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Site suitability evaluation for ecotourism using MCDM methods and GIS: Case study- Lorestan province, Iran

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Abstract

On based environment, ecotourism led to preserve the environment and on based economic, ecotourism led to dynamical economic in local association by creating a labor and an income. On this base, recognize the sufficiency and procedures of development the nature in different geographic regions were important. This study compared the two methods of GIS-based Analytic Hierarchy Process (AHP) and Fuzzy Analytic Hierarchy Process (FAHP) in evaluation of the ecotourism potential in Khorram-Abad country. First, in this process the criteria and sub-criteria were determined and by using the Delphi technique and expert's knowledge the weights of criteria were appointed. Then, required maps were produced and integrated with corresponding weights and ecotourism potential map of study area was produced in both methods of AHP and FAHP. The result of study showed that study area have high potential for ecotourism and in each produced map from two methods of AHP and FAHP, more than 45 percentage of study area had excellent and good classes potential.

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Introduction

Tourism can be a powerful tool for successful economic development on a local and national scale. As global warming and other natural phenomena affect the quality of life around the globe, development of ecologically sustainable tourism (ecotourism) can be the best solution. (Ars and Bohanec, 2010).Ecotourism is the fastest growing sector of one of the world's largest industries—tourism (Scheyvens, 1999; Jones, 2005) and is recognized as a sustainable way to develop regions with numerous tourism resources (Weaver, 2001; Zhang and Lei, 2012).Ecotourism has been identified as a form of sustainable tourism expected to contribute to both environmental conservation and development (Ross and Wall, 1999; Tsaur *et al.*, 2006). Ecotourism can be described with the following five concepts: nature conservation, low impact, sustainability, meaningful community involvement and environmental education (Ars and Bohanec, 2010; Chiu*et al.,* 2014).In this respect, ecotourism evaluation should be regarded as an important tool for sustainable development of tourism in any area (Cruz *et al.*, 2005).

To explore the suitable areas for ecotourism, it is necessary to first evaluate the land ecological suitability for ecotourism (Bo *et al.,* 2012).In other words, identifying suitable sites for ecotourism is the first important step to ensure their roles and functions (Kalogirou, 2002; Malczewshi, 2004; Gillenwater *et al.*, 2006).

With the development of geographical information systems (GIS), the land suitability process for ecotourism is increasingly based on more sophisticated spatial analysis and modeling (Chang *et al.,* 2008).On the other hand, the integration of MCDM techniques with GIS has substantially advanced the conventional map overlay methods to the land-use suitability analysis (Carver, 1991; Banai, 1993; Malczewski, 1999; Thill, 1999). GIS-based MCDM can be thought of as a process that merges and transforms spatial and aspatial data (input) into a resultant decision (output) (Malczewski, 2004). The MCDM procedures (or decision rules) define a relationship between the input maps and the output map. The procedures involve the utilization of geographical data, the decision maker's preferences and the manipulation of the data and preferences according to specified decision rules (Malczewski, 2004).

The GIS-based land-use suitability evaluation has been applied in a wide variety of situations including ecological approaches for defining land suitability (Hopkins, 1977; Ahamed *et al.*, 2000; Collins *et al.*, 2001; Store and Jokimäki, 2003; Dey and Ramcharan, 2008; Gbanie *et al.*, 2013). Boyd *et al.* (1995) identified the many criteria for ecotourism within Ontario by linking their importance criteria with the actual landscape characteristics of this region. Bender (2008) use of GIS-based MCDM to evaluate the areas of USA for ecotourism. Kumari *et al.* (2010) integrated five indicators in order to identify and prioritize the potential ecotourism sites in West District of Sikkim state in India using GIS-based MCDM.

AHP is a well known technique that decomposes a decision making problem into several levels in such a way that they form a hierarchy with unidirectional hierarchical relationships between levels. The top level of the hierarchy is the overall goal of the decision problem. The following lower levels are the tangible and/or intangible criteria and sub-criteria that contribute to the goal (Saaty, 1994). In the conventional AHP, the pair wise comparisons for each level with respect to the goal of the best alternative selection are conducted using a nine-point scale.

