Evaluation of Regional Ecotourism Resources Under the National Park Concept: A Case Study of the Qinghai Lake-Qilian Mountains Adjacent Area (Postprint)

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Abstract

The protection and conservation-oriented utilization of ecological tourism resources in the Qinghai Lake and Qilian Mountain adjacent region have become an important component of Qinghai Province' s demonstration province construction for a protected area system centered on national parks. Selecting the Qinghai Lake and Qilian Mountain adjacent region as the study area, and based on field surveys, this study employs ArcGIS spatial overlay analysis, the Delphi method, and the Analytic Hierarchy Process (AHP) to systematically classify and evaluate ecological tourism resources within the region according to their characteristics under the national park concept. Through evaluation and grading, the ecological tourism resources in the region are classified into five levels: one top-grade (Level 5) recreational resource unit; 30 excellent-grade units, including 8 at Level 4 and 22 at Level 3; and 48 ordinary-grade units, including 32 at Level 2 and 16 at Level 1. The research demonstrates that under the national park concept, the top three factors in the criterion layer of the ecological tourism resource evaluation index system are tourism function and value, cultural characteristics, and ecological environment, with the evaluation layer selecting indicators based on national park resource attributes. It is evident that indicators of authenticity and integrity—the primary functions of national parks—are critical considerations for indicator selection. This study aims to provide data support for the functional zoning of the proposed Qinghai Lake National Park and to offer a methodology for evaluating ecological tourism resources in prohibited development zones of national spatial planning, with its research perspective and approach serving as a reference for the in-depth protection and utilization of recreational resources under the national park concept.

Full Text

Evaluation of Regional Ecotourism Resources Under the National Park Concept: A Case Study of the Adjacent Area Between Qinghai Lake and the Qilian Mountains

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Abstract: The conservation and protective utilization of ecotourism resources in the adjacent area between Qinghai Lake and the Qilian Mountains has become a critical component of Qinghai Province' s demonstration province construction, where the national park system serves as the primary framework for nature reserves. This study selects the adjacent area between Qinghai Lake and the Qilian Mountains as its research object. Based on field investigations and guided by the resource characteristics under the national park concept, we employed ArcGIS spatial overlay analysis, the Delphi method, and the Analytic Hierarchy Process (AHP) to systematically categorize and evaluate regional ecotourism resources. The evaluation classified regional ecotourism resources into five grades, with one special-grade (Grade V) recreational resource monomer; 30 excellent-grade monomers (8 at Grade IV and 22 at Grade III); and 48 ordinary-grade monomers (32 at Grade II and 16 at Grade I). The findings reveal that under the national park concept, the top three weighted elements in the ecotourism resource evaluation index system are tourism function and value, humanistic characteristics, and ecological environment. The evaluation layer specifically incorporates factors reflecting national park resource attributes, with authenticity and integrity—representing the primary functions of national parks—emerging as critical considerations in index selection. This research aims to provide data support for delineating functional zones in the proposed Qinghai Lake National Park and to offer methodological guidance for evaluating ecotourism resources in prohibited development zones of territorial space. The research perspective and approach can serve as a reference for the in-depth protection and utilization of recreational resources under the national park concept.

Keywords: National Park; protection and utilization; regional ecotourism resources; Analytic Hierarchy Process; evaluation

1. Introduction

Ecotourism resources refer to natural and cultural resources that can satisfy recreational needs and provide opportunities and venues for recreational activities [?]. They constitute the foundational basis for resource investigation and evaluation in national parks. Establishing a nature reserve system with national parks as the main body has become China' s primary approach to protecting important natural ecosystems, natural landscapes, natural relics, and rare and endangered wildlife and their habitats [?, ?]. As a model for balancing nature reserve protection and development, national parks have explicitly defined public use, vacation, and recreation as resource utilization approaches since their inception [?]. Currently, the national park model—based on natural ecological environment protection and public recreation—has matured into an effective mechanism for coordinating resource conservation and tourism development [?].

