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Evaluating Nature-Based Tourism Destination Attractiveness with a Fuzzy-AHP Approach

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Abstract: Nature-based tourism attractiveness (NBTA) has yet to be assessed by coupling empirical measurement of supply and demand indicators with simultaneous assessment of tourist and tourism expert perspectives. Based on a guiding principle that the overall attractiveness of a tourism destination should combine the evaluation of existing resources or attractions and their perceived attractiveness, the purpose of this study is to develop and apply a novel methodological approach for assessing tourism attractiveness of nature-based destinations. This approach developed here combines an Analytic Hierarchy Process (AHP) with a Fuzzy Comprehensive Evaluation Method (FCEM). The resulting Fuzzy-AHP approach to NBTA was tested at the Changbai Mountain Biosphere Reserve, a popular nature-based tourism destination in China. The findings confirm that this Fuzzy-AHP approach is a more reliable and comprehensive method for evaluating the destination attractiveness than pre-existing approaches. In addition to theoretical contributions related to the merging of various approaches to assessing destination attractiveness and the development of a tool specific to nature-based tourism destinations, this work will be of interest to decision makers seeking more effective tools for planning, marketing, and developing nature-based tourism destinations.

Keywords: nature-based tourism; destination attractiveness; analytic hierarchy process (AHP); fuzzy comprehensive evaluation method (FCEM); biosphere reserve; China

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1. Introduction

The concept of destination attractiveness has aroused wide interest of practitioners, policymakers, and tourism academic communities [1–4], yet the many approaches to measuring it have yielded little consensus. What has been well-demonstrated is that the attractiveness of a destination has an important influence on a person's expectations, satisfaction, intentions to revisit, choice of destination, perceptions of motivations and benefits, positive perception of opinion leaders, the duration of stay, and the amount of money spent during a tourism experience [5]. Scholars have therefore found it necessary to discern the attributes that induce tourists to select one destination over another or to take part in one type of tourism activity over another [6]. Destination attractiveness has been explored in a variety of research contexts, including but not limited to visits to national forests, camping experiences, industrial sites, honeymoon destinations, and recreational biking [7–17]. Visitation to natural protected areas (e.g., national parks, world heritage site, and biosphere reserves), which is estimated to exceed 8 billion annual visitors [18], is a critically important tourism sector for regions endowed with such natural amenities. Nature-based tourism has grown into a broad and diverse area of scholarship in recent decades [19–23], yet tools for empirically measuring nature-based tourism attractiveness (NBTA) are limited.

A behavioral perspective of the interplay between tourism supply and demand indicates that people engage in such activities because they are either "pushed" by tourism motivations or "pulled" by destination attributes. Based on the assumptions that destination attractiveness is a function of the demand (those who are attracted) and natural resource base (attraction), Formica and Uysal [4] guided a theoretically and methodologically valuable analysis of the overall attractiveness of tourism regions by simultaneously evaluating the demand and supply factors influencing the production and development of tourism goods and services. To effectively account for the push and pull factors, tools developed specifically for assessing nature-based tourism attractiveness would likewise benefit from empirical assessment of both visitors and local expert perspectives.

In accordance with the guiding principle that the overall tourism attractiveness of a destination should integrate the assessment of existing resources or attractions and their perceived attractiveness, the purpose of the current research is essentially three-fold. First, we aim to develop a theoretically driven approach specific to the assessment of nature-based tourism attractiveness that involves expert evaluations of existing attractions and amenities as well as tourists' perceptions of destination attractiveness. Second, we develop a set of methodological tools that combine the Analytic Hierarchy Process (AHP) with Fuzzy Comprehensive Evaluation methods (FCEM) to create a novel Fuzzy-AHP approach for measuring nature-based tourism attractiveness. Third, we apply this Fuzzy-AHP approach at the Changbai Mountain Biosphere Reserve, an increasingly popular nature-based tourism destination in northeastern China. Lastly, we aim to demonstrate how the Fuzzy-AHP approach has practical applications for government agencies, industry organizations, and other tourism stakeholders who seek a framework to guide the comprehensive qualitative and quantitative assessment of both the supply and demand-side dimensions, factors, and attributes that influence nature-based destination attractiveness. This work thus has theoretical, methodological, and direct practical application to the sustainable development and management of nature-based tourism in China and beyond.

2. Literature Review

2.1. Conceptualization of Attractiveness and Destination Attractiveness

According to social exchange theory, behavioral attractiveness is a central aspect of exchanges, interpersonal processes, and reciprocity in business contexts [24–28]. Attractiveness was defined as "the capacity to cause interest and attract or obtain the attention of another party" by La Rocca et al. [27] (pp. 1241–1242). Meanwhile Lott and Lott [29] indicated that people tend to like "those who reward them" or "those whose overall behavior is most rewarding". Furthermore, Hüttinger et al. [28] found that a receiver or provider attracting the attention of others results in the enhancement of loyalty and the improvement of relationships in business contexts. Scholars have thus agreed that the highest ratio of reward to cost is an essential consideration [29,30].

By extending the above ideas, the concept of destination attractiveness has proven to be a productive area of tourism-related scholarship and policymaking [6,7,31]. Echoing Mayo and Jarvis [32], Hu and Ritchie [2] defined destination attractiveness as "the perceived ability of the destination to deliver individual benefits and satisfy potential tourists, and this ability is enhanced by the attributes of a destination, i.e., those components that makeup a destination" [6] (p. 811). Other scholars have further illustrated that once a prerequisite determination to travel has been made, it is the pull factors (i.e., destination attributes) that motivate visitors to prefer one destination over another [9,33–35].

2.2. Attributes Influencing Destination Attractiveness

The multifaceted characteristics of tourism destinations present a considerable challenge of aligning tourism resources and attractions with tourist motivations and preferences [4,8]. Gearing et al. [1] formulated an initial list of the attributes that establish the attractiveness of Turkey as a tourist destination, including natural, social, historical, recreational and shopping facilities, infrastructure, and food and shelter. Van Raaij [36] later distinguished destination attributes that are partly "given" and partly "man-made". "Given" attributes can include natural features such as the mountains, climate, beaches, scenery, and cultural heritage. In contrast, "man-made" attributes consist of hotel and transportation facilities, tour packages, and the types of facilities available. Similarly, Laws [37] divided destination attributes into two major groups. The primary group includes intrinsic characteristics such as natural resources, ecology, climate, historical, and culture architecture, while the secondary characteristics are those developments made specifically for tourism, such as hotels, transport, food services, and entertainment. The former is often what induces a tourist to visit a particular destination, but the latter components enhance the quality of the experience of a destination. By measuring supply and demand indicators, Formica and Uysal [4] provided a more recent model that reduced 20 determinants of tourism destination attractiveness into just four primary factors: tourism services and facilities, cultural/historical factors, rural lodging, and outdoor recreation opportunities. As various scholars have refined their approaches to measuring destination attractiveness, few common attributes have emerged. Yet among the findings is a consensus that attractive attributes are connected with specific types of tourist destinations [6,8,12,38] and thus require site-specific measurement.

2.3. Characteristics of Nature-Based Tourism Destination

The term nature-based tourism (NBT) is generally applied to tourism activities depending on the presence of natural amenities in a relatively undeveloped state, including scenery, topography, waterways, vegetation, wildlife, and cultural heritage [39,40]. Although some scholars consider NBT as an umbrella term for diverse labels such as geo-tourism, nature tourism, adventure tourism, wildlife tourism, wilderness tourism, environmental tourism, outdoor tourism, and ecotourism [22], other scholars insist that critical distinctions exist between these various forms of tourism [41]. Ecotourism specifically is touted for its potential win-win contributions to both environmental conservation and local livelihoods [42,43]. While not all NBT is managed with those specific objectives in mind, it is generally promoted with the assumption that such win-win outcomes may be possible [40].

NBT demand has steadily increased and is currently the most rapidly expanding tourism product across Europe and elsewhere [44]. Some estimates suggest that over 8 billion people visit protected areas annually [18]. Research shows that nature-based tourists become more deeply engaged in embracing pro-environmental behaviors and they tend to express sympathy to environmental issues and are eager to acquire knowledge [45,46]. Through direct, first-hand contact and purposeful engagement with natural history, native wildlife, and conservation messaging, NBT experiences can stimulate and cultivate an interest in ecology, biology, and natural history. NBT experiences also enhance pro-environmental knowledge, attitudes, and behavioral intentions [47–51].

