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Scenario-based capability evaluation of nature-based tourism using MCE-based innovative approach

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ABSTRACT

Increasing demand and the use of recreational areas have exacerbated the effects of nature-based tourism (NBT) on the environment. Assessment of NBT potential can be an approach to identify suitable areas for recreational development and prevent its development in areas without this capability. This not only reduces the environmental impacts of NBT but also ensures its sustainability. This study applied a multi-criteria evaluation (MCE) approach using the weighted linear combination (WLC) method to identify suitable areas for developing NBT in the watershed of Gorgan, northern Iran. The effective criteria which determining suitable areas for recreation were identified and weighted by the Delphi method in three phases. A consensus of opinions was achieved in the third phase with Kendall's W test factor of 0.608. Therefore, 8 main factors (including 38 sub-factors) and 8 constraints were identified. Then, layers of the factors and constraints were prepared to achieve the MCE process through WLC. Separate MCEs were made for developing extensive and intensive tourism (EX and IT), respectively. In the next step, the recreational potential (low, average, & and high) of the area was identified using a zonal land suitability (ZLS) module based on three scenarios with rigorous, intermediate, and lenient approaches. Results of the scenarios showed that the major areas of the region are suitable for ET development and only small areas are suitable for IT development. The final areas for NBT planning were selected through integrating triple MCE scenarios and achieving ZLS.

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1. Introduction

During these decades, increasing urbanization and industrialization rates have resulted in the detachment of human connection with natural areas and green spaces (Luo et al., 2022). It turns ecotourism and recreation into the major issues to be considered in modern societies (Talebi et al., 2021). Consequently, the number of users in such areas is steadily increasing and people attend natural environments for ecotourism and recreation. Being in natural areas contributes greatly to the quality of life. Natural areas play an important role in promoting general vitality and well-being by providing psychological and social services.

Experiences have shown that parks and recreational areas can reduce stress, enhance the power of thought, and make sense of calm, mental benefits, health promotion, and increase social interactions (Galdavi et al., 2022). In addition to these benefits, these places play an important role in sustainable development and can support economic growth, biodiversity conservation, and poverty alleviation. Analysis of factors related to the recreational demand in Iran indicates that this need is growing quickly. On the other hand, the quality of parks and regional recreational areas is impaired with the growth of unmanaged use, which not only gradually affects the recreational demand and

leisure time of the whole society leading to their reduced desirability, but also minimizes the effectiveness of such areas as promenade resources. Thus, it is essential to develop sustainable tourism to protect these valuable areas and their functions. For this purpose, land suitability assessment is a process that seeks to provide sustainable development through the relationship adjustment between humans and nature (Akbari et al., 2023). In fact, this assessment is a useful step for developing sustainable plans in agreement with nature and land suitability by determining and evaluating the Socio_economic characteristics that affect land capability for each land use (Yang et al., 2021). This research tries to determine land suitability for nature-based tourism (NBT) to develop and manage these areas where the land capability is good for extending this use in the Gorgan watershed in the north of Iran. Most of this watershed is covered by the Hyrcanian Natural Forest which has a myriad of natural outdoor recreation attractions. This subject caused to the gradual increase in visitor use in the area over time. However, there isn't any determined program to use these areas for tourism, and people use any desirable area without active tourism management. Using this area without any tourism planning and programming could cause a lot of environmental damage such as soil erosion, pollution, tree damage, etc. Then, land capability evaluation for NBT is necessarily required to inhibit more destruction of these natural forests and their tourist attractions. In this research, land evaluation was determined to remove these problems. To obtain this purpose, NBT evaluation throws multi-criteria evaluation (MCE) about social characteristics based on public needs and preferences was recommended by many researchers (Mirkarimi et al., 2015; Galdavi and Mohammadzadeh, 2019; Akbari et al., 2023). Generally, MCE was used in many studies (Ok et al., 2011; Gomaa, 2013; Chen and Bau, 2016; Ronizi et al., 2020; Hajizadeh et al., 2020; Abrehe et al., 2021; Yang et al., 2021; Galdavi et al., 2022; Islam et al., 2022; Valanszki and Abualhagag, 2022; Akbari et al., 2023; Yasin and woldemariam, 2023). For example, Valanszki and Abualhagag (2022) used this method for developing recreation and ecotourism in Aswan city in Egypt. To do this, they used 12 effective criteria of environmental and socioeconomic for achieving MCE through the WLC method. The result showed more than half of the area had the capability for ecotourism. Also, Akbari et al. (2023) used this method to determine suitable places for ecotourism development in an area. To do this, at first, they determined the effective criteria including three criteria (physical, biological, and socio-economic features), 13 sub-criteria, and 33 indices. Then, they achieve the MCE for land capability evaluation. Other researchers as mentioned achieved Land suitability evaluation using MCE (Mahdavi and Niknejad, 2014; Gomaa, 2013; Suryabhagavan, 2015; Harun and Samat, 2016; Gigovic et al., 2016; Galdavi et al., 2022) through WLC method which is one of the most common techniques used for the MCE and decision-making analysis based on GIS. Also, some researchers used the Delphi method to determine the affected tourism development criteria (Konu, 2015; Ashok et al., 2017; Ocampo et al., 2018; Sobhani et al., 2022). For example, Ashok et al (2017) used this method to prepare a framework for evaluating the sustainability of NBT in an area of India. Ocampo et al. (2018) identified Sustainable ecotourism indicators with the fuzzy Delphi method from a Philippine perspective. Sobhani et al. (2022) used the Delphi method to determine the sustainable indices for ecotourism in protected areas. They collected 38 indicators in the environmental–physical criteria, 42 criteria in the demographic–social criteria, and 30 criteria in the economic–institutional criteria. Then, Delphi ran and the final criteria were identified. The investigation of these researches showed that these methods (MCE and Delphi) were used for many different purposes in the NBT field. Also, there are a few types of research, were simultaneously used these methods for land capability evaluation for NBT. In most researches, the criteria selected by the authors and the ideas of other experts didn't have any role in land capability evaluation. Using the Delphi method could obtain this aim and get a better result that contains the experiences and ideas of more experts. The technique is also highly potent to reduce the cost and time and increase the accuracy of decision-making, providing a fitting framework for solving issues related to determining the appropriate locations for recreational development. Also, the researchers believed Ecotourism activities without suitable planning can cause negative impacts on the environment. In this study, the Delphi and MCE