The fundamental purpose of ecotourism resource evaluation is to identify resource type characteristics, analyze resource organizational structures, determine resource values, and assess the impacts of resource utilization, thereby enabling rational protection and utilization of recreational resources in the target area [?]. However, as noted in the literature, "although ecotourism has the potential to generate positive environmental and social impacts, it can be as destructive as mass tourism if improperly implemented" [?]. The key distinction between national park recreational resources and general ecotourism resources lies in spatial constraints: national park recreation occurs within protected area spaces, while ecotourism is not spatially restricted. In evaluation practice, the former emphasizes the protection of authenticity and integrity of natural ecosystems, natural landscapes, and natural relics, whereas the latter focuses more on promoting regional sustainable development without damaging the ecological environment.

Ecotourism resource evaluation encompasses diverse assessment methods and models. Internationally, Gössling [?] pioneered quantitative evaluation of ecotourism resource value, providing valuable references for domestic research. As studies on conservation and protective utilization have deepened, Chinese scholars have begun applying statistical and econometric methods to evaluate ecotourism resources. Wang et al. [?] proposed a tourism resource classification and evaluation framework that equally emphasizes landscape and environment, constructing a qualitative and quantitative comprehensive evaluation framework combining landscape resources and environmental resources through AHP. Zhou [?] developed a comprehensive evaluation index system and model for ecotourism resources, assessing resource landscape value and characteristics, ecological environmental conditions, and tourism development conditions. Zeng et al. [?] quantified fuzzy information and qualitative data for lake wetland ecotourism resources, establishing a lake wetland-specific ecotourism resource evaluation system using AHP. Ma et al. [?] combined logical framework analysis with AHP to establish an evaluation index system applicable to national park ecotourism wildlife resources.

In recent years, emerging big data types have further optimized relevant standards and models. However, under China's new national park system framework, discussions and methods for ecotourism resource evaluation remain relatively limited. The adjacent area between Qinghai Lake and the Qilian Mountains, designated as one of the first national all-for-one tourism demonstration zones by the Ministry of Culture and Tourism in 2019, represents a key high-altitude ecotourism demonstration area in Qinghai Province and an important tourist distribution center along the Qinghai-Tibet Railway' s premier tourism corridor. Against this background, this study selects this area as its research object to systematically survey and evaluate existing natural and cultural resources. By screening resource elements that highlight the national park concept as the basis for resource classification and factor weight assignment, and employing spatial overlay analysis, the Delphi method, and AHP, this research aims to clarify the current distribution of ecotourism resources, elucidate the hierarchical grading and weight assignment methods under the national park concept, provide foundational data for regional ecotourism development planning decisions, offer data support for delineating functional zones in the proposed Qinghai Lake National Park, and propose methods for evaluating ecotourism resources in prohibited development zones of territorial space.

2. Materials and Methods

2.1 Study Area The geographic scope of the adjacent area between Qinghai Lake and the Qilian Mountains covers the administrative boundaries of Haiyan County, Gangcha County, Qilian County, and Menyuan Hui Autonomous County in Haibei Prefecture (98°05 00 -102°41 03 E, 36°44 00 -39°05 18 N). This includes the northern section of the proposed Qinghai Lake National Park and the southern foothills of the Qilian Mountains National Park in the Haibei area [Figure 1: see original paper], accounting for 15.4% of Qinghai Province' s total land area. The region encompasses various types of nature reserves with a total area of 3.4$×10^{4}$ km^2, which reduces to 1.54$×10^{4}$ km^2 after removing overlaps, representing 45.29% of the region' s total land area. This area constitutes a prohibited or restricted development zone in China' s national main functional area planning. Its ecotourism resources epitomize the natural landscape of the Qinghai-Tibet Plateau.

The study area connects to the ancient Tang-Tibet Road in the south and the Silk Road in the north, commanding a strategic passage between Han and Tibetan regions. It features extensive mountain landscapes, unique peaks and rocks, canyons and gullies, alpine meadows, glaciers, and periglacial landforms, forming numerous geomorphological, hydrological, and biological natural landscapes. The region has a plateau continental climate, with maximum elevation of 5,287 m and minimum elevation of 2,180 m. Its "four mountains embracing four basins" topography creates distinctive plateau scenery. Water systems including the Yellow River, Qinghai Lake, Qilian Mountains water systems, Datong River, Huangshui River, and Heihe River run through the area, with total