AHP is criticized for using lopsided judgmental scales and its inability to properly consider the inherent uncertainty and carelessness of pair comparisons. In the real world, linguistic environment is used by human beings to make decisions. Classical decision making method works only with exact and ordinary data without qualitative data. Fuzzy can be used for vague and qualitative assessment of human beings (Torfi *et al.*, 2010). It has the advantage of representing uncertainty and vagueness in mathematical terms and it provides formalized tools for dealing with the imprecision intrinsic to many problems (Kayakutlu and Buyukozkan, 2008).

There are enormous challenges toward proper management of ecotourism in Khorram-Abad country-Lorestan province. The challenges reveal the importance of taking appropriate strategies to manage ecotourism in a sustainable manner in this region. We believe that sustainable ecotourism development efforts can be improved if priority areas for ecotourism and sustainable land uses are modified based on a comprehensive land suitability evaluation. In this regard, the study will use from the integration of GIS technology and two MCDM methods including Analytic Hierarchy Process (AHP) and Fuzzy Analytic Hierarchy Process (FAHP), in locating the suitable sites for ecotourism development in the county of Khorram-Abad. Finally, the results of these methods will be compared together.

Material and methods

Study area

The county of Khorram-Abad as the capital for Lorestan province is located in west of Iran. Its area is about 500000 hectares and is located between east longitude from 48° 2´ 56" to 49° 0´ 4" and north latitude from 33° 53´ 42" to 33° 53´ 27" (e.g. Fig. 1). There are some important characteristics that make the area suitable for a successful ecotourism development program. For example, this county has an attractive mountainous forest landscapes, a rich vegetation cover and considerable wildlife, traditional indigenous people groups and folks and so on. Such attributes suit the selection of the area for a case study to demonstrate the application of the methodology.