methods were used simultaneously for NBT land evaluation and determining the suitable patches for tourism planning in the study area. The Delphi panel included experts in the tourism field which are from different offices including experts in Cultural Heritage, handicrafts, and Tourism Organizations, Environmental protection agencies, Municipal green space and parks associations, and universities. The main reason for selecting this panel is to try to involve the ideas of tourism experts with different experiences and views because of different workplaces and the different challenges they have. This helps the research to identify the affected criteria on NBT development which is accepted by most of them. Then, it helps to use the best criteria for evaluating the land capability of NBT and getting the best result by determining the best site for NBT. In the present study, MCE by WLC was applied to prepare the land suitability map for the NBT development in the study area. The WLC method performs weighting based on the relative importance of each factor. Afterward, a point or a final score is obtained from the product of relative weight by the value or quantity of each factor based on each spatial option. The option that gains the highest score is introduced as an appropriate location or class (Galdavi et al., 2022). In this research, NBT was identified in two types including extensive tourism (ET) and intensive tourism (IT) and developments, respectively. The IT includes those that need to develop, such as swimming, skiing, picnicking, camping, bicycling, and visiting cultural works, which are possible in areas where there are primarily low slopes (0-15%). ET covers those outings that need no development, such as climbing and hunting, or those requiring little development, including fishing, desert tours, horse riding, and watching animals in nature, can develop in areas with more slopes (up to 50%) as they need not development and provision of facilities (Makhdoum, 2010). The aim of determining tourism capability about the mentioned 2 types is to help managers and decision-makers select the correct sites for planning outdoor recreation activities. So, tourism impacts would decrease in the area. As mentioned above, in the present study, the effective factors in tourism capability were obtained using the Delphi method. This process aims to gain insights into the panel of experts, analyze their opinions, and ultimately solve complex problems. This methodology is one of the intuitive mental methods of foresight domain developed at Rand Co. by Dalker and Helmer in Santa Monica, California, during the 1950s (Konu, 2015). Ashok et al. (2017) define the Delphi method as "a systematic approach or research method to extract the comments from a group of experts on a subject or question". Some researchers have introduced the Delphi method as the most effective tool for the identification of factors and indices affecting the land evaluation process which has been applied by many researchers to evaluate land suitability (Trinh Hai et al., 2009; Mahdavi and Niknejad, 2014; Ghasemi and Hamzah, 2014; Konu, 2015; Ashok et al., 2017; Jokar et al., 2021). For example, Trinh Hai et al. (2009) used this method to identify effective factors for sustainable development in an area of Vietnam. The investigation of these researches showed that this method by using the knowledge of a group of experts can help them through the decision-making about a particular object. Then, in this research, the Delphi method was used to determine the effective criteria for land-use evaluation for recreational planning and development. So, in this research WLC method and the Delphi approach were used to determine the best places for NBT by considering ecotourism needs and environmental protection simultaneously. The Innovations of this research were the separate use of MCE for Extensive and Intensive outdoor recreation as well as the use of multiple scenarios for MCE Maps to detect the most optimal places for the purpose. Also, this research was achieved in an area that is important in hence of Environmental protection due to containing the protected areas that have individual Biodiversity (fauna and flora) and landscapes that show clearly the necessity of implementing this research for enabling sustainable use of the area.

2. Material and Methods

2.1. Study area

This study was carried out at the Gorgan watershed in Golestan Province, Iran, which is located at 32ˊ36° to 2ˊ37° northern latitude and 12ˊ54° to 58ˊ54° eastern longitude. With an area of 1127 Km^2, this area comprises a large part of Gorgan Township (Fig. 1). The study area contains two mountainous regions (the southern region) and the plains (the northern region). Gorgan City is the most important residential

area located in the northern part of the study area. One of the important villages in the region is Ziarat in the south of Gorgan. The forest area is located in the lower region including parts of the forest areas of Toskastan, ShastKalateh, Mohammad Abad, and Ziarat. The regional recreational resources include forests, mountains, rivers, and waterfalls. The region was chosen for the study due to the diversity of recreational resources in the area resulting in a high attractiveness to tourists, job creation, and local income as well as its individual Biodiversity and great landscapes that show clearly the necessity of implementing this research for enabling sustainable use of the area that provides the possibility of development and protection simultaneously. Given the types of land use, potentially 63,036.82 ha of the area can be explored for NBT development in the region, which encompasses regional forest lands and pastures. Other areas are dedicated to agricultural, residential, and industrial uses. Also, Fig. 2 shows an overview of the study area.

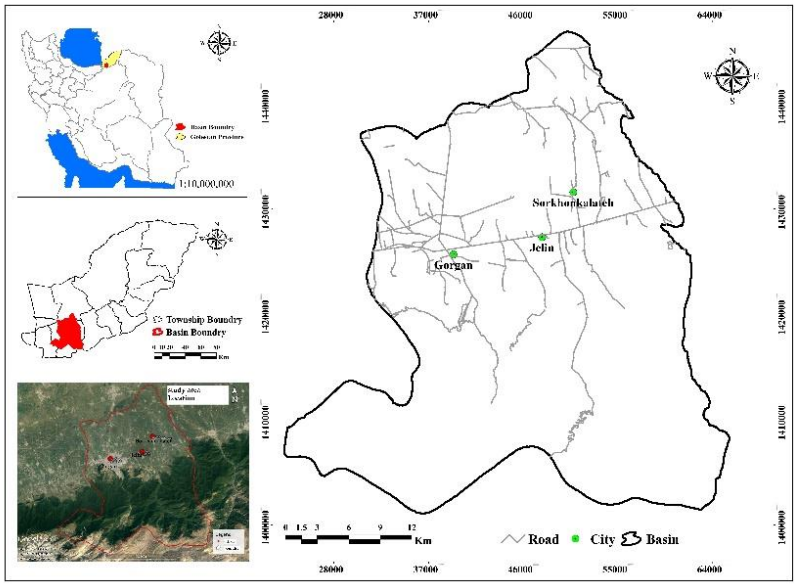

Fig. 1. Site of the study area (Source: Derived from Google Earth).

