

Research Article

Destination Management for Ecotourism Activity Using Analytical Hierarchy Process

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Analytic hierarchy process (AHP) refers to a decision-making method that decomposes the elements related to decision-making into goals, criteria, plans, and other levels and performs qualitative and quantitative analysis. Ecotourism is one component of sustainable tourism. Due to ecotourism activity, ecotourism links the reserved area with local residents and tourists. The aim of this research is to identify the proper ecotourism activity in Diaoluo Mountain National Nature Reserve with the help of the AHP method. The motivation behind the use of AHP is its widespread use in the decision-making process of selection of suitable candidate or alternative spot for tourists' activity in the domain of ecotourism. The result shows that the most suitable ecotourism activity is "visit and experience life in the original ecology villages of Li and Miao ethnic minorities with a guide." The proposed AHP decision-making method has effectively been used to select ecotourism activity based on multiple criteria evaluations.

1. Introduction

Ecotourism is the embodiment of the concept of sustainable development in the tourism industry, aiming to realize the balance among environmental, economical, and social aspects [1]. Ecotourism especially is fully reflected in the developing countries due to unique advantages of not only promoting the protection of the local ecological environment but also improving the local development [2]. So far, different organizations and researchers have defined ecotourism from different focuses. No matter how various the definitions are, the content always concerns 3 aspects: activity of ecotourism, environmental conservation, and the sustainable development of local community [3]. Among various concepts, one of them is earliest universally recognized, proposed by Ceballos-Lascurain. It emphasizes an activity of travelling to relatively undisturbed or uncontaminated natural areas with the specific object of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspects (both past and present) found in these areas [4]. Ceballos-Lascurain provided this definition from the consumer-centered aspect [5].

In fact, the connotation of ecotourism activities is revealed through the description of ecotourism. Ecotourism is based on nature-oriented experiences [5] and cultural experiences [6], such as viewing animals in the wild, viewing wild plants, walking in the forest path, hill tribe trekking, and local custom experience [5, 7, 8]. Ecotourists, characterized by more educated and above-average incomes [8], tend to stay longer and to spend more per day than the typical tourists and to seek out local goods and services for personal consumption [9, 10] due to their allocentric tendencies [11]. Ecotourists demand more environmentally aimed tourism experiences [9] and often display strong interest in conservation [8]; their age range and gender ratio varies based on the types of ecotourism activity and their interests [12].

Planning and decision-making processes are important in ecotourism than in other kinds of tourism [13]. Firstly, ecotourism is not homogenous [3]. The same management cannot be used in regions with different characteristics and situations. Secondly, the impact of ecotourism is not always positive [14]. Generally speaking, the impact of the ecotourism activities may be measurable concerning their environmental, economical, and social results [13]. If

inappropriate management methods are used, ecotourism will bring many negative impacts on local areas [15, 16]. In addition, ecotourism is complex, reflecting on multiplicity of goals [17] and diversity of stakeholders, such as local people, local government, tourists, and related enterprises [18].

Therefore, what method should be adopted to effectively evaluate and manage the destination is the clave issue for ecotourism managers and decision makers. The approach analytic hierarchy process (AHP) technique is recommended for ecotourism planning because it helps to incorporate explicit statement of stakeholder preferences and derive the relative weights of criteria [9]. AHP is one type of multiple criteria decision-making (MCDM) and was proposed by the Professor T. L. Saaty in the early 1970s [19]. AHP is a simple, flexible, and practical multicriteria decision-making method, using quantitative analysis for qualitative problems. This method has been widely used in many fields, such as: economy, energy, policy, human resource, project evaluation, education, environment, business management, law, etc. At present, AHP method has also been widely used in the research of ecotourism, such as the work of Kumari et al [20]; they prioritized the potential ecotourism sites in West District of Sikkim state in India using the AHP method and GIS modeling technique. Lin and Chuang [21] used fuzzy AHP to evaluate Taiwan's coastal wetlands' ecotourism. Bunruamkaew and Murayam [22] have done the research on the potential ecotourism sites using AHP and GIS techniques in Surat Thani Province, Thailand. Based on visitors' proposal, Dhani et al. [23] modeled the dynamic evaluation of forest-based ecotourism areas in West Virginia using AHP and GIS. Mobaraki et al. [24] pointed out the suitable ecotourism site in Isfahan Townships, Iran, using GIS and AHP. Nahuelhual et al. [25] used GIS and AHP to map recreation and ecotourism in Southern Chile. Zabihi et al. [26] presented an approach to identifying suitable ecotourism sites by integrating a geographic information system (GIS) with a fuzzy-analytic hierarchy (F-AHP) in Babol in Iran. In research on sustainable ecotourism development in the best area in Lorestan Province, Iran, the authors [27] formulated the strategies in the SWOT-AHP-TOWS analysis, with the aim of developing a model to recognize the indicators of evaluating the ecotourism sustainability. Mansour et al. [28] utilized AHP and GIS techniques to spatially evaluate land suitability for ecotourism activities in Msirah Island, Oman.