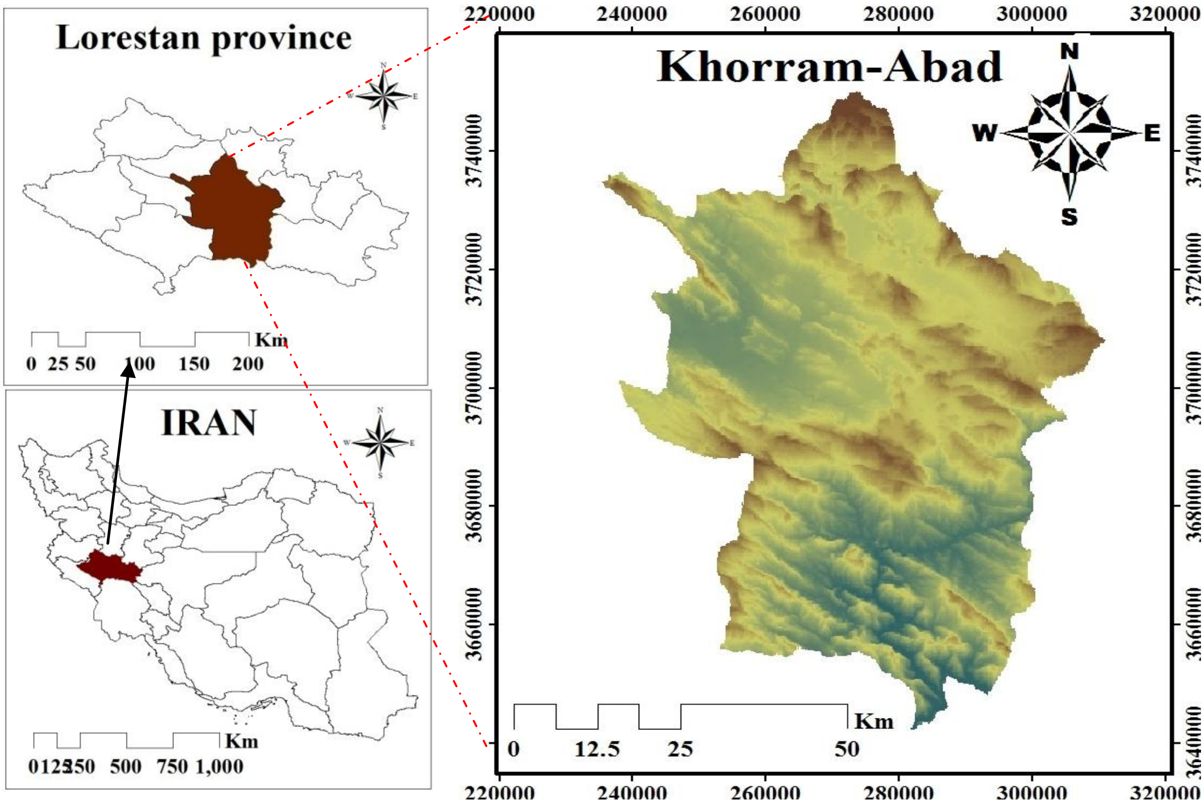

Fig. 1. The location of the study area in Lorestan province and Iran.

Methods

The three main phases of the methodology adopted for this research are determination and assessment of criteria and sub-criteria, spatial analysis and suitability evaluation for ecotourism.

1- Determination and assessment of criteria and sub-criteria

1-1- Identifying of criteria and sub-criteria

This study selected 5 main criteria and 14 sub-criteria in the form of GIS-based layers in determining what areas are best suited for ecotourism development. In order to identify the effective criteria and sub-criteria for ecotourism development in the study area, firstly based on literature review and previous studies (Gul *et al.*, 2006; Amino, 2007; Babaie-Kafaky *et al.*, 2009. Bunruamkaew and Murayama, 2011; Lawal *et al.*, 2011; Anane *et al.*, 2012; Mahdavi *et al*, 2013), special conditions of the region and expert's opinions, 5 main criteria and 14 sub criteria were selected. The selected criteria and sub criteria have been shown in Table 2.

1-2- Delphi method and estimating the relative weights of criteria and sub-criteria using AHP and FAHP

Delphi method mostly aims at easy common understanding of group decisions through twice provision of questionnaires (Hsu *et al.*, 2010). This study also conducted a Delphi method based on AHP and FAHP questionnaires survey with 10 expert scholars specializing in the field ecotourism and government tourism offices for weighting of criteria and sub-criteria. Weighting to criteria and sub-criteria were performed based on pairwise comparison technique using a nine-point scale in AHP and using fuzzy values taken from a pre-defined set of ratio scale values. After normalized weight of each criterion, the aggregation of ten experts' opinions for the five main criteria and 14 sub-criteria was performed using the geometric mean approach for each method (Kabir and Sumi, 2013).

1-2-1- Weighting in Analytic Hierarchy Process

The AHP, which is a mathematic technique for multi-criteria decision making. The AHP, which is used as a decision analysis device (saaty, 1980), is a mathematical method developed by Saaty in 1977 for analyzing complex decisions involving many criteria (Kurttila *et al.*, 2000). In AHP, a matrix is generated as a result of pairwise comparisons and criteria weights are reached as a result of these calculations (Uyan, 2013):

If n number criteria are determined for comparison, the specific procedures are as following for AHP performs (Uyan, 2013):

(1) To create ($n*n$) pair-wise comparison matrix for multiple factors, let P_{ij}=extent to which we prefer factor i to factor j. Then assume $P_{ij}=1/P_{ij}$. The possible assessment values of P_{ij} in the pair-wise comparison matrix, along with their corresponding interpretations, are shown in Table 1.

(2) A normalized pair-wise comparison matrix is found. For this;

a. Compute the sum of each column,

b. Divide each entry in the matrix by its column sum,

c. Average across rows to get the relative weights.

1-2-2- Weighting in Fuzzy Analytic Hierarchy Process

The central to the FAHP is a series of pair-wise comparisons that indicating the relative preferences between pairs of criteria in the same hierarchy. Using triangular fuzzy numbers with the pair-wise comparisons made, the fuzzy comparison matrix $X = (x_{ij})_{n*m}$ is constructed. The pair-wise comparisons are described by values taken from a pre-defined set of ratio scale values as presented in Table 2 and Fig. 2. The ratio comparison between the relative preference of elements indexed i and j on a criterion can be modeled through a fuzzy scale value associated with a degree of fuzziness. Then an element of X, x_{ij} (i.e., a comparison of the ith decision alternative (DA) with the jth DA) is a fuzzy number defined as x_{ij} (l_{ij}, m_{ij}, u_{ij})

where, m_{ij}, l_{ij}, and u_{ij} are the modal, lower bound, and upper bound values for x_{ij} respectively.