Numerous attributes of NBT destinations have been analyzed to determine nature-based destination attractiveness. For example, Ho [52] noted that forest recreation tourism in Taiwan has helped prompt the construction and refurbishment of safe, hygienic, socially acceptable, and environment-friendly structures and facilities (e.g., tables, signs, toilets, etc.) that mesh well with the natural surroundings. Such tuning of built facilities and structures provide complementary pull factors that help lure people to nature-based settings, thereby enabling the NBT outcomes referenced above. For such reasons, numerous studies have focused on nature-based destination attractiveness in forest recreation contexts (Table 1). Common attributes assessed in that line of research include the natural, cultural, and historical resources (e.g., woodland scenery, flora and fauna, amazing waterfalls, climatic phenomena, topographic and geologic features, well-conserved environment, and local man-made attractions) [6,12,53–58] as well as built features related to accessibility and transportation [6,12,53–55]. Other studies emphasize the supporting infrastructure (e.g., provision of lodging and catering, recreation facilities) [6,12,54–57] or complementary services [6,12,55]. Levels of environmental degradation and the environmental impacts of local communities are also frequently assessed [53,55]. This breadth of attributes present in literature on nature-based destinations provided a valuable rationale for our decision to conduct new empirical research at Changbai Mountain Biosphere Reserve.

Table 1. Destination attributes in the nature-based tourism literature.

Author(s)	Nature of Tourism	Destination Attributes
Jeong [56]	Forest recreation tourism; national forests, Korea	Natural resources; historical cultural resources; mountain walking trails; recreational facilities; information and convenience infrastructures; lodging and commercial facilities
Hsueh and Lai [57]	Forest recreation tourism; forest sites, China	Natural assets: flora and fauna, spectacular waterfalls, woodland scenery, special topographic and geologic features, climatic phenomena; man-made attractions: bridges, tunnels, reservoirs, Chinese-style pavilions, trails, archaeological sites, temples, memorials, monuments, aboriginal heritages, and forest railways; supporting tourism infrastructures: public convenience facilities, recreational facilities, education-oriented facilities, the provision of transport, food and drinks, and accommodation available
Priskin [55]	Nature-based tourism; the Central Coast of Western Australia	Attraction: floral diversity, scenic diversity, recreation opportunity, adventure opportunity, bay or inland water body, rocky coastline/bluff, sandy beach, good vistas, scientifically interesting, geologic feature; accessibility: road type, vehicle class; supporting infrastructure: toilet facilities, picnic tables, seats/benches, barbecue, rubbish bins, access for disabled, shade/shelter; level of environmental degradation: litter, weeds, disease, impact of fire, erosion, trampling of vegetation, destruction of dunes, erosion of landforms, tracks, built structures
Deng et al. [53]	Nature-based tourism; national parks and forest reserves, Australia	Tourism resources: natural resources, cultural resources; tourist facilities: infrastructure, recreational facilities, educational facilities; accessibility: external accessibility, internal accessibility; local communities: social impact, cultural impact, economic impact; peripheral attractions: importance of attractions, number of attractions
Kim et al. [54]	Nature-based tourism; national parks, Korea	Key tourist resources: appropriate areas for children's study of natural resources, rare fauna and flora (or aquatic plants/animals), beautiful natural resources, tranquil rest areas, cultural and historic resources, well-conserved environment; information and convenience of facilities: well-organized tourist information systems, convenient facilities (e.g., restroom, drinking stand), convenient parking lots, clean and comfortable accommodations; accessibility and transportation: easy accessibility, convenient transportation
Martin [58]	Woodland tourism; forests, Great Britain	Imagery/scenery; access to the natural environment: biological materials (plants and animals), sights, sounds, smells, overall aesthetics, and ambience; facilities and services: trails, visitor centers, interpretation boards, car parks, toilets, guided walks, and activities
Lee et al. [6]	Forest recreation tourism; forests, China	Tourist attractions: natural resources, cultural assets; accessibility: external access, internal access; amenities: provision of lodging and catering, recreation facilities; complementary services: information services, safety, and sanitation
Lee [12]	Camping tourism; camp sites, China	Tourism attractions: natural attractions, man-made attractions; accessibility: external access, internal access; amenities: provision of lodging, provision of catering; complementary services: safety and security services, information services

2.4. Evaluating Tourism Attractiveness

Behavioral approaches to assessing supply and demand suggests that people travel because they are pushed by their motivations or pulled by destination attributes [4]. Crompton [59] and Dann [60] considered push factors to be a sociopsychological construct of tourists that motivates individuals to travel or partake in leisure activities. Consequently, prior research suggests that supply and demand, either independently or simultaneously, should be incorporated into measures of tourism attractiveness [1–4,6,12,38,61–64].

The demand-driven approach dictates that "the travel destination reflects the feelings, beliefs, and opinions that an individual has about a destination's perceived ability to provide satisfaction in relation to his or her special vacation needs" [2] (p. 25). As such, Formica [3] argued that travelers are the final judges in deciding the level of attractiveness of a region and the success or failure of a given area depends on tourists' perceptions about this tourist destination. Mayo and Jarvis [32] likewise believe that tourism attractiveness hinges on the personal benefits of tourists and on the perceived delivery of those benefits.

In contrast, Formica [3] defines the supply approach to tourism attractiveness as a need to "investigate and measure tourism resources and their spatial distribution" (p. 351). This approach generally employs attractiveness measurements based on supply indicators that are quantitative in nature. Likewise, Kaur [65] agrees that tourism attractiveness is a pull force resulting from the overall combination of attractions existing in a given place at a given time. This view is highly consistent with the supply perspective that requires determining "the overall attractiveness of the area by carrying out an accurate inventory of existing tourism resources" [3] (p. 351).

Since destination attractiveness is a function of both the resource base (attraction) and of demand (those who are attracted), it is therefore prudent to measure destination attractiveness from both an objective (supply) and a subjective (demand) perspective [3,4]. The attractive power of a region depends not only on their objective value (the number of tourist resources located in a given area), but also on how these resources are valued and perceived by tourists (the favorable/unfavorable perceptions of a given area). Therefore, an analytical technique to measure destination attractiveness should integrate the evaluation of existing resources and their perceived attractiveness.

3. Methods

3.1. Study Site: Changbai Mountain Biosphere Reserve, China

Located in Jilin Province of northeastern China [41°41′49″–42°25′18″ N, 127°42′55″–128°16′48″ E] and situated on the China-North Korea border, the Changbai Mountain Biosphere Reserve (CMBR) occupies an area of 196,456 ha (Figure 1). The climate of the Reserve is continental temperate with obvious altitudinal variation between elevations ranging from 720 to 2691 m above sea level. The region is featured with temporary warm summers, and long cold winters. The annual precipitation is between 700 and 1400 mm, most of which occurs from June to September [66,67]. A wide range of topography, weather, soil, and other natural factors conduce abundant biodiversity and vertical vegetational landscapes ranging from temperate to arctic biomes [68]. As such, the CMBR is recognized as a rare gene bank of endemic species, with research showing that 2277 species of plants and 1225 known animal species are found in the reserve [67]. The CMBR has witnessed a long history of development and has gained a large reputation. It was established in 1960 with approval of the Government of Jilin Province, later allowed to join in the International Man and Biosphere Reserve Network of UNESCO in 1980, identified as a national forest wild animal nature reserve by the State Council in 1986, designated as an international A-level nature reserve by the International Union for Conservation of Nature (IUCN) in 1992, rated as one of the first national 4A-grade tourism areas by the China National Tourism Administration (CNTA) in 2001, and admitted as the first national 5A-level tourism scenic area in 2007 [67,69].

The CMBR has many unique and extremely rich natural and cultural tourist attractions. The ancient forests, striking geologic and volcanic landforms (e.g., a crater lake at the top of Changbai Mountain, waterfalls, canyons, and hot springs), as well as remarkable local cultures combine to make the CMBR an amenity-rich nature-based tourism destination. The CMBR has thus enjoyed a great reputation at home and abroad as tourist numbers have been continuously increasing over the past four decades. Visitation to the reserve increased from 29,000 in 1980 to 570,000 in 2005 [68], later reaching 900,000 in 2007 [66]. By 2019 the number of visitors had climbed to more than 6.10 million. Total revenues accrued to governments and private sector enterprises amounted to nearly RMB 5.61 billion (approximately USD 813 million) [70].