Analytic hierarchy process (AHP) and Delphi analysis have effectively been used to evaluate key factors in the development of the Taiwan cruise tourism industry (YM) [29].

The analytic hierarchy process (AHP) was chosen for this study. When previous studies was carried out on ecotourism using AHP technique, it was seen that most of them were research studies about the evaluation of ecotourism areas and works on the selection of sustainable ecotourism destinations. However, a study using decision-making technique for raking ecotourism activities in this paper showed that research can be done in such areas.

Due to the establishment of Hainan Tropic Rainforest National Park and the special emphasis on constructing

ecological civilization, ecotourism is becoming increasingly popular in Hainan Province. In this process, it is imperative to understand the potential impacts of ecotourism activities in Hainan and to select the most suitable ecotourism activity based on complex criteria.

Key contributions of the study include

- (1) A multicriteria decision-making method analytic hierarchy process (AHP) is adopted to accurately selection the best activity during picnic
- (2) Key influential features called criteria and subcriteria are identified that help in right decision-making regarding referral of best suitable activity in ecotourism for tourists

Therefore, the purpose of this study was to select the most proper ecotourism activity in Diaoluo Mountain National Nature Reserve in Hainan Province in China using AHP technique. After a brief literature in Section 1, followed by Section 2, we design a set of criteria and we provide a new AHP system model for selecting the most suitable ecotourism activity. In Section 3, we analyze and discuss the results. Finally, in Section 4, we draw conclusions from this research.

2. Materials and Methods

This section explains the proposed research area and the methodology which has been adopted for making decision regarding selection of the best ecotourism in a picnic spot.

2.1. Research Scope. Forests have many ecotourism attractions [13]. The number of forest areas managed under the protection status has increased, including national parks, nature parks, nature protected areas, nature monuments, and gene conservation forests [30]. In addition to natural resources, ecotourism activity can be diversified by using cultural attractions such as historical places, ancient residuals, and authentic lifestyle of local villagers [9].

Diaoluo Mountain Nature Reserve is located in the southeast of Hainan, which is promoted to the National Nature Reserve in January 2008 and is one of the main destinations in Hainan Tropical Rainforest National Park. The Diaoluoshan Mountain National Nature Reserve has 1955 species of plants, 337 species of vertebrates, 96 families, and 26 orders, of which 79 species of endangered and key protected vertebrates are included. In the protected area, the forest coverage rate is 98.8%, including mainly five vegetation types: tropical lowland rain forest, tropical monsoon rain forest, tropical mountain rain forest, tropical mountain evergreen broad-leaved forest, and mountain top evergreen broad-leaved dwarf forest. The entrance of Diaoluo Mountain National Nature Reserve is located in the northwest of Lingshui County, where many Li ethnic minorities live. And tourism has developed to a certain extent there. In order to obtain valuable research information, the scope of this research is the Diaoluo Mountain National Nature Reserve in Lingshui County.

The main economic sectors around Diaoluo Mountain National Nature Reserve within Lingshui County are fishing, crop farming, livestock, and tourism. Unfortunately, the tourism industry in the area is seasonal, and due to the inadequate publicity, there are an estimated 30,000 visitors per year. The tourism sector in the region does not benefit from the rare ecosystems and natural and cultural attractions except mountain walk activity. There was no systematically conducted ecotourism activity in the project area before this research.

In recent years, with the increasing number of tourists, many problems have arisen in Diaoluo Mountain National Nature Reserve. The planners and policy makers responsible for management of this reserve tend to plan ecotourism activity and ecotourism assessment. However, such planning in Hainan remains under-researched. For that reason, Diaoluo Mountain National Nature Reserve was selected for this study.

2.2. Materials and Methods Adopted in the Research. In general, the collection of materials is divided into two steps:

- (i) On the one hand, in order to have an overall judgment of Diaoluo Mountain National Nature Reserve and to form the indicators and alternatives of the evaluation model, it is benefited from other research studies, official government data, and regulatory documents. Specifically speaking, the data come from the National Forestry and Grassland Administration, National Park Administration, Forestry Department of Hainan Province, the People's Government of Hainan Province, and Nationality Autonomous Country People's Government. These relevant documents include "Construction and operation guidelines for prototype-zone of national ecotourism attractions" (GB/T26362-2010), "China forest park landscape resources grade evaluation" (GB/T18005-1999), "Indicators for the evaluation of ecotourism in nature reserves" (LY/T 1863-2009), "Classification, investigation and evaluation of tourism resources" (GB/T 18972-2017), "Overall plan on the development and management of National Parks," and "Planning of Hainan Tropical Rain Forest National Park" (2019–2025).
- (ii) On the other hand, the opinions of experts and stakeholders were also asked, to identify indicators of evaluation model and to form pairwise comparisons in AHP method. They are ten experts, four protected area staff, four local people, three tourists (including English speaking interviews), three tour operators, and four government agencies.