Table 1. AHP evaluation scale.

Numerical value of P_{ij}	Definition
1	Equal importance of *i* and *j*
3	Moderate importance of *i* over *j*
5	Strong importance of *i* over *j*
7	Very strong importance of *i* over *j*
9	Extreme importance of *i* over *j*
2, 4, 6, 8	Intermediate values

Table 2. Linguistic variables describing weights of criteria and values of ratings

Triangular Fuzzy scale (*l*,*m*,*u*)	Fuzzy numbers	Definition
(1,1,1)		Just equal
$(\frac{1}{2}, 1, \frac{3}{2})$	1	Equally Important (EI)
$(1, \frac{3}{2}, 2)$	3	Weakly more Important (WMI)
$(\frac{3}{2}, 2, \frac{5}{2})$	5	Strongly more Important (SMI)
$(2, \frac{5}{2}, 3)$	7	Very strongly more Important (VSMI)
$(\frac{5}{2}, 3, \frac{7}{2})$	9	Absolutely more Important (AMI)

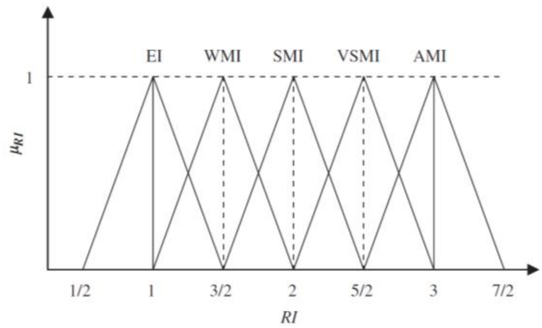

Fig. 2. Linguistic Variables for the Importance Weight of Each Criterion

Let $C = \{C_1, C_2, ..., C_n\}$ be a criteria set, where n is the number of criteria and $A = \{A_1, A_2, ..., Am\}$ is a DA set with m the number of DAs. Let $M_c^1, M_c^2, ... M_c^m$ be values of extent analysis of the ith criteria for m DAs. Here i = 1, 2,..., n and all the M_c^1 (j = 1,2,...,m) are triangular fuzzy numbers (TENs). The value of fuzzy synthetic extent s_i with respect to the ith criteria is defined as:

$$S_k = \sum_{j=1}^{n} M_{kj} \times \left[\sum_{i=1}^{m} \sum_{j=1}^{n} M_{ij} \right]^{-1} = \left(\frac{\sum_{j=1}^{n} l_{ij}}{\sum_{k=1}^{n} \sum_{j=1}^{n} u_{kj}}, \frac{\sum_{j=1}^{n} m_{ij}}{\sum_{k=1}^{n} \sum_{j=1}^{n} m_{kj}}, \frac{\sum_{j=1}^{n} u_{ij}}{\sum_{k=1}^{n} \sum_{j=1}^{n} l_{kj}} \right) \quad (2)$$

Where superscript -1 represents the fuzzy inverse. For more information about the concepts of synthetic extent, refer to Chang (1996).

To obtain the estimates for the sets of weight values under each criterion, it is necessary to consider a principle of comparison for fuzzy numbers (Chang, 1996). For example, for two fuzzy numbers M_1 and M_2, the degree of possibility of $M_1 \geq M_2$ is defined as:

$V(M_1 \geq M_2) = \sup_{x \geq y} [\min(\mu_{M_1}(x), \mu_{M_2}(y))]$, (3)

Where sup represents supremum (i.e., the least upper bound of a set) and when a pair (x, y) exists such that $x \geq y$ and $(\mu M)_1(x) = \mu_{M_2}(y) = 1$, it follows that $V(M_1 \geq M_2) = 1$ and $V(M_2 \geq M_1) = 0$. Since M_1 and M_2 are convex fuzzy numbers defined by the TFNs (l_1, m_1, u_1) and (l_2, m_2, u_2) respectively, it follows that:

$V(M_1 \geq M_2) = 1$ iff $m_1 \geq m_2$;
$V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) = \mu_{M_1}(x_d)$, (4)

where iff represents "if and only if" and d is the ordinate of the highest intersection point between the μ_{M_1} and μ_{M_2} TFNs (see e.g. Fig. 3) and x_d is the point on the domain of μ_{M_1} and μ_{M_2} where the ordinate d is found. The term hgt is the height of fuzzy numbers on the intersection of M_1 and M_2. For $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$, the possible ordinate of their intersection is given by Equation (4). The degree of possibility for a convex fuzzy number can be obtained from the use of Equation (5)

$$V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) = \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} = d. \quad (5)$$

The degree of possibility for a convex fuzzy number M to be greater than the number of k convex fuzzy numbers M_i (i = 1, 2,..., k) can be given by the use of the operations max and min (Dubois and Prade, 1980) and can be defined by:

$V(M \geq M_1, M_2, \ldots M_k) = V[(M \geq M_1)$ *and* $(M \geq M_2)$ *and*...... $(M \geq M_k)]$

Assume that $d'(Ai) = \min V(S_i \geq S_k)$, where k = 1, 2, ..., n, $k \neq i$, and n is the number of criteria as described previously. Then a weight vector is given by:

$W' = (d'(A_1), d'(A_2), \ldots, d'(A_m))$,

Where A_i(i = 1, 2, ..., m) are the m DAs. Hence each $d'(A_i)$ value represents the relative preference of each DA. To allow the values in the vector to be analogous to weights defined from the AHP type methods, the vector W' is normalized and denoted:

$W = (d(A_1), d(A_2), \ldots, d(A_m))$.

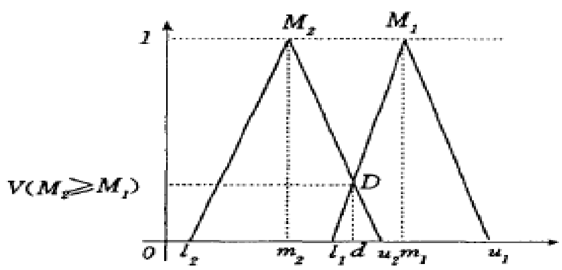

Fig. 3. The comparison of two fuzzy number M_1 and M_2

1-3- Consistency test

The important thing about the pair -wise comparison matrixes is their incompatibility. According to consideration Professor Saaty (1980) for stability arbitrations is necessary that rate of their incompatibility matrixes be less or equal to 0.1. Otherwise, the respective expert is required to repeat itself adjudication as a stable matrixes (Uyan, 2013). The Consistency index (CI) is performed as follows:

$$CI = \frac{\overline{\lambda}_{\max} - n}{n - 1},$$

Where $\lambda_{\max}$ is the maximum eigenvalue, and n is the dimension of matrix. The consistency ratio (CR) was introduced to aid the decision on revising the matrix or not. It is defined as the ratio of the CI to the so-called random index (RI), which is a CI of randomly generated matrices:

$$CR = \frac{CI}{RI}.$$

2- Spatial analysis

A GIS application is used for managing, producing, analyzing and combing spatial data. Some of the attribute data needed in the suitability evaluation process are collected by field inventories and rest prepared from collected or existing data.

For mapping the suitable areas for ecotourism development in the study area, firstly, the respective layers to selected criteria should be prepared. For this regard, some maps (topography, soil, geology and vegetation) were provided from related offices. All these maps were classified using Arc GIS 9.3 software in GIS environment. After providing a digital elevation model (DEM) from topography map, different layers such as slop, aspect and elevation were extracted. The layers for other used criteria in this study like distances from recreational tourist attractions, negative factors, roods, water sources and settlements were created in GIS environment after providing some maps and field visiting and recording their location with GPS. To create Isohyetal map and Isotherms map for the study area, after providing related meteorological information, we used Inverse Distance Weighted interpolation method in GIS environment. In the next step, to be comparable all the created map layers in terms of units and scales, the standardization of maps were performed. For this regard, the pixel values of all sub-criteria raster layers were transformed on a scale suitability ranging from 0 (not suitable) to 255 (most suitable) using fuzzy membership functions extension in IDRISI software.