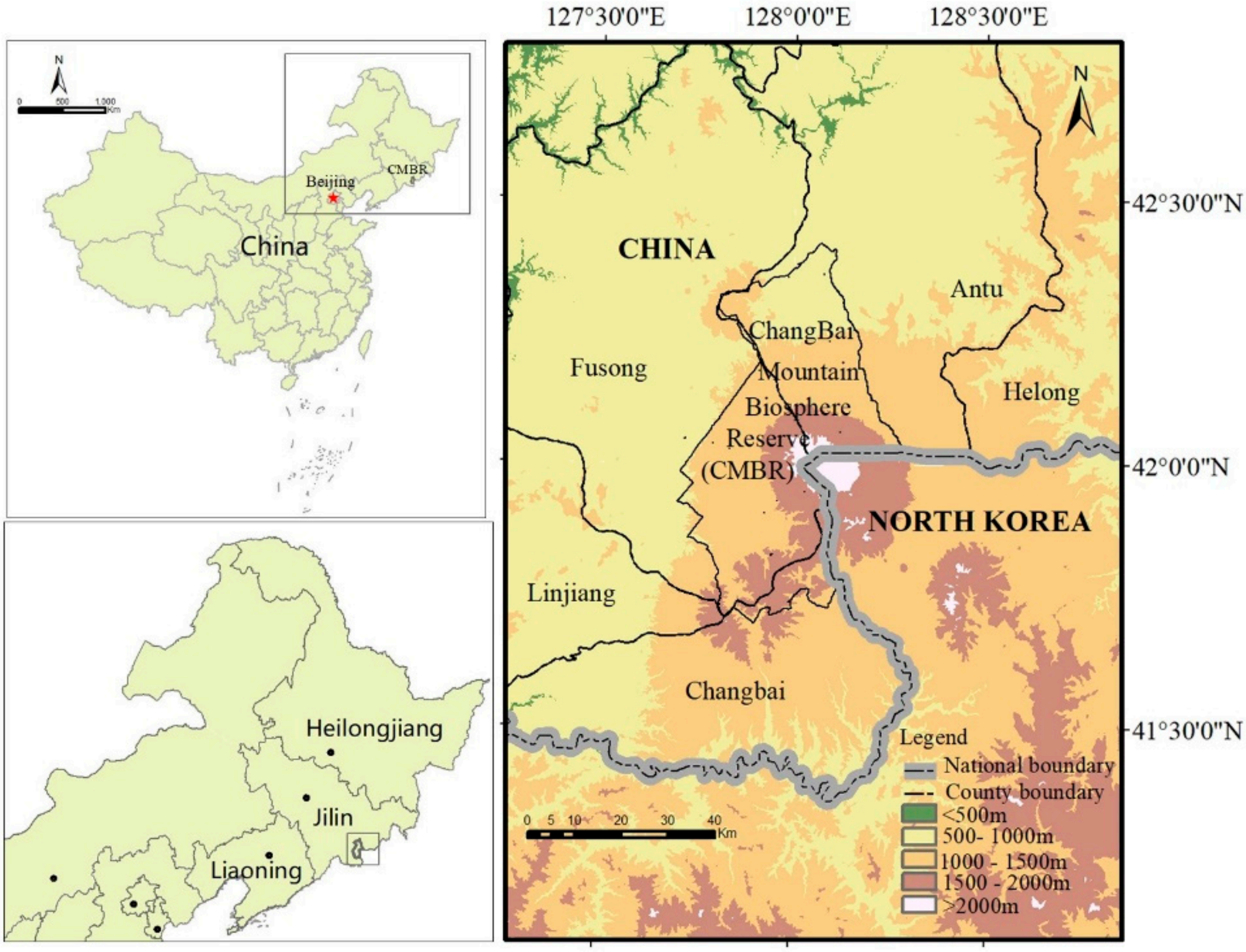

Figure 1. Location of the study area.

3.2. Research Design

3.2.1. Fuzzy-AHP Evaluation Method

Destination attractiveness has been measured via two primary methods: a supply side perspective assessing tourist attractions and resources existing in a given area [6,8,12,63,64] and a demand side perspective assessing visitors' perceptions of attractiveness [2,7,10,38,61]. Formica and Uysal [4] presented a model to explain and explore the determinants of tourism attractiveness of a destination by measuring supply and demand indicators. These authors noted that the overall tourism attractiveness of a destination is determined by the relationship between the availability of existing attractions and the perceived importance of such attractions. To account for these various factors, this study develops a novel procedure utilizing a Fuzzy-Analytical Hierarchy Procedure (AHP) for its measurement. This Fuzzy-AHP holistically incorporates expert evaluations of existing attractions and resources existing in a given area as well as tourists' attractiveness perceptions. Introduced by Satty [71], AHP allocates the relative importance of evaluation items based on weights of criteria [71,72]. The Fuzzy Comprehensive Evaluation method (FCEM) aims to convert fuzzy and qualitative factors into a quantitative analysis via fuzzy mathematical theory [73], which can adequately deal with the inherent uncertainty and imprecision of the human decision-making process [74]. A combined Fuzzy-AHP approach combines AHP with FCEM in multi-criteria Fuzzy Comprehensive Evaluation. This combination is proved to be functional in handling fuzzy evaluations, such as smart tourist attraction [17]. The current study adapted the Fuzzy-AHP to the evaluation of the attractiveness of NBT. The five specific steps in the Fuzzy-AHP are as follows [17,75]:

Step 1. Determining the item set of the evaluated object: The item set of the evaluated object is the various items which can influence the evaluated object, and is defined by U as follows:

$$U = \{u_1, u_2, u_3, \ldots, u_\mathrm{m}\} \tag{1}$$

In Equation (1), u_i refers to the ith item affecting evaluated objects. These items usually have different degrees of fuzziness.

Step 2. Determining the evaluation set: The evaluation set consists of the elements of various comprehensive evaluation results of the evaluated object, which are set by the evaluators. It is designated by V as follows:

$$V = \{v_1, v_2, v_3, \ldots, v_\mathrm{n}\} \tag{2}$$

In Equation (2), v_j represents the jth evaluation result. In this study, $V = \{V_1, V_2, V_3, V_4, V_5\}$ = {"poor", "fair", "moderate", "good", and "excellent"}.

Step 3. Determining the weight set: The procedure for using AHP to generate the weight set of NBTA can be outlined as follows: (1) to evaluate the relative significance of different criteria by judges based on a "1–9" scale process [71] (Table 2) and constructing a judgment matrix; (2) to calculate the maximum eigenvalue of the judgement matrix and using the eigenvector of the largest eigenvalue to determine the evaluation weight vector A; and (3) to decrease the subjectivity of judgment and ensure the rationality of weights by using a consistency test. Only when the consistency ratio (CR) is less than 0.1 is the consistency of the judgment matrix regarded as reasonable. Otherwise, the matrix must be resized until the consistency standard is met.

Table 2. Scales of relative importance.

Scales of Relative Importance	Meaning
1	Item i is equally important to item j
3	Item i is slightly more important than item j
5	Item i is more important than item j
7	Item i is much more important than item j
9	Item i is substantially more important than item j
2, 4, 6, 8	Intermediate scales

Step 4. Constructing the fuzzy judgment matrix: The fuzzy judgment matrix R can be defined as follows:

$$R = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} & \cdots & R_{1n} \\ R_{21} & R_{22} & \cdots & R_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ R_{m1} & R_{m2} & \cdots & R_{mn} \end{bmatrix} \tag{3}$$

In Equation (3), R refers to the evaluation results of the item set U, and R_{ij} means the degree of membership of the ith item u_i to the jth evaluation rank v_j, which reflects the fuzzy relationship of every item. In this study, R_{ij} is calculated by the ratio of the number of questionnaires at the corresponding evaluation level to the total number of valid questionnaires.

Step 5. Accomplishing Fuzzy Comprehensive Evaluation: The Fuzzy Comprehensive Evaluation can be procured by calculating between the single item weight vector A and the fuzzy judgment matrix R, that is shown as:

$$B = A \circ R = (b_1,\ b_2,\ \ldots\ ,\ b_{\mathrm{m}}) \tag{4}$$

In Equation (4), b_i is the membership degree value of evaluated samples to each evaluation standard. The evaluation results are usually defined based on the maximum-membership degree principle.

3.2.2. Establishing an Attractiveness Evaluation Model

Consistent with the existing literature on NBTA [6,52–54,56,57,76], an attractiveness evaluation structure of NBT combined with the actual situation of the CMNR was established for the present study (Figure 2). To validate literature-based characteristics of NBTA, pilot work was carried out with a purposive sample of eight crucial participants each with at least 10 years of professional experience in the operation and management of the CMBR. The relevant work experience of these individuals ensured the credibility of the proposed model, which consists of a four-level hierarchical structure with a total of 43 attributes. The overall goal of this model is to form a framework for assessing the attractiveness of NBT with weights corresponding to the entire range of destination attributes. Secondarily, the model establishes the four major dimensions that are conducive to the overall attractiveness of NBTD (i.e., tourist attractions, accessibility, development conditions, and complementary services).