Fig. 2. An overview of the study area (Source: Authors)

2.2. Methodology

In this study, the Delphi method was used for identifying and weighing the variables (factors and constraints) affecting the NBT development in the area. To do this, a criteria list was first prepared by the available literature review. Then, the final criteria were determined for the land suitability assessment using the Delphi method (Table 1). After that, the MCE approach using WLC was applied to Evaluate Land Suitability for NBT Development at the Gorgan basin. In the next step, the zonal land suitability (ZLS) method was used to extract ET and IT- in four categories including high, medium, low and unsuitable. Sensitivity analysis was achieved using 3 scenarios including strict, intermediate, and lenient approaches to get Confirm about the result and to select the best and optimal places for the NBT. Fig. 3 shows the flowchart of the Executive Steps of the study.

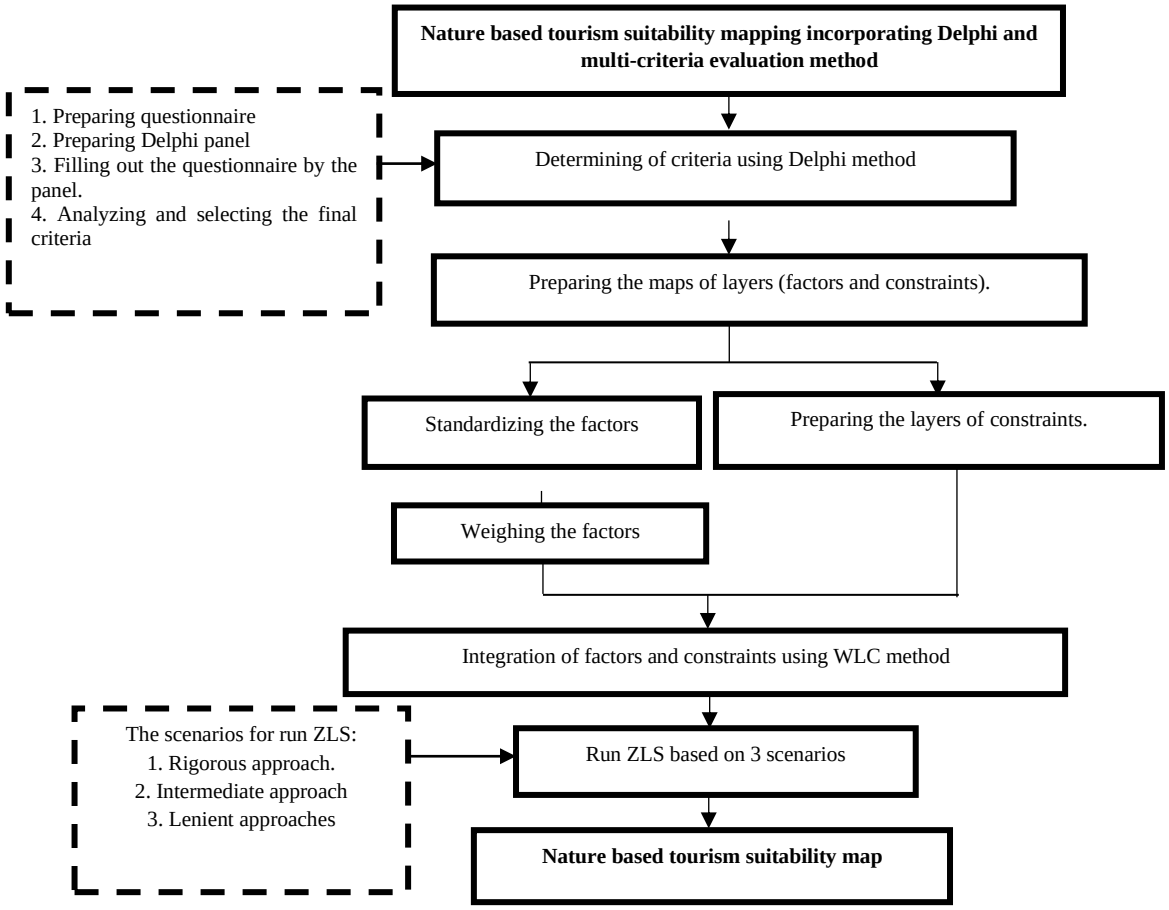

Fig. 3. Flowchart for executive steps of the study

The following steps were taken to land evaluation for NBT through the MCE:

1. Determination of criteria affecting the land recreational potential at the study area.
2. Preparation of criteria maps (including factors and constraints).
3. Standardization of factors and constraints.
4. Weighing the factors.
5. Integration of factors and constraints by WLC method.

Step I: Identification of criteria by the Delphi method:

The Delphi method was used to determine the criteria affecting the land suitability for NBT at the Gorgan Watershed. The Delphi group was formed using 17 experts consisting of organizational and administrative staff from various sectors connected with recreation and NBT, including faculty members, the Department of Environment, Cultural Heritage and Tourism Organization, and the Municipal Parks and Green Spaces. In the first round, a semi-structured questionnaire was developed according to previous studies and based on the experts' experiences in the form containing a list of factors and constraints affecting the recreation development in the region. The Delphi panel was able to mention any other criterion in the questionnaire. Also, they scored all criteria according to a Likert scale of 1-5 (1. very low importance, 2. Low importance, 3. Moderate importance, 4. High importance, and 5. Very high importance).