However each sub-criteria value is processed differently depending on their continuous or discrete form or the defined suitability classes.

3- Suitability evaluation of the study area for ecotourism development

After creating different layers and determination of their final weights by AHP and FAHP, the layers were integrated with their assigned weights using Weighted Linear Combination technique in GIS environment (Sante-Riveira *et al.*, 2008). This technique can be done with by calculating the composite decision value (*Rij*) for each pixel *(ij)* as follows:

$$R_{ij}= \sum w_k \, r_{ijk}$$

Where, W_k is the assigned weight for sub-criteria k and r_{ijk} is the standardized value of pixel (*i,j*) in the map of sub-criterion k. r_{ijk} varies between 0 and 255 where 0 is the least suitable value and 255 is the most suitable value. (Anane *et al.*, 2012).

Results

Determination of criteria and sub-criteria

In this study, based on literature review and previous studies, special conditions of the region and expert's opinions criteria and sub-criteria for suitability evaluation for ecotourism were determined. Forthispurpose,5criteria including Climate, Topography, Geo-pedology, Environmental and Socio-economic and 14 sub-criteria were selected and sub-criteria were classified (table 3).

Table 3. Hierarchical structure, Criteria and sub-criteria in land suitability analysis for ecotourism

Goal	criteria	Sub-criteria	Suitability rating (assigned fuzzy amounts for the classes in parentheses)				
			Class 1 (255)	Class 2 (191)	Class 3 (128)	Class 4 (64)	Class5 (26)
Suitable evaluation for ecotourism development	Climate	Precipitation (mm)	912<	778-912	645-778	512-645	379-512
		Temperature (°C)	11-14	14-17	-	-	-
	Topography	Slop (%)	0-5	5-15	15-25	25-50	50<
		Aspect	West	North	South	East	-
		Elevation (m)	458-1050	1050-1650	1650-2250	2250-2850	>2850
	Geo-pedology	Soil type	alluvium	lithosol	braun soil	-	-
		petrology	limestone	conglomerate	alluvium	Gypsum	-
		Erosion	Very low	Low	Moderate	Much	Very much
	Environmental	Vegetation type and density	Forest (26-50% density)	Forest (6-25% density)	Forest (1-5% density)	Rangeland	Others
		Distance from Water resources (m)	0-300	300-600	600-1200	1200-2000	2000<
	Socio-economic	Distance from rood (km)	0-5	5-10	10-15	15-20	20<
		Distance from settlements (km)	0-3	3-6	6-9	9-12	12<
		Distance from negative factors (km)	0-5	5-10	10-15	15-20	20<
		Distance from recreational tourist attractions (km)	0-5	5-10	10-15	15-20	20<

Weighting of criteria and sub-criteria

The results of the weighting criteria based on AHP and FAHP were performed using Expert choice 2000 software for AHP and MATLAB software for FAHP are shown in Table 4. These weights are obtained based on Delphi method and mathematical relations in each method. Inconsistency ratio (CR) calculated less than 0.1 that is indicating an acceptable level of pair wise comparisons in the AHP matrix. According to these methods in the study area as it shows in Table 4, in AHP distance from water resources (with final weight of 0.1795), distance from the access roods (with final weight of 0.171), and Distance from recreational tourist attractions (with final weight of 0.1375) are the most effective criteria in evaluation capability of ecotourism in the Khorram-Abad county, respectively. While in FAHP distance from water resources (with final weight of 0.205), distance from the access roods (with final weight of 0.117), and vegetation type and density (with final weight of 0.114) are the most effective criteria, respectively. The difference between the weights that obtained from AHP and from FAHP is shown in Fig. 4.

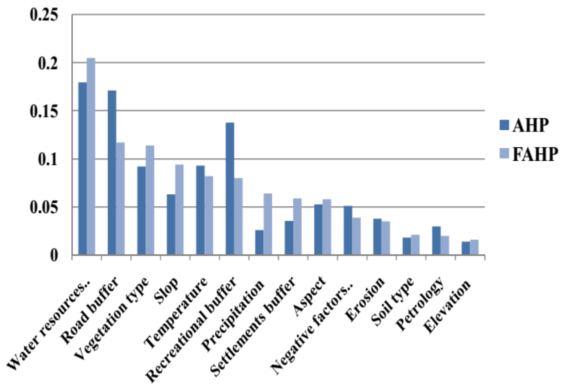

Fig. 4. The difference between the weights that obtained from AHP and from FAHP

Criteria layers creation and their classification

The related criteria and sub-criteria as seen in Table 2 were created and kept as GIS layers. The layers were classified based on Table 2 and fuzzy concept theory, as the biggest fuzzy number value was assigned for the most suitable class. For instance, between slop classes, the class that has the least slop the biggest value was assigned.