These four dimensions are further subdivided at a third level of the model. *Tourist attractions* are regarded as the principal elements of destination attractiveness. The primary purpose of tourists is to experience the important attributes in a destination such as climate, ecology, natural resources, culture, and historic architecture and they are the key motivators and the fundamental reasons for visitation to a destination [37,77]. It is subsequently divided into two factors: natural attractions and cultural attractions. *Accessibility* generally refers to the extent of conveniences and difficulties of moving from one place to another and may be evaluated from two aspects: external access and internal access.

Development conditions dimension comprises a variety of supporting tourism infrastructures provided to visitors to meet their basic needs and the attitude of stakeholders to travel industry or tourists, such as host governments, host communities and tourism practitioners. A wide variety of well-developed amenities can not only be helpful to make the destination more attractive but also contribute to enhancing tourist satisfaction because of the improved quality of infrastructure base [78]. The importance of host government, local communities, and tourism practitioners in tourism development and management is increasingly accepted in literature on sustainable tourism [79–81].

Lastly, in the *Complementary services* dimension, safety and sanitation, and information services are considered to be of significance for determining the quality of recreational experience in NBT. Lee et al. [6] pointed out that visitors traveling to nature-based sites (e.g., forest) demand information to ensure more safety at various stages in the recreation journey from deciding to visit a particular site to arriving at and experiencing that site. The provision of such information services and security performs a particularly important role in encouraging visitors to visit a particular site or to partake in a recreational experience [6,82]. All four levels of this model are outlined in Figure 2.

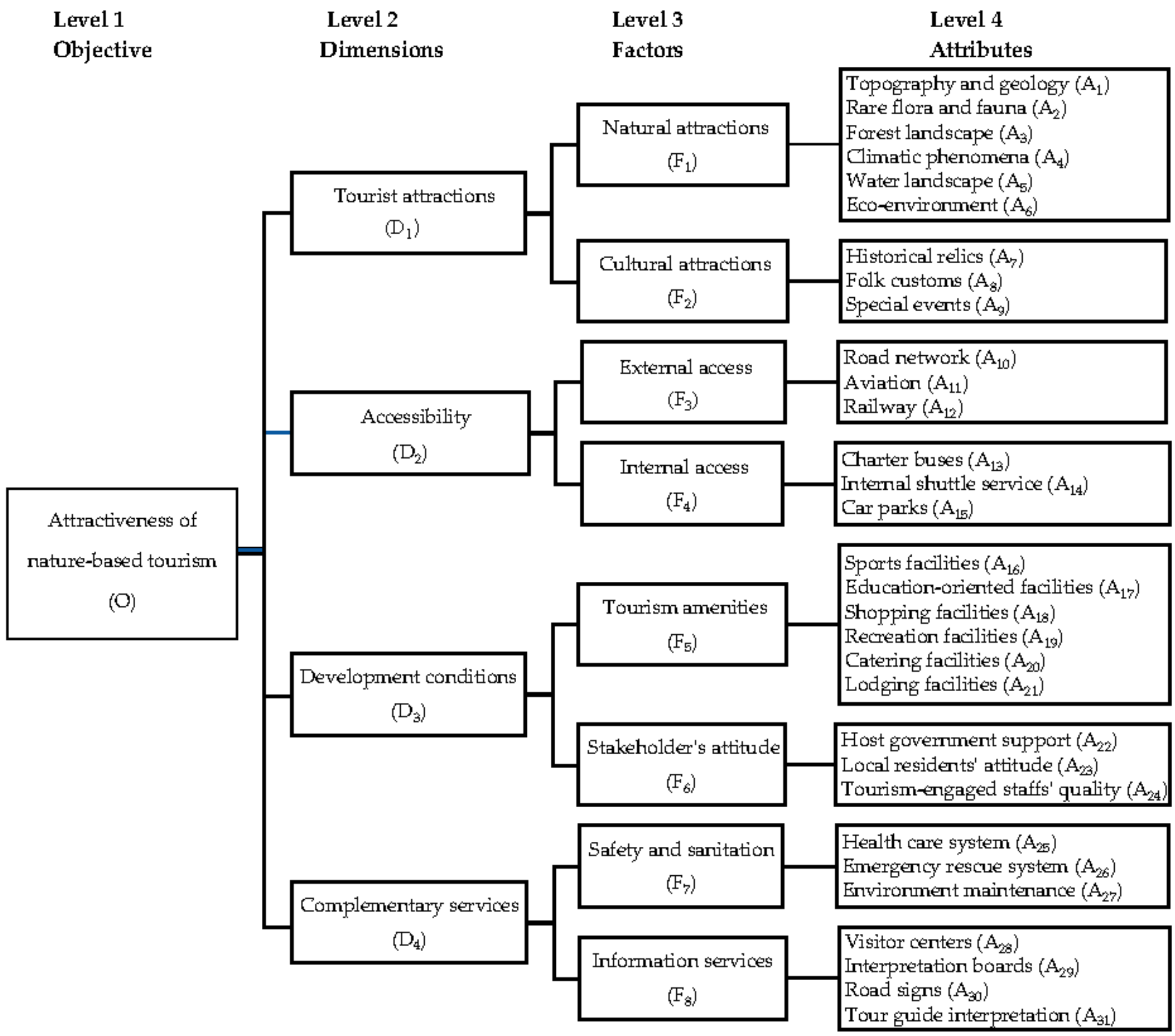

Figure 2. The hierarchy of determinants of attractiveness of nature-based tourism.

3.2.3. Questionnaire Design

To assess the above model, two questionnaires were designed for this study: one to determine the weight of evaluation factors via expert consultation, and another to measure tourists' perception of attractiveness of nature-based tourism in the CMBR. Both surveys also gathered basic demographic information. Tourism expert participants were asked to evaluate the relative importance of all four dimensions, eight factors, and 31 attributes in Table 2. Consistent with the approach of Satty [71], these experts were then asked to choose between various pairs of statements (e.g., to acquire the relative importance of tourist attractions versus accessibility dimensions).

Meanwhile, a self-administrated tourist questionnaire asked respondents to provide their opinions of 31 CMBR attribute items using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). For example, the first question assesses landscapes such as this: Do you agree the topography of the CMBR is complex and changeable, with typical geomorphic features? (Table 3).

Table 3. The original perception items of NBTD.

No.	Attributes	Attribute Description
A_1	Topography and geology	The topography of the CMBR is complex and changeable, with typical geomorphic features.
A_2	Rare flora and fauna	The number of species of animals and plants in the CMBR is extremely rich.
A_3	Forest landscape	The CMBR has high vegetation coverage, rich tree species, and is a unique forest landscape.
A_4	Climatic phenomena	The climatic and meteorological phenomena of the CMBR are changing rapidly, increasing its attractiveness to tourists.
A_5	Water landscape	The CMBR has rich water landscape types with a high aesthetic value.
A_6	Eco-environment	The ecological environment in the CMBR is good, with fresh air, comfortable climate, high-quality water, and a clean environment.
A_7	Historical relics	There are many historical relics in the CMBR which create a strong atmosphere of cultural heritage.
A_8	Folk customs	The CMBR has colorful folk culture with distinctive local characteristics.
A_9	Special events	The festival activities in the CMBR are colorful and of special heritage significance.
A_{10}	Road network	The highway traffic to the CMBR is convenient and the road conditions are excellent.
A_{11}	Aviation	There are many flights to the CMBR and the journey is short and comfortable.
A_{12}	Railway	There are many trains to the CMBR with easy access and reasonable cost.
A_{13}	Charter buses	There are plenty of sightseeing vehicles in the CMBR with ample interpretive signage.
A_{14}	Internal shuttle service	Sightseeing vehicles for attractions in the CMBR are easy to access and have a short waiting time.
A_{15}	Car parks	The space of the parking lot in the CMBR is sufficient, convenient, and well-integrated with the surrounding environment.
A_{16}	Sports facilities	The sports facilities in the CMBR are complete, meeting the needs of tourists at different levels for various sports.
A_{17}	Education-oriented facilities	The education-oriented facilities in the CMBR are perfect, and tourists can obtain extensive ecological and environmental knowledge.
A_{18}	Shopping facilities	The shopping facilities in the CMBR are sufficient and there are extensive souvenirs with local characteristics.
A_{19}	Recreation facilities	The CMBR provides a high number of entertaining places for tourists to enjoy.
A_{20}	Catering facilities	The CMBR has adequate food service facilities, and these services highlight the local cuisine, rich variety, and reasonable cost of food.
A_{21}	Lodging facilities	The accommodation environment in the CMBR is clean and safe, and the accommodation index meets the relevant regulations.
A_{22}	Host government support	Local governments strongly support the development of the CMBR and provide numerous preferential policies.
A_{23}	Local residents' attitude	Local residents in the CMBR are friendly and courteous to tourists.
A_{24}	Tourism-engaged staffs' quality	The quality of the staff in the CMBR is very high, and their level of service quality is satisfactory.
A_{25}	Health care system	The medical system in the CMBR is perfect, and can effectively deal with the sudden illness or injury of tourists.
A_{26}	Emergency rescue system	The rescue system in the CMBR is perfect, and can quickly deal with any emergency events for tourists.