2.3. Methods Adopted. Basing on the multiobjective and various stakeholders involved in ecotourism, the multi-indicators and the diversity of evaluation decision makers are necessary in the process of ecotourism planning and management [31]. For that reason, the multicriteria

decision-making method AHP was used. And there are some supporting tools for decision-making process-based AHP solution, such as WEB-HIPRE, AHP-OS, SPSS, and Excel. In this research, we used Excel 2010 to support AHP operations.

2.3.1. The Analytic Hierarchy Process (AHP). AHP is a structured technique for organizing and analyzing complex decisions, which were proposed by Thomas Saaty in 1980 for decision-making. It helps decision makers find the "answer" that best suits their goal rather than a "correct" decision because AHP can specify a general objective with respect to a series of alternatives that are evaluated on the different criteria. That is, along with changes in the evaluation criteria, or the weight of the evaluation criteria, the results provided by AHP will also change accordingly [32, 33]. According to AHP, the multicriteria problem is visually structured into a value tree of objectives through the construction of a hierarchy of attributes [34, 35].

2.3.2. Alternatives, Criteria Set, and AHP Model. Basic components of the multicriteria decision models consist of alternative and criteria sets [9].

In this research, the objective is to select the proper ecotourism activity in Hainan Diaoluo Mountain National Nature Reserve using the AHP method. For this aim, firstly, it should set alternative and criteria sets. According to the previous theory review and local actual situation, at first, the criteria and alternatives are formulated with 3 aspects and 18 subcriteria. Next, Delphi is applied to quantify suggestions of experts' and stakeholders interviewed, and through this process, the model is identified as 3 criteria and 10 subcriteria finally. They are B1 ecology (wildlife, vegetation, economic contribution for conservation, and environmental education to locals and tourists), B2 economy (income, employment, and indirect benefits), and B3 socio-culture (participation, protection, and demand). The subcriteria are divided into 10 aspects (Table 1).

Alternative of ecotourism activities is

- (1) Alternative I: bird watching and wildlife observation with a guide
- (2) Alternative II: trekking for discovering of nature with a guide
- (3) Alternative III: bicycle tour on the specified route
- (4) Alternative IV: visit and experience life in the original ecology villages of Li and Miao ethnic minorities with a guide

Totally, the AHP model is pictorially depicted in Figure 1. In this model, there are 4 levels. The goal level is to select the most proper ecotourism activity in Diaoluo Mountain National Nature Reserve. The criteria level contains 3 aspects, "ecology," "economy," and "social culture," and according to criteria, the subcriteria level is created correspondingly. In the last alternative level, it involves 4 ecotourism activities.

TABLE 1: Criteria sets' model of ecotourism activity selection in Hainan Diaoluo Mountain National Reserve.

Criteria	Subcriteria
B1 ecology	C1 impact on animals and plans
	C2 direct economic contribution of ecotourism to local ecological protection
	C3 level of ecological knowledge training for employees and local people
	C4 level of promoting and education of ecological knowledge for tourists
B2 economy	C5 economic benefits for related local administrations and enterprises
	C6 economic benefits for local people
	C7 indirect economic benefits to local
B3 social culture	C8 level of protection and support for local culture
	C9 level of demand for activities by local people
	C10 extent to which local people are supported to participate in ecotourism activities