Table 4. Criteria, sub-criteria and their final weights

Goal	criteria	Sub-criteria	Weight (AHP)	Weight (FAHP)
Suitabilityevaluation for ecotourism development	Climate	Precipitation	0.064	0.026
		Temperature	0.082	0.093
	Topography	Slop	0.094	0.063
		Aspect	0.058	0.053
		Elevation	0.016	0.014
	Geo-pedology	Soil type	0.021	0.018
		petrology	0.020	0.029
		Erosion	0.035	0.038
	Environmental	Vegetation type and density	0.114	0.092
		Distance from Water resources	0.205	0.179
	Socio-economic	Distance from rood	0.117	0.171
		Distance from settlements	0.059	0.035
		Distance from negative factors	0.039	0.051
		Distance from recreational tourist attractions	0.080	0.137

Table 5. The area and percentages of different suitable classes for ecotourism development

Classes	map of suitable areas using AHP		map of suitable areas using FAHP	
	Area (ha)	Area (%)	Area (ha)	Area (%)
C_1 (Excellent suitability)	38823.61	7.80	32819.77	6.57
C_2 (Good suitability)	188719.44	37.75	193145.51	38.65
C_3(Moderate suitability)	232832.19	46.60	242031.44	48.44
C_4 (Weak suitability)	27275.98	5.50	22615.45	4.54
C_5 (not-suitable)	11461.89	2.35	8497.95	1.8

Table 6. Comparison of the number of the pixels of different map classes of two methods

FAHP \ AHP	C_1	C_2	C_3	C_4	C_5
C_1	6800	3821	809	0	0
C_2	1548	8767	16942	2	0
C_3	189	10026	196248	26781	2
C_4	0	0	28178	154034	6414
C_5	0	0	1	12400	26431

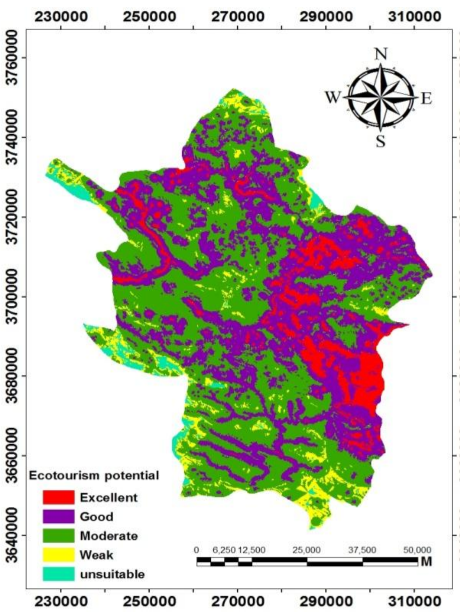

Fig. 5. Final map of suitable areas using AHP

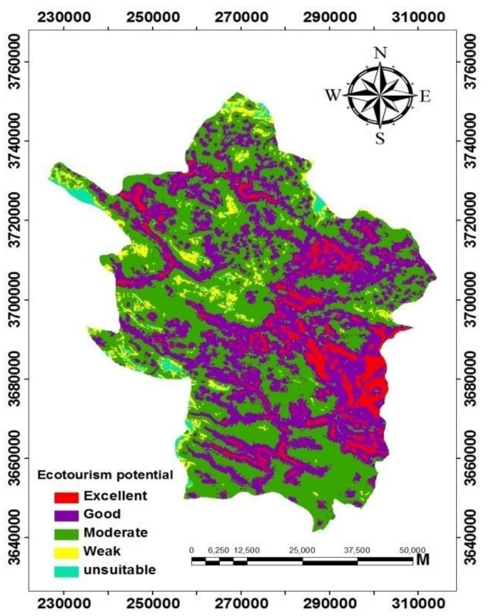

Fig. 6. Final map of suitable areas using FAHP

After preparing of suitable areas maps for ecotourism using AHP and FAHP methods, these maps compared together as presented in table 5. In this table the column 1 is the classes of the map that created using FAHP method and row 1 is the classes of the map that created using AHP method. Measurement unit in table 5 is the number of the class pixels. The results show that about 79% of pixels of each of the two maps classified similar to another map.