Table 3. *Cont.*

No.	Attributes	Attribute Description
A_{27}	Environment maintenance	Waste is dealt with in a very timely fashion in the CMBR, and the environment is clean and tidy.
A_{28}	Visitor centers	The environment of the visitor center in the CMBR is comfortable, and tourists can enjoy warm, thoughtful, convenient, and fast services.
A_{29}	Interpretation boards	The explanations provided on the interpretation signs are accurate and humanized, and tourists can enrich themselves and expand their knowledge in the CMBR.
A_{30}	Road signs	The road signs in the CMBR are concise and clear, and match the scenic environment very well.
A_{31}	Tour guide interpretation	The service attitude of tour guides is excellent, and their interpretive knowledge is accurate and rich, meeting the educational needs of tourists in the CMBR.

3.3. Data Collection

The expert questionnaire was employed by the first author in May of 2017 via mail survey. Based on recommendations from initial participants, the snowball sampling method was used to eventually identify 14 experts who completed this questionnaire. These experts included scholars engaged in scientific research, reserve managers, tourism enterprise operators, and tourism practitioners. All have intimate and extensive familiarity with the CMBR. As Cheng and Li [83] note, AHP is a subjective method that does not necessarily demand a large quantity of participating experts. The work by [6] also suggested that the opinions from a small group of key informants are usually sufficient to obtain useful and reliable results, despite only providing rough estimates. Thus, the total of 12 responses received, representing a response rate was 85.7%, was deemed sufficient for the purpose of the AHP methodology. Table 4 summarizes expert participant characteristics.

Table 4. Summary of experts' profile (N = 12).

Characteristics		N	Percent	Characteristics		N	Percent
Sex	Male	9	75.0	Education	College/University	7	58.3
	Female	3	25.0		Graduate	5	41.7
Age	Below 40	4	33.3	Work field	Position in the organization		
	41–50	5	41.7	Academic	Professor/Research fellow	4	33.3
	51–60	2	16.7		Associate professor	1	8.3
	Above 61	1	8.3	Managers	Engineer of nature reserve center	2	16.7
Experience (years)	Five or below	3	25.0		Director of tourism bureau	1	8.3
	6–10	0	0		Senior technical specialists	1	8.3
	11–15	2	16.7	Tourism enterprises	Director of tourism Co., Ltd.	1	8.3
	16–20	1	8.3	Staffs of scenic areas	Staff of tourist service center	2	16.7
	More than 20	6	50.0				

Chinese visitors to CMBR also completed a paper-and-pencil tourist survey on-site. To ensure validity, a pretest with 20 tourists was conducted before the formal questionnaires were carried out in late July 2017. The formal survey data were then gathered over 12 days in August 2017 at several sites within and near the CMBR: Huahai Wetland Park, Transfer Center of Environment Protecting Automobile, Tourist Service Center, and Underground Forest Scenic Spot of the North Slope Scenic Area. A total of 500 questionnaires were distributed among a convenience sample of tourists by the first author and four trained graduate students. The investigators approached tourists resting on site, explained the significance of study, and then invited their voluntary and confidential participation in the study. In order to ensure the representativeness of the data, only tourists who visited the CMBR were asked to participate. Of the 500 questionnaires collected, 460 contained valid questionnaires utilized in this analysis, representing an effective response rate of 92.0%. Tourists' sociodemographic information is outlined in Table 5.

Table 5. Summary of tourists' profile (N = 460).

Demographic Variables		N	Percent	Demographic Variables		N	Percent
Sex	Male	189	41.1	Monthly income (RMB)	Below 2000	138	30.0
	Female	271	58.9		2000–4000	142	30.9
Age	Less than 18	32	7.0		4001–6000	91	19.8
	18–30	166	36.1		6001–8000	33	7.2
	31–40	106	23.0		Above 8000	56	12.2
	41–50	87	18.9	Occupation	Student	119	25.9
	51–65	55	12.0		Government officer	94	20.4
	Over 65	14	3.0		Company staff	91	19.8
Education	Junior high school or below	55	12.0		Worker	11	2.4
					Merchant	72	15.7
	Senior high school/Special secondary school	78	16.9		Researcher or teacher	20	4.3
					Housewife	11	2.4
	College	276	60.0		Retiree	20	4.3
	Graduate school or above	51	11.1		Others	22	4.8

3.4. Data Analysis

For the 12 expert questionnaires, normalized weighting priorities were set up for the hierarchy of elements within the AHP model by utilizing the yaahp software package. Participants' comparisons were input into yaahp, which allowed the researchers to check the consistency of individual responses and to extract normalized local and global weightings of all elements at each level of the hierarchy. Consistency ratios were generated for each matrix. When the consistency ratio (CR) is lower than 0.1, which coincides with the threshold of 10% consistency proposed by Satty [71], the reliability and consistency of expert judgments is confirmed.

Tourist questionnaires assessed 31 attributes of the attractiveness of NBT in the CMBR. As Step 4 showed, R_{ij} is calculated in the fuzzy judgment matrix by the ratio of the number of questionnaires at the corresponding evaluation level to the total number of valid questionnaires. All the data were analyzed using IBM SPSS Statistics 20. Based on the weight set (Step 3) and the results of R (Step 4), each evaluation set was calculated with Microsoft Office Excel.

4. Results

4.1. Results of AHP

Five sets of normalized weights were obtained to establish relative importance of elements in contributing to NBTA (Table 6). Weightings apply to each dimension, factor, and attribute (Figure 2). The application of local weights by ***dimension*** shows that *tourist attractions* (0.4796) is the most important dimension contributing to NBTA, followed by *accessibility* (0.2538) and *development conditions* (0.1373). *Complementary services* (0.1293) appear to be the dimension with the lowest importance. The ***factors*** of *natural attractions* (0.7083), *external access* (0.5049), *tourism amenities* (0.6708), and *safety and sanitation* (0.7000) were most important aspects of dimensions in the order of tourist attractions, accessibility, development conditions, and complementary services. In contrast, the ***attributes*** of *topography and geography* (0.2894), *historical relics* (0.5026), *road network* (0.4419), *charter buses* (0.3692), *education-oriented facilities* (0.2071), *host government support* (0.4041), *emergency rescue system* (0.3968), and *visitor centers* (0.3876) were most important with respect to each factor in the sequence of natural attractions, cultural attractions, external access, internal access, tourism amenities, stakeholder's attitude, safety and sanitation, and information services.

Table 6. Local and global weights of each element for determining the attractiveness of NBTD.