First-round responses were collected, summarized, categorized, and eventually compiled as a questionnaire for the second step, which was started by designing a questionnaire containing a five-point Likert scale. In this phase, the questionnaire was structurally distributed among the Delphi group members, and all the first-phase responses of the subjects were placed there. As Step I, the respondents were asked to indicate the importance of factors using a scale of 1-5. The goal of the second step or any subsequent step was to reach a consensus or consistency among the Delphi panel, after which the Delphi method was completed. An analysis and a statistical summary were prepared following the collection of the second questionnaire. The main statistics used in Delphi studies are the central tendencies (mean, median, and mode) and the distribution indices

(standard deviation and interquartile range). Also, the Kendall W test was used to test the agreement and consistency levels, ranging from zero to one with a value over 0.5% representing a consensus, after which the Delphi process ends (Danladi Musa et al., 2015). Since the consensus was not reached in the second step, a third-step questionnaire was also distributed among the members, who were asked to complete the questionnaire according to the mean levels of the previous step. At this step, the respondents could confirm or change their previous opinions, and each expert had the opportunity to review one's views and evaluate the opinions of other experts, which is an important part of moving toward consensus. An analysis and a statistical summary were prepared after collecting the third questionnaire. A review of the consensus criteria at this step showed good agreement on the subject among the experts. Therefore, Phase III of the Delphi process ended with a consensus in the present study.

Step II: Mapping the factors and constraints:
The criteria include factors and Constraints. A factor refers to a criterion that is worthwhile for the intended use, which affects the land suitability for the desired use. The factor layers have a range of numbers, which can range from 0 to 1, or 0 to 255, or any other range. After standardization, the larger number in the layer showed the greater its proportionality for the desired use. Conversely, the Constraint layer contains zero and one values only, in which zero indicates the absolute disproportion and one denotes fitting for the desired use. The MCE with WLC is used in this research, which uses both factor and constraint layers. With the implementation of the Delphi process, 38 factors and 8 constraints were identified to assess the regional capability for extensive and intensive ecotourism that is used for NBT development. Table 1 shows the data used in this study.

Table 1. Data used in this study

	Data used	Data description
1	Layers of slope and aspect	Using the digital elevation model layer
2	Layers of the river, water bodies (pond and dam), and other regional land use	Watershed land use map (Governorate of Golestan Province, 2021).
3	Layers of service centers including residential areas, restaurants, police station, gas station	Library studies, the internet, and field survey using GPS.
4	The layer of health centers	Obtained from Gorgan Municipality
5	Layers of water quality, vegetation type, soil texture, drainage, fertility, soil depth, wildlife distribution range, wildlife diversity, temperature, rainfall, number of sunny days, flood-prone areas, earthquake-prone areas, areas at risk of landslide and drift, fire, mines, industrial facilities, livestock and poultry farms, and the possibility of freezing	Golestan Governorate, 2021
6	Layers of vegetation density and diversity of vegetation density	Using satellite images (Landsat imagery, 2021)

The factors were prepared, fuzzified, and weighed in Idrisi Selva software. Regarding the vegetation type layer, it should be noted that there were 49 different forest types and one rangeland type in the study area according to the existing map. Figs 4 to 10 depict layers of the slope, aspect, elevation, land use, service centers, NDVI, and diversity of vegetation density, respectively, at the watershed of Gorgan.