Preparation of suitable areas map for ecotourism development

Finally, the maps integrated with the corresponding weights using WLC technique in GIS environment and ecotourism potential map of the study area was prepared using both AHP and FAHP in 5 class (e.g. Fig. 5 and 6).

From the suitability maps for ecotourism as seen in Fig. 5 and Fig. 6, it was found that the total area of excellent and good suitable areas (C_1 and C_2) for ecotourism development in both methods is more than 45% and these are located mostly in the eastern part of the county. Other results are shown in Table 4.

Discussion and conclusion

Evaluation of the potential for ecotourism is complex procedure that implement for synchronic consideration of several factors such as geo-morphologic, environmental and socio-economical criteria were required. Thus, in this study five criteria including the climate, morphological, environmental, socio-economical and geo-pedology and fourteen sub-criteria or map layer including the slope, aspect, elevation, vegetation cover and density, soil type, erosion, distance from road, distance from settlements, distance from water source, distance from recreational attraction, distance from negative factors, temperature, precipitation and petrology were used.

In this study, for determination and assessment of the effective criteria and sub-criteria in evaluation of potential area for ecotourism expert's opinion were used. The important advantage of using experts' opinion is a decrease in probability in judgments. One of characteristics of this study is performance the ecotourism potential evaluation by using of two types of data includes of i) physical and environmental data and ii) intrinsic data that are experts' judgments. Accuracy and precision of these judgments were surveyed by calculation of the inconsistency rate. (Amino, 2007; Babaie-Kafaei *et al*., 2009; Koumari *et al*., 2010; Mahdavi *et al*., 2013)

In this study AHP and FAHP were used for effective factors weighting in ecotourism potential evaluation in Khorram-Abad country Result showed that despite of differences in created weights of each method, there is little different in created weights by AHP and FAHP, and two factors include of distance from water resources and distance from roads in each of two method had maximum weights. In Gul *et al.* (2006), Babaei *et al.* (2009) and Mahdavi *et al.* (2013) studies, water resources had the maximum important in evaluation of ecotourism potential. On the other hand results of this study with Talebi (2011) is consist, Talebi (2011) pay to optimum setting of parking places in Tehran city using AHP and FAHP, and same with our study the weights that created from two method had little difference.

Both in AHP and in FAHP the weight of water resources and distance from roads together accounted for over one third of weights of all sub-criteria, therefore was being prospected that further more ultimate ecotourism potential maps that created by two methods be somewhat the same. Moreover, the regions with high ecotourism potential must be located in environs area of river, springs and main roads. Result showed that in both methods, region located in southeast and central of study area have maximum potential for ecotourism, because these regions have both plenty water resources and little distance from main road.

In addition, result of this study can be effective in recognition of ecotourism capability of study area and thereupon the development ecotourism in the region. For example, creation proper organization and facilities in the region that have high suitability (C1 and C2) for ecotourism, proper managing and doctrine planning in this context can be effective in more development of area for tourist attraction.

Conclusion

By attention to result of this study can conclude that by regarding to low difference of weights in two methods of AHP and FAHP, if the number of classes was fewer in ultimate map, the maps of ecotourism potential created by each of two methods are approximately similar. Therefore AHP that had lower complexes can be used instead of the FAHP, because performance AHP is simpler and easier than FAHP that cause an increase in evaluation speed. But if we produce the ultimate ecotourism potential map with more classes regarding to requirement precision and goal, difference is higher between ultimate ecotourism potential plans that created by each of two methods. Thus using the FAHP is recommending. Although AHP have high capability in assessment of the multi-criteria Problems, but It seems that in practice when there are pairwise comparisons, FAHP more proper and effective than AHP.

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