Dimension(D)/Level 2	Local Weights	Factor(F)/Level 3	Local Weight	Global Weight	Attribute(A)/Level 4	Local Weight	Global Weight	Rank
Tourist attractions (D_1)	0.4796	Natural attractions (F_1)	0.7083	0.3397	Topography and geology (A_1)	0.2894	0.0983	1
					Rare flora and fauna (A_2)	0.1418	0.0482	6
					Forest landscape (A_3)	0.1561	0.0530	5
					Climatic phenomena (A_4)	0.0788	0.0268	16
					Water landscape (A_5)	0.1154	0.0392	11
					Eco-environment (A_6)	0.2185	0.0742	2
		Cultural attractions (F_2)	0.2917	0.1399	Historical relics (A_7)	0.5026	0.0703	3
					Folk customs (A_8)	0.3094	0.0433	9
					Special events (A_9)	0.1880	0.0263	17
Accessibility (D_2)	0.2538	External access (F_3)	0.5049	0.1281	Road network (A_{10})	0.4419	0.0566	4
					Aviation (A_{11})	0.3170	0.0406	10
					Railway (A_{12})	0.2411	0.0309	14
		Internal access (F_4)	0.4951	0.1257	Charter buses (A_{13})	0.3692	0.0464	7
					Internal shuttle service (A_{14})	0.3451	0.0434	8
					Car parks (A_{15})	0.2857	0.0359	12
Development conditions (D_3)	0.1373	Tourism amenities (F_5)	0.6708	0.0921	Sports facilities (A_{16})	0.1608	0.0148	24
					Education-oriented facilities (A_{17})	0.2071	0.0191	19
					Shopping facilities (A_{18})	0.1301	0.0120	27
					Recreation facilities (A_{19})	0.1192	0.0110	28
					Catering facilities (A_{20})	0.1837	0.0169	22
					Lodging facilities (A_{21})	0.1991	0.0183	20
		Stakeholder's attitude (F_6)	0.3292	0.0452	Host government support (A_{22})	0.4041	0.0183	20
					Local residents' attitude (A_{23})	0.3034	0.0137	25
					Tourism-engaged staffs' quality (A_{24})	0.2925	0.0132	26
Complementary services (D_4)	0.1293	Safety and sanitation (F_7)	0.7000	0.0905	Health care system (A_{25})	0.2853	0.0258	18
					Emergency rescue system (A_{26})	0.3968	0.0359	12
					Environment maintenance (A_{27})	0.3180	0.0288	15
		Information services (F_8)	0.3000	0.0388	Visitor centers (A_{28})	0.3876	0.0150	23
					Interpretation boards (A_{29})	0.2671	0.0104	29
					Road signs (A_{30})	0.2359	0.0091	30
					Tour guide interpretation (A_{31})	0.1094	0.0042	31

Careful observation of the global weights (Table 6) indicates that the ***top three ranking factors*** are *natural attractions* (0.3397), *cultural attractions* (0.1399) and *external access* (0.1281). The ***top five ranked attributes*** are *topography and geography* (0.0983), *eco-environment* (0.0742), *historical relics* (0.0703), *road network* (0.0566), and *forest landscape* (0.0530). The ***five lowest ranking attributes*** are *tour guide interpretation* (0.0042), *road signs* (0.0091), *interpretation boards* (0.0104), *recreation facilities* (0.0110) and *shopping facilities* (0.0120). Thus, according to the results (Table 6), the weight vector of each index is as follows:

- Attractiveness of nature-based tourism (WD_1–WD_4): (0.4796, 0.2538, 0.1373, 0.1293);
- Tourist attractions (WF_1–WF_2): (0.7083, 0.2917);
- Accessibility (WF_3–WF_4): (0.5049, 0.4951);
- Development conditions (WF_5–WF_6): (0.6708, 0.3292);
- Complementary services (WF_7–WF_8): (0.7000, 0.3000);
- Natural attractions (WA_1–WA_6): (0.2894, 0.1418, 0.1561, 0.0788, 0.1154, 0.2185);
- Cultural attractions (WA_7–WA_9): (0.5026,0.3094, 0.1880);
- External access (WA_{10}–WA_{12}): (0.4419, 0.3170, 0.2411);
- Internal access (WA_{13}–WA_{15}): (0.3692, 0.3451, 0.2857);
- Tourism amenities (WA_{16}–WA_{21}): (0.1608, 0.2071, 0.1301, 0.1192, 0.1837, 0.1991);
- Stakeholder's attitude (WA_{22}–WA_{24}): (0.4041, 0.3034, 0.2925);
- Safety and sanitation (WA_{25}–WA_{27}): (0.2853, 0.3968, 0.3180);
- Information Services (WA_{28}–WA_{31}): (0.3876, 0.2671, 0.2359, 0.1094).

4.2. Constructing Fuzzy Judgement Matrix R

As outlined above (Section 3.2.1), R_{ij} is calculated by the ratio of the number of tourist questionnaires at the corresponding evaluation level to the total number of valid questionnaires. Eight fuzzy judgement matrixes of the fourth level of CMBR: R_{41}, R_{42}, R_{43}, R_{44}, R_{45}, R_{46}, R_{47}, and R_{48} can be constructed (Appendix A). These eight matrixes show that some attributes have the same appeal to tourists as to experts (i.e., *topography and geography, rare flora and fauna, forest landscape, water landscape, eco-environment, folk customs, road network, railway, charter buses, internal shuttle service, car parks, and environment maintenance*). However, there is a sharp difference between experts and tourists when they evaluate the attractiveness of other attributes (i.e., *climatic phenomena, historical relics, aviation, shopping facilities, local residents' attitude, tourism-engaged staff's quality, emergency rescue system, interpretation boards, and road signs*). Despite some shared evaluation of attributes in both expert and tourist surveys, distinct evaluation results emerge depending on whether the demand-driven or the supply perspective is implemented, though these are less focused on elements of the natural environment in CMBR.

4.3. Fuzzy Comprehensive Evaluation of Attractiveness of NBTD

By using eight fuzzy judgment matrixes (R_{41}–R_{48}) and the corresponding weights sets (WA_1–WA_{31}), the row vector results of the third-level Fuzzy Comprehensive Evaluation can be calculated as follows:

$$VF_1 = (WA_1\text{-}WA_6) \circ R_{41} = (0.0047, 0.0121, 0.0614, 0.4667, 0.4589)$$

$$VF_2 = (WA_7\text{-}WA_9) \circ R_{42} = (0.0132, 0.1275, 0.3549, 0.3172, 0.1872)$$

$$VF_3 = (WA_{10}\text{-}WA_{12}) \circ R_{43} = (0.0232, 0.1126, 0.2998, 0.3729, 0.1915)$$

$$VF_4 = (WA_{13}\text{-}WA_{15}) \circ R_{44} = (0.0183, 0.0586, 0.1420, 0.4930, 0.2880)$$

$$VF_5 = (WA_{16}\text{-}WA_{21}) \circ R_{45} = (0.0224, 0.1008, 0.3167, 0.3856, 0.1745)$$

$$VF_6 = (WA_{22}\text{-}WA_{24}) \circ R_{46} = (0.0108, 0.0475, 0.2323, 0.4613, 0.2482)$$

$$VF_7 = (WA_{25}\text{-}WA_{27}) \circ R_{47} = (0.0087, 0.0166, 0.4122, 0.3365, 0.2262)$$

$$VF_8 = (WA_{28}\text{-}WA_{31}) \circ R_{48} = (0.0092, 0.0491, 0.1711, 0.5155, 0.2551)$$

Then, by utilizing the above row vector results VF_i, four fuzzy judgement matrixes of the third level: R_{31}, R_{32}, R_{33}, and R_{34} can be constructed as follows:

$$\underset{R_{31}}{\begin{bmatrix} 0.0047 & 0.0121 & 0.0614 & 0.4667 & 0.4589 \\ 0.0132 & 0.1275 & 0.3549 & 0.3172 & 0.1872 \end{bmatrix}} \underset{R_{32}}{\begin{bmatrix} 0.0232 & 0.1126 & 0.2998 & 0.3729 & 0.1915 \\ 0.0183 & 0.0586 & 0.1420 & 0.4930 & 0.2880 \end{bmatrix}}$$

$$\underset{R_{33}}{\begin{bmatrix} 0.0224 & 0.1008 & 0.3167 & 0.3856 & 0.1745 \\ 0.0108 & 0.0475 & 0.2323 & 0.4613 & 0.2482 \end{bmatrix}} \underset{R_{34}}{\begin{bmatrix} 0.0087 & 0.0166 & 0.4122 & 0.3365 & 0.2262 \\ 0.0092 & 0.0491 & 0.1711 & 0.5155 & 0.2551 \end{bmatrix}}$$

Next, by employing four fuzzy judgment matrixes (R_{31}–R_{34}) and the corresponding weights sets (WF_1–WF_8), the row vector results of the second-level Fuzzy Comprehensive Evaluation can be calculated as follows:

$$VD_1 = (WF_1\text{-}WF_2) \circ R_{31} = (0.0072, 0.0458, 0.1470, 0.4231, 0.3797)$$

$$VD_2 = (WF_3\text{-}WF_4) \circ R_{32} = (0.0208, 0.0859, 0.2217, 0.4324, 0.2393)$$

$$VD_3 = (WF_5\text{-}WF_6) \circ R_{33} = (0.0186, 0.0833, 0.2889, 0.4105, 0.1988)$$

$$VD_4 = (WF_7\text{-}WF_8) \circ R_{34} = (0.0088, 0.0264, 0.3398, 0.3902, 0.2349)$$