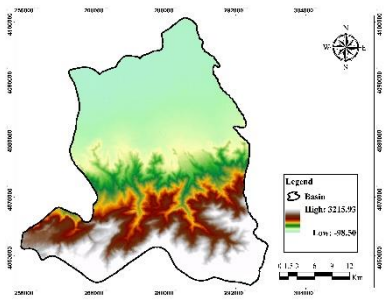

Fig. 4. Map of elevation

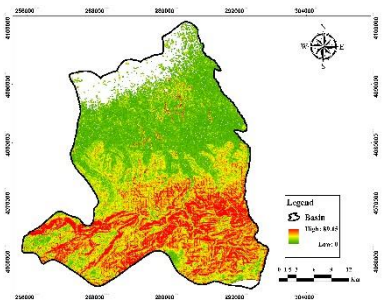

Fig. 5. Map of Slope

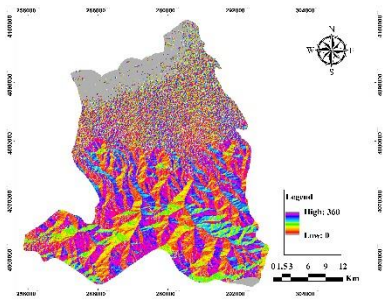

Fig. 6. Map of Aspect

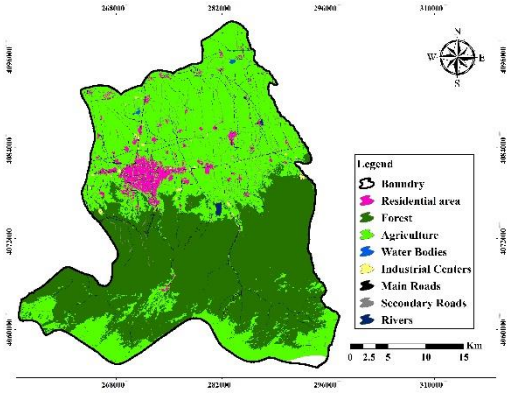

Fig. 7. The layer of land use

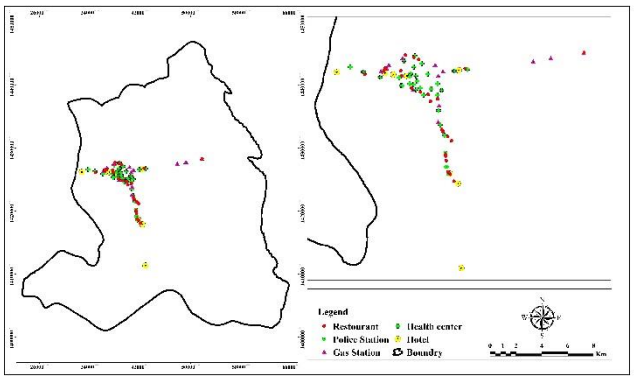

Fig. 8. The layer of service centers

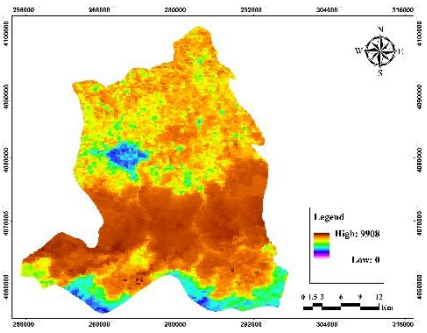

Fig. 9. The layer of NDVI

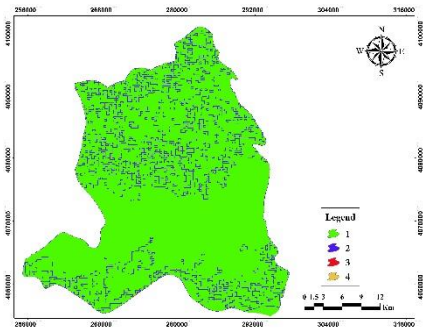

Fig. 10. The layer of vegetation density diversity

(Source of all maps: Authors)

Step III: Fuzzification of factors:

The factors were fuzzified by fuzzy functions in the Idrisi software. Table 2 shows the type of function and the fuzzification mode of the layers used to identify the suitability of areas for extensive and intensive tourism. Fuzzy functions and the intervals used to fuzzify the layers were determined by a literature review (Mahdavi and Niknejad, 2014; Suryabhagavan et al., 2015; Islam et al., 2022; Valanszki and Abualhagag, 2022; Akbari, et al., 2023; Yasin and woldemariam, 2023), and in some cases based on expert opinions.

Table 2. Fuzzy functions and distances used for the fuzzification of layers

	Main factors	Secondary factors	Function type and the distance for fuzzification
1	Water resources	Water quantity	Linear, Decreasing
2		Water quality	Linear, Decreasing
3		Existence of rivers	0-30 m as 0, 30-3000 as 0-255 Linear, Decreasing
4		Existence of water bodies (pond and dam)	0-30 m as 0, 30-3000 as 0-255 Linear, Decreasing
5		Existence of spring	0-3000 as 0-255 Linear, Decreasing
6		Existence of waterfall	0-3000 as 0-255 Linear, Decreasing
7	Topography	Slope	0-50 % as 0-255 Linear, Decreasing
8		Aspect	Plane as 255, East as 191, North as 128, South as 64, and West as 26
9		Elevation	0-3215 m as 0-255 Linear, Decreasing
10	Geology	Characteristics of Geology	Based on the weighing by experts
11	Climatology	Temperature	0-18.26 as 0-255 Linear, Decreasing
12		Rainfall	0-724.47 as 0-255 Linear, Decreasing
13		Number of sunny days	0-2306 as 0-255 Linear, Decreasing
14	Vegetation cover	Vegetation Type	Based on the weighing by experts
15		Vegetation density	40-80 % as 0-255 Linear, Decreasing
16		Diversity of vegetation density	Linear, Increasing

17	Characteristics of soil	Soil Texture	Based on the weighing by experts
18		Drainage	Linear, Decreasing
19		Fertility	Linear, Decreasing
20		Soil depth	Linear, Increasing
21	Wildlife	wildlife distribution	200-5000 m Linear, Increasing
22		wildlife diversity	Linear, Decreasing
23		Habitats of dangerous species	200-5000 m Linear, Increasing
24	Land use	Availability of Tourism area	0-5000 m Linear, Decreasing
25		Protected area	100-5000 m Linear, Increasing
26		Agriculture lands	1000-5000 m Linear, Decreasing
27		Garden	100-3000 m Linear, Decreasing
28		Distance to urban area	2000-5000 m as 0, 5000-20000 m as 0-255 Linear, Decreasing
29		Distance to Rural area	0-3000 m as 0, 3000-10000 m as 0-255 Linear, Decreasing
30	Accessibility	Distance to historical sites	0-3000 as 0-255 Linear, Decreasing
31		Distance to religious areas	3000 as 0-255 Linear, Decreasing
32		Main Roads	1000-5000 m Linear, Decreasing
33		Secondary Roads	300-3000 m Linear, Decreasing
34	Services	Hotels	Linear, Decreasing
35		Health centers	3000-15000 m Linear, Decreasing
36		Police station	3000-15000 m Linear, Decreasing
37		Gas station	0-1000 m as 0, more than 1000 as 0-255 Linear, Decreasing
38		Restaurants	Linear, Decreasing

To assess the land suitability for intensive ecotourism, some criteria including water quantity, slope, elevation, wildlife distribution, wildlife diversity, rare species habitat, distances from rural and urban residential areas, main roads, residential centers, health centers, and restaurants were fuzzified and prepared from Table 2. The reason for this is that areas intended for intensive recreation should provide the construction and numerous recreational facilities in terms of their environmental potential for visitors. Therefore, these areas were selected for sustainable development of land ecotourism activities concerning their potential for development and construction in the domains. Table 3 shows different factors and their fuzzifications.

Table 3. Fuzzy functions and distances are used for the fuzzification of some layers to assess the potential of intensive recreation development

	Main factors	**Secondary factors**	**Function type and the distance for fuzzification**
1	Water resources	Water quantity	Linear, Decreasing
2	Topography	Slope	0-15 % as 0-255
3	Wildlife	Wildlife distribution	2000-5000 m Linear, Increasing
4		Wildlife diversity	Linear, Increasing
5		Habitats of dangerous species	200-5000 m Linear, Increasing
6	Land use	Distance to urban area	1000-2000 m as 0, 2000-100000 m as 0-255 Linear, Decreasing
7		Distance to Rural area	500-1000 m as 0, 1000-5000 m as 0-255 Linear, Decreasing
8	Accessibility	Main Roads	1000-3000 m Linear, Decreasing
9	Services	Hotels	100-10000 m Linear, Decreasing
10		Health centers	1000-10000 m Linear, Decreasing
11		Restaurants	1000-10000 m Linear, Decreasing

It should be explained that the vegetation type map was first fuzzified and ranked in different classes by the Edit-Assign command. Then, the tree species were ranked by the experts depending on the value of species and the vegetative area, eventually followed by fuzzification. Also, the geological layers and soil texture were similarly ranked by the experts (between 1 and 10) and eventually fuzzified.