water area of 6.25$×10^{3}$ km^2 (river area: 18.14$×10^{3}$ km^2, lake area: 20.17$×10^{3}$ km^2, marsh area: 44.65$×10^{3}$ km^2, artificial wetland area: 0.086$×10^{3}$ km^2), serving as an important water source conservation area for the Yellow River' s Qinghai section. The forest ecosystem is dominated by alpine coniferous forests in the Qilian Mountains, with forest land area of 87.04$×10^{3}$ km^2 and forest coverage reaching 17.0%. Grassland area is 264.8$×10^{3}$ km^2, accounting for 77.73% of total land area, with grassland landscapes primarily comprising forest grassland, meadow grassland, and wetland grassland. The region is also a key biodiversity conservation area in China, serving as an important corridor and habitat for national protected wildlife such as snow leopards, red deer, and Tibetan antelopes [Figure 2: see original paper].

2.2 Data Sources The data employed in this study primarily include the latest remote sensing imagery, forest land change data, 2020 national land survey data, vectorized boundary data of various nature reserves in the region, and survey data of ecotourism resources. Landsat 8 imagery (30 m$×$30 m spatial resolution) was used as the base, with maximum values composited annually to detect vegetation growth status and coverage changes. Data were compiled and organized, unified under a geographic information system coordinate system, and analyzed using spatial overlay, buffering, classification summarization, and spatial density analysis based on geographic spatial statistics principles to construct an evaluation model system and calculate comprehensive ecotourism resource evaluation scores.

2.3 Evaluation Methodology

2.3.1 Principles for Constructing the Evaluation Index System First, we determined the attributes and classification of ecotourism resource evaluation indices. Referencing the *Classification, Investigation and Evaluation of Tourism Resources* (GB/T 18972-2017) (hereinafter "national standard") and the *Regulation of Resources Surveying and Evaluating in National Park* (LY/T 3189-2020) (hereinafter "industry standard"), we screened 155 basic types of resource monomers available for ecotourism resource development and utilization. Using the Delphi method, we selected 28 indicators reflecting the ecotourism resource evaluation layer to construct a hierarchical evaluation model, created judgment matrices, tested their consistency, determined index weights through consistency verification, and conducted equal-weight overlay analysis of individual index calculation results to obtain evaluation outcomes. The evaluation object selection principles emphasized scientificity and practicality, referencing the national and industry standards. Based on resource characteristics, we selected spatially stable physical tourism resources and material cultural resource monomers as evaluation objects, specifically choosing geomorphological landscapes, water landscapes, and biological landscapes—three categories of spatially stable physical tourism resources—while excluding celestial and climatic phenomena as unstable spatial forms, and focusing on material cultural resources like

buildings and facilities and historical sites rather than intangible cultural resources such as human activities.

2.3.2 Selection of Evaluation Indices Based on field investigations, relevant ecological resource literature, and expert consultation, the evaluation model was structured into three layers: a comprehensive evaluation target layer (A), a constraint layer (B) comprising three factors influencing ecotourism conservation and protective utilization (material cultural resource quality B1, environmental characteristics B2, and development conditions B3), and an evaluation layer (C) with nine indicators (C1–C9). The constraint layer was further subdivided into 28 element-layer indicators (D1–D28).

2.3.3 Determination of Evaluation Index Weights Index weights reflect the relative importance of each evaluation indicator in the system and directly affect result rationality [**?**]. Through field surveys, weights were determined primarily through AHP combined with the Delphi method via expert questionnaires distributed through email, face-to-face consultation, and video calls to 15 experts. Using the AHP evaluation index system, we established comparison judgment matrices for the total target layer A–B1~B3, constraint layer B1–C1~C3, B2–C4~C7, B3–C8~C9, and evaluation layer C1–D1~D3, C9–D27~D28. The 1–9 scale method was applied for relative importance scoring, where S represents the correlation value between evaluation target n and factor m. The larger the ratio, the greater the importance, with values typically being 1–9 and their reciprocals .

To verify weight rationality and determine evaluation scores, we calculated the maximum eigenvalue after uniformization processing of judgment matrices and conducted consistency tests. When the consistency ratio CR < 0.1, the judgment matrix is considered acceptably consistent; otherwise, it requires adjustment. Using yaahp software for AHP calculations, all weights in this study met the consistency ratio requirement, indicating good matrix consistency. Combined with ecotourism resource evaluation scoring standards, we determined weights for each element and evaluation layer .