Furthermore, by applying the above row vector results, the second-level fuzzy comprehensive judgement matrix of CMBR (R) can be constructed as follows:

$$R = \begin{bmatrix} 0.0072 & 0.0458 & 0.1470 & 0.4231 & 0.3797 \\ 0.0208 & 0.0859 & 0.2217 & 0.4324 & 0.2393 \\ 0.0186 & 0.0833 & 0.2889 & 0.4105 & 0.1988 \\ 0.0088 & 0.0264 & 0.3398 & 0.3902 & 0.2349 \end{bmatrix}$$

Finally, by using assessment matrix R and the corresponding weights sets (WD_1–WD_4), the result of the first-level or objective-level Fuzzy Comprehensive Evaluation can be obtained by using $B = (WD_1–WD_4) \circ R$.

$$B = (0.0124, 0.0586, 0.2104, 0.4194, 0.3005)$$

The results of a Fuzzy Comprehensive Evaluation are usually defined according to the maximum-membership degree principle. From this vector B, it can be concluded that the membership-degree values of "poor", "fair", "moderate", "good," and "excellent" are 0.0124, 0.0586, 0.2104, 0.4194, and 0.3005, respectively. Among them, the membership degree value of "good" (0.4194) is the largest one. Thus, the NBTA evaluation score in CMBR is 0.4194 (at the level of "good"), which indicates the "attractiveness" level is relatively high when CMBR is assessed as an NBTD via the integration of both expert and visitor evaluations. However, since there are still some areas where CMBR failed to achieve "excellent" evaluations, there remain opportunities for both new research directions and tourism planning and development strategies to improve CMBR management in the future.

5. Discussion

5.1. Research Implications

Visiting protected areas for nature-based tourism experiences has become increasingly fashionable in China [84]. As a result, establishing a guiding framework to help industry and government sectors evaluate NBTA and achieve long-term sustainability of NBT is of increasing importance. With such concerns in mind, the primary objectives of this study were to examine the relative importance of characteristics of nature-based destination, understand tourist perceptions of CMBR, and more specifically develop a novel analytical approach that integrates both into a comprehensive assessment of NBTA. Although exploratory in nature, this study provides important integration of theoretical perspectives on the attractiveness of nature-based contexts, methodological insights derived from novel Fuzzy-AHP tools, and practical applications for managing NBTDs.

First, this study contributes to the understanding of the relative importance of various aspects of nature-based tourism attractiveness. The key findings of the Fuzzy-AHP analysis in this study confirmed that not all destination attributes are equally important [6,8,12,53]. Among eight factors, *natural tourist attractions* performed a decisive role in enhancing the attractiveness of CMBR, which is consistent with the view that forest recreation areas with high-quality natural assets are likely to gain market share and increase competitive advantage [6]. Among 31 key attributes of CMBR, *topography and geography, rare flora and fauna*, and *eco-environment*, together with *forest landscape*, were the most important contributors to NBTA. Not only did experts rank the importance of these four destination attributes highly, but tourists were also consistent in their strong evaluations of these attributes. These findings confirm those of Gu et al. [69] who found that experiencing *wildness-undisturbed nature*, *geological and geomorphic landscapes*, *good ecological environments*, and the *temperate forest landscapes* were the most salient motives for visitors to the CMBR.

Secondly, *external access* and *high-quality tourism amenities* were also considered essential to the overall nature-based tourism experience. Lee et al. [6] argued that "supporting infrastructure" enables visitors to prolong their length of stay in the destination and spending and ease their travel movements. Undoubtedly, *safety and sanitation* are also assumed to be of importance for determining the quality of recreational experience in NBTD. Several scholars [6,82] have admitted that the provision of such information related to services and security plays a pivotal role in encouraging visitors to visit a particular site or to partake in the recreational experience at various stages in the recreation journey.

Furthermore, the focus here on 31 attributes of attractiveness of CMBR yielded the unexpected discovery that many of the nature-based attributes have the same appeal to tourists as to experts. Yet despite occasional overlap, there were also sharp differences between experts and tourists in evaluations of the attractiveness of other attributes of CMBR. Aside from *climatic phenomena*, these evaluations (e.g., historic relics, aviation, shopping facilities, tourism-engaged staff's quality, emergency rescue system, etc.) had less direct association with nature. These observed similarities and differences confirm that models generate different results when using the demand-driven approach or the supply perspective separately, even though some common attributes exist between experts and tourists. This reinforces the value of an integrative approach such as that employed in this study.

The results of this study have other contributions to the study of destination attractiveness measurement and supply–demand interaction. Even though a number of empirical studies on destination attractiveness have been conducted [85–89], there remains a dearth of literature on attractiveness of NBTDs specifically. One exception is An et al. [90], who used thirteen national park attributes to determine destination attractiveness for nature-based tourism. Those researchers found that natural characteristics, such as biodiversity or rare species of animals and plants, were not the most important criteria determining the attractiveness of a particular national park for tourists. Their findings are in sharp contrast with those in the present study. Yet, they also help draw the conclusion that "it is necessary to consider the knowledge and perspectives of both experts and tourists when making a decision" [90] (p. 66), thus strongly supporting the theoretical and methodology approach taken here. Considering the limited literature on quantitative evaluation of the attractiveness of nature-based destinations, the current study extends the destination attractiveness research into the nature-based tourism realm.

Given the inherently qualitative nature of perceptions of natural feature and characteristics, the Fuzzy-AHP method proved to be a useful approach for evaluating NBTA because of its ability to account for multi-criteria fuzzy evaluations. Additionally, this study provides an objective means of comparing supply and demand measures of attractiveness. Sourcing evaluation from two different populations, experts and tourists, enabled an integration of demand and supply perspectives into the determination of NBTA. This approach effectively overcomes the limitations of other approaches focused on only expert or tourist perspectives, thereby demonstrating utility of this approach for quantitative assessments of the attractiveness of other nature-based destinations. Contributing to theoretical views of destination attractiveness as a function of the resource base (attraction) and of demand (those who are attracted), the integrative measurement of attractiveness merges the evaluation of existing resources and their perceived attractiveness [4]. The results yielded here confirm that the Fuzzy-AHP approach can be a reliable and comprehensive means of evaluating destination attractiveness [17].

In addition to these theoretical and methodological contributions, the present work also has important practical applications for management authorities. The approach taken here provides a new blueprint for how to effectively analyze protected area attributes most related to tourists' preferences. For instance, while prior research made it clear that competent tour guides can have a disproportionately positive influence on visitors' evaluations of nature-based experiences [91–93], this study revealed that *tour guide interpretation* was ranked lower ("moderate") than the overall evaluation of the CMBR ("good"), by both experts and tourists! Consistent with prior research at CMBR by Gu et al. [67], the present findings strongly suggest that in order to enhance destination attractiveness, further investment in interpretative guiding at CMBR is essential for elevating NBTA.

Additionally, experts ranked *recreation facilities* 28th out of 31 total attributes. Tourists also evaluated the recreation facilities at the "moderate" level. Recreation facilities are listed as a basic condition for a nature-based tourism destination to successfully attract visitors [6,53,57]. With their spectacular scenery, majestic beauty, and unique amenity values, mountains are one of the most popular destinations for tourists [94], yet the CMBR's exceptional comparative advantage in developing unique mountain tourism activities (e.g., adventure, camping, climbing, and field training) is not currently being optimized in terms of offering and managing recreational facilities. Therefore, the findings here suggest further practical suggestions for government authorities and tourism practitioners, especially a need to take measures to plan and develop diverse recreation facilities to better satisfy the demand identified by both visiting tourists and local expert practitioners.

5.2. Relevant Limitations and Future Research Directions

Several limitations warrant attention here because of the nature and scope of the study design. First, the evaluation model of the attractiveness of nature-based tourism destination proposed here is not completely generic in scope. Due to constraints of time and expense, this study was confined to a single destination. To improve model generalization, further studies undertaken in diverse protected area settings must be conducted. Second, although 460 respondents participated in the perception survey, the sampling population was mainly composed of domestic tourists to the CMBR. This yielded helpful information for understanding the determinants of domestic visitors' perception of the attractiveness of China's nature-based tourism areas; however, to provide high-quality and targeted services for different market segments, future research is needed to explore the viewpoints of international tourists to China as well as nature-based tourists visiting diverse destination around the world. Third, the weights of NBTD evaluation items were judged by twelve experts. Though the sample was selected on the basis of rich experience and in-depth understanding of this particular destination, it was both selective and limited in scale. As the AHP approach provides rapid results with low cost, the size of the sample raised little analytical or practical concern here. Nevertheless, future researchers may wish to investigate larger-scale samples from experts with more diverse backgrounds in order to broaden the validity and generalizability of the Fuzzy-AHP approach in the context of nature-based destination attractiveness.