Step IV: Weighing the factors:

The factors were also weighted using the Delphi method. The criteria were weighted based on the importance that individuals had assigned to the criteria based on the Likert scale. For this purpose, the importance of factors was determined and presented numerically from 0 to 1 through a mathematical equation (Eq. 1).

$$W_i = 0.1 * \frac{Xi}{S} \quad (1)$$

Where Wi: the weight of factor, Xi: the average score of each sub-factor, S: the sum of the maximum points that each major factor can obtain according to the Likert scale, and 0.1 (1/10) is used to standardize the weight of criteria between zero and one.

Step V: Integration of factors and constraints by WLC method:

WLC is the most common method to integrate the criteria for the analysis of land suitability. This approach was developed by Eastman in 1995. In this approach, data are converted into sets of factors for the region under study. In this research, the factors obtained from the previous step were weighted, combined, and then overlapped and compiled to map the suitability for the desired use by the Idrisi Selva software. Considering that the corresponding module with a maximum of 32 factors can execute the WLC process and as the number of factors (38) in this study is more than this value, the utility layer (WLC) was prepared separately for services and land use and implemented in WLC to determine the suitable areas for recreation development by the Idrisi Selva software.

2.2.1. Determination of final zones for recreational use development

In this part, the results of WLC implementation were examined to determine the final zones using the ZLS method. The ZLS command in the Idrisi Selva software runs based on the pixel value and the minimum area of the zones (Galdavi et al., 2022). Because the minimum area required for an intensive recreation zone is one hectare for the selection of suitable areas for intensive recreation (Makhdoum, 2010), the present study considered this value as the minimum area. Moreover, the zones of extensive recreation with an area of less than 20 ha were eliminated due to the lack of sufficient value for ecotourism management and planning. The layers produced by MCE are classified for each type of extensive and intensive recreation in four categories including high, medium, low, and inadequate suitable. Because the MCE layer is fuzzy and the potential classification is based on the thresholds, changes in the thresholds will alter the land suitability as well. Hence, three scenarios of rigorous (1), intermediate (2), and lenient (3) were set up to determine the thresholds of these classes. Table 4 shows the degree of zonal land suitability by the recreational classes in each of the scenarios.

Table 4. Zonal land suitability by recreation classes in the MCE approach

	Scenarios	Land Zonal value			
		Level 1 (High Capability)	Level 2 (Medium Capability)	Level 3 (Low Capability)	Level 4 (Unsuitable)
1	Scene 1	230-255	200-230	180-200	0-180
2	Scene 2	220-255	180-220	150-180	0-150
3	Scene 3	200-255	150-200	100-150	0-100

According to Table (4), the ecotourism suitability was provided in three maps with the approaches mentioned by the MCE method.

3. Results and discussion

3.1. Identification of criteria using Delphi analysis

In this study, the Delphi process was run in three steps and a consensus was reached among experts at the third step. According to the first step, 8 major factors (including 40 sub-factors) and 8 constraints were identified, prepared as a questionnaire for the implementation of the second step, and presented to the experts together with the average responses of step I and individual responses of the experts. finally, the Kendall W agreement test was used to ensure the consensus with a value of 0.608 at the third step, which confirms reaching a consensus. According to the results, two criteria of geological attractions and repair shops were

removed because of their low importance (median and mean values of less than 3). Thus, 8 main factors (including 38 sub-factors) and 8 constraints were confirmed by the experts and used in the land evaluation process. The factors were weighted using the results of Delphi analysis to perform MCE. Table 5 indicates the weight assigned to each of the variables used.

Table 5. The weight (0-1) is assigned to each of the variables used

	Main factors	Secondary factors	weight		Main factors	Secondary factors	weight
1	Water resources	Water quantity	0.0318	21	Wildlife	wildlife distribution	0.0254
2		Water quality	0.0305	22		wildlife diversity	0.0254
3		Existence of rivers	0.0284	23		Habitats of dangerous species	0.0307
4		Existence of water bodies (pond and dam)	0.03	24		Availability of tourism area	0.028
5		Existence of spring	0.0225	25	Land use	Protected area	0.029
6		Existence of waterfall	0.0306	26		Agriculture lands	0.0222
7	Topography	Slope	0.032	27		Garden	0.0241
8		Aspect	0.0218	28		Distance to urban area	0.024
9		Elevation	0.0239	29		Distance to Rural area	0.0231
10	Geology	Characteristics of Geology	0.0227	30		Distance to historical sites	0.0245
11	Climatology	Temperature	0.028	31		Distance to religious areas	0.0228
12		Rainfall	0.0245	32	Accessibility	Main Roads	0.0314
13		Number of sunny days	0.025	33		Secondary Roads	0.0267
14	Vegetation cover	Vegetation type	0.0292	34		Hotels	0.0301
15		Vegetation density	0.0292	35		Health centers	0.0241
16		Diversity of vegetation density	0.025	36	Services	Police station	0.0258
17	Characteristics of soil	Soil Texture	0.0262	37		Gas station	0.0245
18		Drainage	0.0226	38		Restaurants	0.0288
19		Fertility	0.0226				
20		Soil depth	0.0216				

3.2. Land suitability evaluation using WLC

MCE was carried out separately for extensive and intensive ecotourism using the WLC method. Then, the results are used to determine the final sits for NBT development. Fig. 11 illustrates the results of this section.