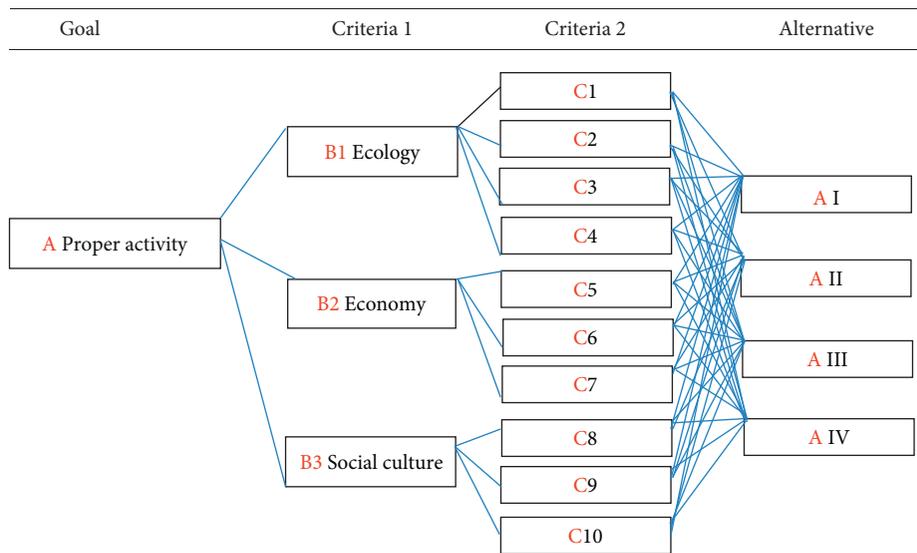


FIGURE 1: AHP model of ecotourism activity selection in Hainan Diaoluo Mountain National Reserve.

TABLE 2: Global weight and ranking of criteria and subcriteria.

Criteria 1	Criteria 2									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
B1 0.40	0.40	0.20	0.20	0.20						
B2 0.40					0.25	0.50	0.25			
B3 0.20								0.33	0.33	0.33
Global weight	0.18	0.08	0.08	0.08	0.10	0.20	0.10	0.07	0.07	0.07
Ranking	2	4	4	4	3	1	3	5	5	5

3. Implementation and Results' Analysis

During the whole calculation, the first step is the comparison of criteria by pairs. Experts' opinions were required to calculate the relative importance of the criteria and the alternatives. In each matrix, all values of C.R are less than 0.1; therefore, the consistency check is passed.

The global weights and ranking of each factor are shown in Tables 2 and 3.

In the level criteria, the global weight of B1 (0.4) and B2 (0.4) are more than B3 (0.2). It means that, by developing ecotourism activity in Diaoluo Mountain National Reserve,

it should pay more attention to the ecology and economic aspects at present.

Then, in the level of subcriteria 2, the top 3 most important aspects are C6 "economic benefits for local people" (No. 1), C1 "impact on animals and plans" (No. 2), C5 "economic benefits for related local administrations and enterprises" (No. 3), and C7 "indirect economic benefits to local" (No. 3).

In addition, it is clear that the order of priority is Alternative IV > Alternative I = Alternative II > Alternative III. Alternative IV gets the highest score from aspects of C1, C6, C8, C9, and C10. Basically, it obtains a high score in all of

TABLE 3: Global weight and ranking of alternatives.

Subcriteria	Alternative			
	A I	A II	A III	A IV
C1 0.16	0.11	0.11	0.21	0.57
C2 0.08	0.29	0.29	0.14	0.29
C3 0.08	0.39	0.39	0.08	0.14
C4 0.08	0.39	0.39	0.14	0.08
C5 0.10	0.39	0.39	0.14	0.08
C6 0.20	0.19	0.19	0.10	0.53
C7 0.10	0.39	0.39	0.08	0.14
C8 0.07	0.19	0.19	0.10	0.53
C9 0.07	0.19	0.19	0.10	0.53
C10 0.07	0.19	0.19	0.10	0.53
Global weight	0.26	0.26	0.13	0.37
Ranking	2	2	3	1

the subcriteria except in C4 “level of promoting and education of ecological knowledge for tourists” and C5 “level of promoting and education of ecological knowledge for tourists.” The last one is Alternative III. It scores low in all criteria, especially performs poor in C3 and C7. As shown in result, there is not difference about scores between Alternative II and Alternative I. They get the same scores.

4. Conclusion and Commendation

The results of this study indicate that the most weighted are the environmental and economic aspects in this research. On the one hand, like in almost all the natural reserve, the development of ecotourism cannot be at the expense of the environment. Environment destruction not only could lose the purpose of developing ecotourism but also cause the destruction of local tourism resources, leading to unsustainable local development. On the other hand, ecotourism is necessary to connect with local people. Especially, in the underdeveloped area, only when local people get economic income through participating in ecotourism, they will truly support ecotourism, protect the local ecological environment, and help achieve local sustainable development.

According to the findings of the present study, the most suitable ecotourism activity in Hainan Diaoluo Mountain National Nature Reserve is “visit and experience life in the original ecology villages of Li and Miao ethnic minorities with a guide.” This activity scores high in “environment,” “economy,” and “social culture,” three areas, especially in “social culture” factors. And the result also shows that the development of this activity needs to strengthen environmental protection education to tourists and local people.

In this research, the weights of the criteria were determined by a participatory approach in this study. If participants change, the results may change also. Planners in any protected area can resolve the model by changing alternates or weights of the criteria set concerning new positions in time. This research proved that the AHP method is a suitable decision method for ecotourism activity planning. Managers responsible for determination of the ecotourism activities in any area can use the models based on the AHP method.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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