2.3.4 Evaluation Result Grading Based on the weights of influencing factors and data from expert questionnaires and field surveys, we assigned values to corresponding factors in the evaluation model. Using the weighted comprehensive index method [Eq. (1)], we calculated the indicator weights for each tourism resource site and obtained comprehensive evaluation results (full score: 500 points).

$$E_n = \sum_{i=1}^{28} p_i o_i \tag{1}$$

where E is the final score of the nth tourism resource site; p is the weight of the ith basic-level factor; and o is the score of the nth site for the ith factor.

Based on the weights of influencing factors, we graded ecotourism resource evaluation indicators. The scoring intervals were: 400–500 points for Grade I, 300–400 points for Grade II, 200–300 points for Grade III, 100–200 points for Grade IV, and 10–100 points for Grade V. Higher comprehensive scores indicate higher resource grades (Grade V represents special-grade recreational resources, Grades III–IV represent excellent-grade resources, and Grade II and below represent ordinary-grade resources).

3. Results

Using the constructed national park concept-based tourism resource evaluation index system, we conducted practical evaluations of tourism resource sites in the adjacent area between Qinghai Lake and the Qilian Mountains. Calculations yielded various indicator score grades and comprehensive evaluation indices for each site . Higher individual scores indicate greater factor influence, while higher comprehensive scores indicate better resource quality and greater redevelopment potential.

The ecotourism resources in the adjacent area between Qinghai Lake and the Qilian Mountains are classified into five grades . The evaluation identified one special-grade (Grade V) recreational resource monomer—Qinghai Lake (Haibei section). Excellent-grade resources (30 monomers) include eight at Grade IV (e.g., Baili Rapeseed Flower Sea, Zhuo' er Mountain, Ami Dongsuo, Fairy Bay Wetland, Jinyintan Atomic City, Binggou Forest-Sea Scenic Area, Gangshika Snow Peak, Jinshawan Lover' s Cliff) and 22 at Grade III (e.g., Jinyintan Grassland, Shadao, Heihe Grand Canyon Forest Park, Xianmi National Forest Park, Gahai, Bird Island, Gesale King' s Tibetan Sword Cave, Aru Great Temple). Ordinary-grade resources (48 monomers) comprise 32 at Grade II and 16 at Grade I, covering all provincial-level and above historical sites.

The weight allocation results demonstrate that in the constraint layer, resource quality, environmental characteristics, and development conditions were weighted, with emphasis on resource quality. In scoring evaluation indicators, higher scores were assigned for greater historical antiquity, higher site 知名度, stronger protection measures, more rare and endangered species, and lower pollution levels—thereby enhancing the specificity and representativeness of national park characteristics.

4. Discussion

Ecotourism resource evaluation is highly spatial, regional, and comprehensive, representing an ongoing exploration both domestically and internationally [**?**]. The national park concept-based ecotourism resource evaluation system differs from traditional systems in several key aspects. From a qualitative evaluation

perspective, traditional recreational resource evaluation primarily considers scientific research value, historical and cultural value, and aesthetic appreciation value, whereas this study emphasizes scientific and conservation value, educational value, and recreational value. In terms of evaluation objectives, traditional approaches focus on resource natural attributes and natural supply capacity, with the fundamental purpose of rational utilization and protection. In contrast, the national park concept prioritizes spatial characteristics and is more suitable for evaluating ecotourism resources, reflecting a longer-term, more macroscopic consideration of harmonious human-nature coexistence.

When applying this evaluation framework, it is essential to analyze the dominant functional positioning of the study area' s main functional zones and its resource environment, social, and economic development trends, and to adjust and optimize the evaluation index system accordingly. This ensures scientific and rational development and utilization of local tourism resources. In practice, ecotourism resource evaluation should combine forward evaluation (starting from natural attributes to determine development direction) and reverse evaluation (starting from market demand to identify resources for development). Formulating or revising regional ecotourism development plans requires integrating both approaches and focusing on the core balance between ecological resource protection and ecotourism development to correctly determine strategic planning for ecological space resource protection and protective utilization.