Finally, climate change presents numerous challenges for tourism globally and destination resilience in particular [95]. Lew and Cheer [96] noted that climate change's greatest threat to tourist destinations relates to the loss of natural amenities, disappearing attractions, seasonal inaccessibility, or changes in visitor markets requiring different tourism structures and product supply. The CMBR is not immune to such pending disturbances. The current study gathered tourists' perceptions during the summer season. However, the current evaluation model of NBTA needs to be further deployed in other seasons to determine whether destination attractiveness shifts in response to perceived climate change. Such additional studies can effectively supplement the practicality of the current model by helping identify priorities for policymakers and thus better support the sustainable development and adaptive management of nature-based tourism systems in the present age of accelerating anthropogenic disturbance and climate change.

6. Conclusions

Destination attractiveness has been a central concept in tourism studies for decades. The concept has been explored in a variety of research contexts and analyzed in relation to numerous other variables. Yet prior studies have focused on either push or pull factors and supply or demand approaches. Less common are more integrative approaches, and even less common are assessments of nature-based tourism destination attractiveness as a function of local expert views of natural amenities as well as the demand of those who visit such places. Carried out in accordance with the guiding principle that the overall tourism attractiveness of a destination should combine the evaluation of existing amenities and their perceived attractiveness, this study brought a novel analytical approach that combined the Analytic Hierarchy Process with the Fuzzy Comprehensive Evaluation method to assess nature-based destination attractiveness of the Changbai Mountain Biosphere Reserve. The resulting Fuzzy-AHP approach integrated the perspectives of both tourism experts (i.e., supply) and visiting tourists (i.e., demand). The findings provide scholars as well as government agencies, industry organizations, and other tourism stakeholders with a guiding framework for comprehensive qualitative and quantitative assessment of both supply and demand dimensions, factors, and attributes influencing destination attractiveness of nature-based locations. With visitation to protected areas surpassing 8 billion annual visitors [18] and expected to grow in the post-pandemic years, the development of analytical tools for the empirical investigation and measurement of nature-based tourism attractiveness (NBTA) is timely. The Fuzzy-AHP analysis demonstrated here demonstrates much promise for understanding and managing both newly emerging and long-standing nature-based tourism destinations. The theoretical and methodological contributions of this work will thus be of value to not only the academic community but also tourism practitioners and policymakers.

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Appendix A. Eight Fuzzy Judgement Matrixes of the Fourth Level of CMBR

Note: Eight matrixes represent the fuzzy judgement of tourists on 31 attributes. R_{ij} in each matrix is calculated by the ratio of the number of questionnaires at the corresponding evaluation level to the total number of valid questionnaires. The evaluation level in each row from left to right is from 1 (strongly disagree) to 5 (strongly agree). Here, bold font highlights those attributes that have the same appeal to tourists as to experts. Bold italics indicate different views on attributes between experts and tourists. The underlined values indicate attributes that both groups felt needed to be improved.

A_i is 31 attributes which represent in sequence: A_1: Topography and geology; A_2: Rare flora and fauna; A_3: Forest landscape; A_4: Climatic phenomena; A_5: Water landscape; A_6: Eco-environment; A_7: Historical relics; A_8: Folk customs; A_9: Special events; A_{10}: Road network; A_{11}: Aviation; A_{12}: Railway; A_{13}: Charter buses; A_{14}: Internal shuttle service; A_{15}: Car parks; A_{16}: Sports facilities; A_{17}: Education-oriented facilities; A_{18}: Shopping facilities; A_{19}: Recreation facilities; A_{20}: Catering facilities; A_{21}: Lodging facilities; A_{22}: Host government support; A_{23}: Local residents' attitude; A_{24}: Tourism-engaged staffs' quality; A_{25}: Health care system; A_{26}: Emergency rescue system; A_{27}: Environment maintenance; A_{28}: Visitor centers; A_{29}: Interpretation boards; A_{30}: Road signs; A_{31}: Tour guide interpretation.

$$R_{41} = \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \end{matrix} \begin{bmatrix} 0.0066 & 0.0066 & 0.0398 & \mathbf{0.5199} & 0.4270 \\ 0.0023 & 0.0204 & 0.1134 & \mathbf{0.4376} & 0.4263 \\ 0.0022 & 0 & 0.0329 & \mathbf{0.4583} & 0.5066 \\ 0.0044 & 0.0087 & 0.0546 & \boldsymbol{\mathit{0.4389}} & 0.4934 \\ 0.0112 & 0.0491 & 0.1406 & \mathbf{0.4375} & 0.3616 \\ 0.0022 & 0.0044 & 0.0373 & \mathbf{0.4464} & 0.5274 \end{bmatrix}$$

$$R_{42} = \begin{matrix} A_7 \\ A_8 \\ A_9 \end{matrix} \begin{bmatrix} 0.0153 & 0.1441 & \boldsymbol{\mathit{0.3275}} & 0.3166 & 0.1965 \\ 0.0110 & 0.1189 & 0.3106 & \mathbf{0.3634} & 0.1960 \\ 0.0110 & 0.0971 & 0.5011 & 0.2428 & 0.1479 \end{bmatrix}$$

$$R_{43} = \begin{matrix} A_{10} \\ A_{11} \\ A_{12} \end{matrix} \begin{bmatrix} 0.0176 & 0.0813 & 0.1736 & \mathbf{0.4725} & 0.2549 \\ 0.0269 & 0.1278 & \boldsymbol{\mathit{0.4484}} & 0.2489 & 0.1480 \\ 0.0287 & 0.1501 & 0.3355 & \mathbf{0.3532} & 0.1325 \end{bmatrix}$$

$$R_{44} = \begin{matrix} A_{13} \\ A_{14} \\ A_{15} \end{matrix} \begin{bmatrix} 0.0089 & 0.0356 & 0.1022 & \mathbf{0.5311} & 0.3222 \\ 0.0400 & 0.0844 & 0.1111 & \mathbf{0.4711} & 0.2933 \\ 0.0044 & 0.0571 & 0.2308 & \mathbf{0.4703} & 0.2374 \end{bmatrix}$$

$$R_{45} = \begin{array}{c} A_{16} \\ A_{17} \\ A_{18} \\ A_{19} \\ A_{20} \\ A_{21} \end{array} \begin{bmatrix} 0.0198 & 0.1209 & 0.5011 & 0.2286 & 0.1297 \\ 0.0154 & 0.0636 & 0.3004 & 0.4254 & 0.1952 \\ 0.0199 & 0.0751 & 0.2870 & \boldsymbol{0.4283} & 0.1898 \\ 0.0155 & 0.1327 & \underline{\mathbf{0.3761}} & 0.3186 & 0.1571 \\ 0.0395 & 0.1535 & 0.2325 & 0.3969 & 0.1776 \\ 0.0220 & 0.0725 & 0.2462 & 0.4725 & 0.1868 \end{bmatrix}$$

$$R_{46} = \begin{array}{c} A_{22} \\ A_{23} \\ A_{24} \end{array} \begin{bmatrix} 0.0153 & 0.0547 & 0.3435 & 0.3545 & 0.2319 \\ 0.0025 & 0.0224 & 0.1667 & \boldsymbol{0.5398} & 0.2687 \\ 0.0131 & 0.0635 & 0.1466 & \boldsymbol{0.5274} & 0.2495 \end{bmatrix}$$

$$R_{47} = \begin{array}{c} A_{25} \\ A_{26} \\ A_{27} \end{array} \begin{bmatrix} 0.0132 & 0.0308 & 0.5705 & 0.2247 & 0.1608 \\ 0.0088 & 0.0110 & \boldsymbol{0.5758} & 0.2330 & 0.1714 \\ 0.0044 & 0.0110 & 0.0658 & \mathbf{0.5658} & 0.3531 \end{bmatrix}$$

$$R_{48} = \begin{array}{c} A_{28} \\ A_{29} \\ A_{30} \\ A_{31} \end{array} \begin{bmatrix} 0.0109 & 0.0502 & 0.1507 & 0.5393 & 0.2489 \\ 0.0066 & 0.0591 & 0.1816 & \boldsymbol{0.5120} & 0.2407 \\ 0.0066 & 0.0416 & 0.0853 & \boldsymbol{0.5711} & 0.2954 \\ 0.0153 & 0.0372 & \underline{\mathbf{0.4026}} & 0.3195 & 0.2254 \end{bmatrix}$$

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