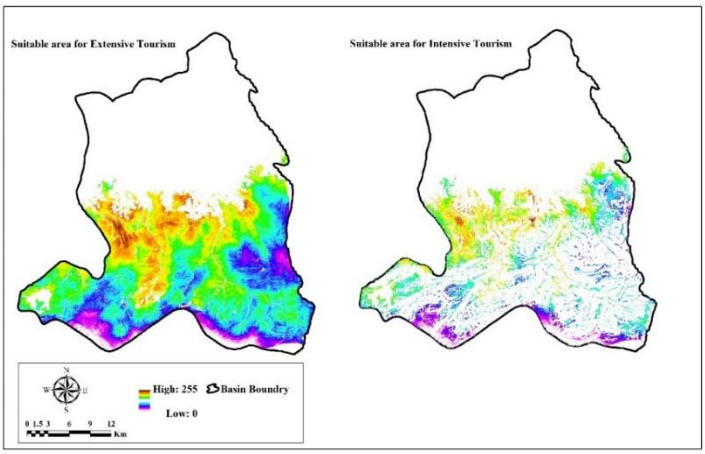

Fig. 11. Areas suitable for extensive and intensive recreation

According to the result, most parts of the area are proper for extensive tourism development. After achieving MCE, ZLS was investigated to select zones based on the ability for ecotourism development. So, the area was classified into seven categories based on the ecotourism

potential, namely intensive recreation Level 1 (high), intensive recreation Level 2 (medium), intensive recreation Level 3 (low), as well as extensive recreation Level 1 (high), extensive recreation Level 2 (medium), extensive recreation Level 3 (low), and unsuitable in three scenarios. The aim of this classification was the determination of recreation type that is possible in each area for planning and developing recreation activities according to the tourism suitability and gaining sustainable tourism management in the area. Thus, managers should select and prepare recreational activities in terms of the individual tourism capability in each patch of area. Fig. 12 displays the final zones suitable for ecotourism based on MCE analysis. Table 6 represents the best area for recreation of the study region.

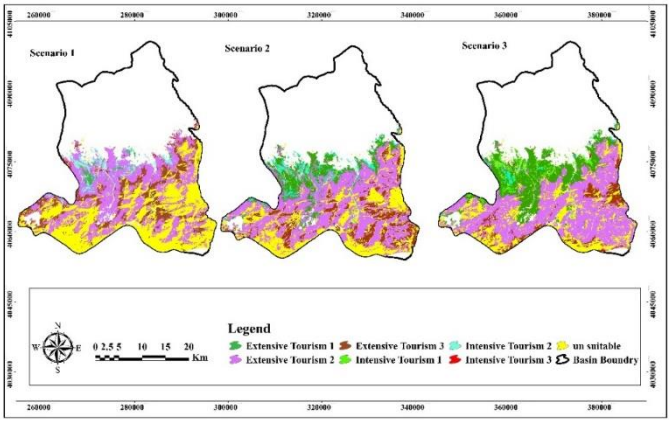

Fig. 12. Final zones suitable for recreation based on Scenarios 1, 2 and 3

Table 6. Final suitable zones for recreation based on Multiple Scenarios

	Recreation type	Scenario	Area (ha)	Area (%)
1	Intensive Tourism level 1	1	61.18	0.1
2		2	242.43	0.39
3		3	2392.67	3.9
4	Extensive Tourism level 1	1	753.11	1.23
5		2	7295.22	11.88
6		3	13324.6	21.71

According to Table 6, the majority of the area is potent for extensive recreation and a small area has the potential for intensive ecotourism, also some parts lack recreational suitability. So, to develop new recreational areas in zones where there are the least environmental impacts, zones were selected for land recreational planning using the overlapping of three layers of scenarios and scientific field visits. So, the NBT zones are identified as shown in Fig. 13.

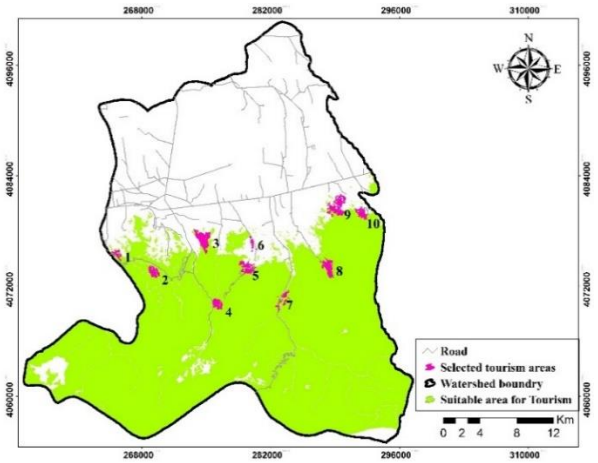

Fig. 13. Areas proposed for NBT development (Source: Authors)

The above zones were chosen to provide the recreational needs of the visitors and local people. The type of ecotourism potential in each zone is based on the results of scenarios extracted from MCE analysis. It is essential to take into consideration land suitability during recreational planning in any region. So, sustainable tourism could be developed by planning and managing recreational activities based on tourism/Ecotourism capability. According to the result, 1252.62 ha (2.38 percent) of areas with recreational potential were selected for the development and planning of recreational areas which 77 percent had extensive recreation (Level 1) and the rest had potential for Intensive recreation (Level 1, 2 and 3). Therefore, it is necessary to carry out development processes and recreational management at the selected parts based on the land suitability and considerations regarding the type of recreational potential.