5. Conclusions

1) The evaluation results and index weights demonstrate that the national park concept is primarily reflected in the selection and weighting of authenticity and integrity indicators. The top three weighted elements are tourism function and value, humanistic characteristics, and ecological environment, which are further subdivided into factors such as ecological resource integrity, uniqueness, diversity, scientific value, utilization degree, aggregation degree, environmental integrity, suitability, and protection intensity. This approach ensures the scientificity and practicality of ecotourism resource evaluation under the national park concept.

2) The adjacent area between Qinghai Lake and the Qilian Mountains is a national park demonstration zone in Qinghai, with 45.29% of its land area designated as nature reserves and prohibited or restricted development zones in the national main functional area planning. The methodology and approach developed in this study are applicable not only to national park recreational resource evaluation but also to ecotourism resource evaluation in territorial space prohibited development zones. While the spatial scope of prohibited development zones is broader than national parks, both share the fundamental function of ecological protection and the goal of enhancing natural ecological space carrying capacity, making their ecotourism resource evaluation concepts, methods, and implementation paths essentially consistent.

3) National parks hold a principal position in China' s nature reserve system in terms of conservation value and ecological function. When evaluating ecotourism resources under the national park concept, it is crucial to select evaluation indicators corresponding to the scientific, conservation, educational, and recreational values of national park core resources, based on the characteristics and spatial distribution patterns of recreational resources. The resulting evaluation outcomes can be applied to protective planning of ecotourism resources and provide analytical data for national park management zoning and functional zoning, particularly offering important boundary delineation basis for traditional utilization zones and scientific-educational-recreational zones within national parks.

References

[1] GB/T 18972-2017. Classification, investigation and evaluation of tourism resources[S]. Beijing: Standards Press of China, 2017.

[2] General Office of the CPC Central Committee, General Office of the State Council. Guiding opinions on establishing a system of natural protected areas with Chinese characteristics, with national parks as the main body[EB/OL]. http://www.gov.cn/xinwen/2019-07/03/content_{5405621}.html.

[3] Li Chunliang. Establishing a system of natural protected areas with Chinese characteristic on Xi Jinping' s ecological civilization thought[J]. Qizhi, 2019, 3(8): 37-38.

[4] Lunney D, Pressey B, Archer M, et al. Integrating ecology and economics: Illustrating the need to resolve the conflicts of space and time[J]. Ecological Economics, 1997, 23(2): 135-143.

[5] Zhang Haixia, Zhang Xuliang. Driving factors and spatial diffusion for the development of national park model for natural heritage sites[J]. Journal of Natural Resources, 2012, 27(4): 705-712.

[6] Bao Jigang. A preliminary study on the quantitative evaluation of the tourist resource[J]. Arid Land Geography, 1988, 11(3): 60-63.

[7] Zhang Shuying, Liu Jiaming, Zhu He, et al. Review of progress in international research on ecotourism and implications[J]. Progress in Geography, 2018, 37(9): 45-59.

[8] Gössling Stefan. Ecotourism: A means to safeguard biodiversity and ecosystem functions?[J]. Ecological Economics, 1999, 29(2): 303-320.

[9] Wang Jianjun, Li Chaoyang, Tian Mingzhong. The establishment of the classification and evaluation system of ecotourism resource[J]. Geographical Research, 2006, 25(3): 507-516.

[10] Zhou Wenli. A study on comprehensive assessment of eco tourism resources system and appraisal model[J]. Journal of Northwest Forestry University, 2007,

22(3): 198-202.

[11] Zeng Tao, Di Xueying, Yang Guang, et al. Evaluation on eco tourism resources in lake wetlands: A case study in Xingkai Lake National Nature Reserve[J]. Journal of Northeast Forestry University, 2010, 38(5): 110-113.

[12] Ma Guoqiang, Zhou Jielong, Ding Dong, et al. Wildlife resources evaluation system for national park ecological tourism[J]. Forest Inventory and Planning, 2011, 36(4): 109-114.

[13] Luo Zhengqing, Yang Shanlin. Comparative study on several scales in AHP[J]. Systems Engineering Theory & Practice, 2004, 24(9): 51-60.

[14] Bao Jigang, Chu Yifang. Geography of tourism[M]. 3rd ed. Beijing: Higher Education Press, 2012: 98-102.

Note: Figure translations are in progress. See original paper for figures.