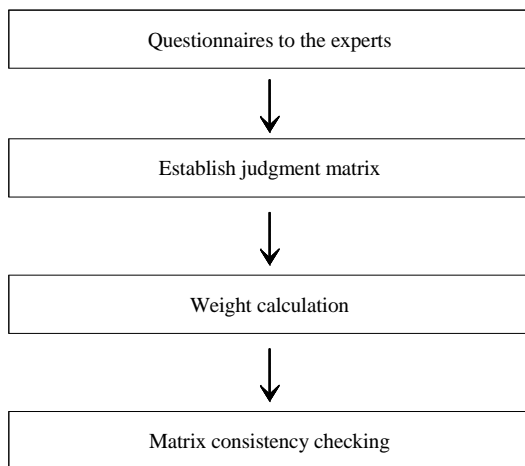


Fig. 1. Weight calculation flow path.

3.3. Importance ranking of evaluation index

Through analyzed the weight of two indicators about the comprehensive evaluation layer of agricultural sightseeing garden landscape resources, we got the influence order as follows: quality of landscape resource (0.686) > condition of exploitation (0.314). The quality of landscape resources carried the weight of 68.6%, and played a crucial role of evaluation of agricultural sightseeing garden landscape. We ranked five indicators in project evaluation layer by their impact as follows: quality of natural landscape resource (0.339) > geographical condition (0.199) > quality of human landscape resource (0.196) > quality of artificial landscape resource

(0.151) > current condition (0.115). The influence of natural landscape resource and geographical condition were carried 53.8% of the weight totally. Therefore, these two things determined the quality of agricultural sightseeing garden landscape, and we should our people should pay more attention to these two factors. Apart from that, the influence ranking of the factor evaluation layer's 19 indicators was as follows: accessibility (0.128), security (0.083), geographical position (0.078), participatory (0.076), cultural value (0.058), ecological status (0.057), scenic beauty (0.0505), environmental quality (0.051), characteristic (0.0501), environmental tolerance (0.048), reputation (0.047), environmental capacity (0.045), humanized (0.041), landscape configuration (0.034), applicable travel period (0.033), scientific value (0.032), artistic value (0.031), integrity (0.03), suitability (0.027).

4. Conclusion

Based on a comprehensive survey of the landscape resources of agricultural sightseeing garden, this article set up an evaluation index system of agricultural sightseeing garden landscape resources. Meanwhile, we obtained the importance ranking of landscape resources' evaluation index by the analytic hierarchy process (AHP), which has important reference value for the scientific planning and design of agricultural sightseeing garden. We had discussed 19 evaluation indexes, but due to the fact that we had limited

professional knowledge, without further study. More importantly, we suggested that the related scholars can concentrate on longitudinal study of the evaluating indexes and improve the science of the evaluation to agricultural sightseeing garden landscape resources.

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