3.3. Discussion

Increasing population growth has intensified the use of recreational areas, but imbalances in the presence of tourists with inappropriate and unplanned use (intensive sightseeing) have destructive effects on ecosystem function (e.g., loss of the diversity of plant species) that showed the necessity of using sustainable development approach for selecting, developing, and managing recreational areas. Especially, in the study area where because of the lack of tourism planning, people use anywhere in the area without attention to their capability and suffer a lot of damage there. In this regard, MCE analysis of land ecotourism potential is a way to obtain sustainable places for recreation development in each area based on ecological and socio-economic criteria. The application of the MCE method provides the possibility of using various physical, biological, and socioeconomic criteria furnishing a good opportunity to select the suitable areas for sustainable development of ecotourism based on different criteria. Meanwhile, the use of methods such as the Delphi technique engages different beneficiaries and expert opinions to select the most suitable areas for expanding land recreation. This has been confirmed by other researchers such as Harun and Samat (2016). They initially identified and weighted the criteria influencing the development of tourism in sensitive environments through interviews with different beneficiaries including experts, environmentalists, and planners. Then, they identified areas suitable for tourism development in the region using the MCE method. As such, in this research for using a collection of experts' Knowledge to determine the variables, the Delphi method was used to identify and weigh the criteria affecting the determination of suitable areas for ecotourism. Delphi's process is implemented in three phases. In Phase III, the Kendall W agreement test coefficient (0.608) confirmed the consensus of comments, and finally, 8 major factors were identified including 38 sub-factors and 8 constraints. In this context, Trinh Hai et al. (2009) stated that Delphi is one of the best methods for the selection of indices in MCE with a sustainable development approach. They identified indices affecting sustainable development in Quangtri state, Vietnam, by the Delphi method. Other researchers have also used the Delphi technique to identify criteria affecting the assessment of land ecotourism potential and ultimately achieved the consensus of experts, thereby, they have determined a list of criteria to evaluate several criteria of land recreational potential (Trinh Hai et al., 2009; Mahdavi and Niknejad, 2014; Ashok et al., 2017). In the present study, the criteria were weighted using the Delphi results. The weights of criteria revealed that slope attained the highest priority gaining the greatest importance level (weighing ca. 0.032), which was identified as the most important factor influencing the development of recreational areas. This suggests the more important role of ecological factors in the determination of recreational potential in the region, which was also confirmed and emphasized by other researchers (e.g., Borzoei et al., 2014). After the slope, the factors of water resources (quantity and quality of water), accessibility (main and secondary roads), and residential centers as the socioeconomic factors attained the highest weights. In the next step, MCE was conducted for the development of extensive and intensive sightseeing, and then the final zones of recreational suitability in the region were identified in three scenarios (with rigorous, intermediate, and lenient approaches) using ZLS. According to the results of all three scenarios, a major part of the region proper for developing extensive ecotourism (nearly 55%, 69%, and 72% in scenarios 1 to 3, respectively), and only a small part (6%) of the region proper

for intensive ecotourism. This is because slope plays an important role in determining suitable areas for intensive ecotourism and is considered a constraint for identifying a suitable area for intensive recreation. Since the slope of major parts of the region is more than 5 %, therefore, a small area is proper for developing intensive tourism. According to Scenario 1 with a strict approach, around 40% of the area, and according to scenarios 2 and 3, 25.68% and 20.31%, respectively, are inappropriate for ecotourism. Other researchers have also investigated this topic (Ok et al., 2011; Gomma; 2013; Borzoei et al., 2014; Suryabhagavan et al., 2015;), and most noted the slope to be a limiting factor for outdoor recreation, especially of an intensive type (Makhdoum, 2010; Borzoei et al., 2014). In this study, some zones were also proposed for sustainable tourism development and planning in the region (Table 6). The selected zones have an extensive and intensive potential for NBT development. Therefore, it is necessary to develop ecotourism with a sustainable development approach in selected zones of the region. In this regard, ecotourism is a good option for the development and management of ecotourism, especially in areas with extensive recreational potential. At the same time, to meet the needs and preferences (including recreational activities) of tourists as the main users of such areas, socioeconomic studies should be conducted on the visitors' needs and preferences to prepare them for the zones by the implementation of appropriate plans. Thus, recreational activities should be developed based on environmental potential and land suitability. This will reduce the environmental impacts of ecotourism and pave the ground for the achievement of the goals of sustainable development. This issue has also been acknowledged by other researchers such as Ok et al. (2011), who stated that ecotourism activities without appropriate planning could have negative impacts on the environment and thus endanger its sustainability. Investigation of selected patches showed these patches located near the roads and this character Makes easy accessibility for people. Also, providing facilities and welfare in this determined area would be a great rule to attract people to use there. To do this, identifying the appropriate area for tourism activities development and preparing the visitors' needs and preferences based on the recreational capability determined using MCE Scenarios.

4. Conclusion

There is a high demand for NBT to spend leisure time. Studies show that the increasing use of natural areas for ecotourism has led to increased negative effects of recreation on the environment. For sustainable development of ecotourism and reduction of environmental impacts of tourism, it is necessary to evaluate land recreational capability before the selection and development of recreational areas. This study applied MCE analysis and the Delphi technique to assess land suitability using experts' comments. The use of group knowledge along with the use of different biophysical and socioeconomic criteria ensures the achievement of reliable and practical results. In this study, the MCE approach using WLC was employed to identify suitable areas for the development of ecotourism and the selection of zones for NBT planning at the watershed of Gorgan, northern Iran. The criteria affecting the determination of suitable areas for outdoor recreation were identified and weighted by the Delphi technique and then the MCE method was used for evaluating land suitability for ecotourism/tourism. This method was separately conducted to determine suitable places for extensive and intensive recreation. In the next step, the final zones were identified based on three scenarios of rigorous, intermediate, and flexible approaches using ZLS. According to the results, a major part of the region has a potential for extensive recreation and only a limited portion is proper for intensive recreation. In the next step, 10 zones were selected for the development and management of ecotourism in the region via overlapping the results from the implementation of MCE triple scenarios. These areas generally were potent for extensive and intensive ecotourism. Therefore, it is recommended to establish recreational activities according to the suitability of the zones to reduce the ecotourism effects and achieve sustainable ecotourism development in the study area. In addition, zones with a potential degree of 1 were detected to have a higher priority than other areas for the development and management of ecotourism in these areas. Consequently, it is proposed to plan and provide public recreational facilities depending on land ecotourism suitability in each final zone, which could be effective in the sustainable development of ecotourism in the region and the reduction and prevention of

environmental impacts of ecotourism. The results of this research by identifying suitable areas for outdoor recreation have had an important role in tourism planning and development based on the sustainable development criteria and in decreasing tourism impacts in the area.

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